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Wetlands in Agricultural Landscapes

A Conservation Effects Assessment Project (CEAP) Bibliography



Wetlands in Agricultural Landscapes

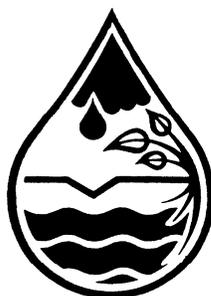
A Conservation Effects Assessment Project (CEAP) Bibliography

Special Reference Briefs Series no. SRB 2006-01

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Joseph R. Makuch**

Water Quality Information Center
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Abstract

Wetlands in Agricultural Landscapes, Special Reference Briefs 2006-01. U.S. Department of Agriculture, National Agricultural Library.

This bibliography is one in a multi-volume set developed by the Water Quality Information Center at the National Agricultural Library in support of the U.S. Department of Agriculture's Conservation Effects Assessment Project (CEAP). This bibliography is a guide to recent scientific literature covering environmental aspects of wetlands in agricultural landscapes. The purpose of the bibliography is to highlight research findings in two main areas: (1) the effect of conservation practices (and other agricultural activities) on wetlands and (2) the environmental effects of wetlands as conservation practices (including constructing and restoring wetlands). The bibliography will also facilitate the identification of knowledge gaps regarding effects of conservation practices on ecosystem services provided by wetlands in agricultural landscapes, and help identify where research is needed.

Keywords: wetlands, conservation practices, wetland conservation, constructed wetlands, ecological restoration, wetland plants, wetland soils, water quality, surface water, wildlife

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September 2006

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Preface

This is one in a series of bibliographies developed by the Water Quality Information Center at the National Agricultural Library in support of the U.S. Department of Agriculture's Conservation Effects Assessment Project (CEAP).

The purpose of CEAP is to study the environmental effects of conservation practices implemented through various U.S. Department of Agriculture conservation programs. A national assessment covers cropland, wetlands, wildlife and grazing lands. Conservation practices that will be assessed include conservation buffers; erosion control; wetlands conservation and restoration; establishment of wildlife habitat; and management of nutrients, irrigation, tillage, pests, and grazing on rangeland and pastureland. More information about this and other components of CEAP is available at www.nrcs.usda.gov/technical/nri/ceap/.

The current titles in this series are

- *Environmental Effects of U.S. Department of Agriculture Conservation Programs*
Special Reference Briefs 2004-01
- *Implementing Agricultural Conservation Practices: Barriers and Incentives*
Special Reference Briefs 2004-02
- *Data and Modeling for Environmental Credit Trading*
Special Reference Briefs 2004-03
- *Agricultural Conservation Practices and Related Issues: Reviews of the State of the Art and Research Needs*
Special Reference Briefs 2004-04
- *Wetlands in Agricultural Landscapes*
Special Reference Briefs 2006-01
- *Environmental Effects of Conservation Practices on Grazing Lands*
Special Reference Briefs 2006-02

Each of the documents, as well as bibliographies on similar topics, is accessible online from the Water Quality Information Center at www.nal.usda.gov/wqic/.

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- National Information Services Corporation (NISC)
www.nisc.com
- Thomson Corporation/Thomson Scientific
scientific.thomson.com

The following databases were used to develop this bibliography:

- **AGRICOLA** (National Agricultural Library)
- **Aquatic Science and Fisheries Abstracts** (CSA)
- **BIOSIS Previews** (Thomson Scientific)
- **CAB Abstracts** (CABI Publishing)
- **Fish and Fisheries Worldwide** (NISC)
- **Scopus** (Elsevier)
- **Treesearch** (USDA Forest Service)
- **Water Resources Abstracts** (CSA)
- **Wildlife and Ecology Studies Worldwide** (NISC)
- **Zoological Record** (Thomson Scientific)

In addition, support from the Natural Resources Conservation Service (NRCS) for the development of these bibliographies is greatly appreciated. Special thanks to Diane Eckles, NRCS, for her valuable assistance with this volume.

About This Bibliography

This bibliography is a guide to recent scientific literature covering environmental aspects of wetlands in agricultural landscapes. The purpose of the bibliography is to highlight research findings in two main areas: (1) the effect of conservation practices (and other agricultural activities) on wetlands and (2) the environmental effects of wetlands as conservation practices (including constructing and restoring wetlands). This information is useful in designing both policies and on-farm conservation systems to optimize the environmental benefits of wetlands. The bibliography will also facilitate the identification of knowledge gaps regarding effects of conservation practices on ecosystem services provided by wetlands in agricultural landscapes, and help identify where research is needed.

When possible, citations are grouped according to CEAP wetlands assessment regions. The regions are shown in the map on page 4. Please note that the regional boundaries are not absolute. Citations were placed in the regions that appeared to be the best fit, but some citations may be relevant to more than one region (e.g., Rolling Plain and Mississippi Alluvial Valley). Also, while there are only a few citations in the Central Plains section, additional relevant citations can be found in the section covering multiple regions on p. 335.

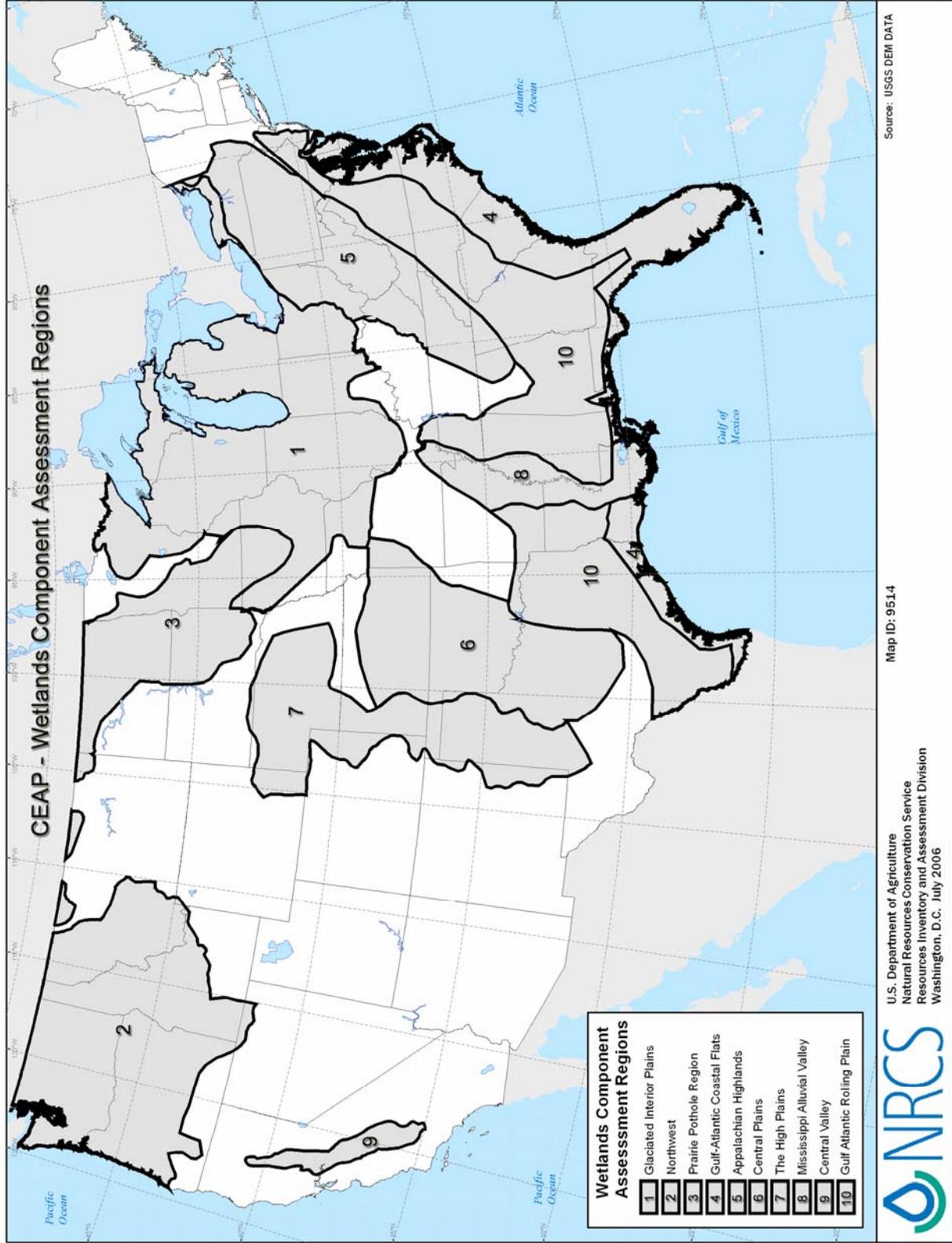
For more information on the CEAP wetlands assessment, see the CEAP Web site at www.nrcs.usda.gov/technical/nri/ceap/.

In addition to the two categories listed above, selected citations to publications that provide general information on wetland functions, processes, and occurrence are also included.

There are 1,225 citations with abstracts (when available) in this bibliography. Citations were found through literature searches of the AGRICOLA database, produced by the National Agricultural Library, and several commercial bibliographic databases. In addition, Water Quality Information Center staff created citations for documents that were located by other means. Documents cited were published from 1980 through early 2006. URLs are provided for online documents that are freely available. The inclusion or omission of a particular citation does not imply endorsement or disapproval.

Within sections, citations are arranged alphabetically by title. To locate information on a specific topic, for example, "frogs," use the subject index beginning on page 371. To ensure that you see all the relevant citations for a particular topic, be sure to also look up related terms in the subject index, such as "Anura," from the example above. An author index is also available beginning on page 411.

To obtain a specific document, please contact your local library. Information on how to obtain documents from the National Agricultural Library can be found at www.nal.usda.gov/services/request.shtml.



Please refer to <http://www.nrcs.usda.gov/technical/nri/ceap/> for the most recent map of the CEAP Wetlands Component Assessment Regions.

Wetlands at the National and International Scale

General Information

1. Agricultural conservation: USDA needs to better ensure protection of highly erodible cropland and wetlands: Report to the ranking Democratic member, Committee on Agriculture, Nutrition, and Forestry, U.S. Senate.

United States. General Accounting Office.
U.S. General Accounting Office, 2003.

Notes: Cover title./ "April 2003."/ Chiefly tables./ Includes bibliographical references (p. 106).

<http://www.gao.gov/new.items/d03418.pdf>

Descriptors: agricultural conservation---United States/ soil conservation---United States/ wetland conservation---United States

2. Agricultural wetlands and waterbirds: A review.

Czech, H. A. and Parsons, K. C.

Waterbirds 25(2 [supplement]): 56-65. (2002)

NAL Call #: QL671; *ISSN:* 1524-4695.

Notes: Managing Wetlands for Waterbirds: Integrated Approaches

Descriptors: wetlands/ agricultural ecosystems/ habitat changes/ habitat utilization/ reviews/ aquatic birds/ habitat/ literature reviews/ agriculture/ breeding sites/ foraging behaviour/ rice fields/ Aves/ birds/ management/ ecology/ community studies/ conservation/ wildlife management and recreation

Abstract: Waterbird use of agricultural wetlands has increased as natural wetlands continue to decline worldwide. Little information exists on waterbird use of wetland crops such as taro, hasu, and wild rice. Several reports exist on waterbird use of cranberry bog systems. Information exists on waterbird use of rice fields, especially by herons and egrets. Rice fields encompass over 1.5 million km² of land and are found on all continents except Antarctica. Rice fields are seasonally flooded for cultivation and to decoy waterfowl, and drawn down for sowing and harvest. A wide variety of waterbirds including wading birds, shorebirds, waterfowl, marshbirds, and seabirds utilize rice fields for foraging and to a lesser extent as breeding sites. In some areas, especially Asia, waterbirds have come to rely upon rice fields as foraging sites. However, few reports exist on waterbird use of rice ecosystems outside of the Mediterranean Region. Species that are commonly found utilizing agricultural wetlands during the breeding season, migration, and as wintering grounds are listed. General trends and threats to waterbirds utilizing agricultural wetlands, including habitat destruction and degradation, contaminant exposure, and prey fluctuations are presented.

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3. Anthropogenic effects on the biodiversity of riparian wetlands of a northern temperate landscape.

Mensing, D. M.; Galatowitsch, S. M.; and Tester, J. R.

Journal of Environmental Management 53(4): 349-377. (1998)

NAL Call #: HC75.E5J6; *ISSN:* 0301-4797

Descriptors: wetlands/ assessment/ land use/ fish/ aquatic invertebrates/ riparian vegetation/ effects/ biodiversity/ landscape/ land resources/ resource conservation/ resource management/ riparian forests/ biological

indicators/ human activity/ forestry practices/ birds/ Amphibia/ Minnesota/ disturbance/ vertebrates/ Chordata/ animals/ west north central states of USA/ north central states of USA/ United States/ North America/ developed countries/ OECD countries/ lake states of USA

Abstract: The present study explores the relationships between riparian wetland communities and anthropogenic disturbances, including urban, forestry and cultivated land. Small stream riparian wetlands in central Minnesota, USA, provided an opportunity to detect these relationships because land use within the region is heterogeneous, resulting in disturbance gradients at the scales of stream reach and landscape. The research tested 2 hypotheses: organismal groups (wet meadow vegetation, shrub carr vegetation, aquatic macro-invertebrates, amphibians, fish and birds) respond differently to various types of anthropogenic disturbance; and the observed biological responses are dependent on the spatial scale of the disturbance. It was shown that birds were the best indicators of landscape condition within the near vicinity of small stream riparian wetlands, and fish community composition corresponded to broader landscape land use patterns. It is suggested that the type of anthropogenic disturbance and the spatial scale at which the disturbance occurs will have variable consequences to different organismal groups. If the effectiveness of the proposed indicators is verified, then managers can strategically monitor the biota and accurately interpret the results. The strength and interpretability of bird and fish relationships to land use of riparian wetlands suggest that indicator and criteria development are warranted.

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4. An approach for assessing wetland functions using hydrogeomorphic classification, reference wetlands, and functional indices.

Smith, R. Daniel. and United States. Army. Corps of Engineers. U.S. Army Engineer Waterways Experiment Station. Wetlands Research Program (U.S.).

Vicksburg, Miss.: U.S. Army Engineer Waterways Experiment Station; Series: Wetlands Research Program technical report WRP-DE-9. (1995)

Notes: Title from title page. "Final report." "October 1995." Includes bibliographical references.

NAL Call #: GB624 .A76 1995

<http://el.erdc.usace.army.mil/elpubs/pdf/wrpde9.pdf>

Descriptors: wetlands---United States/ ecosystem management---United States

This citation is from AGRICOLA.

5. Assessing wetland functional condition in agricultural landscapes.

Eckles, S. Diane. and United States. Natural Resources Conservation Service.

Vicksburg, MS: U.S. Dept. of Agriculture, Natural Resources Conservation Service; Series: Wetland technical note 1. (2002)

Notes: Title from web page. "March 2002." Description based on content viewed May 13, 2003. Includes bibliographical references.

NAL Call #: aQH87.3 .A77 2002

<http://www.nrcs.usda.gov/technical/land/pubs/directiv%5F%20files/TN%5FECS%5F190%5F2%5Fa.pdf>

Descriptors: wetlands---United States/ environmental impact analysis---United States/ wetland restoration---United States/ wetland ecology---environmental aspects---United States/ wetland agriculture---United States/ ecological assessment---biology---United States/ agricultural landscape management---United States
This citation is from AGRICOLA.

6. Base cation chemistry of storm runoff in a forested headwater wetland.

Hill, A. R.

Water Resources Research 29(8): 2663-2674. (1993)

NAL Call #: 292.8 W295; *ISSN:* 0043-1397

Descriptors: wetlands/ storm runoff/ headwaters/ geochemistry/ forest hydrology/ cations/ chemical analysis/ stormwater runoff/ catchment area/ stormwater runoff/ catchment area/ storm runoff/ headwaters/ forest hydrology/ chemical processes/ composition of water

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7. Biological criteria for buffer zones around wetlands and riparian habitats for amphibians and reptiles.

Semlitsch, R. D. and Bodie, J. R.

Conservation Biology 17(5): 1219-1228. (Oct. 2003)

NAL Call #: QH75.A1C5; *ISSN:* 0888-8892

Descriptors: wetlands/ riparian environments/ environment management/ buffers/ conservation/ habitat/ feeding/ life cycle/ water resources/ biodiversity/ nature conservation/ agricultural practices/ overwintering/ ecotones/ silviculture/ breeding/ amphibiotic species/ nesting/ aquatic reptiles/ literature reviews/ habitat selection/ Caudata/ Anura/ salamanders/ frogs/ toads/ conservation/ biodiversity/ habitat community studies/ general environmental engineering

Abstract: Terrestrial habitats surrounding wetlands are critical to the management of natural resources. Although the protection of water resources from human activities such as agriculture, silviculture, and urban development is obvious, it is also apparent that terrestrial areas surrounding wetlands are core habitats for many semiaquatic species that depend on mesic ecotones to complete their life cycle. For purposes of conservation and management, it is important to define core habitats used by local breeding populations surrounding wetlands. Our objective was to provide an estimate of the biologically relevant size of core habitats surrounding wetlands for amphibians and reptiles. We summarize data from the literature on the use of terrestrial habitats by amphibians and reptiles associated with wetlands (19 frog and 13 salamander species representing 1363 individuals; 5 snake and 28 turtle species representing more than 2245 individuals). Core terrestrial habitat ranged from 159 to 290 m for amphibians and from 127 to 289 m for reptiles from the edge of the aquatic site. Data from these studies also indicated the importance of terrestrial habitats for feeding, overwintering, and nesting, and, thus, the biological interdependence between aquatic and terrestrial habitats that is essential for the persistence of populations. The minimum and maximum values for core habitats, depending on the level of protection needed, can be used to set

biologically meaningful buffers for wetland and riparian habitats. These results indicate that large areas of terrestrial habitat surrounding wetlands are critical for maintaining biodiversity.

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8. Bottom-up control of carabid beetle communities in early successional wetlands: Mediated by vegetation structure or plant diversity?

Brose, U.

Oecologia (Berlin) 135(3): 407-413. (2003)

NAL Call #: QL750.O3; *ISSN:* 0029-8549

Descriptors: terrestrial ecology: ecology, environmental sciences/ cluster analysis/ linear regression analysis/ mathematical and computer techniques/ pitfall trapping/ applied and field techniques/ agricultural landscapes/ biodiversity/ bottom up control/ early successional woodlands: habitat/ enemy free space/ feeding activity/ hunting efficiency/ morphological traits/ plant height/ predation/ spatial heterogeneity/ species diversity/ species richness/ vegetation structure

Abstract: Two hypotheses of bottom-up control that predict that the species richness of Carabidae will depend either on the taxonomic diversity of plants ("taxonomic diversity hypothesis") or on the structural heterogeneity of the vegetation ("structural heterogeneity hypothesis") were tested. Plant species were classified into nine plant structural groups through cluster analysis of morphological traits (e.g. total height) at 30 early successional temporary wetlands in the East-German agricultural landscape. In a linear regression analysis, the heterogeneity of vegetation structures explained 55% of the variation in carabid beetle diversity. According to a partial correlation analysis, plant taxonomic diversity did not have a significant effect, consistent with the "structural heterogeneity hypothesis," and contradicting previous studies which concluded that plant taxonomic diversity would be the most important factor in early successional habitats. An experimental study was used to test hypotheses on the processes underlying this bottom-up control by vegetation structure: the "hunting efficiency hypothesis," the "enemy-free space hypothesis," and the "microhabitat specialization hypothesis." The composition of plant structural groups in 15 vegetation plots (1 m²) was manipulated, creating a gradient from dense vegetation to open plots. Subsequent pitfall catches revealed significant differences in the activity-abundances of the carabid species. Large species preferred dense vegetation plots, consistent with the enemy-free space hypothesis that large species are more vulnerable to predation on the open plots and prefer dense vegetation to escape from natural enemies. The results indicate that bottom-up control is not mediated only by plant taxonomic or functional group diversity and that vegetation structures may be more important than previously suggested.

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9. Capacity of natural wetlands to remove nutrients from wastewater.

Nichols, D. S.

Journal of the Water Pollution Control Federation 55(5): 495-505. (1983)

NAL Call #: TD419.R47; *ISSN:* 1047-7624

Abstract: Interest in removing nitrogen and phosphorus from treated wastewater by applying it to wetlands is rapidly increasing. This may be a simple and energy efficient

means of removing these nutrients from wastewater. However, the capacities and limitations of wetlands to function in this manner have not been well quantified. This paper reviews the major mechanisms by which wetlands remove N and P from wastewater flows, and develops some approximate relations between the nutrient removal efficiency of wetlands and wastewater N and P loading rates. Wetlands retain P by adsorption and precipitation reactions. This capacity declines with continued P addition, and a wetland eventually can become saturated. Nitrogen removal is mainly by denitrification, which seems not to diminish with time. Plant uptake of N and P can be important during the growing season, but most of these nutrients are quickly returned to the system when the vegetation dies and decays. Wetland removal of wastewater nutrients can be effective at low loading rates, but efficiency decreases rapidly as application rates increase. About 1 ha of wetland area seems to be required to remove 50% of the N and P from the wastewater generated by 60 people.
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10. Carbon distribution of a well- and poorly-drained black spruce fire chronosequence.

Wang, C.; Bond-Lamberty, B.; and Gower, S. T. *Global Change Biology* 9(7): 1066-1079. (July 2003)
NAL Call #: QC981.8.C5G6323; ISSN: 1354-1013
Descriptors: wetlands/ carbon/ drainage/ methodology/ environmental impact/ forests/ vegetation cover/ plant populations/ biomass/ roots/ ecosystem disturbance/ fire/ biological age/ *Picea mariana*/ Bryophyta/ Canada, Manitoba/ black spruce/ bryophytes/ hornworts/ mosses/ conifers/ habitat community studies
Abstract: The objective of this study was to quantify carbon (C) distribution for boreal black spruce (*Picea mariana* (Mill.) BSP) stands comprising a fire chronosequence in northern Manitoba, Canada. The experimental design included seven well-drained (dry) and seven poorly-drained (wet) stands that burned between 1998 and 1850. Vegetation C pools (above-ground + below-ground) steadily increased from 1.3 to 83.3 t C ha^{super(-1)} for the dry chronosequence, and from 0.6 to 37.4 t C ha^{super(-1)} for the wet chronosequence. The detritus C pools (woody debris + forest floor) varied from 10.3 to 96.0 t C ha^{super(-1)} and from 12.6 to 77.4 t C ha^{super(-1)} for the dry and wet chronosequence, respectively. Overstorey biomass, mean annual biomass increment (MAI), woody debris mass, and litterfall were significantly greater ($\alpha = 0.05$) for the dry stands than for the wet stands, but the bryophyte, understorey, and forest floor C pools were significantly less for the dry than for the wet stands. The root mass ratio decreased with stand age until 37 years after fire, was fairly constant thereafter, and was not significantly affected by soil drainage. The C pools of the overstorey and bryophyte tended to increase with stand age. Foliage biomass, litterfall, and MAI (for the dry stands) peaked at 71 years after fire and declined in the oldest stands. The results from this study illustrate that the effects of disturbance and edaphic conditions must be accounted for in boreal forest C inventories and C models. The appropriateness of using chronosequences to examine effects of wildfire on ecosystem C distribution is discussed.
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11. Carrying capacity of wetland habitats used by breeding greater snow geese.

Masse, H.; Rochefort, L.; and Gauthier, G. *Journal of Wildlife Management* 65(2): 271-281. (Apr. 2001)
NAL Call #: 410 J827; ISSN: 0022-541X
Descriptors: wetlands/ carrying capacity/ grazing/ wildlife management/ Canada, Nunavut/ population number/ breeding sites/ herbivores/ food availability/ ecosystem management/ environment management/ *Chen caerulescens atlantica*/ Canada, Nunavut, Bylot I./ greater snow goose/ management/ population dynamics/ conservation, wildlife management and recreation
Abstract: Because geese can damage their arctic breeding habitats through overgrazing, there is debate about limiting the rapid growth of the greater snow goose (*Chen caerulescens atlantica*) population and setting a population goal. To answer these questions, we assessed the nutritional carrying capacity of freshwater wetland habitats for breeding greater snow geese at the Bylot Island colony, Nunavut, Canada. Specifically, we (1) mapped the different types of wetlands on the island; (2) estimated net aboveground primary production of these habitats; (3) compared total food availability with predicted total food requirements of the current population; and (4) validated our predictions of plant biomass consumed by comparing them to the intensity of goose grazing measured. Freshwater wetlands represented 173 plus or minus 6 km^{super(2)} or 11% of the total area of the south plain of Bylot Island. Streams and wet polygons were the most important habitats in terms of availability of suitable forage plants for geese. The average net aboveground primary production ranged from 21.0 plus or minus 4.6 along lakes to 46.0 plus or minus 9.8 g/m^{super(2)} in polygon channels. We estimated the total food supply available for geese in wetlands at 2,625 plus or minus 461 tons in 1997 but only 1,247 plus or minus 473 tons in 1996, a year of low plant production. We predicted a summer food requirement for goslings at 8.1 plus or minus 0.6 kg/bird, for breeding adults at 7.9 plus or minus 2.3, and for nonbreeding adults at 4.7 plus or minus 1.5, and we predicted the total summer food requirements of the goose population at 1,201 plus or minus 160 tons. The predicted amount of biomass removed (32 plus or minus 7%) agreed well with the actual amount of biomass removed measured in mid-August (39 plus or minus 11%) in 1997, but not in 1996 (67 plus or minus 27% vs 26 plus or minus 17%, respectively), possibly because the goose population was lower that year due to poor breeding success. In 1997, the goose population was at 46 plus or minus 10% of the theoretical short-term carrying capacity (341,000 geese) of the wetlands of Bylot Island. We recommend keeping the goose population below this theoretical carrying capacity.
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12. A case for wetland restoration.

Hey, Donald L. and Philippi, Nancy S. New York: Wiley; x, 215 p.: ill. (some col.), maps. (1999)
Notes: "A Wiley-Interscience publication." Includes bibliographical references and index.
NAL Call #: QH75 .H49 1999; ISBN: 0471176427
Descriptors: wetland conservation/ restoration ecology/ wetland conservation---United States---case studies
This citation is from AGRICOLA.

13. Classification and inventory of wetlands: A global overview.

Scott, D. A. and Jones, T. A.

Plant Ecology 118(1-2): 3-16. (1995)

NAL Call #: QK900.P63; ISSN: 0042-3106

Descriptors: conservation/ ecology/ environmental sciences/ freshwater ecology/ ecological change monitoring/ conservation and resource management/ environmental biology/ plants/ limnology

Abstract: Classification of wetlands is extremely problematical, definition of the term wetland being a difficult and controversial starting point. Although considerable effort has gone into the development of national and regional wetland classifications, the only attempt at establishing a global system has been under the auspices of the Ramsar Convention on Wetlands of International Importance. In view of the fact that the Ramsar Convention has 70 Contracting Parties world-wide, it is suggested that the Convention's definition and classification system should be adopted generally for international purposes. Much of the world has been covered by preliminary wetland inventories, but there is an urgent need to extend coverage to those areas not yet included. It is essential that all inventory projects give adequate attention to meeting the real information needs of agencies and individuals which have an impact on the conservation and wise use of wetlands. Attention should also be given to providing for wide dissemination and regular updating of information and establishment of procedures for monitoring ecological change at the sites identified.

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14. Climate change, agriculture and wetlands in eastern Europe: Vulnerability, adaptation and policy.

Hartig, Ellen Kracauer; Grozev, Ognyan; and Rosenzweig, Cynthia

Climatic Change 36(1-2): 107-121. (1997)

NAL Call #: QC980; ISSN: 0165-0009

Descriptors: wetlands/ agronomy: agriculture/ climatology: environmental sciences/ conservation/ freshwater ecology: ecology, environmental sciences/ government and law/ agricultural drainage/ agriculture/ climate change/ climatology/ conservation/ evapotranspiration/ policy/ temperature

Abstract: Naturally-occurring wetlands perform such functions as flood control, pollution filtration, nutrient recycling, sediment accretion, groundwater recharge and water supply, erosion control, and plant and wildlife preservation. A large concentration of wetlands is located in Eastern Europe. A significant amount of Eastern European wetlands has been converted to agricultural use in the past, and remaining wetlands are subject to agricultural drainage. Drained wetlands are used as prime agriculture lands for a variety of food crops. Other agricultural uses of wetlands range from growing *Phragmites australis* (common reed) for thatch and livestock feed, to collecting peat for heating and cooking fuel. Altered hydrologic regimes due to global climate change could further exacerbate encroachment of agricultural land use into wetlands. The vulnerability and adaptation studies of the U.S. Country Studies Program are used to analyze where climate change impacts to agriculture may likewise impact wetland areas. Scenarios indicate higher temperatures and greater evapotranspiration altering the hydrologic regime such that freshwater wetlands are potentially vulnerable in Bulgaria,

Czech Republic, and Russia, and that coastal wetlands are at risk in Estonia. Runoff is identified as a key hydrological parameter affecting wetland function. Since wetland losses may increase as a result of climate-change-induced impacts to agriculture, precautionary management options are reviewed, such as establishing buffer areas, promoting sustainable uses of wetlands, and restoration of farmed or mined wetland areas. These options may reduce the extent of negative agricultural impacts on wetlands due to global climate change.

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15. Coastal management practices for prevention of future impacts on wetlands.

Baca, B. J. and Clark, J. R.

In: *Ecology and Management of Wetlands Vol 2: Management, Use and Value of Wetlands*/ Hook, D. D. London: Timber Press, 1988; pp. 28-44

NAL Call #: QH541.5.M3E26

Descriptors: land types/ protection/ coastal wetlands

Abstract: The world's coastal wetlands are seriously threatened by both man-made and natural factors. These include coastal development and erosion, coastal pollution, natural erosion and sea-level rise. Progress in the developed countries in reducing man-made impacts on wetlands has not reached the developing countries.

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16. Coastal salt marsh systems in the U.S.: A review of anthropogenic impacts.

Kennish, M. J.

Journal of Coastal Research 17(3): 731-748. (2001); ISSN: 0749-0208

Descriptors: USA/ coasts/ salt marshes/ reviews/ water level fluctuations/ environmental effects/ dredging/ drainage/ tides/ subsidence/ global warming/ ecosystem disturbance/ coastal morphology/ anthropogenic factors/ coastal engineering/ dredge spoil/ harvesting/ flood control/ tidal effects/ hydrology/ deglaciation/ sea level changes/ eustatic changes/ man-induced effects/ climatic changes/ greenhouse effect

Abstract: During the past century, human modification of environmental systems has greatly accelerated tidal salt marsh deterioration and shoreline retreat in many coastal regions worldwide. As a result, more than 50% of the original tidal salt marsh habitat in the U.S. has been lost. Numerous human activities have contributed directly or indirectly to wetland loss and alteration at local, regional, and global scales. Human impacts at the local scale include those that directly modify or destroy salt marsh habitat such as dredging, spoil dumping, grid ditching, canal cutting, leveeing, and salt hay farming. Indirect impacts, which can be even more significant, typically are those that interfere with normal tidal flooding of the marsh surface, alter wetlands drainage, and reduce mineral sediment inputs and marsh vertical accretion rates. These impacts usually develop over a greater period of time. At the regional scale, subsidence caused by subsurface withdrawal of groundwater, oil, and gas has submerged and eliminated hundreds of square kilometers of salt marsh habitat in the Chesapeake Bay, San Francisco Bay, and Gulf of Mexico. At the global scale, atmospheric warming due to increased burden of anthropogenic greenhouse gases and tropospheric sulfate aerosols appears to be strongly coupled to glacial melting, thermal expansion of ocean

waters, and eustatic sea-level rise. Changes in coastal water levels ascribable to eustatic sea-level rise pose a long-term threat to the stability and viability of these critically important coastal systems.

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17. Conflicting processes in the wetland plant rhizosphere: Metal retention or mobilization?

Jacob, D. L. and Otte, M. L.

Water, Air, and Soil Pollution: Focus 3(1): 91-104. (2003)

NAL Call #: TD172 .W36; ISSN: 1567-7230

Descriptors: bioavailability/ metals/ organic matter/ pH/ redox/ rhizosphere/ wetland

Abstract: Increasingly wetlands are used for treatment of metal-contaminated water or as a cover over metal-enriched mine tailings. Natural wetlands may also be contaminated with metals from anthropogenic sources. While wetland conditions tend to be favorable for immobilization of metals, wetland plants could influence metal mobility through redox and pH processes in the rhizosphere. Our current knowledge of these processes is reviewed, focusing on the question of whether the advantages of growing wetland plants in metal-contaminated sediments outweigh the disadvantages. Wetland plants alter the redox conditions, pH and organic matter content of sediments and so affect the chemical speciation and mobility of metals. Metals may be mobilized or immobilized, depending on the actual combination of factors, and it is extremely difficult to predict which effects plants will actually have on metal mobility under a given set of conditions. However, while the effects of plants can extend several tens of centimeters into the sediments, there are no reports suggesting large-scale mobilization of metals by wetland plants. © 2003 Kluwer Academic Publishers. © 2006 Elsevier B.V. All rights reserved.

18. Conservation management of freshwater habitats: Lakes, rivers and wetlands.

Maitland, Peter S. and Morgan, N. C.

London; New York: Chapman & Hall; Series: Conservation Biology Series 9; 233 p. (1997)

Notes: Includes bibliographical references (p. 207-223) and index.

NAL Call #: QH75.M34 1997; ISBN: 0412594102

Descriptors: wetland conservation/ fishery conservation/ wildlife conservation/ conservation of natural resources/ freshwater fishes

This citation is from AGRICOLA.

19. Constructed wetlands for pollution control: Processes, performance, design and operation.

International Water Association. IWA Specialist Group on Use of Macrophytes in Water Pollution Control.

London: IWA Pub.; Series: Scientific and technical report (International Water Association) no. 8; 156 p. (2000)

Notes: Includes bibliographical references (p. 141-149) and index.

NAL Call #: TD756.5 .C76 2000

Descriptors: constructed wetlands/ sewage---purification---biological treatment

This citation is from AGRICOLA.

20. Constructed wetlands for the treatment of organic pollutants.

Haberl, R.; Langergraber, G.; Grego, S.; Kadlec, R. H.; Cicalini, A.-R.; Dias, S. M.; Novais, J. M.; Aubert, S.; Gerth, A.; Thomas, H.; and Hebner, A.

Journal of Soils and Sediments 3(2): 109-124. (2003);

ISSN: 1439-0108

Descriptors: constructed wetlands/ groundwater/ organic contaminants/ wastewater/ water treatment

Abstract: Background. Constructed wetlands (wetland treatment systems) are wetlands designed to improve water quality. They use the same processes that occur in natural wetlands but have the flexibility of being constructed. As in natural wetlands vegetation, soil and hydrology are the major components. Different soil types and plant species are used in constructed wetlands. Regarding hydrology surface flow and subsurface flow constructed wetlands are the main types. Subsurface flow constructed wetlands are further subdivided into horizontal or vertical flow. Many constructed wetlands deal with domestic wastewater where BOD and COD (Biochemical and Chemical Oxygen Demand respectively) are used as a sum parameter for organic matter. However, also special organic compounds can be removed. Objective. The objectives are to summarise the state-of-the-art on constructed wetlands for treatment of specific organic compounds, to the present the lack of knowledge, and to derive future research needs. Methods. Case studies in combination with a literature review are used to summarise the available knowledge on removal processes for specific organic compounds. Results and Discussion. Case studies are presented for the treatment of wastewaters contaminated with aromatic organic compounds, and sulphonated anthraquinones, olive mill wastewater, landfill leachate, and groundwater contaminated with hydrocarbons, cyanides, chlorinated volatile organics, and explosives. In general the removal efficiency for organic contaminants is high in all presented studies. Conclusion. Constructed wetlands are an effective and low cost way to treat water polluted with organic compounds. There is a lack of knowledge on the detailed removal pathways for most of the contaminants. Removal rates as well as optimal plant species are substance-specific, and also typically not available. If a constructed wetland provides different environmental conditions and uses different plant species the treatment efficiency can be improved. Recommendations and Outlook. There is a great need to lighten the black box 'constructed wetland' to obtain performance data for both microbial activity and the contribution of the plants to the overall removal process. Also genetic modified plants should be considered to enhance the treatment performance of constructed wetlands for specific compounds. © 2006 Elsevier B.V. All rights reserved.

21. Constructed wetlands for water quality improvement.

Moshiri, Gerald A.

Boca Raton, Fla.: Lewis Publishers; 632 p. (1993)

Notes: Papers presented at the Pensacola conference. Includes bibliographical references and index.

NAL Call #: TD756.5.M67 1993; ISBN: 0873715500

Descriptors: constructed wetlands---congresses/ water quality management---congresses/ constructed wetlands---case studies---congresses

This citation is from AGRICOLA.

22. Created and natural wetlands for controlling nonpoint source pollution.

Olson, Richard K.; United States. Environmental Protection Agency. Office of Research and Development; and United States. Environmental Protection Agency. Office of Wetlands, Oceans and Watersheds

Boca Raton, Fla.: C.K. Smoley; 216 p. (1993)

Notes: "U.S. EPA, Office of Research and Development, and Office of Wetlands, Oceans, and Watersheds."

Includes bibliographical references.

NAL Call #: TD223.C73 1993; *ISBN:* 0873719433

Descriptors: water quality management--United States/ water--pollution--United States/ wetland conservation--United States/ constructed wetlands--United States
This citation is from AGRICOLA.

23. Criteria and procedures to maximize the quality and value of wetlands constructed at surface mines.

Nelson, R. W.

International Journal of Ecology and Environmental Sciences 17(2): 77-90. (1991)

NAL Call #: QH540.I54; *ISSN:* 0377-015X

Abstract: Provides a synthesis of ideas or principles derived from recent experience, both at mine reclamation sites and with projects designed to replace wetland functions and values lost to agricultural and urban development. -from Author

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24. Cumulative effects on wetland landscapes: Links to wetland restoration in the United States and southern Canada.

Bedford, B. L.

Wetlands 19(4): 775-788. (1999)

NAL Call #: QH75.A1W47; *ISSN:* 0277-5212.

Notes: Conference: Temperate Wetlands Restoration Workshop, Barrie, ON (Canada), 27 Nov-1 Dec 1995

Descriptors: wetlands/ land management/ geohydrology/ biogeochemistry/ land reclamation/ environmental quality/ environmental restoration/ human impact/ regional planning/ hydrology/ biogeochemical cycle/ land use/ restoration/ environment management/ ecosystem management/ USA/ Canada/ land restoration

Abstract: The cumulative effects of human actions on wetland ecosystems motivate current efforts at wetland restoration. They also have created in part the context within which restorations are undertaken. Using modern hydrogeological understanding of wetland-landscape linkages, I argue that restorations should begin with a cumulative impact analysis for the entire region in which the restoration is proposed. The analysis, however, should not focus merely on number of hectares of wetlands lost or degraded. It should be based on the concept of templates for wetland development. These templates are the diversity of settings created in specific landscapes by the complex interactions of hydrogeologic factors and climate. They control key hydrologic variables and hydrologically influenced chemical variables that cause specific wetland types to form and to be maintained through time. They also determine in large part the biogeochemical cycling characteristics specific to different types of wetlands. They thus account for both the biological and functional diversity of wetlands. A cumulative impact assessment for restoration purposes should identify the kinds, numbers, relative abundances, and spatial distribution of wetland

templates in a region - both past and present. These past and present profiles of the wetland landscape can be used to make decisions regarding the type and location of restorations. Matching type and location to the appropriate hydrogeologic setting will maximize the probability of success for individual projects. Regional wetland diversity can be restored if individual restoration decisions about wetland type and location are made in light of the diversity of templates in past and present regional profiles.

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25. Cumulative impacts to wetlands.

Johnston, C. A.

Wetlands 14(1): 49-55. (1994)

NAL Call #: QH75.A1W47; *ISSN:* 0277-5212

Descriptors: wetlands/ United States/ environmental impact/ forest industry/ agriculture/ literature reviews/ geographic information systems/ environmental effects/ forestry/ geographic information systems/ cumulative impact analysis/ mechanical and natural changes/ freshwater pollution/ effects on water of human nonwater activities/ environmental degradation

Abstract: "Cumulative impact," the incremental effect of an impact added to other past, present, and reasonably foreseeable future impacts, was reviewed as it pertains to southern forested wetlands. In the U.S., the largest losses of forested wetlands between the 1970s and 1980s occurred in southeastern states that had the most bottomland hardwood to begin with: Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, and South Carolina. These losses were due primarily to forestry and agriculture. Other sources of cumulative impact include decrease in average area of individual wetlands, shift in proportion of wetland types, change in spatial configuration of wetlands, and loss of cumulative wetland function at the landscape scale. For two wetland-related functions, flood flow and loading of suspended solids, watersheds that contained less than 10% wetlands were more sensitive to incremental loss of wetland area than were watersheds with more than 10% wetlands. The relative position of wetlands within a drainage network also influenced their cumulative function. Geographic Information Systems (GIS) are becoming an important tool for evaluating cumulative impacts and their effects.

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26. Denitrification in freshwater wetlands.

Groffman, P. M.

Current Topics in Wetland Biogeochemistry 1: 15-35. (1994); *ISSN:* 1076-4674

Descriptors: wetlands/ denitrification/ nitrogen fixing bacterial/ energy transfer/ biogeochemistry/ nitrogen cycle/ water quality/ physiological ecology/ cycling nutrients/ bacterial/ nutrient cycles/ nutrient cycles/ nitrogen fixing bacterial/ physiological ecology/ cycling nutrients/ energy transfer

Abstract: In this paper, I first review the physiology and ecology of denitrifying organisms, focusing on how conditions in wetlands influence denitrification at organismal, ecosystem, landscape, and regional scales. My focus is on the role that denitrification plays in wetland processes more than on denitrification per se. As a result, the physiology discussion is oriented more towards how environmental factors regulate physiology than on the specifics of the physiology itself. The review of physiology

and ecology is followed by a brief review of methods for study of denitrification. The main section of the paper is a synthesis of existing data to determine general principles of where and when denitrification is likely to be important to energy flow, nutrient cycling and water quality maintenance in wetlands. The final section discusses key questions and issues for future research.

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27. Designing constructed wetlands for nitrogen removal.

Hammer, D. A. and Knight, R. L.

Water Science and Technology 29(4): 15-27. (1994)

NAL Call #: TD420.A1P7; ISSN: 0273-1223

Descriptors: wastewater treatment/ artificial wetlands/ nitrogen removal/ biochemical oxygen demand/ nitrification/ denitrification/ toxicity/ case studies/ design criteria/ artificial wetlands/ case studies/ design criteria

Abstract: Many constructed wetlands adequately treat BOD sub(5), TSS, and bacteria. However, a review of nitrogen (N) data from 52 constructed and natural wetlands in the North American data base confirmed that N removal was variable. Nitrification and denitrification require aerobic and anaerobic conditions. This paper presents case histories of systems that use alternating shallow and deep zones to create both environments. Regression analysis of N removal and N loadings in 18 shallow-deep water systems suggested that NH sub(4) super(+) loading (kg N/ha/day) could be used to predict effluent NH sub(4) super(+) values. Combinations of shallow water-emergent vegetation and deep water-submergent vegetation with low NH sub(4) super(+) (and TKN) loading rates can produce very low levels of discharged NH sub(4) super(+).

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28. Determining ecological equivalence in service-to-service scaling of salt marsh restoration.

Strange, E.; Galgrath, H.; Bickel, S.; Mills, D.; Beltman, D.; and Lipton, J.

Environmental Management 29(2): 290-300. (Feb. 2002)

NAL Call #: HC79.E5E5; ISSN: 0364-152X

Descriptors: wetlands/ habitat/ environmental restoration/ salt marshes/ environmental policy/ natural resources/ ecology/ habitats/ rehabilitation/ planning/ environmental effects/ nutrient cycles/ policies/ ecosystem management/ environment management/ restoration/ environmental action/ water quality control/ peclamation/ protective measures and control/ general environmental engineering

Abstract: The amount of ecological restoration required to mitigate or compensate for environmental injury or habitat loss is often based on the goal of achieving ecological equivalence. However, few tools are available for estimating the extent of restoration required to achieve habitat services equivalent to those that were lost. This paper describes habitat equivalency analysis (HEA), a habitat-based "service-to-service approach for determining the amount of restoration needed to compensate for natural resource losses, and examines issues in its application in the case of salt marsh restoration. The scientific literature indicates that although structural attributes such as vegetation may recover within a few years, there is often a significant lag in the development of ecological processes such as nutrient cycling that are necessary for a fully functioning salt marsh. Moreover, natural variation can make recovery trajectories difficult to define and predict for

many habitat services. HEA is an excellent tool for scaling restoration actions because it reflects this ecological variability and complexity. At the same time, practitioners must recognize that conclusions about the amount of restoration needed to provide ecological services equivalent to those that are lost will depend critically on the ecological data and assumptions that are used in the HEA calculation.

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29. Developing an invertebrate index of biological integrity for wetlands.

Helgen, Judy; United States. Environmental Protection Agency. Office of Science and Technology; and United States. Environmental Protection Agency. Office of Wetlands, Oceans and Watersheds

In: *Methods for evaluating wetland condition*; Washington, D.C.: U.S. Environmental Protection Agency, Office of Water, 2002.

Notes: Original title: Developing an invertebrate index of biological integrity for wetlands (#9); Title from web page. "March 2002." "EPA-822-R-02-019." Description based on content viewed April 10, 2003. "Prepared jointly by U.S. Environmental Protection Agency, Health and Ecological Criteria Division (Office of Science and Technology) and Wetlands Division (Office of Wetlands, Oceans, and Watersheds)" Includes bibliographical references.

NAL Call #: QH541.5.M3 H46 2002

<http://www.epa.gov/waterscience/criteria/wetlands/9Invertebrate.pdf>

Descriptors: wetlands---United States/ aquatic invertebrates---environmental aspects---United States

This citation is from AGRICOLA.

30. Developing the scientific basis for assessing cumulative effects of wetland loss and degradation on landscape functions: Status, perspectives, and prospects.

Bedford, B. L. and Preston, E. M.

Environmental Management 12(5): 751-771. (1988)

NAL Call #: HC79.E5E5; ISSN: 0364-152X

Descriptors: wetlands/ comprehensive planning/ reviews/ environmental effects/ cumulative impacts/ landscape functions/ research priorities/ regulations/ synoptic analysis/ data acquisition/ environmental protection

Abstract: The incongruity between the regional and national scales at which wetland losses are occurring, and the project-specific scale at which wetlands are regulated and studied, has become obvious. A synthesis is presented of recent efforts by the Environmental Protection Agency and the Ecosystems Research Center at Cornell University to bring wetland science and regulation into alignment with the reality of the cumulative effects of wetland loss and degradation on entire landscapes and regions. It summarizes the status of our present scientific understanding, discusses means by which to actualize the existing potential for matching the scales of research and regulation with the scales at which effects are observed, and provides guidelines for building a stronger scientific base for landscape-level assessments of cumulative effects. It also provides the outlines for a synoptic and qualitative approach to cumulative effects assessment based on a reexamination of the generic assessment framework. A sound scientific basis for regulation will not come merely from acquiring more information on more

variables. It will come from recognizing that a perceptual shift to larger temporal, spatial, and organizational scales is overdue. The shift in scale will dictate different--not necessarily more--variables to be measured in future wetland research and considered in wetland regulation. (Author 's abstract)

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31. Diel flux of dissolved carbohydrate in a salt marsh and a simulated estuarine ecosystem.

Burney, C. M.; Johnson, K. M.; and Sieburth, J. M.
Marine Biology 63(2): 175-187. (1981)

NAL Call #: QH91.A1M35; ISSN: 0025-3162

Descriptors: organic compounds/ salt marshes/ diurnal variations/ carbohydrates/ zooplankton/ nutrient cycles/ bacterial/ Narragansett Bay/ habitat community studies/ ecosystems and energetics

Abstract: The concentrations of total dissolved carbohydrate (TCHO), monosaccharide (MCHO) and polysaccharide (PCHO) were followed over a total of ten diel cycles in a salt marsh and a 13 m super(3) seawater tank simulating an estuarine ecosystem. Their patterns are compared to those for total dissolved organic carbon (DOC), Sigma CO sub(2), pH, O sub(2), chlorophyll a, phaeopigments and solar radiation. During 5 of the 6 marsh studies, PCHO underwent periods of sustained accumulation starting in the late morning or early afternoon and continuing into the early evening. These periods possibly represent release of recently synthesized PCHO from phototrophs. Similar patterns were not found in the tank although direct associations between TCHO and phaeopigment dynamics suggest that zooplankton excretion was an important source of dissolved carbohydrate. The numbers of planktonic bacteria determined in one tank study increased rapidly during a late morning PCHO pulse and varied inversely with PCHO throughout the afternoon and evening, indicating that they were able to respond rapidly and control natural substrate concentrations on a time scale of a few hours.

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32. Ecoclimatological survey of the wetland biota in the tropical wet-and-dry climatic zone.

Heckman, Charles W.

Global Ecology and Biogeography Letters 6(2): 97-114. (1997)

NAL Call #: QH84.G56; ISSN: 0960-7447

Descriptors: agronomy: agriculture/ climatology: environmental sciences/ ecology: environmental sciences/ aquatic ecosystem/ biodiversity/ climate/ climatology/ floodplains/ Mato grosso/ pantanal/ phylogeny/ recruitment/ rice field/ seasonal changes/ tropical ecology/ wetland biota

Abstract: The distinctness of the conditions in the water bodies of the tropical wet-and-dry climatic zone is demonstrated by a survey of the adaptations employed by the plant and animal species to survive the seasons unfavourable to their activity. The species filling common niches in the water bodies of this zone on different continents are compared. Unmistakable phylogenetic relationships among the species filling common niches in various parts of the world can be recognized. Through comparisons of the activity and distribution of 104 species, the adaptations of the biota to the seasonal changes were found to be generally similar to those of the biota in the temperate zones in that both must produce dormant stages

during the same months each year. The inherent instability of the aquatic ecosystem encourages the development of very fast growing organisms with high rates of recruitment and very unstable but resilient populations. As a consequence of their characteristic population dynamics, the impact of intercontinental introductions of aquatic species inhabiting this zone are found to be more likely to cause severe biotic disturbances than similar introductions of species adapted to other climatic zones.

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33. Ecological issues related to wetland preservation, restoration, creation and assessment.

Whigham, Dennis F

Science of the Total Environment 240(1-3): 31-40. (1999)
NAL Call #: RA565.S365; ISSN: 0048-9697

Descriptors: ecologically based Hydrogeomorphic approach/ wetland assessment/ wetland creation/ wetland ecosystem function/ wetland-no-net-loss policy/ wetland preservation/ wetland restoration

Abstract: A wide range of local, state, federal, and private programs are available to support the national (USA) policy of wetland 'No Net Loss'. Implementation of programs, however, has resulted in the continued loss of natural wetlands on the premise that restored or created wetlands will replace the functions and values lost by destruction of natural wetlands. What are the ecological implications and consequences of these programs from a biodiversity and ecosystem perspective? From a biodiversity perspective, ongoing wetland protection policies may not be working because restored or created wetlands are often very different from natural wetlands. Wetland protection policies may also be inadequate to preserve and restore ecological processes such as nutrient cycling because they mostly focus on individual wetlands and ignore the fact that wetlands are integral parts of landscapes. Wetland mitigation projects, for example, often result in the exchange of one type of wetland for another and result in a loss of wetland functions at the landscape level. The most striking weakness in the current national wetlands policy is the lack of protection for 'dry-end' wetlands that are often the focus of debate for what is and what is not a wetland. From an ecological perspective, dry-end wetlands such as isolated seasonal wetlands and riparian wetlands associated with first order streams may be the most important landscape elements. They often support a high biodiversity and they are impacted by human activities more than other types of wetlands. The failings of current wetland protection and mitigation policies are also due, in part, to the lack of ecologically sound wetland assessment methods for guiding decision making processes. The ecologically based Hydrogeomorphic (HGM) approach to wetland assessment has the potential to be an effective tool in managing biodiversity and wetland ecosystem function in support of the national 'No Net Loss' policy.

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34. Ecology of insect communities in nontidal wetlands.

Batzer, D. P. and Wissinger, S. A.
Annual Review of Entomology 41: 75-100. (1996)
 NAL Call #: 421 An72; ISSN: 0066-4170 [ARENAA]
 Descriptors: wetlands/ insects/ community ecology/
 habitats/ interactions/ colonization/ nature conservation/
 insect communities/ reviews/ freshwater ecology
 This citation is from AGRICOLA.

35. Ecotoxicology and risk assessment for wetlands: Proceedings from the SETAC Pellston Workshop on Ecotoxicology and Risk Assessment for Wetlands.

Lewis, Michael A.
 Pensacola, Fla.: SETAC Press, 1999. 375 p. SETAC special publications series.
 Notes: ISBN: 1880611163. "Publication sponsored by the Society of Environmental Toxicology and Chemistry (SETAC) and the SETAC Foundation for Environmental Education." Includes bibliographical references and index.
 Venue: Fairmont Hot Springs, Anaconda, Montana.
 NAL Call #: QH541.5.M3 S48 1995
 Descriptors: wetland ecology---congresses/ pollution---environmental aspects---congresses/ ecological risk assessment---congresses
 This citation is from AGRICOLA.

36. Ecotoxicology and wetland ecosystems: Current understanding and future needs.

Catallo, W. J.
Environmental Toxicology and Chemistry 12(12): 2209-2224. (1993)
 NAL Call #: QH545.A1E58; ISSN: 0730-7268
 Descriptors: wetlands/ contaminants/ ecosystem analysis/ toxins/ ecosystems/ pollutants/ aquatic environment/ environmental policy/ literature reviews/ ecotoxicology/ environmental policy/ literature reviews/ contaminants/ ecosystem analysis/ pollutants/ toxins
 Abstract: The term wetlands refers to a mosaic of important ecosystems that typically form transition zones between uplands and aquatic environments. These areas provide support functions for natural and living resources and mediate biogeochemical transformations of global significance. It is becoming clear that the introduction of toxic and other contaminants to large wetland areas has contributed to a series of undesirable trends in habitat quality; availability of valuable fish and wildlife; and quality of associated resources, including surface and ground waters. The purpose of this review is to indicate the importance of wetlands to regional and global ecology and discusses research on the effects of contaminants in wetland ecosystems. Areas of needed future research also are suggested.
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37. The effect of aquatic plant species richness on wetland ecosystem processes.

Engelhardt, K. A. M. and Ritchie, M. E.
Ecology 83(10): 2911-2924. (2002)
 NAL Call #: 410 Ec7; ISSN: 0012-9658
 Descriptors: wetlands/ algal colonization/ competitive ability/ diversity/ ecosystem functioning/ indirect sampling effect/ inverse sampling effect/ nutrient retention/ productivity/ sampling effect/ submersed aquatic macrophytes

Abstract: Rapid environmental changes have fostered debates and motivated research on how to effectively preserve or restore ecosystem processes. One such debate deals with the effects of biodiversity, and the loss thereof, on ecosystem processes. Recent studies demonstrate that resource-use complementarity, now known as the "niche-differentiation effect," and the presence of a competitive species with strong effects on ecosystem processes, now known as the "sampling effect," can explain why productivity and nutrient retention are sometimes enhanced with increasing species richness. In a well-replicated outdoor mesocosm experiment, we tested these and other alternative mechanisms that could explain the effects of submersed aquatic plant (macrophyte) diversity on wetland ecosystem processes. Algal biomass increased and phosphorus loss decreased as species richness increased. This result can best be explained by an indirect sampling effect caused by one of the weakest competitors, which appeared to facilitate algal growth and thereby filtering of particles, and thus phosphorus, from the water column. The dominant competitor also appeared to decrease phosphorus loss through direct effects on phosphorus availability in the soil and water. Thus, the effects by one of the weakest and the most dominant competitors combine to produce a diversity effect on phosphorus loss. Macrophyte biomass was not enhanced, but converged toward the intermediate biomass of the most competitive species. Such an "inverse sampling effect" may be produced when the most competitive species is not the most productive species owing to species-specific feedbacks and adaptations to the wetland environment. In summary, we reject the niche-differentiation effect as the dominant mechanism in our macrophyte communities and expand on the role of sampling effects in explaining the relationship between plant communities and ecosystem processes. In particular, indirect and inverse sampling effects combine to drive the relationship between species richness and wetland ecosystem processes. Thus, we demonstrate that plant diversity may affect wetland ecosystem processes when inferior competitors drive system productivity and nutrient retention. To ensure coexistence of such species with superior competitors, wetland systems may need to be maintained in a nonequilibrium state, such as with hydrologic disturbances, which would maintain both higher diversity and enhance ecosystem functioning.
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38. Effects of macrophyte species richness on wetland ecosystem functioning and services.

Engelhardt, K. A. M. and Ritchie, M. E.
Nature 411(6838): 687-689. (June 2001)
 Descriptors: wetlands/ species richness/ mesocosms/ phosphorus/ macrophytes/ ecosystems/ biomass/ human impact/ biological diversity/ nutrient retention/ aquatic plants/ phosphorus cycle/ species diversity/ plants/ ecosystem management/ environment management/ plant populations/ suspended particulate matter/ uptake/ man-induced effects/ phytoplankton/ pollution control/ nutrient cycles/ Phytobenthos/ aquatic macrophytes/ algae/ Potamogeton crispus/ Potamogeton pectinatus/ sago pondweed/ biodiversity/ nutrient retention/ human population-biosphere interactions/ physiology, biochemistry, biophysics/ protective measures and control/ water resources and supplies

Abstract: Wetlands provide many important ecosystem services to human society, which may depend on how plant diversity influences biomass production and nutrient retention. Vascular aquatic plant diversity may not necessarily enhance wetland ecosystem functioning, however, because competition among these plant species can be strong, often resulting in the local dominance of a single species. Here we have manipulated the species richness of rooted, submerged aquatic plant (macrophyte) communities in experimental wetland mesocosms. We found higher algal and total plant (algal plus macrophyte) biomass, as well as lower loss of total phosphorus, in mesocosms with a greater richness of macrophyte species. Greater plant biomass resulted from a sampling effect; that is, the increased chance in species mixtures that algal production would be facilitated by the presence of a less competitive species--in this case, crisped pondweed. Lower losses of total phosphorus resulted from the greater chance in species mixtures of a high algal biomass and the presence of sago pondweed, which physically filter particulate phosphorus from the water. These indirect and direct effects of macrophyte species richness on algal production, total plant biomass and phosphorus loss suggest that management practices that maintain macrophyte diversity may enhance the functioning and associated services of wetland ecosystems.

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39. Effects of open marsh water management on selected tidal marsh resources: A review.

Wolfe, R. J.

Journal of the American Mosquito Control Association 12(4): 701-712. (1996)

NAL Call #: QL536.J686; ISSN: 8756-971X

Descriptors: pest control/ marshes/ water management/ reviews/ literature reviews/ aquatic insects/ literature review/ ecological effects/ resources management/ Culicidae/ Diptera/ Diptera/ literature reviews/ aquatic insects/ literature review/ mosquito control/ ecological effects/ resources management/ reviews/ pest control/ Culicidae

Abstract: Open Marsh Water Management (OMWM) is a method of salt-marsh mosquito control that advocates source reduction and biological control through selective pond creation and ditching in mosquito breeding areas. This method has been used as an alternative to chemical insecticides in coastal wetlands for 30 years. This paper reviews the effects of OMWM on hydrology, topography, vegetation, mosquitoes, invertebrates, fishes, birds, mammals, and water quality. Other source reduction techniques and the economics of OMWM are also discussed.

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40. The end of a tradition: 1000 years of embankment and reclamation of wetlands in the Netherlands.

Wolff, W. J.

Ambio 21(4): 287-291. (1992)

NAL Call #: QH540.A52; ISSN: 0044-7447

Descriptors: wetlands/ land reclamation/ historical account/ marshes/ salt marshes/ environment management/ agriculture/ embankments/ Netherlands/ embankments/ reclamation/ conservation, wildlife management and recreation/ conservation and environmental protection/ environmental action

Abstract: Embankment and subsequent reclamation of coastal salt marshes in The Netherlands started about 1000 years ago. Thousands of km² of salt marshes have been reclaimed since that time. In about the same period, reclamation of inland peat moors and swamp forests by improving drainage started, again resulting in the reclamation of thousands of km² mainly in the center of the present-day Netherlands. A few centuries later, another technology was applied to pump dry lakes to gain new agricultural land at the former lake bottom. The embankment and reclamation of wetlands culminated in the 20th century Zuiderzee and Delta projects. However, since the 1960s opposition to the loss of wetlands gradually mounted and finally resulted in changing the nature of some major projects under way and the abandonment of several other projects.

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41. EPW: A procedure for the functional assessment of planned wetlands.

Bartoldus, C. C.

Water, Air, and Soil Pollution 77(3-4): 533-541. (1994)

NAL Call #: TD172.W36; ISSN: 0049-6979

Abstract: The practice of compensating wetland losses through wetland construction, restoration, or enhancement has become more commonplace; however, an appropriate method for assessing replacement of wetland function has been lacking. The Evaluation for Planned Wetlands (EPW) was developed to meet this need. It is a rapid assessment procedure which documents and highlights differences between a wetland assessment area and planned wetland based on their capacity to provide six functions: shoreline bank erosion control, sediment stabilization, water quality, wildlife, fish (tidal, non-tidal stream/river, and non-tidal pond/lake), and uniqueness/heritage. The differences between wetlands are expressed in terms of individual elements, Functional Capacity Indices, and Functional Capacity Units. The results provide information on individual design elements and measures of functional capacity which are a necessity under current regulatory programs that require tangible goals and a method for calculating planned wetland size. EPW includes functional assessment models, a procedure for using these models during the planning/mitigation process, and guidelines for functional design.

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42. Evaluating cumulative effects of disturbance on the hydrologic function of bogs, fens, and mires.

Siegel, D. I.

Environmental Management 12(5): 621-626. (1988)

NAL Call #: HC79.E5E5; ISSN: 0364-152X

Abstract: Any evaluation of cumulative impacts will have to (1) consider the complicated and little understood interactions among wetland hydrology, water chemistry, and biota, and (2) place the effect of individual wetland impacts within the context of the cumulative impacts contributed to the watershed from other geomorphic areas and land uses. It is difficult to evaluate the potential cumulative impacts on wetland hydrology because geologic settings of wetlands are often complex and the methods used to measure wetland streamflow, groundwater flow, and evapotranspiration are inexact. This article reviews current understanding of the hydrologic function of bogs, fens, and mires at different scales and in different

physiographic settings and presents hypotheses on potential cumulative impacts on the hydrologic function that might occur with multiple disturbances. -from Author
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43. Evaluating cumulative effects on wetland functions: A conceptual overview and generic framework.

Preston, E. M. and Bedford, B. L.
Environmental Management 12(5): 565-583. (1988)

NAL Call #: HC79.E5E5; ISSN: 0364-152X

Descriptors: wetlands/ management planning/ environmental effects/ research priorities/ landscape functions/ flood-control storage/ water quality/ sediments/ hydrological regime

Abstract: Issues that must be confronted in developing a sound scientific basis for investigating cumulative effects on freshwater wetlands are outlined. The foundation is laid for a research program to develop methods to quantify cumulative effects of wetland loss or degradation on the functioning of interacting systems of wetlands: (1) the concept of cumulative effects is defined in terms that permit scientific investigation of effects; (2) the scientific component of cumulative impact analysis is distinguished from other aspects of the assessment process; (3) critical scientific issues in assessing cumulative effects on wetlands are defined; and (4) a hypothetical and generic structure is set up for measuring cumulative effects on the functioning of wetlands as landscape systems. A generic framework is provided for evaluating cumulative effects on three basic wetland landscape functions: flood storage, water quality, and life support. The contribution of a particular wetland to landscape function within watersheds or regions will be determined by its intrinsic characteristics, e.g., size, morphometry, type, percent organic matter in the sediments, and hydrologic regime, and by extrinsic factors, i.e., the wetland's context in the landscape mosaic. The time scales of recovery for processes controlling particular wetland functions determine temporal boundaries. Landscape-level measures are proposed for each function. (Author's abstract)

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44. Factors affecting the performance of stormwater treatment wetlands.

Carleton, J. N.; Grizzard, T. J.; Godrej, A. N.; and Post, H. E.

Water Research 35(6): 1552-1562. (2001)

NAL Call #: TD420.W3; ISSN: 0043-1354

Descriptors: ammonia: pollutant/ nitrate: pollutant/ phosphorus: pollutant/ hydraulic loading rate/ pollutant input/ pollutant removal/ stormwater runoff/ stormwater treatment wetlands/ wastewater treatment

Abstract: Data from 35 studies on 49 wetland systems used to treat stormwater runoff or runoff-impacted surface waters were examined and compared in order to identify any obvious trends that may aid future stormwater treatment wetland design efforts. Despite the intermittent nature of hydrologic and pollutant inputs from stormwater runoff, our analysis demonstrates that steady-state first-order plug-flow models commonly used to analyze wastewater treatment wetlands can be adapted for use with stormwater wetlands. Long-term pollutant removals are analyzed as functions of long-term mean hydraulic loading rate and nominal detention time. First-order removal rate constants for total phosphorus, ammonia, and nitrate

generated in this fashion are demonstrated to be similar to values reported in the literature for wastewater treatment wetlands. Constituent removals are also demonstrated via regression analyses to be functions of the ratio of wetland area to watershed area. Resulting equations between these variables can be used as preliminary design tools in the absence of more site-specific details, with the understanding that they should be employed cautiously.
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45. Fire in North American wetland ecosystems and fire-wildlife relations: An annotated bibliography.

Kirby, R. E.; Lewis, S. J.; and Sexson, T. N.
Washington, DC: U.S. Fish and Wildlife Service, 1988.

146 p. Biological Report .

NAL Call #: QH540.U562 no.88(1)

Abstract: Provides an annotated bibliography of 319 citations that provide specific research data, summaries of existing knowledge, or site-specific management advice for North America. To this bibliography is appended a supplemental bibliography of all articles cited in the US Fish & Wildlife Service publication series, Wildlife Review, years 1935 through the September 1987 issue (Number 206) that discussed any aspect of wildlife management and ecology related to fire management, fire behaviour, or fire effects in North America. The 942 citations in the supplemental bibliography are intended to provide a ready reference to the fire-wildlife literature that can be used to evaluate past, current or proposed use of fire in wildlife habitat management. -from Authors

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46. Flood pulsing in wetlands: Restoring the natural hydrological balance.

Middleton, Beth

New York: Wiley; 308 p. (2002)

NAL Call #: QH541.5.V3 F46 2002; ISBN: 0471418072

Descriptors: floodplain ecology---North America/ wetland restoration---North America

This citation is from AGRICOLA.

47. Foreign plant stock: Concerns for wetland mitigation.

Padgett, D. J. and Crow, G. E.

Restoration & Management Notes 12(2): 168-171. (1994)

NAL Call #: QH76.R47; ISSN: 0733-0707

Descriptors: wetlands/ introduced species/ horticulture/ genetic variance/ aquatic plants/ transplantation/ hybridization/ ecosystem disturbance/ genomes/ artificial wetlands/ planning/ flora/ USA, New Hampshire/ constructed wetlands/ genetics/ horticulture/ genetic variance

Abstract: While analyzing the floristic composition and plant species richness of created wetland ecosystems of southeastern New Hampshire, we made several observations on the methodology of vegetation composition planning, and how particular plant species are selected and become incorporated into mitigation projects. The outcome of this investigation along with a review of the subsequent literature, has evoked questions concerning the revegetation strategies, vegetation sources, and resultant floristic compositions of created wetland ecosystems.

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48. Forested wetlands in freshwater and salt-water environments.

Lugo, A. E.; Brown, S.; and Brinson, M. M.
Limnology and Oceanography 33(4): 894-909. (1988)
NAL Call #: GC1 .L5; ISSN: 0024-3590
Descriptors: wetlands/ lakes/ seawater/ reviews/ limnology/
forest hydrology/ forests/ forest watersheds/ ecosystems/
productivity
Abstract: A review of data from over 50 freshwater and
about 50 salt-water sites revealed that freshwater and salt-
water forested wetlands exhibit parallel responses to
hydrologic factors. Greater ecosystem complexity and
productivity are associated with higher hydrologic energy
and more fertile conditions. However, structural complexity
is greater in freshwater forested wetlands than in salt-water
wetlands. Net primary productivity, litter fall, and export of
organic matter are higher in salt-water forested wetlands.
These differences raise questions about the efficiency with
which nutrients are used in forested wetlands. Available
data suggest that nutrient-use efficiency by litter fall and
litter turnover are higher in tidal salt-water wetlands than in
freshwater wetlands. (Author's abstract)
© CSA

49. Freshwater wetlands, urban stormwater, and nonpoint pollution control: A literature review and annotated bibliography.

Stockdale, E. C.
Olympia, Wash.: Washington Department of Ecology,
1991. 273 p.
NAL Call #: Z6004.S94S76 1991
Descriptors: wetlands/ bibliographies/ literature review/
nonpoint pollution sources/ storm runoff/ storm water
management/ urban runoff/ wastewater treatment/ water
pollution control/ wastewater disposal/
water pollution effects
Abstract: It is well established that wetlands under certain
circumstances improve water quality. There is a limited
body of literature on the long-term effects of using
freshwater wetlands for stormwater storage and nonpoint
pollution control. A much larger body of literature pertains to
the use of wetlands for sewage effluent treatment. Some
work has been done utilizing natural as well as artificial
wetlands for flood control and/or water quality
management, but their direct application to this region is
limited. Some researchers believe the characteristics of
wastewater and urban runoff are similar enough that some
findings in the wastewater literature may be applied to
stormwater systems. These findings can be confirmed by
careful studies in the Northwest to help fill the gaps in
present knowledge. The literature strongly indicates that
caution should be taken when natural wetlands are
modified for use in stormwater management. Short-term
water quality benefits are often realized, but long-term
ecological impacts to the wetland system itself are likely
and poorly understood. Constructed wetlands can be
valuable tools for managing the effects of stormwater
impacts on natural systems, particularly if they are built as
part of basin-wide stormwater plans. The literature review
summarizes wetland water quality improvement principles,
case studies, and areas of greatest uncertainty regarding
the use of wetlands for urban stormwater management. A

comprehensive glossary is provided for use as a reference
with definitions to terms contained in the review and
bibliography, as well as the general literature. (Author's
abstract)
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50. From wastelands to wetlands.

Patrick, W. H.
Journal of Environmental Quality 23(5): 892-896. (1994)
NAL Call #: QH540.J6; ISSN: 0047-2425.
Notes: Conference: Symposium on Wetland Processes and
Water Quality, Minneapolis, MN (USA), 3-4 Nov 1992
Descriptors: wetlands/ water quality/ flood control/ land
use/ agriculture/ environmental protection/ water quality
acts/ federal regulations/ ecosystem disturbance/ waste
disposal sites/ historical account/ environmental legislation/
North America/ Clean Water Act/ water quality acts/ effects
on water of human nonwater activities/ environmental
action/ conservation, wildlife management and recreation/
environmental degradation
Abstract: When the Europeans first came to North
America, they discovered vast expanses of fertile land in
forests and prairies that would support the production of
agricultural crops. Along with the upland fertile soils that
lent themselves to clearing and farming, these settlers also
encountered large areas of water-dominated lands that we
now call wetlands. To the early settlers these wetland areas
were for the most part wastelands and were generally
considered to be unpleasant and unhealthy environments.
We have learned in recent decades that the extensive
wetland areas of this country have many beneficial uses.
Improvement in water quality, flood control, storm
abatement, protection of unique species of plants and
animals, and food chain support are some of the important
functions that wetlands perform. Before and during the
same time that the value of natural wetlands was slowly
being recognized, extensive drainage and conversion of
wetlands to other uses were taking place, resulting in
conversion of approximately half of the country's wetlands
to nonwetland uses. Most drainage of wetlands, both past
and present, is for agricultural use. There is now
considerable interest country-wide in slowing this wetland
conversion. Conversion of wetlands to agricultural, urban,
and industrial uses is now regulated under Section 404 of
the Federal Clean Water Act. The present level of
regulation is not without problems, especially in regions
with extensive areas of wetlands where there might be
insufficient upland area for development, and in regions
where the few areas that have wetland characteristics do
not qualify for 404 protection.
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51. Functional assessment of a reference wetland set as a tool for science, management and restoration.

Findlay, S. E. G.; Kiviat, E.; Nieder, W. C.; and Blair, E. A.
Aquatic Sciences 64(2): 107-117. (2002); ISSN: 1015-1621
Descriptors: wetlands/ tidal marshes/ education/
environmental protection/ hydrology/ geomorphology/
analysis/ variability/ restoration/ inland water environment/
USA, New York, Hudson R./ habitat community studies/
protective measures and control/ general environmental
engineering

Abstract: Wetlands are increasingly becoming the target of efforts to restore or mitigate past and current loss of area and other impacts on their function. Tidal wetlands serve an array of functions deemed beneficial (ecosystem services) but there are relatively few efforts to provide verified indicators of these functions or assess variability in function among wetlands. We assessed twelve functions ranging from wave energy dissipation to fish species richness in tidal freshwater wetlands on the Hudson River. These functions were assessed along with potential "indicators" of function at fifteen marshes selected to span hydrogeomorphic classes as well as expected level of function. Functions varied dramatically among wetland sites, with scores summed across functions ranging from 16% to 70% of the maximum possible. Some of the functions were positively associated such that improvement in one would probably be accompanied by improvements in others. Some functions (e.g., surface water exchange and breeding bird habitat) were negatively correlated indicating that one site cannot maximize all potential functions. A verified reference data set allows more objective selection of targets and sites for restoration as well as establishing realistic goals for what might be achieved. The validated indicators of function are valuable tools for extrapolating from a few intensively studied sites to the larger, unsampled, population of wetland sites in a region.
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52. Genetic issues for the restoration of seagrass populations.

Williams, S. L. and California Sea Grant.
In: Restoration Genetics Workshop. (Held 4 Dec 1997-5 Dec 1997 at St. Petersburg, FL (USA).); pp. 53-60; 1997.
Notes: Conference: Workshop on the Restoration Genetics of Wetland Plants

Descriptors: wetlands/ sea grass/ genetic diversity/ bioturbation/ ecosystem disturbance/ habitat improvement (biological)/ restoration/ nature conservation/ environment management/ coastal zone management/ genetics and evolution/ protective measures and control

Abstract: This paper explores the relationships between genetic variation and seagrass restoration. The author discusses some topics restorationists must address such as temporal scale, evolutionary potential, bioturbation, and habitat fragmentation.
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53. Geochemical processes and nutrient uptake by plants in hydric soils.

McKee, W. H. and McKevlin, M. R.
Environmental Toxicology and Chemistry 12(12): 2197-2207. (Dec. 1993)

NAL Call #: QH545.A1E58; *ISSN:* 0730-7268
Notes: Annual Review Issue: Wetland Ecotoxicology and Chemistry. Includes references.

Descriptors: wetland soils/ flooding/ biological production/ plant water relations/ plant nutrition/ metabolism/ mineral nutrition/ nutrient uptake/ soil physical properties/ reduction
This citation is from AGRICOLA.

54. Geographically isolated wetlands: A preliminary assessment of their characteristics and status in selected areas of the United States.

Tiner, Ralph W. and U.S. Fish and Wildlife Service.
Region 5.
Hadley, Mass.: U.S. Fish and Wildlife Service, Northeast Region. (2002)
Notes: Title from web page. "June 2002." Description based on content viewed July 3, 2003. Includes bibliographical references.
NAL Call #: QH87.3 .G64 2002
<http://wetlands.fws.gov/Pubs%5FReports/isolated/report.htm>
Descriptors: wetlands---United States/ wetland ecology---United States
This citation is from AGRICOLA.

55. Grazing management for riparian wetland areas.

Leonard, S. G.; National Applied Resource Sciences Center (U.S.); and United States. Forest Service.
Denver, CO: U.S. Dept. of the Interior, Bureau of Land Management, National Applied Resource Sciences Center; Series: Riparian area management. Technical reference (United States. Bureau of Land Management) 1737-14; 63 p. (1997)
Notes: "U.S. Department of Agriculture, Forest Service"--Cover. Shipping list no.: 98-0126-P. "BLM/RS/ST-97/002+1737"--P. [2] of cover. Includes bibliographical references (p. 57-63). SUDOCs: I 53.35:1737-14.
NAL Call #: SF85.3.G75 1997
Descriptors: range management---United States/ grazing---environmental aspects---United States/ riparian ecology---United States/ wetland conservation---United States
This citation is from AGRICOLA.

56. Groundwater-surface water interactions in headwater forested wetlands of the Canadian Shield.

Devito, K. J.; Hill, A. R.; and Roulet, N.
Journal of Hydrology (Amsterdam) 181(1-4): 127-147. (1996)
NAL Call #: 292.8 J82; *ISSN:* 0022-1694
Descriptors: wetlands/ surface-groundwater relations/ forest hydrology/ swamps/ headwaters/ runoff/ catchment areas/ hydrological regime/ hydrology/ catchment area/ vegetation cover/ stormwater runoff/ ground water/ catchment area/ vegetation cover/ stormwater runoff/ ground water/ surface-groundwater relations/ forest hydrology/ headwaters/ catchment areas/ hydrological regime/ dynamics of lakes and rivers
Abstract: Groundwater and surface water interaction in two conifer swamps located in headwater catchments with contrasting till depth, typical of the southern Canadian Shield, were studied from June 1990 to August 1992. Both swamps had little influence on the regulation or attenuation of seasonal runoff response in the catchment. The two valley bottom swamps were connected to local aquifers but the upland-wetland connection was continuous in the catchment with deeper till and ephemeral in the catchment with thin till-rock ridges. Groundwater movement through the wetlands was restricted mainly to the surface peat layer in both wetlands, because a large portion of inputs from shallow soil layers and stream inflows enter near the peat surface. However, differences in upland-wetland connections resulted in contrasting hydrologic regimes in the two swamps. During seasons with larger inputs, both

swamps were hydrologically connected to uplands and had a similar hydrology characterized by a high water table, rapid storm response, and predominance of saturated overland flow. In summer, upland inputs were absent in the catchment with thin till-rock ridges, resulting in cessation of baseflow and a lower water table that varied in response to variations in rainfall. Continuous upland inputs throughout the summer in the catchment with deeper tills (1-3 m) sustained baseflow and kept the water table near the peat surface. This study demonstrates the control of morphology and shallow subsurface geology on the hydrology of valley bottom swamps influenced by local aquifers.

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57. How 'green' are aquaculture, constructed wetlands and conventional wastewater treatment systems?

Brix, H.

Water Science and Technology 40(3): 45-50. (1999)

NAL Call #: TD420.A1P7; ISSN: 0273-1223.

Notes: Conference: 6. International Conference on Wetland Systems for Water Pollution Control, Aguas de Sao Pedro, SP (Brazil), 27 Sep-2 Oct 1998; Issue editor: Cooper, P.

Descriptors: aquaculture development/ environmental impact/ environment management/ eutrophication/ pollution control/ energy/ aquaculture/ wastewater treatment/ artificial wetlands/ water quality/ nutrients/ biomass/ tropical regions/ productivity/ comparison studies/ technology/ effects of aquaculture on the environment/ effects of aquaculture on the environment/ mechanical and natural changes/ wastewater treatment processes

Abstract: The term 'green' is nowadays widely used (and misused) in connection with many types of technologies. If a technology is 'green' it usually means that the technology requires less non-renewable energy sources than other alternatives. However, other parameters need to be considered as well, such as sustainability, recycling potential, treatment capacity and potential, conservation of ecosystems, etc. In this paper the energy requirements and nutrient recycling potential of constructed wetlands and wastewater aquaculture facilities are compared with that of conventional wastewater treatment technologies. The energy requirements of constructed wetlands are very low, but if significant reuse of nutrients is included (aquaculture), the energy requirements increase significantly and usually beyond the energy equivalent of the biomass produced. This is especially true in cold temperate climates where the aquaculture systems need to be housed in heated greenhouses and artificial light must be provided to secure operation throughout the year. In countries where fresh water itself is a limiting resource and where the economic capability may limit the use of artificial fertilisers, the reuse potential of wastewater may be more important. The potential for sustainable cropping of the plant biomass is excellent in tropical wetlands as the plants have a high productivity and a continuous growing season. In order to evaluate in more detail the 'greenness' of the different wastewater treatment technologies, the life-cycle approach might be applied. However, because constructed wetlands, besides the water quality improvement function, perform a multitude of other functions such as biodiversity, habitat, climatic, hydrological and public use functions, methodologies need to be developed to evaluate these functions and to weigh them in relation to the water quality issues.

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58. Hydrological modelling and the sustainable development of the Hadejia-Nguru Wetlands, Nigeria.

Thompson, J. R. and Hollis, G. E.

Hydrological Sciences Journal 40(1): 97-116. (1995)

NAL Call #: 292.9 As7; ISSN: 0262-6667

Descriptors: productivity/ irrigation/ groundwater recharge/ flooding/ hydrologic budget/ model studies/ water storage/ water use/ hydrology/ water resources/ water management/ biological production/ water budget/ resource development/ ground water/ Nigeria, Hadejia-Nguru Wetlands/ sustainable development/ biological production/ water budget/ resource development/ ground water/ productivity/ groundwater recharge/ hydrologic budget/ model studies/ water storage/ general papers on resources/ conservation, wildlife management and recreation

Abstract: The Hadejia-Nguru Wetlands produce agricultural, fishing and fuelwood benefits of upto 1277 Naira/ha (N1 = US\$22, October 1994), over five times the productivity of formal irrigation schemes. The wetlands play a vital role in aquifer recharge. The key is the annual wet season flooding of over 2000 km super(2) in the 1960s and around 1500 km super(2) in the 1970s. A water balance model, utilizing monthly hydrological and meteorological data simulates flood extent and groundwater storage within the wetlands. The model was operated between 1964 and 1987 and was calibrated using observed flood extents ranging from 50 to 3265 km super(2). Subsequently elements were added for dams and irrigation schemes. Results indicate that full implementation of all the schemes constructed or planned would cause flooding to be less than 375 km super(2) for 60% of the time and groundwater storage to fall by over 5500 10 super(6) m super(3). It is possible to define an operating regime for the basin's hydraulic structures which could provide artificial floods and enable a distribution of water between formal irrigation, small scale irrigators, the wetlands and downstream users. This regime would provide assured flooding, of around 1000 km super(2) each year and a reduced loss of groundwater storage. Such a sustainable development scheme could offset decades of piecemeal development.

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59. Hydrology of natural wetlands and wet nature reserves.

Van Der Molen, W. H.

Agricultural Water Management 14(1-4): 357-364. (1988)

NAL Call #: S494.5.W3A3; ISSN: 0378-3774

Descriptors: wetlands/ hydrology/ ecosystems/ ecological effects/ reviews/ salt marshes/ swamps/ marshes/ hydrologic systems/ bogs

Abstract: This review considers wetlands as they occur in nature, first discussing common properties, and then distinguishing different varieties. Wetlands discussed lack extensive open water spaces or large areas of bare sands and mudflats, and are mostly vegetated. The water logged wetland environment severely limits the number of plant species. Other factors, like high salinity, abundant or very poor supply of plant nutrients, may further reduce the possibilities. Often the vegetation is dominated by only a few but highly typical species. The following main types of wetlands are considered: swamp forests; reedlands and wet grasslands; highmoor bogs; and salt marshes. The general features of wetlands, and their botanical and zoological aspects have been extensively studied. The knowledge about the hydrology of wetlands, however, is

scanty. More studies have been made on the hydrology of nature reserves. Interest in wetland hydrology is obviously rising as such areas become scarcer. Our present knowledge of the hydrology of wetlands is insufficient as a base to make the right decisions on how to preserve threatened wetlands. (Author 's abstract)

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60. Identifying vulnerable wetland systems: Modelling the impact of sea-level rise on large-scale wetland response.

McFadden, L.; Spencer, T.; and Nicholls, R. J.

In: Solutions to Coastal Disasters 2005 - Proceedings of the Conference.; pp. 453-465; 2005.

Descriptors: coastal forest/ ecological sensitivity/ tidal flats, saltmarsh/ wetland loss/ wetland transition

Abstract: A broad-scale Wetland Change Model has been developed to identify the vulnerability of coastal wetlands at the large-scale. The model provides a dynamic and integrated assessment of regional to global patterns of wetland loss, and a means of estimating the transitions between different vegetated wetland types and open water under a range of scenarios of sea-level rise and changes in accommodation space from human intervention. This paper discusses key concepts raised in the process of quantifying the vulnerability of coastal wetlands to forcing from sea-level rise.

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61. The impact of a riparian wetland on streamwater quality in a recently afforested upland catchment.

Emmett, B. A.; Hudson, J. A.; Coward, P. A.; and Reynolds, B.

Journal of Hydrology (Amsterdam) 162(3-4): 337-353. (1994)

NAL Call #: 292.8 J82; *ISSN:* 0022-1694

Descriptors: wetlands/ water quality/ streams/ geochemistry/ stream pollution/ sinks/ nutrients/ water treatment/ agricultural runoff/ aquaculture effluents/ nutrients (mineral)/ aquaculture effluents/ nutrients (mineral)/ streams/ stream pollution/ sinks/ nutrients/ sources and fate of pollution/ mechanical and natural changes/ freshwater pollution

Abstract: The influence of a small remnant wetland on streamwater chemistry at the outflow of an afforested catchment has been investigated. The wetland reduced the volume weighted mean concentrations of a number of solutes. Stream solute loadings were calculated from chemical and flow data from two flumes situated above and below the wetland at the catchment outlet. The flow contribution from the wetland itself was estimated on an areal basis and combined with sampled chemistry to estimate solute fluxes. Streamwater dissolved nitrogen loading equivalent to an input of 55 kg N/ha/year, was reduced by 38% after flowing through the wetland. Reductions in streamwater loadings were also observed for phosphate (94%), total dissolved-P (42%), total monomeric aluminium (39%), total filtrable aluminium (21%), iron (54%), DOC (34%) and silica (21%). All other retention rates were within the original streamwater loading estimate errors. Retention of nitrogen was lower than expected, perhaps due to exhaustion of the wetland's immobilisation capacity by the large nitrogen loading in the streamwater entering the wetland from the surrounding land in combination with atmospheric loadings. Retention of

nitrogen and other solutes was also reduced due to a prolonged period of low rainfall during the summer of 1989 which resulted in high concentration events of various elements from the wetland relative to concentrations at the wetland inflow.

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62. The impact of federal programs on wetlands: A report to Congress.

United States. Dept. of the Interior

Washington, D.C.: U.S. Dept. of the Interior, 1988.

Notes: v. 1. The Lower Mississippi Alluvial Plain and the Prairie Pothole Region -- v. 2. The Everglades, coastal Louisiana, Galveston Bay, Puerto Rico, California's Central Valley, western riparian areas, southeastern and western Alaska, the Delmarva Peninsula, North Carolina, northeastern New Jersey, Michigan, and Nebraska.

NAL Call #: QH76.I48 1988

<http://www.doi.gov/oepec/wetlands2/index.html>

Descriptors: wetland conservation---government policy---United States/ wetlands---government policy---United States/ reclamation of land---government policy---United States

This citation is from AGRICOLA.

63. Impact of urbanization on coastal wetland structure and function.

Lee, S. Y.; Dunn, R. J. K.; Young, R. A.; Connolly, R. M.; Dale, P. E. R.; Dehayr, R.; Lemckert, C. J.; Mckinnon, S.; Powell, B.; and Teasdale, P. R.

Austral Ecology 31(2): 149-163. (2006)

NAL Call #: QH540 .A8; *ISSN:* 1442-9985

Abstract: Urbanization is a major cause of loss of coastal wetlands. Urbanization also exerts significant influences on the structure and function of coastal wetlands, mainly through modifying the hydrological and sedimentation regimes, and the dynamics of nutrients and chemical pollutants. Natural coastal wetlands are characterized by a hydrological regime comprising concentrated flow to estuarine and coastal areas during flood events, and diffused discharge into groundwater and waterways during the non-flood periods. Urbanization, through increasing the amount of impervious areas in the catchment, results in a replacement of this regime by concentrating rain run-off. Quality of run-off is also modified in urban areas, as loadings of sediment, nutrients and pollutants are increased in urban areas. While the effects of such modifications on the biota and the physical environment have been relatively well studied, there is to date little information on their impact at the ecosystem level. Methodological issues, such as a lack of sufficient replication at the whole-habitat level, the lack of suitable indices of urbanization and tools for assessing hydrological connectivity, have to be overcome to allow the effects of urbanization to be assessed at the ecosystem level. A functional model is presented to demonstrate the impact of urbanization on coastal wetland structure and function.

This citation is from AGRICOLA.

64. Impacts of sediment burial on mangroves.

Ellison, J. C.

Marine Pollution Bulletin 37(8-12): 420-426. (1998)

NAL Call #: GC1000.M3; *ISSN:* 0025-326X

Descriptors: wetlands/ roots/ tolerance/ sedimentation/ burying/ mangrove swamps/ ecosystem disturbance/

restoration/ environment management/ nature conservation/ ecosystem management/ rehabilitation/ elevation/ accretion/ literature review/ mortality/ trees/ environmental restoration/ habitat/ respiration/ forests/ sediments/ mangroves

Abstract: Aerial roots are a common adaptation of mangrove trees to their saline wetland habitat, allowing root respiration in the anaerobic substrate. While mangroves flourish on sedimentary shorelines, it is shown here that excess input of sediment to mangroves can cause death of trees owing to root smothering. Descriptions of 26 cases were found in the literature or described here, where mangroves have been adversely affected by sediment burial of roots. The impacts ranged from reduced vigour to death, depending on the amount and type of sedimentation, and the species involved. There are insufficient data to establish specific tolerances. For rehabilitation, where the disturbance was a past event, the elevation change must be assessed in selection of species for replanting, and field trials are required in areas where rapid accretion is an ongoing problem.

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65. The importance of wetlands in water resource management: A literature review.

Brady, Anne.; Riding, Tim.; and New South Wales. Dept. of Land and Water Conservation.

Sydney, Australia: Sydney Dept. of Land & Water Conservation; 48 p.: ill. (1996)

Notes: "March 1996"--T.p. verso. Includes bibliographical references (p. 30-37).

NAL Call #: QH541.5.M3B73 1996; **ISBN:** 0731023544

Descriptors: wetland conservation---Australia---New South Wales/ wetlands---Australia---New South Wales---management

This citation is from AGRICOLA.

66. An integrated model of soil, hydrology, and vegetation for carbon dynamics in wetland ecosystems.

Zhang, Yu; Li, Changsheng; Trettin, Carl C.; Li, Harbin; and Sun, Ge

Global Biogeochemical Cycles 16(4): 1-17. (2002)

NAL Call #: QH344.G562; **ISSN:** 0886-6236

<http://www.srs.fs.usda.gov/pubs/20282>

Descriptors: wetland/ model/ carboncycles/ methane emissions/ hydrology

Abstract: Wetland ecosystems are an important component in global carbon (C) cycles and may exert a large influence on global climate change. Predictions of C dynamics require us to consider interactions among many critical factors of soil, hydrology, and vegetation. However, few such integrated C models exist for wetland ecosystems. In this paper, we report a simulation model, Wetland-DNDC, for C dynamics and methane (CH₄) emissions in wetland ecosystems. The general structure of Wetland-DNDC was adopted from PnET-N-DNDC, a process-oriented biogeochemical model that simulates C and N dynamics in upland forest ecosystems. Several new functions and algorithms were developed for Wetland-DNDC to capture the unique features of wetland ecosystems, such as water table dynamics, growth of mosses and herbaceous plants, and soil biogeochemical processes under anaerobic conditions. The model has been validated against various observations from three

wetland sites in Northern America. The validation results are in agreement with the measurements of water table dynamics, soil temperature, CH₄ fluxes, net ecosystem productivity (NEP), and annual C budgets. Sensitivity analysis indicates that the most critical input factors for C dynamics in the wetland ecosystems are air temperature, water outflow parameters, initial soil C content, and plant photosynthesis capacity. NEP and CH₄ emissions are sensitive to most of the tested input variables. By integrating the primary drivers of climate, hydrology, soil and vegetation, the Wetland-DNDC model is capable of predicting C biogeochemical cycles in wetland ecosystems. This citation is from Treesearch.

67. Intensive wetland agriculture in Mesoamerica: Space, time, and form.

Sluyter, A.

Annals of the Association of American Geographers 84(4): 557-584. (1994)

NAL Call #: 500 As73; **ISSN:** 0004-5608

Descriptors: wetlands/ agriculture/ maps/ irrigation practices/ ecological effects/ population density/ irrigation/ land use/ historical account/ anthropogenic factors/ ecosystem disturbance/ environmental impact/ mesoamerica/ archeology/ historical account/ anthropogenic factors/ ecosystem disturbance/ environmental impact/ irrigation practices/ ecological effects/ conservation in agricultural use/ habitat community studies/ mechanical and natural changes

Abstract: Geographers have led the effort to better understand Prehispanic, intensive wetland agriculture ("raised fields") in Mesoamerica. An overview of that literature provides the database for a subsequent spatial-temporal analysis and a resource for primary research. The analysis employs maps to identify changing relationships among distribution, hectareage, and morphometry in order to address wetland agriculture's role in the emergence of sedentism, urbanism, statism, and corollary environmental change; its interrelationships with other agroecosystems and ecological parameters; and its productivity and sustainability. The result is a modest benchmark in the research process which identifies significant variables, putative patterns, and several testable hypotheses, namely 1) that wherever social processes elicited dense population nucleations and hydrology was appropriate, farmers built wetland fields; 2) that the emergence of intensive wetland agriculture was ecologically interrelated with terracing, canal irrigation, and extensive agroecosystems; 3) that morphometric variation among wetland fields reflected contextual variables of hydrology, population density, taxation, and centralization of decision making; and 4) that intensive wetland agriculture in Mesoamerica was a productive and sustainable agroecosystem.

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68. Interior wetlands of the United States: A review of wetland status, general ecology, biodiversity, and management.

Giudice, John H.; Ratti, John T.; United States. Army. Corps of Engineers; U.S. Army Engineer Waterways Experiment Station; and Wetlands Research Program (U.S.)

Vicksburg, Miss.: U.S. Army Engineer Waterways Experiment Station; Series: Wetlands Research Program technical report WRP-SM-9; 156 p. (1995)

Notes: "November 1995." Includes bibliographical references (p. 100-132).

NAL Call #: QH76.G58 1995

Descriptors: biological diversity conservation---United States/ ecosystem management---United States/ wetlands---United States

This citation is from AGRICOLA.

69. Invasiveness in wetland plants in temperate North America.

Galatowitsch, S. M.; Anderson, N. O.; and Ascher, P. D. *Wetlands* 19(4): 733-755. (1999)

NAL Call #: QH75.A1W47; *ISSN:* 0277-5212

Descriptors: wetlands/ exotic species/ vegetation/ literature review/ hydrology/ salinity/ introduced species/ vegetation patterns/ growth/ herbivores/ hybridization/ ecosystem disturbance/ plant populations/ salinity effects/ temperate zones/ *Phragmites australis*/ *Typha glauca*/ *Lythrum salicaria*/ *Myriophyllum spicatum*/ *Phalaris arundinacea*/ North America/ invasive taxa

Abstract: The spread of invasive taxa, including *Lythrum salicaria*, *Typha X glauca*, *Myriophyllum spicatum*, *Phalaris arundinacea*, and *Phragmites australis*, has dramatically changed the vegetation of many wetlands of North America. Three theories have been advanced to explain the nature of plant invasiveness. Aggressive growth during geographic expansion could result because 1) growth is more favorable under new environmental conditions than those of resident locales (environmental constraints hypothesis); 2) herbivores may be absent in the new locale, resulting in selection of genotypes with improved competitive ability and reduced allocation to herbivore defenses (evolution of increased competitive ability hypothesis); and 3) interspecific hybridization occurred between a new taxon and one existing in an area, resulting in novel phenotypes with selective advantages in disturbed sites or phenotypes that can grow under conditions not favorable for either parent (introgression/hybrid speciation hypothesis). A review of published literature found few studies that compare the growth and dynamics of invasive populations in their new range versus those in historic ranges. However, there is evidence that hydrologic alterations could facilitate invasions by *Typha X glauca* and *Phalaris arundinacea* and that increased salinity promoted spread of *Typha angustifolia* (parental taxon) and *Phragmites australis*. The potential for reduced herbivory causing aggressive growth is greatest for *Lythrum salicaria*. Introgressive hybridization is potentially a cause of invasiveness for all five species but has been established only for *Typha X glauca* and *Lythrum salicaria*.

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70. Land-use characterization for nutrient and sediment risk assessment.

Valk, Arnoud van der; United States. Environmental Protection Agency. Health and Ecological Criteria Division.; United States. Environmental Protection Agency. Wetlands Division.; and United States. Environmental Protection Agency. Office of Water.

In: *Methods for evaluating wetland condition*; Washington, D.C.: U.S. Environmental Protection Agency, Office of Water, 2003.

Notes: Original title: Land use characterization for nutrient and sediment risk assessment #17; Title from web page. "March 2002." Prepared jointly by: the U.S. Environmental

Protection Agency, Health and Ecological Criteria Division (Office of Science and Technology) and Wetland Division (Office of Wetlands, Oceans, and Watersheds). "EPA-822-R-02-025." Description based on content viewed Feb. 28, 2003. Includes bibliographical references.

NAL Call #: QH76.5.N8 V47 2002

<http://www.epa.gov/waterscience/criteria/wetlands/17LandUse.pdf>

Descriptors: wetland ecology---evaluation/ land use surveys---United States/ wetland management---United States/ water quality management---United States
This citation is from AGRICOLA.

71. Lessons learned from five decades of wetland restoration and creation in North America.

Lewis, R. R.; Kusler, J. A.; and Erwin, K. L.

In: *Proceedings of the Conference on Challenges and Opportunities in the Marine Environment*.

Washington D.C.: 1994; pp. 233-240.

Notes: Conference: MTS 94. Challenges and Opportunities in the Marine Environment, Washington, DC (USA), 7-9 Sep 1994

Descriptors: wetlands/ environmental protection/ ecosystem disturbance/ historical account/ ecosystem management/ hydrology/ site selection/ ecosystems/ monitoring/ environmental restoration/ siting criteria/ USA/ wetland restoration

Abstract: Practical experience and the available science base on restoration and creation are limited for most wetland types and vary regionally. Most wetland restoration and creation projects do not have specific, measurable goals, complicating efforts to evaluate "success". Monitoring of wetland restoration and creation projects has been lacking and needs more emphasis. Despite thousands of instances in which wetlands have been intentionally or unintentionally restored or created in the United States, in the last 50 years there has been very little short term monitoring and even less long term monitoring of sites. Monitoring of sites of comparisons with naturally occurring wetlands over time would provide a variety of information including rates of revegetation, repopulation by animal species, and redevelopment of soil profiles, patterns of succession, and evidence of persistence.

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72. Linking actions to outcomes in wetland management: An overview of U.S. state wetland management.

La Peyre, M. K.; Reams, M. A.; and Mendelsohn, I. A. *Wetlands* 21(1): 66-74. (2001)

NAL Call #: QH75.A1W47; *ISSN:* 0277-5212

Descriptors: wetlands/ government policy/ surveys/ environment management/ planning/ ecology/ ecosystem management/ regional planning/ Mapping/ nature conservation/ environmental protection/ policies/ management/ United States/ government policies/ resource management/ land management/ environmental quality/ resources management/ state jurisdiction/ assessments/ resource conservation/ environmental law, regulations & policy/ conservation, wildlife management and recreation/ management/ environmental action/ evaluation process

Abstract: Despite a national focus on saving wetland systems in the U.S., evaluations of wetland resources and management outcomes have been limited. A fifty-state

survey of wetland managers was conducted in order to collect information on (1) wetland resources, (2) management actions taken, and (3) management impact on the resources (wetlands). An overview of the general status of state knowledge of the quantity and quality of their wetland resources is presented. Results indicate that most states have a rough estimate of the resources and most have wetland conservation plans and intend to develop better databases of wetland resources. However, few states track management actions relevant to wetlands and fewer have any idea of the success or impact of past management actions. The ability to assess program effectiveness is key to implementing adaptive management frameworks. A number of lessons learned suggest a basic framework for future wetland management that includes state planning, better quantification (mapping) of wetlands, development of methods to measure wetland quality, and tracking of wetland management actions and outcomes. This framework could also be used as an outline for the development of a more adaptive approach to wetland management.

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73. Mercury sequestration in forests and peatlands: A review.

Grigal, D. F.

Journal of Environmental Quality 32(2): 393-405. (2003)

NAL Call #: QH540.J6; ISSN: 0047-2425

Abstract: Nearly all Hg in vegetation is derived directly from the atmosphere. Mass of Hg in forest vegetation (roughly 0.1 mg m⁻²) is about an order of magnitude smaller than that in the forest floor (1 mg m⁻²) and two orders of magnitude smaller than that in the mineral soil (10 mg m⁻²). Mass of Hg in peat (20 mg m⁻²) is greater than the sum of that in mineral soil and the forest floor; wetlands usually sequester more Hg than associated uplands. The strong relationship of Hg to organic matter, associated with binding by reduced S groups, is fundamental to understanding Hg distribution and behavior in terrestrial systems. The stoichiometry of the Hg-C relationship varies; Hg-S relationships, though less variable, are not constant. Because of the Hg-organic matter link, landscape conditions that lead to differential soil organic matter accumulation are likely to lead to differential Hg accumulation. The ratio of methylmercury (MeHg) to total Hg is generally low in both vegetation (near 1.5%) and soil (<1%), but areas of poorly drained soils and wetlands are sites of MeHg production. The annual emission of anthropic Hg from the 48 contiguous states of the USA (144 Mg) is two orders of magnitude less than the pool of Hg in forests of those states (30 300 Mg). Peatlands, less than 2% of total land area, sequester more than 20 times annual emissions (2930 Mg). If global climate change affects C storage it will indirectly affect Hg storage, having a major effect on the balance between emissions and sequestration and on the global Hg cycle.

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74. Metal accumulation within salt marsh environments: A review.

Williams, T. P.; Bubb, J. M.; and Lester, J. N.

Marine Pollution Bulletin 28(5): 277-290. (1994)

NAL Call #: GC1000.M3; ISSN: 0025-326X

Descriptors: salt marshes/ heavy metals/ literature reviews/ sea grass/ pollution indicators/ indicator species/

biogeochemical cycle/ erosion/ pollution effects/ physicochemical properties/ chemical speciation/ accumulation/ biogeochemistry/ bioaccumulation/ literature review/ water pollution effects/ *Zostera marina*/ British Isles/ accumulation/ literature reviews

Abstract: A comprehensive assessment of the chemical and physical factors affecting metal accumulation and cycling within salt marshes is presented. The effects that changes in physico-chemical properties (redox potential, salinity, pH, etc.) have upon metal mobility, speciation and consequent biological availability are described together with the implications for salt marsh habitat loss. Salt marshes act as very efficient sinks for metal contaminants although metal concentrations in halophytes do not generally reflect environmental contamination levels. Marine angiosperms, particularly *Zostera marina*, do however, reflect external metal concentrations and can therefore be used as biomonitors. Evidence suggests that the concentration of heavy metals in the sediments of most estuaries is not sufficiently high to cause ill effects to salt marsh plants although further investigations are necessary to assess potential threats of pollutants upon the health of these intertidal ecosystems.

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75. Methane production and methane consumption: A review of processes underlying wetland methane fluxes.

Segers, R.

Biogeochemistry 41(1): 23-51. (1998)

NAL Call #: QH345 .B564; ISSN: 0168-2563

Descriptors: wetlands/ methane/ fluctuations/ atmosphere/ atmospheric gases/ atmospheric chemistry/ peat/ oxidation/ methanogenesis/ greenhouse effect/ climatic changes/ soils/ anoxic conditions/ biogeochemical cycle/ soil microorganisms/ greenhouse gases/ microorganisms

Abstract: Potential rates of both methane production and methane consumption vary over three orders of magnitude and their distribution is skew. These rates are weakly correlated with ecosystem type, incubation temperature, in situ aeration, latitude, depth and distance to oxic/anoxic interface. Anaerobic carbon mineralisation is a major control of methane production. The large range in anaerobic CH₄:CO₂ production rates indicate that a large part of the anaerobically mineralised carbon is used for reduction of electron acceptors, and, hence, is not available for methanogenesis. Consequently, cycling of electron acceptors needs to be studied to understand methane production. Methane and oxygen half saturation constants for methane oxidation vary about one order of magnitude. Potential methane oxidation seems to be correlated with methanotrophic biomass. Therefore, variation in potential methane oxidation could be related to site characteristics with a model of methanotrophic biomass.

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76. Modeling habitat change in salt marshes after tidal restoration.

Boumans, R. M.; Burdick, D. M.; and Dionne, M.

Restoration Ecology 10(3): 543-555. (Sept. 2002)

NAL Call #: QH541.15.R45R515; ISSN: 1061-2971

Descriptors: hydrology/ salt marshes/ human impact/ tides/ topography/ coastal zone management/ restoration/ man-induced effects/ plant populations/ vegetation cover/ tidal

effects/ tidal currents/ USA, New England/ reclamation/ conservation, wildlife management and recreation/ ecosystems and energetics

Abstract: Salt marshes continue to degrade in the United States due to indirect human impacts arising from tidal restrictions. Roads or berms with inadequate provision for tidal flow hinder ecosystem functions and interfere with self-maintenance of habitat, because interactions among vegetation, soil, and hydrology within tidally restricted marshes prevent them from responding to sea level rise. Prediction of the tidal range that is expected after restoration relative to the current geomorphology is crucial for successful restoration of salt marsh habitat. Both insufficient (due to restriction) and excessive (due to subsidence and sea level rise) tidal flooding can lead to loss of salt marshes. We developed and applied the Marsh Response to Hydrological Modifications model as a predictive tool to forecast the success of management scenarios for restoring full tides to previously restricted areas. We present an overview of a computer simulation tool that evaluates potential culvert installations with output of expected tidal ranges, water discharges, and flood potentials. For three New England tidal marshes we show species distributions of plants for tidally restricted and nonrestricted areas. Elevation ranges of species are used for short-term (<5 years) predictions of changes to salt marsh habitat after tidal restoration. In addition, elevation changes of the marsh substrate measured at these sites are extrapolated to predict long-term (>5 years) changes in marsh geomorphology under restored tidal regimes. The resultant tidal regime should be designed to provide habitat requirements for salt marsh plants. At sites with substantial elevation losses a balance must be struck that stimulates elevation increases by improving sediment fluxes into marshes while establishing flooding regimes appropriate to sustain the desired plants.

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77. Modelling biodiversity and land use: Urban growth, agriculture and nature in a wetland area.

Eppink, F. V.; van den Bergh, J.; and Rietveld, P.

Ecological Economics 51(3-4): 201-216. (2004)

NAL Call #: QH540.E26; ISSN: 0921-8009

Descriptors: wetlands/ integrated modelling/ species richness/ land cover/ bid rent models/ land use/ anthropogenic impacts/ dynamic simulation models/ conservation/ ecology/ mathematical models/ equations/ forestry/ agriculture

Abstract: Wherever human land use is located near sensitive natural areas, such as wetlands, it has significant impacts on biodiversity in those areas. Both species richness and species composition are affected. As biodiversity is lost, conservation efforts increase and act as a constraint on land use options. Given these links, land use is a central factor in an ecological-economic analysis of biodiversity. This paper presents a general, dynamic simulation model of the interaction between wetland biodiversity and land use. Results for a set of scenarios suggest that urban growth is unsustainable and that there may be a conflict between conservation of distinct aspects of biodiversity.

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78. Modification of peak flood discharges by wetland environments: A review.

Tobin, G. A.

Geographical Perspectives 57: 6-18. (1986);

ISSN: 0199-994X

Abstract: The traditional view equating wetland environments with wasteland has gradually given way to one which recognizes several valuable functional roles of such areas. This review paper focuses on just one of these roles, the ability of wetlands to mitigate peak flood flows, and questions the basic assumption that all wetlands a priori act as sponges temporarily, storing water during times of excess and releasing it during times of drought. Both theoretical arguments and empirical evidence are examined and it is concluded that more attention should be given to controlled research studies which develop more sophisticated hydrological models of wetlands. -Author © 2006 Elsevier B.V. All rights reserved.

79. Multiple limiting gradients in peatlands: A call for a new paradigm.

Bridgham, S. D.; Pastor, J.; Janssens, J. A.; Chapin, C.; and Malterer, T. J.

Wetlands 16(1): 45-65. (1996)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ peat/ classification systems/ gradients/ biogeochemistry/ hydrology/ community composition/ nutrients (mineral)/ hydrogen ion concentration/ acidic soils/ plant populations

Abstract: Peatlands often have readily apparent gradients of plant species distributions, biogeochemistry, and hydrology across several spatial scales. Many inferences have been drawn about the colinearity of these gradients, and these assumptions have become ingrained in the terminology that describes and classifies peatlands. We review the literature and present some of our own data that show that many of these inferences are either wrong or correct only under a limited set of ecological conditions. We examine historical classification schemes of peatlands and, in this context, gradients of alkalinity, pH, nutrient availability for plant growth, nutrient mineralization, hydrology, and decomposition. We further suggest a strictly defined set of terms to describe separate gradients of hydrology, alkalinity, and nutrients that limit plant growth in peatlands. Specially, we make the following suggestions concerning terminology. (1) The suffix O-trophicO should only be used when referring to nutrients that directly limit plant growth at natural availabilities (e.g., eutrophic and oligotrophic). (2) Terms such as circumneutral, moderately acid, and very acidic (or alternatively strong, intermediate, and weak) should be used to describe the pH of peatlands. (3) Ombrogenous and geogenous (or limnogenous, topogenous, and soligenous) should be used to describe the hydrology of peatlands. (4) The terms bog and fen should be defined broadly based on water/soil chemistry and dominant plant species without accompanying assumptions regarding hydrology, topography, ontogeny, nutrient availability, or the presence or absence of nondominant indicator plant species. Better yet, the generic term peatland be used when possible to avoid confusion about conditions that may or may not be present at a particular site.

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80. N:P balance in wetland forests: Productivity across a biogeochemical continuum.

Lockaby, B. G. and Conner, W. H.

Botanical Review 65(2): 171-185. (1999)

NAL Call #: 450 B6527; ISSN: 0006-8101

Descriptors: nitrogen: nutrient/ phosphorus: nutrient/ net primary productivity/ nitrogen:phosphorus balance: biogeochemical continuum, productivity/ nutrient transformation/ wetland forest

Abstract: The nature of and driving forces behind variation among wetland forests in terms of biogeochemistry and vegetation production are not well understood. We suggest that insight into biogeochemical and productivity differences may be gained by examining the degree to which nitrogen and phosphorus are balanced within wetland vegetation. On the basis of examinations of data related to N:P balance and nutrient use efficiencies, vegetation productivity in both depressional and riverine forests appears to be primarily N limited. In contrast to some current theories of wetland biogeochemistry, these data suggest that when P deficiency occurs at all, it represents a secondary productivity constraint in comparison to N. Similarly, a biogeochemical continuum is suggested for wetland forests based on the relationship between N:P ratios in senesced foliage vs. annual litterfall mass. We theorize that the position of a particular wetland forest on this continuum reflects the integration of its geomorphic position and biogeochemical history. In addition, the position of a particular system on the continuum may have predictive value with regard to net primary productivity and nutrient transformation capabilities.

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81. National water summary of wetland resources.

Fretwell, J. D.; Williams, John S.; Redman, Phillip J.; and Geological Survey (U.S.).

Washington, D.C.: U.S. G.P.O; Series: U.S. Geological Survey water-supply paper 2425; 431 p. (1996)

NAL Call #: 407 G29W no.2425; ISBN: 0607856963

Descriptors: wetlands---United States/ water resources development---United States/ wetland conservation---United States

This citation is from AGRICOLA.

82. Natural and constructed wetlands in Canada: An overview.

Kennedy, Gavin and Mayer, Tatiana

Water Quality Research Journal of Canada 37(2): 295-325. (2002); ISSN: 1201-3080

Descriptors: bioprocess engineering/ freshwater ecology: ecology, environmental sciences/ wildlife management: conservation/ wetland research needs/ identification/ Canadian economy/ anthropogenic activities/ climate change/ constructed wetlands: cold weather performance, cost effective, design adaptation, environmentally friendly wastewater treatment method, non point source pollution treatment, wildlife effects/ consumptive activities: derived value/ freshwater wetland research/ hydrogeochemistry/ hydrology/ intrinsic water quality amelioration wetland function/ natural wetlands: sustainability/ non consumptive activities: derived value/ wetland degradation/ wetland loss/ wetland treatment technology

Abstract: A review of freshwater wetland research in Canada was conducted to highlight the importance of these ecosystems and to identify wetland research needs. Both

natural and constructed wetland systems are discussed. Natural wetlands are an important part of the Canadian landscape. They provide the habitat for a broad variety of flora and fauna and contribute significantly to the Canadian economy. It is estimated that the total value derived from consumptive and non-consumptive activities exceeds dollar sign10 billion annually. The past decades have witnessed the continued loss and degradation of wetlands in Canada. In spite of recent protection, Canadian wetlands remain threatened by anthropogenic activities. This review shows that more research on fate and transport of pollutants from urban and agricultural sources in wetland systems is needed to better protect the health and to assure the sustainability of wetlands in Canada. Furthermore, improved knowledge of hydrology and hydrogeochemistry of wetlands will assure more effective management of these ecosystems. Lastly, better understanding of the effect of climate change on wetlands will result in better protection of these important ecosystems. Constructed wetlands are man-made wetlands used to treat non-point source pollution. The wetland treatment technology capitalizes on the intrinsic water quality amelioration function of wetlands and is emerging as a cost-effective, environmentally friendly method of treating a variety of wastewaters. The use of wetland technology in Canada is, however, less common than in the U.S.A. A number of research needs has to be addressed before the wetland treatment technology can gain widespread acceptance in Canada. This includes research pertaining to cold weather performance, including more monitoring, research on design adaptation and investigation of the effects of constructed wetlands on wildlife.

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83. The need to define hydrologic equivalence at the landscape scale for freshwater wetland mitigation.

Bedford, B. L.

Ecological Applications 6(1): 57-68. (1996)

NAL Call #: QH540.E23; ISSN: 1051-0761

Descriptors: wetlands/ environmental restoration/ biological diversity/ hydrology/ ecosystem management/ environment management/ reclamation/ plant populations/ geohydrology/ decision making/ reclamation/ plant populations/ geohydrology/ decision making/ environmental restoration/ biological diversity/ ecosystem management/ environment management

Abstract: Attempts to replace wetlands or define hydrologic equivalence for wetland mitigation must be based on an understanding of the complexity of wetland hydrology and of the relationship of individual wetlands to the landscape. Because mitigation has the potential to re-configure the kinds and spatial distribution of wetland ecosystems over large geographic areas, I advocate a landscape approach to defining hydrologic equivalence. This approach does not depend on specification of hydroperiod or other hydrologic variables for individual wetlands. It relies instead on knowledge of landscape properties that control wetland hydrology and water chemistry. In this paper I develop the conceptual framework for defining hydrologic equivalence for wetland mitigation viewed as a de facto landscape management policy with the potential to reduce the diversity of wetland types within regions. I review modern hydrogeological understanding of where wetlands form in the landscape and identify key hydrologic variables responsible for the formation of specific wetland types. I

also review existing evaluations of mitigation projects in several states. On the basis of these reviews, I argue that, in setting regulatory criteria for judging hydrologic equivalence, the scale must be enlarged from the individual wetland project to include the broader landscape. Only this broader view can provide the context within which decision-makers can evaluate the potential cumulative effects of individual mitigation decisions on broad-scale patterns of wetland diversity. The landscape approach to defining hydrologic equivalence that I advocate is based on the concept of templates for wetland development. These templates are the diversity of settings created in specific landscapes by the complex interactions of hydrogeologic factors and climate. These interactions, in turn, control key hydrologic variables and hydrologically influenced chemical variables that cause specific wetland types to form. Hydrologic equivalence then can be defined at the scale of landscape in terms of the kinds, numbers, relative abundances, and spatial distribution of wetland templates. The approach can be implemented through the identification of landscape goals and profiles based on knowledge of these templates. The profiles would catalog and map the diversity of wetland templates and the diversity of existing wetland types within a given landscape, focusing the attention of decision-makers on broad-scale patterns of loss in wetland types and providing a context within which individual mitigation projects could be evaluated. Landscape goals for maintaining a diversity of wetland templates are suggested.

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84. Nutrient enrichment and decomposition in wetland ecosystems: Models, analyses and effects.

Rybczyk, J. M.; Garson, G.; and Day, J. W.

Current Topics in Wetland Biogeochemistry 2: 52-72. (1996); ISSN: 1076-4674

Descriptors: wetlands/ litter/ ecosystems/ mineralization/ decomposition/ nutrients/ cycling nutrients/ model studies/ enrichment/ literature review/ degradation/ biodegradation/ leAves/ biogeochemistry/ nutrient cycles/ nutrients (mineral)/ literature reviews/ decomposers/ nutrient cycles/ nutrients (mineral)/ literature reviews/ decomposers/ nutrient enrichment/ decomposition/ nutrients/ cycling nutrients/ model studies/ enrichment/ literature review/ degradation/ leaves

Abstract: Decomposition refers to the breakdown of organic matter to carbon dioxide, water and inorganic mineral components (mineralization) (Dickinson and Pugh 1974). Inorganic components can also be re-incorporated into the litter matrix during decomposition (immobilization). Generally, nutrient availability limits the rate of biological decomposition of plant organic matter because of the disparity between the high demand for nitrogen and phosphorus by decomposer organisms that use plant litter carbon as an energy source and the relatively low concentrations of nutrients found in the leaf litter (Swift et al. 1979, Neely and Davis 1985, Enriquez et al. 1993). Nutrient amendments to wetland ecosystems can potentially increase the rates of decomposition by either improving initial litter nutrient quality, via fertilization of the growing plant (Coulson and Butterfield 1978, Valiela et al. 1985, Lukumbuzya et al. 1994), or by increasing externally, the nutrients available to decomposer communities (Howarth and Fisher 1976, Haines and Hanson 1979, Fairchild et al. 1984). Nutrient amendments can also affect

the mineralization and immobilization of nutrients within the decomposing litter matrix by altering the distribution and amounts of nutrients associated with the labile and refractory litter components, and by increasing the external pool of nutrients that can be re-incorporated into the decomposing litter matrix (Kaushik and Hynes 1971, Howarth and Fisher 1976, Andersen 1978, Coulson and Butterfield 1978, Elwood et al. 1981, Marinucci et al. 1983, DeBusk and Dierberg 1984, Fairchild et al. 1984, Neely and Davis 1985, Valiela et al. 1985, Hohmann and Neely 1993). We reviewed 24 studies that examined the effects of nutrient amendments, most commonly nitrogen and phosphorus, on the rates of wetland plant litter decomposition in either, wetland ecosystems, laboratory wetland mesocosms, streams or vegetated littoral zones of lakes.

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85. Nutrient limitation and botanical diversity in wetlands: Can fertilization raise species richness?

Gusewell, Sabine; Bailey, Kathleen M.; Roem, Wilma J.; and Bedford, Barbara L.

Oikos 109(1): 71-80. (Apr. 2005)

NAL Call #: 410 O14; *ISSN:* 0030-1299

Descriptors: wetlands/ species richness/ nutrients/ biomass/ pH effects/ soil chemistry/ grasslands/ fertilization/ nature conservation/ species diversity/ aquatic plants/ nitrogen/ phosphorus/ limiting factors/ rare species/ Switzerland/ USA/ Denmark/ Netherlands/ productivity

Abstract: The 'resource balance hypothesis' proposes that the species richness of grassland vegetation is potentially highest when the N:P ratio of plant tissues is 10-15 (co-limitation), so that species richness could be raised by fertilization with N or P at sites with lower or higher N:P ratios, respectively. Here we use data from field surveys in Swiss, Dutch and American fens or wet grasslands to analyze what changes in N:P ratios might produce noticeable changes in species richness. Plant species numbers, aboveground biomass, tissue N and P concentrations and soil pH were recorded in plots of 0.06-4 m super(2). In each data set, plots with intermediate tissue N:P ratios (6-20) were on average most species-rich, but N:P ratios explained only 5-37% of the variation in species richness. Moreover, these effects were partially confounded with those of vegetation biomass and/or soil pH. The unique effects of N:P ratios (excluding those shared with biomass and pH) explained 11-17% of variation in species richness. The relationship between species richness and N:P ratios was asymmetric: plots with high N:P ratios were more species-poor than those with low N:P ratios. This was paralleled by a smaller species pool size at high N:P ratios (estimated from species numbers in multiple records), suggesting that fewer species are adapted to P-limited conditions than to N-limited conditions. According to these data, species richness in wetlands may possibly be raised by P-fertilization when the initial N:P ratio of the vegetation is well above 20, but this option is not recommended for nature conservation as it might promote common species at the expense of rare ones.

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86. Nutrient removal from wastewater by wetlands.

Nichols, D. S.

In: Proceedings 6th International Peat Congress. (Held 17 Aug 1980-23 Aug 1980 at Duluth, Minn.)

Eveleth, Minn.: Fisher Company; pp. 638-642; 1981.

NAL Call #: S598.I53 1980

Descriptors: wetlands/ wastewater management/ nitrogen removal/ phosphorus removal/ nutrient removal/ literature review/ wastewater/ water quality/ water quality control/ wastewater disposal/ wastewater discharge/ wastewater lagoons/ wastewater treatment/ phosphorus/ nitrogen/ denitrification/ ammonium/ nitrates

Abstract: The literature on the capacity of wetlands for removing nitrogen (N) and phosphorus (P) from wastewater was reviewed and assessed. Retention of inflowing P under natural conditions appears to be limited to the relatively small amount of P that is accumulated as peat is formed from partially-decayed vegetation. Some P is absorbed by the soil when above-natural levels are added to a wetland. Wastewater P is most efficiently removed at low loading rates, and efficiency decreases rapidly as loading rates increase. Further, P removal declines with time; hence, short-term studies can give misleadingly high estimates of ultimate P removal capacity. Removal of N in excess of the natural accumulation rate in the peat is apparently by denitrification. As with P, N removal efficiency decreases rapidly as wastewater N loading rates are increased. The denitrification rate may be limited by the nitrification rate of ammonium-N, nitrate-N, or by oxygen diffusion. From the sparse literature data available, it is estimated that 1 ha of wetland would be needed to remove 75% of the P and N generated by 15 and 20 people, respectively, or to remove 54% of the P and N generated by 50 people. Hence, wetland application is feasible only where wetlands are abundant and population densities are low. Large populations cannot be served by this means. (Zielinski-MAXIMA)

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87. An overview of constructed wetlands as alternatives to conventional waste treatment systems.

Hamilton, H.; Nix, P. G.; and Sobolewski, A.

Water Pollution Research Journal of Canada 28(3): 529-548. (1993)

NAL Call #: TD420.A1W34; ISSN: 0197-9140.

Notes: Conference: BIOQUAL '92 Meet., Vancouver, BC (Canada), 9-11 Jun 1992; Editors: Hall, E. R.

Descriptors: wetlands/ construction/ wastewater treatment/ hydrocarbons/ organic compounds/ biodegradation/ bacteria/ biofilms/ non patents/ microbial degradation/ environmental applications/ impact/ sewage & wastewater treatment/ wastewater treatment processes

Abstract: Constructed wetlands are an attractive alternative to conventional wastewater treatment under certain conditions. This review presents background information on wetland treatment and wetland design, and outlines the potential for wetlands to treat water contaminated with organic compounds including hydrocarbons. The major mechanisms that reduce contaminant concentrations in wetlands are sedimentation, filtration, chemical precipitation, microbial interaction and plant uptake. The presence of bacteria in "Biofilms" on the enormous plant and detrital surface area in wetlands is fundamental to their ability to degrade complex organic contaminants. There are few examples in the literature of wetlands being used to

control organic chemical pollution. However, the very high level of biochemical activity in the water column and upper sediment layer in wetlands, combined with a high degree of ecological resilience, suggests that wetlands can be an attractive low cost, low energy, low maintenance alternative to conventional treatment methods.

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88. An overview of major wetland functions and values.

Sather, J. H.; Smith, R. D.; and Western Energy and Land Use Team

Washington, D.C.: U.S. Fish and Wildlife Service; FWS/OBS-84/18, 1984.. iv + 68 p.

Notes: Microfiche item number: 611-R-1; Other number: SFA 29 (4)

Descriptors: wetlands/ management/ research/ ecology/ freshwater environment/ food chains/ nutrients/ trophic interactions/ habitats/ fishery/ aquatic birds/ sociological aspects/ economics/ hydrology/ water quality/ ecology and conservation/ aquaculture, aquariology and water use
© NISC

89. Overview of the hydrologic concerns related to wetlands in the United States.

Carter, V.

Canadian Journal of Botany 64(2): 364-374. (1986)

NAL Call #: 470 C16C; ISSN: 0008-4026

Descriptors: wetlands/ hydrologic aspects/ vegetation/ ecosystems/ surface-groundwater relationships/ hydrologic budget/ floods/ recharge/ base flow/ estuarine environment/ water quality

Abstract: Regional, geologic, topographic, and climatic differences create a tremendous diversity in wetland types and wetland vegetation in the United States. Wetland hydrology, a primary driving force influencing wetland ecology, development, and persistence, is as yet poorly understood. The interaction between groundwater and surface water and the discharge-recharge relationships in wetlands affect water quality and nutrient budgets as well as vegetative composition. Hydrologic considerations necessary for an improved understanding of wetland ecology include detailed water budgets, water chemistry, water regime, and boundary conditions. Wetland values are often based on perceived wetland functions. These hydrologic functions include (1) flood storage and flood-peak desynchronization, (2) recharge and discharge, (3) base flow and estuarine water balance, and (4) water-quality regulation. Expanded research and basic data collection focussed on wetland hydrology and its relation to wetland ecology are needed to identify and quantify the hydrologic functions of wetlands. (Lantz-PTT)

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90. Overview: Surface flow constructed wetlands.

Kadlec, R. H.

Water Science and Technology 32(3): 1-12. (1995)

NAL Call #: TD420.A1P7; ISSN: 0273-1223

Descriptors: wetlands/ design/ macrophytes/ marshes/ nutrients/ performance/ processes/ wastewater treatment

Abstract: Several hundreds of marshes have now been built primarily for the purposes of water quality improvement. This paper reviews statistics on the types and numbers and character of these low-tech water treatment wetlands. The operational processes are

discussed, including sedimentation, plant uptake, sorption, nutrient cycling, and chemical and microbial conversion. Performance has been good for reduction of suspended solids, biological oxygen demand, phosphorus, nitrogen, metals and some anthropogenic chemicals. Design procedures are evaluated, showing that the overly simplistic techniques used in the infancy of the technology may now be replaced by rational procedures based on the large and rapidly growing information base for constructed surface flow treatment wetlands. Ancillary wildlife and human use is an important part of this type of wetland, and should be acknowledged in design. Capital costs are low, but the principal financial advantage is the extremely low base cost of operation. Several hundreds of marshes have now been built primarily for the purposes of water quality improvement. This paper reviews statistics on the types and numbers and character of these low-tech water treatment wetlands. The operational processes are discussed, including sedimentation, plant uptake, sorption, nutrient cycling, and chemical and microbial conversion. Performance has been good for reduction of suspended solids, biological oxygen demand, phosphorus, nitrogen, metals and some anthropogenic chemicals. Design procedures are evaluated, showing that the overly simplistic techniques used in the infancy of the technology may now be replaced by rational procedures based on the large and rapidly growing information base for constructed surface flow treatment wetlands. Ancillary wildlife and human use is an important part of this type of wetland, and should be acknowledged in design. Capital costs are low, but the principal financial advantage is the extremely low base cost of operation.

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91. Parasitism and ecology of wetlands: A review.

Thomas, F.; Cezilly, F.; De Meeues, T.; Crivelli, A.; and Renaud, F.

Estuaries 20(3): 646-654. (1997)

NAL Call #: GC96.E79; ISSN: 0160-8347

Descriptors: wetlands/ ecosystems/ ecology/ coastal waters/ parasites/ reviews/ predation/ conservation/ literature reviews/ estuaries/ nature conservation/ species interactions: parasites and diseases/ ecology/ community studies

Abstract: Recent advances in ecology have suggested that parasites, through the spectrum of their effects, could act as key species in ecosystems. Wetlands are productive ecosystems within which parasitism is diversified. There already exists evidence for direct and indirect effects of parasites on their host species. The influence of parasites on the population ecology of hosts includes survival, castration, sexual selection, predation, and spatial distribution. Parasites can also affect the evolution of host biological diversity (i.e., genetic structure and interspecific competition) and trophic interactions between prey and predators. The key role parasites might play in the ecology of coastal waters and wetlands should be considered in conservation programs applied to such ecosystems.

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92. Perspectives on setting success criteria for wetland restoration.

Kentula, M. E.

Ecological Engineering 15(3-4): 199-209. (July 2000)

NAL Call #: TD1.E26; ISSN: 0925-8574

Descriptors: wetlands/ environmental restoration/ compliance/ environment management/ natural resources/ environmental protection/ conservation/ environmental policy/ performance evaluation/ planning/ restoration/ hydrology/ biota/ ecology/ terminology/ ecosystem management/ biodiversity/ structure-function relationships/ ecological evaluation/ soil fauna/ models/ compliance success/ functional success/ landscape success/ reclamation/ environmental action/ techniques of planning/ protective measures and control/ land/ general environmental engineering

Abstract: The task of determining the success of wetland restoration has long been challenging and sometimes contentious because success is an imprecise term that means different things in different situations and to different people. Compliance success is determined by evaluating compliance with the terms of an agreement, e.g. a contract or permit, whereas functional success is determined by evaluating whether the ecological functions of the system have been restored. Compliance and functional success have historically focused on the individual project (the site being restored); we are only beginning to consider another important factor, the success of restoration at the landscape scale. Landscape success is a measure of how restoration (or management, in general) has contributed to the ecological integrity of the region or landscape and to achievement of goals such as the maintenance of biodiversity. The utility of all definitions of success is ultimately constrained by the current status of the science of restoration ecology and by our ability to use that information to make sound management decisions and to establish measurable success criteria. Measurements of vegetation are most commonly used in evaluations of restoration projects, with less frequent analysis of soils, fauna, and hydrologic characteristics. Although particular characteristics of projects, such as vegetative cover and production, can resemble those in similar naturally occurring wetlands, overall functional equivalency has not been demonstrated. However, ongoing research is providing information on what can and cannot be accomplished, valuable insights on how to correct mistakes, and new approaches to defining success. The challenge is how to recognize and deal with the uncertainty, given that projects are ecologically young and that our knowledge of the process of restoration is evolving. One way to deal with the uncertainty is to use scientific principles of hypothesis testing and model building in an adaptive management framework. In this way, options can be systematically evaluated and needs for corrective actions identified when a project is not progressing toward goals. By taking such an approach we can improve our ability to reliably restore wetlands while contributing to our understanding of the basic structure and function of ecosystems.

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93. Phosphorus retention in streams and wetlands: A review.

Reddy, K. R.; Kadlec, R. H.; Flaig, E.; and Gale, P. M.

Critical Reviews in Environmental Science and Technology 29(1): 83-146. (1999)

NAL Call #: QH545.A1C7; ISSN: 1064-3389

Descriptors: wetlands/ phosphorus/ nutrients/ retention/ streams/ reviews/ kinetics/ biogeochemical cycle/ rivers/ nutrient cycles/ residence time/ biogeochemistry/ sources

and fate of pollution/ ecosystems and energetics/
composition of water/ behavior and fate characteristics/
freshwater pollution/ chemical processes

Abstract: Wetlands and streams buffer the interactions among uplands and adjacent aquatic systems. Phosphorus (P) is often the key nutrient found to be limiting in both estuarine and freshwater ecosystems. As such, the ability of wetlands and streams to retain P is key to determining downstream water quality. This article reviews the processes and factors regulating P retention in streams and wetlands and evaluates selected methodologies used to estimate P retention in these systems. Phosphorus retention mechanisms reviewed include uptake and release by vegetation, periphyton and microorganisms; sorption and exchange reactions with soils and sediments; chemical precipitation in the water column; and sedimentation and entrainment. These mechanisms exemplify the combined biological, physical, and chemical nature of P retention in wetlands and streams. Methodologies used to estimate P retention include empirical input-output analysis and mass balances, and process kinetics applied at various scales, including micro- and mesocosms to full-scale systems. Although complex numerical models are available to estimate P retention and transport, a simple understanding of P retention at the process level is important, but the overall picture provided by mass balance and kinetic evaluations are often more useful in estimating long-term P retention.

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94. Physiological-ecological impacts of flooding on riparian forest ecosystems.

Kozlowski, T. T.

Wetlands 22(3): 550-561. (Sept. 2002)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetland forests/ ecosystems/ riparian vegetation/ water resources management/ ecological effects/ water deficit/ flooding/ trees/ plant physiology/ plant growth/ mortality/ forests/ riparian environments/ ecophysiology/ riparian zone/ man-induced effects/ environmental impact/ flood control/ river engineering/ river basin management/ ecological impact of water development/ temperate forests/ habitat community studies/ soil pollution: monitoring, control and remediation

Abstract: Riparian forest ecosystems are important for their high productivity of biomass, their biodiversity, and ecological services including control of floods and erosion, removal of nutrients from agricultural runoff, alleviation of pollution effects, and as habitats for birds and mammals. Intermittent cycles of flooding by meandering streams followed by soil drainage are essential for regeneration, optimal growth, preservation of biodiversity, and sustainability of these valuable ecosystems. The straightening of river channels and disruption of intermittent river flow by dams lead to decreases in downstream forest productivity and ecological services, reflecting arrested forest regeneration, suppression of tree growth, and early tree mortality. These responses result from inadequate seed supplies and poor seedbeds, as well as deficiencies of ground water and mineral nutrients. Water deficits in downstream forest trees induce dysfunctions in photosynthesis and mineral nutrition, which lead to growth inhibition and plant mortality. Very few bottomland forest species can withstand extended soil inundation. Hence, prolonged upstream flooding by interruption of river flow is

followed by massive losses of biomass as a result of poor seed germination, arrested plant growth, and accelerated mortality of trees. The adverse impacts of flooding on upstream forests are associated with physiological dysfunctions induced by soil anaerobiosis.

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95. Phytoremediation in wetland ecosystems: Progress, problems, and potential.

Williams, J. B.

Critical Reviews in Plant Sciences 21(6): 607-635. (2002)
NAL Call #: QK1.C83; ISSN: 0735-2689 [CRPSD3].

Notes: Special issue: Phytoremediation II/ edited by B.V. Conger. Includes references.

Descriptors: wetlands/ bioremediation/ seasonal variation/ plant succession/ site factors/ heavy metals/ litter plant/ waste disposal/ rhizosphere/ indicator species/ temporal variation/ toxicity/ organic compounds/ herbicides/ pesticides/ explosives/ soil pollution/ evapotranspiration/ petroleum/ petroleum hydrocarbons/ plant communities/ monitoring/ literature reviews

This citation is from AGRICOLA.

96. Phytosociology and succession on earthquake-uplifted coastal wetlands, Copper River Delta, Alaska.

Thilenius, J. F. Pacific Northwest Research Station, USDA Forest Service, 1995. 58 p. General Technical Reports .

NAL Call #: aSD11.A46 no.346

<http://www.fs.fed.us/pnw/pubs/gtr346.pdf>

Descriptors: wetlands/ deltas/ earthquakes/ marshes/ plant communities/ plant succession/ salinity/ shrubs/ tides/ woody plants/ *Carex*/ plants

Abstract: The delta formed by the Copper River stretches more than 75 kilometres along the south-central coastline of Alaska, USA. It is the terminus of the outwash deposits from a large part of the most heavily glaciated region of North America, and all major rivers that flow into the delta carry extremely high levels of suspended sediments. Coastal wetlands extend inland for as much as 20 kilometres. In 1964, an earthquake of Richter Scale 8.4 to 8.6 raised the entire delta from 1.8 to 3.4 metres above the previous mean sea level. Subtidal areas became intertidal, and intertidal areas supertidal. Marshland advanced seaward as much as 1.5 kilometres in the intertidal zone. Vegetation on many, but not all, newly supertidal levees began to change from herb to shrub. A change in frequency and duration of tidal inundation and water salinity has been thought to be the most obvious cause of this succession, but explanation is lacking. Fresh water dominates the estuarine circulation as a result of a bar-built estuary and the extremely high input of fresh water from glacier runoff and precipitation. Tides merely raise fresh water onto the wetlands. Halophytes are rare even at the seaward edge of vegetation. The characteristic species of the present intertidal marshes, *Carex lyngbyei*, is also the characteristic of inland fresh water marshes. Initial postearthquake invasion of woody plants was confined to natural levees. More recently, shrubs have begun to move seaward into new intertidal marshland and into supertidal interlevee basins. Current plant communities on new marshland (tidal) are *Carex* C-T (low marsh); *Carex* C-T (high marsh); *Carex*/Potentilla C-T (low levee); and *Myrica*/*Carex*-*Potentilla* C-T (high levee). On old marshland (nontidal) the current plant communities are *Alnus*/*Myrica*-*Salix*/*Carex* C-T (foreshore levee); *Myrica*/*Carex*-*Calamagrostis* (foreshore

levee); *Carex/Equisetum-Lathyrus* C-T (interior levee); *Carex/Lathyrus* C-T (moderately hydric interlevee basin); and *Carex-Cicuta/C-T* (hydric interlevee basin). Vegetation analogous to that developing on supertidal levees and basins is present on older wetland habitats further inland. Likely, the same plant successions would have occurred without an uplift. The uplift appears to have altered locations and rates, but not the nature, of wetland plant succession on the Copper River Delta.

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97. Picoplankton dynamics in a hypertrophic semiarid wetland.

Ortega-Mayagoitia, E.; Rodrigo, M. A.; Rojo, C.; and Alvarez-Cobelas, M.

Wetlands 22(3): 575-587. (Sept. 2002)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ ecology/ plankton/ bacterial/ cyanophyta/ population dynamics/ spatial distribution/ temporal distribution/ experimental data/ nutrients/ grazing/ semiarid environments/ abundance/ nanoplankton/ phytoplankton/ zooplankton/ trophic structure/ water budget/ algae/ bacteria/ Spain/ bacteria/ algae/ productivity

Abstract: This study was carried out on a neglected component of wetlands: the picoplankton community. We analyzed the picoplanktonic community patterns and their related environmental factors in a hypertrophic semi-arid wetland located in Central Spain (Las Tablas de Daimiel National Park, TDNP). We determined the bacterial and autotrophic picoplankton (APP) abundance over a three-year period (1996: the end of a long drought period and 1997-1998: after flooding) in five sites of the wetland. The overall range of bacterial abundance was 0.2×10^6 to 10×10^6 cells/ml. The annual mean abundance increased in the wettest 1997. APP was composed mainly by coccoid phycocyanin-containing cyanobacteria, with the greatest abundance up to 25×10^5 cells/ml. The annual mean also increased considerably in wetter 1997-98. Despite the large APP biomass in some sites, its percentage of total phytoplankton biomass was low (the annual average did not exceed 1.5%). We observed spatial heterogeneity in the picoplankton fraction depending on the fluctuating hydrology: bacteria tends to spatial homogeneity after flooding while APP showed only similarity among the output sites. Among the considered predictive variables (temperature, phosphorus, nitrogen, zooplankton, phytoplankton) of the picoplanktonic dynamics, temperature was the most closely correlated to picoplankton, especially to bacterial abundance. Further, in two factorial, coupled-hierarchical laboratory experiments (constant temperature), we searched for control mechanisms of picoplankton. We tested (a) the trophic cascade hypothesis by analyzing the effect of presence/absence of mosquitofish (experiment 1) or directly modifying the zooplanktonic community (experiment 2) and (b) the bottom-up regulation by altering the nutrient conditions (presence/absence of sediment in experiment 1; reducing the nutrient content in experiment 2). Bacterioplankton failed to show any behavior related to trophic cascade direct effects, while nutrients increased its abundance. APP was affected positively by nutrients and negatively by zooplankton grazing.

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98. Plant-mediated controls on nutrient cycling in temperate fens and bogs.

Aerts, R.; Verhoeven, J. T. A.; and Whigham, D. F.

Ecology 80(7): 2170-2181. (1999)

NAL Call #: 410 Ec7; ISSN: 0012-9658

Descriptors: bogs/ climate control of nutrient cycling/ decomposition/ evergreen/ fens/ leaf life-span/ litter chemistry effects on decomposition/ mineralization/ nutrient cycling/ nutrient resorption/ nutrient-use efficiency/ sphagnum/ temperate

Abstract: This paper reports on patterns in plant-mediated processes that determine the rate of nutrient cycling in temperate fens and bogs. We linked leaf-level nutrient dynamics with leaf-litter decomposition and explored how the observed patterns were reflected in nutrient cycling at the ecosystem level. Comparisons were made among growth forms (evergreen and deciduous shrubs and trees, graminoids and Sphagnum mosses) and between mire types (fens and bogs). A literature review showed that the predominant growth form was more important as a determinant of leaf-level nutrient-use efficiency (NUE) than mire type (fen vs. bog). Evergreens had the highest N and P use efficiency. The growth form differences in NUE were mainly determined by differences in N and P concentrations in mature leaves and not by differences in resorption efficiency from senescing leaves. Sphagnum leaves had lower N and P concentrations than the other growth forms, but because of a lack of data on nutrient resorption efficiency the NUE of these mosses could not be calculated. Nitrogen use efficiency did not differ among fen and bog species, whereas bog species had a higher P use efficiency than fen species. However, a complete evaluation of mire-type or growth-form effects on NUE is only possible when data become available about nutrient resorption from senescing Sphagnum leaves. As leaf-level NUE is negatively correlated with leaf-litter nutrient concentrations, there is a direct link between NUE and litter decomposition rate. Rates of litter decomposition of Sphagnum mosses are lower than in the other growth forms, but there is still much speculation about possible reasons. The role of litter chemistry of Sphagnum mosses (including decay inhibitors and decay-resistant compounds) in decomposition especially warrants further study. The strongly deviating nutritional ecology of Sphagnum mosses clearly distinguishes fens and bogs from other ecosystems. Moreover, N and P concentrations in mature leaves from vascular plant species from fens and bogs are in almost all cases lower and leaf-level N use efficiency is higher than in species from other ecosystems, irrespective of the growth form considered. Both literature data and data from a comparative study on soil nutrient cycling in temperate fens and bogs in the United States (Maryland), The Netherlands, and Poland showed that nutrient mineralization did not differ clearly between fens and bogs. The comparative study further showed that cellulose decomposition in bogs was lower than in fens and that nutrient mineralization was higher in forested than in herbaceous mires. The occurrence of dominant growth forms was clearly related to soil nutrient-cycling processes, and observed patterns were in agreement with patterns in the components of NUE as found in the literature study. We conclude that a protocol with standardized procedures for measuring various nutrient-cycling process rates that is used by scientists in

various wetland types and geographical regions is a useful tool for unravelling large-scale patterns in soil nutrient-cycling processes in wetlands and for linking plant-mediated nutrient dynamics with ecosystem nutrient-cycling processes.

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99. Pollution filtration by plants in wetland-littoral zones.

Mickle, A. M.

Proceedings of the Academy of Natural Sciences Philadelphia 144: 282-290. (1993)

NAL Call #: 500 P53; ISSN: 0097-3157 [PANPA5].

Notes: Literature review. Includes references.

Descriptors: wetlands/ aquatic plants/ bog plants/ filtration/ purification/ waste water/ waste water treatment/ coastal areas/ literature reviews

This citation is from AGRICOLA.

100. Pre-European settlement conditions and human disturbance of a coniferous swamp in southern Ontario.

Bunting, M. J.; Morgan, C. R.; Van Bakel, M.; and Warner, B. G.

Canadian Journal of Botany 76(10): 1770-1779. (Oct. 1998)

NAL Call #: 470 C16C; ISSN: 0008-4026

Descriptors: wetlands/ plant communities/ succession/ paleoecology/ human impact/ swamps/ palaeoecology/ man-induced effects/ land use/ ecological succession/ pollen/ human settlements/ forests/ rare species/ community composition/ community structure/ terrestrial ecosystems/ *Picea mariana*/ *Plantae*/ sphagnum/ Canada, Ontario/ black spruce/ mechanical and natural changes/ human population-biosphere interactions

Abstract: A vegetation survey at Oil Well Bog, southern Ontario, suggested that the central *Picea mariana* - Sphagnum (black spruce swamp) community represented the most mature point in the wetland succession. Pollen analysis of short sediment cores from beneath three major communities in the wetland (black spruce swamp, white pine swamp, and low shrub swamp) showed that the black spruce community only became established in the last 100 years. From around 2000 BP, the wetland was dominated by low shrubs with a tall shrub element. Upland forest composition around the wetland changed around 500 BP, with a decrease in percentages of *Fagus* and an increase in *Pinaceae*. At the same time trees colonized parts of the wetland. When the upland forest was cleared by European settlers (ca. AD 1830-1845), low shrub communities reestablished, suggesting that initially the wetland surface became wetter. Over time, the present-day mosaic of swamp types began to develop. The pollen analyses showed that the black spruce swamp is present as a result of changes in the wetland hydrology induced by human activity, and the fragmentary low shrub vegetation community (which contains locally rare plant species) represents a relic of the pre-European settlement wetland community.

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101. Processes of wetland loss in India.

Foote, A. Lee; Pandey, Sanjeeva; and Krogman, Naomi T.

Environmental Conservation 23(1): 45-54. (1996)

NAL Call #: QH540.E55; ISSN: 0376-8929

Descriptors: agronomy: agriculture/ conservation/ forestry/

freshwater ecology: ecology, environmental sciences/ accumulative water demand/ agricultural conversion/ altered upper watershed/ biodiversity/ conservation/ defoliation/ deforestation/ ground water depletion/ hydrologic alteration/ inundation/ oriental region/ resource management/ water quality degradation/ wetland consolidation/ wetland loss

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102. Progress in wetland restoration ecology.

Zedler, J. B.

Trends in Ecology & Evolution 15(10): 402-407. (Oct. 2000)

NAL Call #: QH540.T74; ISSN: 0169-5347

Descriptors: wetlands/ environmental restoration/ research programs/ restoration/ environmental factors/ ecology/ reclamation/ protective measures and control

Abstract: It takes more than water to restore a wetland. Now, scientists are documenting how landscape setting, habitat type, hydrological regime, soil properties, topography, nutrient supplies, disturbance regimes, invasive species, seed banks and declining biodiversity can constrain the restoration process. Although many outcomes can be explained post hoc, we have little ability to predict the path that sites will follow when restored in alternative ways, and no insurance that specific targets will be met. To become predictive, bolder approaches are now being developed, which rely more on field experimentation at multiple spatial and temporal scales, and in many restoration contexts.

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103. Regional diversity of temporary wetland carabid beetle communities: A matter of landscape features or cultivation intensity?

Brose, Ulrich

Agriculture Ecosystems and Environment 98(1-3): 163-167. (2003)

NAL Call #: S601.A34; ISSN: 0167-8809

Descriptors: agriculture/ biodiversity/ ecology: environmental sciences/ cultivation intensity/ habitat heterogeneity/ landscape ecology/ landscape features/ landscape structure/ macro ecology/ regional diversity/ species richness/ temporary wetland community

Abstract: The challenge of finding applicable indicators for sustainable agriculture requires evaluations at regional scales to lead to policy-relevant results. In this study, the regional diversity of temporary wetland carabid beetles was analysed for six landscapes of 10 km² each. The relative importance of landscape features and cultivation intensity for the regional diversity was compared. Total species richness was correlated with the mean soil-indices that were used as indicators of cultivation intensity. This is consistent with studies on local scales, which emphasise the importance of cultivation intensity for arthropod communities. The diversity of wetland and habitat-specific species correlated with the temporary wetlands mean duration of flooding and the density of temporary wetlands, but apart from this, there was no impact of landscape features on diversity. These results do not corroborate concepts of using indices of landscape structure as biodiversity indicators, but the importance of cultivation intensity cannot be too strongly emphasised.

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104. Restoration of aquatic ecosystems: Science, technology, and public policy.

Committee on Restoration of Aquatic Ecosystems: Science, Technology and Public Policy and National Research Council

Washington, DC: National Academy Press; 576 pp. (1992)

NAL Call #: QH541.5.W3N38 1992; ISBN: 0309092884

<http://fermat.nap.edu/catalog/1807.html>

Descriptors: wetlands/ environmental restoration/ aquatic ecosystems/ rivers/ lakes/ environmental management/ aquatic environment/ USA/ books/ environmental management/ aquatic environments/ environmental restoration/ aquatic ecosystems/ books/ conservation, wildlife management and recreation/ environmental action/ basic approaches, concepts, and theory/ reclamation
Abstract: This volume examines the prospects for repairing the damage society has done to the USA's aquatic resources: lakes, rivers and streams, and wetlands. Restoration of Aquatic Ecosystems outlines a national strategy for aquatic restoration, with practical recommendations covering both the desired scope and scale of projects and needed government action. It features case studies of aquatic restoration activities throughout the country. With a wealth of data and commentary, the book examines key concepts and techniques used in restoration; common factors in successful restoration efforts; threats to the health of the nation's aquatic ecosystems; approaches to evaluation before, during, and after a restoration project; and the emerging specialties of restoration and landscape ecology--and how they will contribute to better integration of restoration efforts. Individual chapters provide an overview; a selective history of aquatic ecosystem management; planning and evaluating ecosystem restoration; lakes; rivers and streams; wetlands; integrated ecosystem restoration; and a national restoration strategy. An appendix discusses restoration case studies.

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105. Restoration of temperate wetlands.

Wheeler, Bryan D.

Chichester; New York: Wiley; xiv, 562 p.: ill. (1995)

Notes: Papers from a symposium held at the University of Sheffield, England in Sept. 1993. Includes bibliographical references and index.

NAL Call #: QH541.5.M3R47 1995; ISBN: 0471951056

Descriptors: wetland ecology--congresses/ restoration ecology--congresses/ wetland conservation--congresses
This citation is from AGRICOLA.

106. Restored wetlands as management tools for wetland-dependent birds.

Dick, Thomas M.

Pennsylvania Birds 7(1): 4-6. (1993); ISSN: 0898-8501

Descriptors: wetlands/ birds/ communities/ ecosystems/ habitat management/ management/ restoration/ wildlife
© NISC

107. Review and assessment of methane emissions from wetlands.

Bartlett, K. B. and Harriss, R. C.

Chemosphere 26(1-4): 261-320. (1993)

NAL Call #: TD172.C54; ISSN: 0045-6535

Abstract: The number of emission measurements of methane (CH₄) to the atmosphere has increased greatly in recent years, as recognition of its atmospheric chemical

and radiative importance becomes widespread. In this report, we review progress on estimating and understanding both the magnitude of, and controls on, emissions of CH₄ from natural wetlands. We also calculate global wetland CH₄ emissions using this extensive flux data base and the wetland areas compiled and published by Matthews and Fung (1987). Tropical regions (20° N-30° S) were calculated to release 66 TgCH₄/yr, 60% of the total wetland emission of 109 Tg/yr. Flux data from tropical wetlands, reported only within the last four years, are currently restricted in geographic coverage. Additional data from other regions will be required to confirm these calculated large emissions. Although emissions from subtropical and temperate wetlands (45° N-20° N and 30° S-50° S) were relatively low at 5 Tg/yr, the process-oriented focus of most of the research in this region suggests that work at these latitudes may serve as models to examine controls and possible uncertainties in estimating fluxes. These types of efforts are frequently not possible in more remote, globally significant wetlands. Northern wetlands (north of 45° N) were calculated to release a total of 38 TgCH₄/yr (34% of total flux); 34 Tg/yr from wet soils and 4 Tg/yr from relatively dry tundra. These latitudes have been the focus of recent intensive research. Significant differences between the relatively large flux data bases accumulated in the two primary measurement areas, northern Minnesota and the Hudson Bay Lowlands of Canada, indicate that extrapolation from one wetland region to another may be subject to considerable error. Global emissions were also compared to fluxes calculated using the wetland areas published by Aselmann and Crutzen (1989) in an effort to assess uncertainties due to wetland area estimates. Further refinement of wetland CH₄ emissions awaits flux measurements from large areas currently lacking data, particularly in the tropics and the Siberian Lowlands, more realistic assessments of seasonal active periods, and accurate, up-to-date habitat classification and measurement.

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108. A review on habitats, plant traits and vegetation of ephemeral wetlands: A global perspective.

Deil, Ulrich

Phytocoenologia 35(2-3): 533-705. (2005)

NAL Call #: QK911.P52; ISSN: 0340-269X

Descriptors: terrestrial ecology/ environmental sciences/ systematics and taxonomy/ plant traits/ ephemeral wetlands
Abstract: Based upon a world-wide literature review and a database, which refers to 250 publications and documents about 8500 phytosociological relevés, the following questions are discussed: What are the common ecological parameters for temporary wetlands and which environmental conditions offer a niche for dwarf ephemerals? Which taxa have evolved and speciated within ephemeral wetland habitats? How do the relations between relief features, local hydrology and climatic conditions change in different parts of the world? Which global patterns in flora and vegetation do occur? The review is restricted to ephemeral freshwater ecosystems with the following two properties: Above-ground plant cover is seasonal, and the habitats are water-saturated or submerged only part of the year. For a better understanding of large-scale patterns, the results of studies about small-scale zonation, variability in time (phenology and year-to-year dynamics), ecophysiology and life strategies are briefly

reported. Finally, conservation aspects and trends of floristic globalization are considered.

1. Seasonal pools: They occur in semi-arid and subhumid climates at both sides of the Tropic of Cancer. The catchment areas are local or the ponds are purely rainwater systems.
2. Amphibic shorelines of permanent ponds, lakes and rivers: They concentrate in perhumid extratropical temperate zones and in orotropical climates. Along allochthonous rivers with extended catchments and with seasonal flood pulse, large temporary flood-plains also occur in semi-arid regions.
3. Ephemeral flush habitats: In the perhumid tropics and in the subhumid subtropics, ephemeral wetlands are linked to runoff-habitats like the slopes of inselbergs and rock outcrops and to interflow habitats along intermittent streams. The distribution of some keystone taxa reflects the present climatic differentiation of the globe and to some extent also historical events (palaeogeography, speciation processes). *Myosurus* for example is linked to extratropical regions, *Lilaeopsis* to the New World and the Southern Hemisphere, *Limnophila* and *Rhamphicarpa* to the Palaeotropical region. Vicariance patterns are a common phenomenon. Examples can be seen in *Isoetes*, *Marsilea*, *Ophioglossum*, *Juncus* (sections *Tenageia*, *Ozophyllum* and *Caespitosi*), *Limosella*, *Crassula* (section *Helophyllum*), *Bacopa*, *Hydrocotyle*, *Eriocaulon* and *Xyris*. These genera speciated within this environment and evolved habitat equivalent species. The reduced size and the spatial isolation of the habitat reduce gene flow and favour allopatric speciation. The variability in time and small-scale ecological gradients stimulate sympatric speciation by temporal separation of the populations. Niche-equivalent taxa replace each other in different parts of the world. The niche of dwarf ephemeroïd annuals is occupied by *Centrolepidaceae* in the Australian region, by *Restionaceae* in the Capensis, by *Eriocaulaceae* in the Australian region and East Asia, by *Juncaceae* in the holarctic kingdom, by *Orcuttieae* in the Californian phytogeographical sector, and by *Cyperaceae*, *Crassulaceae*, *Gentianaceae*, *Elatinaceae* and *Apiaceae* in all floristic kingdoms. Other predominant life forms are herbaceous perennials with the isoetid syndrome, geophytic ferns (*Ophioglossum*, *Marsilea*), carnivorous plants from the families *Lentibulariaceae* and *Droseraceae*, and polkilohydric vascular plants with the xyroid syndrome. The latter occur in the Tropics, with *Xyridaceae* (pantropical), *Velloziaceae* (neotropical region), *Afrotrilepis*, *Craterostigma*, *Lindernia*, *Chamaegigas* (palaeotropical region), *Trilepis* (neotropical region) and *Borya* (Australian region).

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109. Riparian wetlands and water quality.

Gilliam, J. W.

Journal of Environmental Quality 23(5): 896-900. (1994)

NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: nitrate/ phosphorus/ plant (Plantae unspecified)/ Plantae (Plantae unspecified)/ plants/ drainage/ farming/ nitrate/ nonpoint source pollution/ phosphorus/ urban activity/ wet soils

Abstract: Because of wet soils adjacent to the streams, riparian buffers are frequently present between farming and urban activities on the uplands and small streams. These riparian areas have been shown to be very valuable for the removal of nonpoint-source pollution from drainage water. Several researchers have measured 90% reductions in sediment and nitrate concentrations in water flowing

through the riparian areas. The riparian buffers are less effective for P removal but may retain 50% of the surface-water P entering them. I consider riparian buffers to be the most important factor influencing nonpoint-source pollutants entering surface water in many areas of the USA and the most important wetlands for surface water quality protection.

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110. The role of wetlands in the hydrological cycle.

Bullock, A. and Acreman, M.

Hydrology and Earth System Sciences 7(3):

358-389. (2003)

NAL Call #: GB651.H937; ISSN: 1027-5606

Descriptors: wetlands/ hydrology/ stream flow rate/ water management/ floods/ ground water/ policies/ flood control/ hydrologic cycle/ wetlands hydrology/ water balance/ groundwater recharge/ flood plains/ river flow variations/ streamflow analysis/ low flow/ river flow/ hydrologic models/ aquifers/ water supply/ surface-groundwater relations/ base flow

Abstract: It is widely accepted that wetlands have a significant influence on the hydrological cycle. Wetlands have therefore become important elements in water management policy at national, regional and international level. There are many examples where wetlands reduce floods, recharge groundwater or augment low flows. Less recognised are the many examples where wetlands increase floods, act as a barrier to recharge, or reduce low flows. This paper presents a database of 439 published statements on the water quantity functions of wetlands from 169 studies worldwide. This establishes a benchmark of the aggregated knowledge of wetland influences upon downstream river flows and groundwater aquifers. Emphasis is placed on hydrological functions relating to gross water balance, groundwater recharge, base flow and low flows, flood response and river flow variability. The functional statements are structured according to wetland hydrological type and the manner in which functional conclusions have been drawn. A synthesis of functional statements establishes the balance of scientific evidence for particular hydrological measures. The evidence reveals strong concurrence for some hydrological measures for certain wetland types. For other hydrological measures, there is diversity of functions for apparently similar wetlands. The balance of scientific evidence that emerges gives only limited support to the generalised model of flood control, recharge promotion and flow maintenance by wetlands portrayed throughout the 1990s as one component of the basis for wetland policy formulation. That support is confined largely to floodplain wetlands, while many other wetland types perform alternate functions - partly or fully. This paper provides the first step towards a more scientifically defensible functional assessment system.

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111. Saline wetlands related to groundwater flows from low permeability Tertiary formations in the Somontano area of Huesca, Spain.

Sanchez Navarro, J. A.; Coloma Lopez, P.; and Perez Garcia, A.

Hydrological Processes 15(4): 633-642. (Mar. 2001)

NAL Call #: GB651.H93; ISSN: 0885-6087

Descriptors: wetlands/ surface-groundwater relations/

groundwater movement/ permeability/ model studies/ alkalinity/ soil chemistry/ salinity/ ground water/ saline water/ rivers/ tertiary/ irrigation/ soils/ saline intrusion/ Spain, Aragon, Huesca/ dynamics of lakes and rivers
Abstract: Presence of groundwater flow in the 'Somontano de Huesca' Area, derived from low-permeability detrital Tertiary rocks, is considered. A groundwater flow model is constructed for these Tertiary rocks. This model explains both water flow through them and the chemical characteristics of the water. Groundwater flow has clear surface manifestations: it causes wetlands (which are called 'paules' in the area) with sodic waters, it produces saline, sodic or alkaline soils, and it produces modifies the chemical composition of rivers in Somontano. Irrigation has increased the volume of filtered water, especially in the interfluvial areas, causing the extension of the wetlands in the valley thalwegs, and also the greater movement of salts has increased the problems of saline and/or sodic soils in the area.

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112. Salt marsh tidal channel morphometry: Applications for wetland creation and restoration.

Zeff, M. L.

Restoration Ecology 7(2): 205-211. (June 1999)

NAL Call #: QH541.15.R45R515; ISSN: 1061-2971

Descriptors: wetlands/ salt marshes/ tides/ drainage/ hydrology/ channels/ geomorphology/ environmental restoration/ coastal environments/ restoration/ meandering/ tidal inlets/ fluvial morphology/ morphometry/ USA, New Jersey/ reclamation/ protective measures and control/ habitat community studies/ topography and morphology
Abstract: The morphometry of tidal channels in a back-barrier salt marsh in New Jersey was investigated.

Characteristics of the tidal channel drainage network plan form (order, bifurcation ratio, length, sinuosity) and cross section channel form (width:depth ratio, hydraulic geometry) are compared with data from other studies. Drainage patterns follow Horton's Law of Stream Numbers and Law of Stream Lengths. Mitigation sites should be designed in accordance with these laws. The degree to which site-specific substrate, vegetation, and flow conditions constrain or facilitate the development of sinuous, meandering channel reaches should be estimated to provide information for the design of tidal channel geometries and dimensions that will accommodate predicted discharges. Drainage networks in created and restored wetlands should reflect the spatial distribution of width and depth properties (width:depth ratios, cross-sectional areas, longitudinal slopes, hydraulic geometry) found in similar natural systems. Reproducing these characteristics will lessen the practice of oversizing channels. Hydraulic geometry relationships can facilitate the sizing of channels at Atlantic coast salt marsh mitigation sites. Recommendations are given to promote the development of drainage networks that function like the coastal back-barrier Avalon/Stone Harbor marsh in New Jersey.

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113. Salt marshes: Biological controls of food webs in a diminishing environment.

Valiela, Ivan; Rutecki, Deborah; and Fox, Sophia

Journal of Experimental Marine Biology and Ecology 300 (1-2): 131-159. (2004)

NAL Call #: QH91.A1J6; ISSN: 0022-0981

Descriptors: literature review/ role of biological controls in coastal salt marsh food webs/ diet/ bottom up and top down controls in food webs/ ecology/ food webs/ predators/ top down controls in food webs/ coastal salt marshes/ salt marsh/ coastal saltmarsh ecosystem/ role of bottom up and top down controls/ wetland habitat decline relations/ review

Abstract: This essay reviews two important topics in coastal ecology: the work on the relative role of bottom-up and top-down controls in natural communities and the loss of wetlands worldwide. In salt marshes and other coastal wetlands, bottom-up and top-down mechanisms of control on natural communities are pervasive. Bottom-up effects through nutrient supply may propagate to upper trophic levels via better food quality, or indirectly by altering water and sediment quality. Top-down control by consumers alters lower trophic levels through consumption of primary producers, and indirectly by trophic cascades in which higher predators feed on grazers. The combined forcing of bottom-up and top-down controls govern assemblages of species in natural communities, mediated by physical and biogeochemical factors. Although there is much information about biological controls of coastal food webs, more information is needed. Even more important is that large losses of wetland are occurring along coastlines worldwide due to a variety of economic and social activities including filling, wetland reclamation, and sediment interception. Such losses are of concern because these wetlands provide important functions, including export of energy-rich material to deeper waters, nursery and stock habitats, shoreline stabilization, and intercept land-derived nutrients and contaminants. These important functions justify conservation and restoration efforts; barring such efforts, we will find it increasingly difficult to find coastal wetlands where we can continue to gain further understanding of ecology and biogeochemistry and lack the aesthetic pleasure these wetlands provide to so many of us.

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114. Salt marshes: Present functioning and future change.

Boorman, L. A.

Mangroves and Salt Marshes 3(4): 227-241. (1999);

ISSN: 1386-3509

Descriptors: salt marshes/ coastal zone management/ habitats/ nutrients/ organic matter/ climatic changes/ environmental protection/ nature conservation/ sea level changes/ environmental impact/ pollution monitoring/ pollutant persistence/ ecosystem disturbance

Abstract: Salt marshes are no longer viewed as intertidal wastelands of little value to anyone. They are now widely recognised as playing a major role in coastal defence, in wildlife conservation on the coast and as a key source of organic material and nutrients vitally important for a wide range of marine communities. This appreciation of the importance of salt marshes has been brought even more sharply into focus because of the threats posed by predicted rise in sea level as a result of global climatic change. Three decades ago the possibilities of exchanges of organic matter between salt marshes and the sea were

already being recognised in certain areas but it is only in the past five years or so that this process has been studied in a wide range of different areas. Detailed studies have been made into the way that salt marsh fluxes change with the development of increasingly mature and, therefore, increasingly complex salt marsh communities. As well as being sources and sinks of mineral nutrients and organic matter, salt marshes can also function as a sink for pollutants that would otherwise be damaging to the environment. Salt marshes also act as a sink for the sediment within coastal ecosystems. Through their various functions they can be seen to be acting as dynamic living filters for various ecologically important materials. With increasing threats to the survival of salt marshes as a result of man's activities in the coastal zone being augmented by the threats from predicted sea level rise, a new approach to salt marsh conservation has come to the fore and that is the actual creation of new salt marshes. For this process to be fully effective we have to make full use of our increased understanding of salt marsh structure and function. Following a review of the current state of the art in the field of salt marsh research, an assessment is made of specific future research needs. Despite the greatly increased effort which has been directed to salt marsh research over the past few years we still have to recognise that resources are limited and, therefore, critical evaluations of the various options regarding the direction of our future efforts need to be made.

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115. Saltmarshes in a time of change.

Adam, P.

Environmental Conservation 29(1): 39-61. (2002)

NAL Call #: QH540.E55; ISSN: 0376-8929

Descriptors: salt marshes/ sea level/ sedimentation/ human impact/ environment management/ environmental quality/ exotic species/ resources management/ ecological effects/ water resources planning/ environmental policy/ tides/ aquatic habitats/ human factors/ sustainable development/ intertidal environment/ ecosystem management/ climatic changes/ greenhouse effect/ sea level changes/ tidal range/ erosion control/ man-induced effects/ world oceans

Abstract: Saltmarshes are a major, widely distributed, intertidal habitat. They are dynamic systems, responding to changing environmental conditions. For centuries, saltmarshes have been subject to modification or destruction because of human activity. In this review, the range of factors influencing the survival of saltmarshes is discussed. Of critical importance are changes in relative sea level and in tidal range. Relative sea level is affected by changes in absolute sea level, changes in land level and the capacity of saltmarshes to accumulate and retain sediment. Many saltmarshes are starved of sediment because of catchment modification and coastal engineering, or exposed to erosive forces, which may be of natural origin or reflect human interference. The geographical distribution of individual saltmarsh species reflects climate, so that global climatic change will be reflected by changes in distribution and abundance of species, although the rate of change in communities dominated by perennial plants is difficult to predict. Humans have the ability to create impacts on saltmarshes at a range of scales from individual sites to globally. Pressures on the environment created by the continued increase in the human population, particularly in developing tropical

countries, and the likely consequences of the enhanced greenhouse effect on both temperature and sea level give rise to particular concerns. Given the concentration of population growth and development in the coastal zone, and the potential sensitivity of saltmarsh to change in sea level, it is timely to review the present state of saltmarshes and to assess the likelihood of changes in the near (25 years) future. By 2025, global sea level rise and warming will have impacts on saltmarshes. However, the most extensive changes are likely to be the direct result of human actions at local or regional scales. Despite increasing recognition of the ecological value of saltmarsh, major projects involving loss of saltmarshes but deemed to be in the public interest will be approved. Pressures are likely to be particularly severe in the tropics, where very little is known about saltmarshes. At the local scale the cumulative impacts of activities, which individually have minor effects, may be considerable. Managers of saltmarshes will be faced with difficult choices including questions as to whether traditional uses should be retained, whether invasive alien species or native species increasing in abundance should be controlled, whether planned retreat is an appropriate response to rising relative sea level or whether measures can be taken to reduce erosion. Decisions will need to take into account social and economic as well as ecological concerns.

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116. Shift in wetland plant composition and biomass following low-level episodes in the St. Lawrence River: Looking into the future.

Hudon, Christiane

Canadian Journal of Fisheries and Aquatic Sciences 61(4): 603-617. (2004)

NAL Call #: 442.9 C16J; ISSN: 0706-652X

Descriptors: freshwater ecology: ecology, environmental sciences/ terrestrial ecology: ecology, environmental sciences/ agricultural landscape/ climate change/ emergent waterlogged mudflats/ faunal habitats/ human intervention/ industrialized landscape/ low level episodes/ natural hydrologic variability/ shoreline alteration/ urbanized landscape/ water level fluctuations: future effects, past effects/ wetland plant biomass shifts/ wetland plant composition shifts

Abstract: The effects of a 1-m drop in average water levels in 1999 on species composition and biomass were documented for a St. Lawrence River wetland and compared with a similar episode in 1931. These observations highlight the manifold effects of past and future water level fluctuations on St. Lawrence River wetlands and faunal habitats, resulting from natural hydrologic variability, climate change, and (or) human intervention. In 1931 and 1999, waters were 2-3 degreeC warmer than the previous 10-year average. Low water levels markedly altered wetland vegetation: various Graminea (including *Phalaris arundinacea* and *Phragmites australis*) and facultative annual species invaded previously marshy areas. Submerged species previously found in shallow waters were replaced on dry ground by annual terrestrial plants; *Alisma gramineum* colonized emergent waterlogged mudflats. The low water levels of 1999 induced a spatially discontinuous plant biomass that was richer in terrestrial material than in previous years (1993-1994). In comparison with the 1930s, recent surveys indicate a decline of assemblages dominated by *Equisetum*

spp. and *Najas flexilis* and a rise of those dominated by *Lythrum salicaria*, *Potamogeton* spp., and filamentous algae. These shifts reveal the additional effects of nutrient enrichment, alien species, and shoreline alteration accompanying a change from a mostly agricultural to a mostly urbanized and industrialized landscape.

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117. A simple wetland habitat classification for boreal forest waterfowl.

Rempel, R. S.; Abraham, K. F.; Gadawski, T. R.; Gabor, S.; and Ross, R. K.

Journal of Wildlife Management 61(3): 746-757. (July 1997)
NAL Call #: 410 J827; ISSN: 0022-541X

Descriptors: wetlands/ classification systems/ nature conservation/ aquatic birds/ habitats/ forests/ waterfowl/ surveys/ classification/ marshes/ habitat/ community structure/ Aves/ Canada, Ontario, Cochrane, Great Clay Belt/ habitat/ birds/ conservation, wildlife management and recreation/ network design/ birds

Abstract: We propose a wetland habitat classification for boreal forest waterfowl that builds on existing classification systems, and apply the habitat classification to wetlands surveyed for 14 species of waterfowl breeding pairs and broods in the boreal Claybelt of Ontario. The habitat classification is based on simple and easily observable structural characteristics measured from black-and-white aerial photography collected for forest resource inventories. Habitat associations were examined using chi super(2) analysis for individual waterfowl species, and canonical correspondence analysis for overall community structure. Habitat use deviated significantly from that expected by random association for both pairs and broods, and canonical ordination of habitat/community structure was significant for both breeding pairs and broods. Beaver-pond marshes, lacustrine marshes located at river mouths, and open-water fens with <25% vegetative cover were used at rates much higher than expected, and deserve attention for conservation in the boreal forest. Based on expected distribution of wetland habitat types, we estimate 96.9 pairs x 100 km super(-2) and 96.1 broods x 100 km super(-2) to occur on average throughout the Claybelt.

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118. Simulation of subsurface flow constructed wetlands: Results and further research needs.

Langergraber, G.

Water Science and Technology 48(5): 157-166. (2003)
NAL Call #: TD420.A1P7; ISSN: 0273-1223

Descriptors: freshwater ecology/ models and simulations: computational biology/ pollution assessment control and management/ waste management: sanitation/ nitrogen/ wastewater chemistry/ phosphorus/ CW2D reactive transport model/ subsurface flow constructed wetlands: design optimization, research needs, simulation/ wetland systems: water pollution control

Abstract: Simulation of constructed wetlands has two main tasks: to obtain a better understanding of the processes in constructed wetlands, and to check and optimise existing design criteria. This paper shows simulation results for two indoor pilot-scale constructed wetlands for wastewater and surface water treatment respectively. The results presented and discussed are mainly focussed on the hydraulic behaviour of the constructed wetland systems. In addition results of reactive transport simulations with CW2D are

shown. The multi-component reactive transport model CW2D (Constructed Wetlands 2 Dimensional) was developed to model transport and reactions of the main constituents of wastewater (organic matter, nitrogen, and phosphorus) in subsurface flow constructed wetlands. For the pilot-scale constructed wetlands a calibration of the flow model was possible and therefore the results of the reactive transport simulations with CW2D fit the measured data well. The further research needs regarding the simulation of subsurface flow constructed wetlands are discussed.

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119. Status and trends of wetlands in the conterminous United States 1986 to 1997.

Dahl, Thomas E. and U.S. Fish and Wildlife Service
Washington, D.C.: U.S. Dept. of the Interior, Fish and Wildlife Service; 82 p. (2000)

Notes: "December 2000"--P. 4 of cover. Includes bibliographical references (p. 70-72).

NAL Call #: QH541.5.M3 D33 2000

Descriptors: wetlands---United States/ wetland conservation---United States

This citation is from AGRICOLA.

120. Status and trends of wetlands in the conterminous United States 1998 to 2004.

Dahl, Thomas E.

Washington, D.C.: U.S. Dept. of the Interior, U.S. Fish and Wildlife Service, 2005. 112 p.

NAL Call #: QH541.5.M3 D33 2005

http://wetlandsfws.er.usgs.gov/status_trends/national_reports/trends_2005_report.pdf

Descriptors: wetlands--United States/ wetland conservation--United States

121. The status of forested wetlands and waterbird conservation in North and Central America.

Erwin, R. Michael

Conservation Biology Series 6: 61-109. (1996);

ISSN: 1363-3090

Descriptors: Aves/ conservation measures/ waterbirds/ forested wetland status relations/ semiaquatic habitat/ forest and woodland/ Nearctic Region/ neotropical region/ Central America/ forested wetland status/ waterbird conservation significance

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122. Status of knowledge, ongoing research, and research needs in Amazonian wetlands.

Junk, W. J. and Piedade, M. T.

Wetlands Ecology and Management 12(6): 597-609. (Jan. 2005)

NAL Call #: QH541.5.M3 W472; ISSN: 0923-4861

Descriptors: wetlands/ basins/ economics/ rivers/ structure-function relationships/ classification/ soil/ flood plains/ agriculture/ inland fisheries/ natural resources/ potential resources/ hydroelectric power/ research programmes/ education establishments/ deforestation/ ranching/ biodiversity/ institutions/ economic development/ construction/ channels/ structure/ ecology/ fisheries/ exploitation/ degradation/ priorities/ training/ research priorities/ cattle/ navigation/ surveys/ technology transfer/ artificial wetlands/ exploration/ South America/ South America, Amazonia, Amazon R./ Brazil, Amazonia/

management/ general papers on resources/ other aquatic communities/ control of water on the surface
Abstract: Exploitation and exploration of the Amazon basin by Europeans started in the 17th century, but only since about 1970 has the Brazilian government given priority to the connection of the Amazon basin to the industrialized southern part of the country. This new policy required scientific research on the natural resources of the area. Wetlands cover about 20% of the Amazon basin. Inland fishery, fertile floodplain soils, and hydroelectric energy offer a large potential for economic development. Research concentrates on major wetlands and water bodies near the large cities. The Amazon River floodplain belongs to the best studied tropical river floodplains in the world. However, studies in other areas suffer from lack of wetland inventory and classification. Accelerated economic development is not adequately accompanied by wetland research. Insufficient knowledge about distribution, size, structure and function of many wetlands leads to increasing degradation and loss of biodiversity, for instance, by the construction of hydroelectric power plants, large scale deforestation for cattle ranching and agro-industrial projects, mining activities, the construction of navigation channels (hidrovias), etc. The low number of scientists working in the area and lack of funding require close cooperation in problem-oriented multidisciplinary projects (scientific clustering) to optimize scientific outcome. Intensive, long-term cooperation and scientific exchange with institutions from southern Brazil and from abroad is recommended to improve the scientific infrastructure in Amazonian institutions, to accelerate the transfer of new scientific methods and technology, and to intensify the training program for local human resources.
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123. Surface flow constructed wetlands: Overview.

Kadlec, R. H.
Water Science and Technology 32(3): 1-12. (1995)
 NAL Call #: TD420.A1P7; ISSN: 0273-1223.
Notes: Proceedings for the 4th International Conference on Wetland Systems for Water Pollution Control Held in Guangzhou, China, 6-10 November 1994
Descriptors: flow/ costs/ operation/ performance/ design/ waste water/ biological treatment/ artificial wetlands/ land types/ wastes/ waste water treatment/ wetland systems for water pollution control/ human wastes and refuse/ waste handling and treatment equipment
Abstract: Statistics on the types and character of low-tech waste water treatment wetlands are reviewed. The operational processes are discussed, including sedimentation, plant uptake, sorption, nutrient cycling, and chemical and microbial conversion. Performance was good for reduction of suspended solids, biological oxygen demand, phosphorus, nitrogen, metals and some anthropogenic chemicals. Design procedures were evaluated, showing that the overly simplistic techniques used in the infancy of the technology may now be replaced by rational procedures based on the large and rapidly growing information base for constructed surface flow treatment wetlands. Ancillary wildlife and human use is an important part of this type of wetland, and should be acknowledged in design. Capital costs were low, but the principal financial advantage was the extremely low base cost of operation.

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124. Synthesis of soil-plant correspondence data from twelve wetland studies throughout the United States.

Segelquist, C. A.; Slauson, W. L.; Scott, M. L.; and Auble, G. T.
 Washington D.C.: U.S. Fish and Wildlife Service, 1990.
 32 p. Biological Report.
 NAL Call #: QH540.U562 no.90(19)
Descriptors: wetlands/ soils/ vegetation/ identification for classification/ census-survey methods/ cover/ North America/ United States/ South Dakota/ Florida/ Nebraska/ New Mexico/ Nevada/ California/ North Carolina/ Alaska/ Mississippi/ Rhode Island/ Massachusetts
Abstract: Objectives were to evaluate the relation between hydric and nonhydric soils and hydrophytic and nonhydrophytic vegetation for selected wetlands and to test the weight average and index average procedures of Wentworth and Johnson (1986)
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125. Temperate freshwater wetlands: Types, status, and threats.

Brinson, M. M. and Malvarez, A. I.
Environmental Conservation 29(2): 115-133. (2002)
 NAL Call #: QH540.E55; ISSN: 0376-8929
Descriptors: wetlands/ land use/ environmental protection/ environmental quality/ eutrophication/ water quality/ drainage/ resources management/ ecosystem analysis/ temperate environments/ environmental degradation/ marshes/ ecosystem disturbance/ man-induced effects/ freshwater pollution/ degradation/ habitat/ pollution effects/ species diversity/ biodiversity/ freshwater organisms/ temperate zones/ North America/ South America/ Europe/ Mediterranean Region/ Russia/ China, People's Rep./ Japan/ Australia/ New Zealand
Abstract: This review examines the status of temperate-zone freshwater wetlands and makes projections of how changes over the 2025 time horizon might affect their biodiversity. The six geographic regions addressed are temperate areas of North America, South America, northern Europe, northern Mediterranean, temperate Russia, Mongolia, north-east China, Korea and Japan, and southern Australia and New Zealand. Information from the recent technical literature, general accounts in books, and some first-hand experience provided the basis for describing major wetland types, their status and major threats. Loss of biodiversity is a consequence both of a reduction in area and deterioration in condition. The information base for either change is highly variable geographically. Many countries lack accurate inventories, and for those with inventories, classifications differ, thus making comparisons difficult. Factors responsible for losses and degradation include diversions and damming of river flows, disconnecting floodplain wetlands from flood flows, eutrophication, contamination, grazing, harvests of plants and animals, global warming, invasions of exotics, and the practices of filling, dyking and draining. In humid regions, drainage of depressions and flats has eliminated large areas of wetlands. In arid regions, irrigated agriculture directly competes with wetlands for water. Eutrophication is widespread, which, together with effects of invasive species, reduces biotic complexity. In northern Europe and the northern Mediterranean, losses have been ongoing for hundreds of years, while losses in North America accelerated during the 1950s through to the 1970s. In contrast, areas such as China appear to be on the cusp of

expanding drainage projects and building impoundments that will eliminate and degrade freshwater wetlands. Generalizations and trends gleaned from this paper should be considered only as a starting point for developing world-scale data sets. One trend is that the more industrialized countries are likely to conserve their already impacted, remaining wetlands, while nations with less industrialization are now experiencing accelerated losses, and may continue to do so for the next several decades. Another observation is that countries with both protection and restoration programmes do not necessarily enjoy a net increase in area and improvement in condition. Consequently, both reductions in the rates of wetland loss and increases in the rates of restoration are needed in tandem to achieve overall improvements in wetland area and condition.

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126. Temporary forest pools: Can we see the water for the trees?

Williams, D. D.

Wetlands Ecology and Management 13(3): 213-233. (2005)

NAL Call #: QH541.5.M3 W472; ISSN: 0923-4861

Descriptors: community succession/ forests/ freshwater invertebrates/ hydroperiod/ riparian vegetation/ temporary ponds/ wetland management

Abstract: Temporary waters, in general, are fascinating habitats in which to study the properties of species adapted to living in highly variable environments. Species display a remarkable array of strategies for dealing with the periodic loss of their primary medium that sets them apart from the inhabitants of permanent water bodies. Survival of individuals typically depends on exceptional physiological tolerance or effective migrational abilities, and communities have their own, distinctive hallmarks. This paper will broadly overview the biology of temporary ponds, but will emphasize those in temperate forests. In particular, links will be sought between aquatic community properties, the nature of the riparian vegetation, and forestry practices. Quite apart from their inherent biological interest, temporary waters are now in the limelight both from a conservation perspective, as these habitats come more into conflict with human activities, and a health-control perspective, as breeding habitats for vectors of arboviruses. Traditionally, many temporary waters, be they pools, streams or wetlands, have been considered to be 'wasted' areas of land, potentially convertible to agriculture/silviculture once drained. In reality, they are natural features of the global landscape representing distinct and unique habitats for many species - some that are found nowhere else, others that reach their maximum abundance there. To be effective, conservation measures must preserve the full, hydroseral range of wetland types. © Springer 2005.

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127. Threats to waterbirds and wetlands: Implications for conservation, inventory and research.

O'Connell, Mark

Wildfowl 51: 1-15. (2000)

NAL Call #: SK351.W575; ISSN: 0954-6324

Descriptors: waterbirds (Aves)/ animals/ birds/ chordates/ nonhuman vertebrates/ vertebrates/ biodiversity/ conservation implications/ demographic changes/ economic changes/ human activity/ social changes/ wetlands: habitat

Abstract: The world has undergone major social, economic

and demographic changes in the last two centuries.

Predictions suggest that during the next 100 years, even greater changes will occur and this will put increasing pressure on wetlands and their biodiversity. This paper examines the changes that have occurred, and the nature of threats facing waterbirds and wetlands as a result of human activities. The need for specific areas of research is identified, particularly in relation to detecting and measuring change and the need to provide solution-oriented research to underpin conservation action.

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128. Trace and toxic metals in wetlands: A review.

Gambrell, R. P.

Journal of Environmental Quality 23(5): 883-891. (Sept. 1994-Oct. 1994)

NAL Call #: QH540.J6; ISSN: 0047-2425 [JEVQAA].

Notes: Paper presented at the symposium, "Wetland Processes and Water Quality," November 3-4, 1992, Minneapolis, MN. Includes references.

Descriptors: wetland soils/ upland soils/ heavy metals/ leaching/ immobilization/ soil pH/ redox reactions/ bioavailability/ plants

Abstract: The mobility and plant availability of many trace and toxic metals in wetland soils is often substantially different from upland soils. Oxidation-reduction (redox) and associated pH changes that occur in soils as a result of flooding or drainage can affect the retention and release of metals by clay minerals, organic matter, iron oxides, and, for coastal wetlands, sulfides. Except where a Hooded soil or sediment becomes strongly acid upon drainage and oxidation, as sometimes occurs, the processes immobilizing metals tend to be complimentary such that large-scale metal releases from contaminated soils and sediments do not occur with changing redox conditions. Metals tend to be retained more strongly in wetland soils compared with upland soils.

This citation is from AGRICOLA.

129. Tracking wetland restoration: Do mitigation sites follow desired trajectories?

Zedler, J. B. and Callaway, J. C.

Restoration Ecology 7(1): 69-73. (Mar. 1999)

NAL Call #: QH541.15.R45R515; ISSN: 1061-2971

Descriptors: wetlands/ environmental restoration/ environment management/ USA, California/ USA, California, San Diego Bay/ rehabilitation/ ecosystems/ damage/ monitoring/ wildlife habitats/ model studies/ alternative planning/ nature conservation/ environmental assessment/ USA, California, San Diego/ trajectories/ Sweetwater Marsh National Wildlife Refuge/ reclamation/ water quality control/ conservation, wildlife management and recreation/ general environmental engineering

Abstract: Hypothetical models in the scientific literature suggest that ecosystem restoration and creation sites follow a smooth path of development (called a trajectory), rapidly matching natural reference sites (the target). Multi-million-dollar mitigation agreements have been based on the expectation that damages to habitat will be compensated within 5-10 years, and monitoring periods have been set accordingly. Our San Diego Bay study site, the Sweetwater Marsh National Wildlife Refuge, has one of the longest and most detailed records of habitat development at a mitigation site: data on soil organic matter, soil nitrogen, plant growth, and plant canopies for up to 10 years from a 12-year-old

site. High interannual variation and lack of directional changes indicate little chance that targets will be reached in the near future. Other papers perpetuate the trajectory model, despite data that corroborate our findings. After reviewing "trajectory models" and presenting our comprehensive data for the first time, we suggest alternative management and mitigation policies.
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130. The U.S. Fish and Wildlife Service's National Wetlands Inventory project.

Wilén, B. O. and Bates, M. K.

Vegetatio 118(1-2): 153-169. (1995)

NAL Call #: 450 V52; ISSN: 0042-3106.

Notes: Conference: 4th International Wetlands Conference, Symposium on Classification and Inventory of the World's Wetlands, Columbus, OH (USA), 13-18 Sep 1992

Descriptors: wetlands/ inventories/ classification/ data banks/ mapping/ USA/ US Fish and Wildlife Service/ data banks/ miscellaneous topics/ general papers on resources

Abstract: In 1974, the US Fish and Wildlife Service directed its Office of Biological Services to design and conduct an inventory of the Nation's wetlands. The mandate was to develop and disseminate a technically sound, comprehensive data base concerning the characteristics and extent of the Nation's wetlands. The purpose of this data base is to foster wise use of the Nation's wetlands and to expedite decisions that may affect this important resource. To accomplish this, state-of-the-art principles and methodologies pertaining to all aspects of wetland inventory were assimilated and developed by the newly formed project. By 1979, when the National Wetlands Inventory (NWI) Project became operational, it was clear that two very different kinds of information were needed. First, detailed wetland maps were needed for site-specific decisions. Second, national statistics developed through statistical sampling on the current status and trends of wetlands were needed in order to provide information to support the development or alteration of Federal programs and policies. The NWI has produced wetland maps (scale = 1:24 000) for 74% of the conterminous United States. It has also produced wetland maps (scale = 1:63 360) for 24% of Alaska. Nearly 9000 of these wetland maps, representing 16.7% of the continental United States, have been computerized (digitized). In addition to maps, the NWI has produced other valuable wetland products. These include a statistically-based report on the status and trends of wetlands that details gains and losses in United States wetlands that have occurred from the mid-1970's to the mid-1980's. Other wetland products include a list of wetland (hydric) soils, a national list of wetland plant species, wetland reports for certain individual States such as New Jersey and Florida, and a wetland values data base.
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131. Urbanization impacts on the structure and function of forested wetlands.

Faulkner, Stephen

Urban Ecosystems 7(2): 89-106. (2004)

NAL Call #: QH541.5.C6 U73; ISSN: 1083-8155

Descriptors: biochemistry and molecular biophysics/ soil science/ terrestrial ecology: ecology, environmental sciences/ forested wetland: function, structure/ nutrient cycling/ soil saturation/ urbanization/ watershed hydrology

Abstract: The exponential increase in population has

fueled a significant demographic shift: 60% of the Earth's population will live in urban areas by 2030. While this population growth is significant in its magnitude, the ecological footprint of natural resource consumption and use required to sustain urban populations is even greater. The land use and cover changes accompanying urbanization (increasing human habitation coupled with resource consumption and extensive landscape modification) impacts natural ecosystems at multiple spatial scales. Because they generally occupy lower landscape positions and are linked to other ecosystems through hydrologic connections, the cascading effects of habitat alteration on watershed hydrology and nutrient cycling are particularly detrimental to wetland ecosystems. I reviewed literature relevant to these effects of urbanization on the structure and function of forested wetlands. Hydrologic changes caused by habitat fragmentation generally reduce species richness and abundance of plants, macroinvertebrates, amphibians, and birds with greater numbers of invasives and exotics. Reduction in soil saturation and lowered water tables result in greater nitrogen mineralization and nitrification in urban wetlands with higher probability of NO₃- export from the watershed. Depressional forested wetlands in urban areas can function as important sinks for sediments, nutrients, and metals. As urban ecosystems become the predominant human condition, there is a critical need for data specific to urban forested wetlands in order to better understand the role of these ecosystems on the landscape.

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132. Use of constructed wetlands in water pollution control: Historical development, present status, and future perspectives.

Brix, H.

Water Science and Technology 30(8 pt 8): 209-223. (1994)

NAL Call #: TD420.A1P7; ISSN: 0273-1223

Descriptors: biochemical oxygen demand/ free water surface flow systems/ nitrogen/ phosphorus/ reaction rate constants/ subsurface flow systems/ suspended solids

Abstract: During the last two decades the multiple functions and values of wetlands have been recognized not only by the scientists and managers working with wetlands, but also by the public. The ability of wetlands to transform and store organic matter has been exploited in constructed wetlands. This paper summarizes the state-of-the-art of the uses of constructed wetlands in water pollution control by reviewing the basics of the technology, the historical development, and the performance expectations with focus on the use of free water surface and subsurface flow constructed wetlands for municipal wastewater treatment. Performance data from a total of 104 subsurface flow systems and 70 free water surface flow systems are reviewed. The present state of knowledge is sufficient to apply constructed wetlands as a tool for improving water quality. The potential applications range from secondary treatment of municipal and various types of industrial wastewaters to polishing of tertiary treated waters and diffuse pollution. In many situations constructed wetlands is the only appropriate technology available. The treatment capacity of subsurface flow systems can be improved by selecting vertical flow systems with intermittent loading, by proper media selection, and by recycling of the wastewater.

Further research is needed to help define and optimize engineering design criteria and the long-term performance capabilities and operational problems.

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133. Use of restored small wetlands by breeding waterfowl in Prince Edward Island, Canada.

Stevens, C. E.; Gabor, T. S.; and Diamond, A. W.

Restoration Ecology 11(1): 3-12. (2003)

NAL Call #: QH541.15.R45R515; ISSN: 1061-2971

Descriptors: wetlands/ environmental restoration/ breeding/ restoration/ environment management/ aquatic birds/ abundance/ plant populations/ environmental factors/ nature conservation/ *Anas crecca carolinensis*/ *Anas rubripes*/ *Typha*/ Canada, Prince Edward Island/ green-winged teal/ American black duck/ ring-necked ducks/ gadwell

Abstract: Since 1990 under the Eastern Habitat Joint Venture over 100 small wetlands have been restored in Prince Edward Island, Canada. Wetlands were restored by means of dredging accumulated sediment from erosion to emulate pre-disturbance conditions (i.e., open water and extended hydroperiod). In 1998 and 1999 we compared waterfowl pair and brood use on 22 restored and 24 reference wetlands. More pairs and broods of Ring-necked Ducks, Gadwall, Green-winged Teal, and American Black Ducks used restored versus reference wetlands. In restored wetlands waterfowl pair density and species richness were positively correlated with wetland/cattail area, percent cattail cover, and close proximity to freshwater rivers. In addition, a waterfowl reproductive index was positively correlated with percent cattail cover. Green-winged Teal pair occurrence in restored wetlands was positively correlated with greater amounts of open water and water depths. American Black Duck pairs occurred on most (86%) restored wetlands. Restored small wetlands likely served as stopover points for American Black Duck broods during overland or stream movements, whereas they likely served as a final brood-rearing destination for Green-winged Teal broods. We suggest that wetland restoration is a good management tool for increasing populations of Green-winged Teal and American Black Ducks in Prince Edward Island.

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134. Using algae to assess environmental conditions in wetlands.

Stevenson, R. Jan; McCormick, Paul V.; Frydenborg, Russ; United States. Environmental Protection Agency. Office of Water; United States. Environmental Protection Agency. Office Science and Technology; and United States.

Environmental Protection Agency. Office of Wetlands, Oceans and Watersheds

In: *Methods for evaluating wetland condition*; Washington, D.C.: U.S. Environmental Protection Agency, Office of Water, 2002.

Notes: Original title: Using algae to assess environmental conditions in wetlands (#11); Title from web page. "March 2002." "Prepared jointly by U.S. Environmental Protection Agency, Health and Ecological Criteria Division (Office of Science and Technology) and Wetlands Division (Office of Wetlands, Oceans, and Watersheds)" "EPA-822-R-02-021." Description based on content viewed April 14, 2003.

Includes bibliographical references.

NAL Call #: QH541.15.15 S74 2002

<http://www.epa.gov/waterscience/criteria/wetlands/11Algae.pdf>

Descriptors: indicators---biology---United States/ environmental indicators---United States---mathematical models/ algae---United States/ wetland conservation---United States

This citation is from AGRICOLA.

135. Using amphibians in bioassessment of wetlands.

Sparling, Donald W.; United States. Environmental Protection Agency. Office of Water.; United States. Environmental Protection Agency. Health and Ecological Criteria Division.; and United States. Environmental Protection Agency. Wetlands Division.

In: *Methods for evaluating wetland condition*; Washington, D.C.: U.S. Environmental Protection Agency, Office of Water, 2002.

Notes: Using amphibians in bioassessment of wetlands. (#12). Title from web page. "March 2002." "Prepared jointly by the U.S. Environmental Protection Agency, Health and Ecological Criteria Division (Office of Science and Technology) and Wetlands Division (Office of Wetlands, Oceans, and Watersheds)" "EPA-822-R-02-022."

Description based on content viewed March 31, 2003.

Includes bibliographical references.

NAL Call #: QH541.15.15 M472 2002

<http://www.epa.gov/waterscience/criteria/wetlands/12Amphibians.pdf>

Descriptors: wetlands management---United States/ indicators---biology---United States/ environmental indicators---United States/ monitoring, biological---United States/ amphibians---United States

This citation is from AGRICOLA.

136. Using vegetation to assess environmental conditions in wetlands.

Fennessy, Slobhan; United States. Environmental Protection Agency. Health and Ecological Criteria Division; United States. Environmental Protection Agency. Wetlands Division; and United States. Environmental Protection Agency. Office of Water

In: *Methods for evaluating wetland condition*; Washington, D.C.: U.S. Environmental Protection Agency, Office of Water, 2002.

Notes: Original title: Using vegetation to assess environmental conditions in wetlands (#10); Title from web page. "March 2002." Major contributors: Slobhan Fennessy and others. "Prepared jointly by the U.S. Environmental Protection Agency, Health and Ecological Criteria Division (Office of Science and Technology) and Wetlands Division (Office of Wetlands, Oceans, and Watersheds)" "EPA-822-R-02-020." Description based on content viewed March 31, 2003. Includes bibliographical references.

NAL Call #: QH541.15.15 M473 2002

<http://www.epa.gov/waterscience/criteria/wetlands/10Vegetation.pdf>

Descriptors: plant indicators---United States/ indicators---biology---United States/ wetland management---United States/ environmental monitoring---United States

This citation is from AGRICOLA.

137. Vegetation-based indicators of wetland nutrient enrichment.

Craft, C.; United States. Environmental Protection Agency. Health and Ecological Criteria Division; United States. Environmental Protection Agency. Wetlands Division; and United States. Environmental Protection Agency. Office of Water

In: Methods for evaluating wetland condition; Washington, D.C.: U.S. Environmental Protection Agency, Office of Water, 2003.

Notes: Title from web page. "March 2002." Prepared jointly by: the U.S. Environmental Protection Agency, Health and Ecological Criteria Division (Office of Science and Technology) and Wetland Division (Office of Wetlands, Oceans, and Watersheds). "EPA-822-R-02-024." Includes bibliographical references.

NAL Call #: QH76.5.N8 V47 2002

<http://www.epa.gov/waterscience/criteria/wetlands/16indicators.pdf>

Descriptors: wetlands/ ecology/ land use/ nutrient enrichment/ nutrient enrichment/ vegetation/ environmental management

138. Wetland and water bird diversity in desert area of the Western China.

Liu, Nai-Fa; Huang, Zu-Hao; and Wen, Long-Ying

Wetland Science 2(4): 259-266. (Dec. 2004)

NAL Call #: QH87.3 .S47; ISSN: 1672-5948

Descriptors: wetlands/ deserts/ habitat selection/ rare species/ species diversity/ ponds/ migratory species/ irrigation/ salt lakes/ ecosystem management/ conservation/ environmental protection/ water use/ Podiceps grisegena/ Aves/ Ciconia ciconia/ China, People's Rep., Qingzang Plateau/ red-necked grebe/ birds/ white stork/ habitat community studies

Abstract: The western part of China includes the Mongolia-Xinjiang and Qingzang Plateaus where the climate is either arid or semi-arid with low precipitation levels. Here, wetlands only exist in the depressions, overflowing zones of piedmont groundwater, and lake depressions. The area of wetlands in desert area is 96 180 km super(2), accounting for about 3.6% of the total land area of the Western China. In accordance with the formation, there are four types of wetlands in the desert area of the Western China, (1) wetland formed by gathering water in the basins due to the subsidence of the earth's crust, (2) glacier lake, (3) wetland formed by springs, (4) wetland formed by water withdrawn from irrigated farmland. The special natural conditions and geographical location of these wetlands have resulted in abundant species of waterfowl and play a special role the worldwide waterfowl protection. According to preliminary investigation and statistics, there are 142 species of waterfowls in above wetland as defined in "Wetland Convention", 54.8% of the total number of waterfowls in China. There are many rare and endangered species in these wetlands. These include 8 species of national first-grade protected birds, such as Ciconia ciconia, and 18 species of national second-grade protected birds, such as Podiceps grisegena. Waterbirds are protected by international convention and agreement. There are 12 species listed in "Convention on International Trade in Endangered Species of Wild Fauna and Flora" (CITES). A total of 83 species among 142 species birds are listed in the "Agreement to Protect Migratory Birds and their Habitats in China and Japan". Wetlands in the desert area of the Western China play an important role in migration,

breeding and overwinter of waterfowl. However, wetlands have been destroyed to different extents. The wetland in the desert area is ultimately developed into salt pond or desert. Important factors leading to desertification of wetlands are climate to transform into dry, irrational use of water resources and reclaiming land from marshes, resulted in considerable loss of waterfowl diversity. Therefore, for the purpose of waterfowl conservation, the wetland in the desert should be strongly conserved.

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139. Wetland creation and restoration: Description and summary of the literature.

Schneller-McDonald, K.; Ischinger, L. S.; and Auble, G. T.; 90(3), 1990. 198 p. Biological Report - US Fish & Wildlife Service.

NAL Call #: QH540.U562 no.90(3)

Abstract: Provides a hard copy of the bibliographic information contained in the US Wetland Creation/Restoration data base. -from Authors
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140. Wetland ecosystem studies from a hydrological perspective.

Labough, J. W.

Water Resources Bulletin 22(1): 1-10. (1986)

NAL Call #: 292.9 Am34; ISSN: 0043-1370

Descriptors: wetlands/ hydrologic budget/ groundwater/ review articles/ chemical budget/ input-output relationship/ biogeochemical processes/ ecosystem research/ hydrology/ ecosystems

Abstract: Selected studies from the literature were reviewed to determine the extent of knowledge about the relationship between hydrology and wetland ecosystem studies. Wetland studies of chemical input-output relationship have been the most dependent on hydrologic data of all wetland investigations; yet, very few of these studies have attempted to measure all components of a wetland's water balance. Usually, unmeasured components were calculated as the difference between measured inputs and outputs. Ground water was frequently overlooked. Chemical input-output investigations primarily were concerned with determining the amount of input retained in the wetlands. Few studies also included direct measurement of biogeochemical processes within wetlands of elements that were part of simultaneous input-output investigations. The importance of uncertainties in hydrologic budgets that are due to uncertainties in hydrologic budgets has been addressed in very few wetland investigations. Although many studies have emphasized the importance of hydrology to wetland ecosystem research, few studies have documented this, so that hydrology remains one of the least understood components of wetlands ecosystems. (Author's abstract)

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141. Wetland indicators: A guide to wetland identification, delineation, classification, and mapping.

Tiner, Ralph W.

Boca Raton, Fla.: Lewis Publishers; 392 p. (1999)

NAL Call #: GB624.T564-1999; ISBN: 0873718925

Descriptors: wetlands---United States/ wetland ecology---

United States/ plant indicators---United States

This citation is from AGRICOLA.

142. Wetland management and conservation of rare species.

Doust, Lesley Lovett and Doust, Jon Lovett

Canadian Journal of Botany 73(7): 1019-1028. (1995)

NAL Call #: 470 C16C; ISSN: 0008-4026

Descriptors: Plantae (Plantae unspecified)/ plants/ ethics/ genetics/ habitat protection/ habitat quality/ legislation

Abstract: The value of wetland is now widely recognized; some legislation requires 'no net loss' of wetlands, although economic incentives still exist for wetland conversion. Rare plants may be protected by law; however, wetlands are rarely managed specifically to conserve rare species. Furthermore, it is not always clear how the environment should be manipulated to increase the abundance of such species, since necessary autecological details are rarely available. Species conservation involves demographic and genetic elements, as well as ethical decisions about the merits of transplanting or importing genes through controlled pollinations. Rare species may serve as indicators of habitat quality, although this will depend on the reasons behind the species' rarity. There is a need for multiple-use management plans that incorporate species- and habitat-conservation goals and that implement overall strategies to maintain or enhance the total quantity and quality of wetlands.

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143. Wetland management for shorebirds and other species: Experiences on the Canadian prairies.

Dickson, H. Loney and McKeating, Gerald

Transactions of the North American Wildlife and Natural Resources Conference 58: 370-377. (1993)

NAL Call #: 412.9 N814; ISSN: 0078-1355

Descriptors: Aves/ habitat management/ semiaquatic habitat/ wetlands management/ multispecies approach/ Canada/ Alberta/ Manitoba/ Saskatchewan/ multispecies approach to wetland management/ overview

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144. Wetland mercury research: A review with case studies.

Rood, B. E.

Current Topics in Wetland Biogeochemistry 2: 73-108.

(1996); ISSN: 1076-4674

Descriptors: wetlands/ mercury/ case studies/ contamination/ literature review/ biogeochemistry/ literature reviews/ biogeochemical cycle/ pollution effects/ USA, Florida, Everglades/ case reports/ literature reviews/ biogeochemical cycle/ pollution effects/ case studies/ contamination/ literature review

Abstract: Interestingly, there is a paucity of information regarding the role that wetlands play in the regional and global cycles of mercury (Zillioux et al., 1993). Eugene Odum has said that "a healthy wetland is an indicator of a healthy watershed" (Oglethorpe Power Corporation, 1990). As such, there is a compelling need to: 1) evaluate the

status of mercury contamination in a variety of wetland types, both impacted and unimpacted by regional anthropogenic activities, 2) examine chemical and biological transformations of mercury under the unique ambient conditions associated with wetlands, and 3) reconstruct trends of mercury accumulation in wetlands preserved in the sediment record. The goals of this literature review are to provide wetland scientists with an overview of current issues and observations regarding research of environmental mercury contamination, to identify the critical need for mercury researchers to incorporate detailed wetland studies into current research, and to overview current studies of mercury in wetlands including a case study of mercury paleoecological research in the Florida Everglades.

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145. Wetland nutrient removal: A review of the evidence.

Fisher, J. and Acreman, M. C.

Hydrology and Earth System Sciences 8(4):

673-685. (2004)

NAL Call #: GB651 .H937; ISSN: 1027-5606

Descriptors: pollution load/ artificial wetlands/ nutrients/ water quality control/ marshes/ sampling/ nitrogen/ hydrologic models/ ecosystems/ swamps/ high flow/ nutrient removal/ eutrophication/ water quality control/ water treatment/ water and wastewater treatment

Abstract: Data from 57 wetlands from around the world have been collated to investigate whether wetlands affect the nutrient loading of waters draining through them: the majority of wetlands reduced nutrient loading and there was little difference in the proportion of wetlands that reduced N to those that reduced P loading. However, some wetlands increased nutrient loadings by increasing the loading of soluble N and P species thus potentially driving aquatic eutrophication. Studies conducted over a period of a year or more, or that involved frequent sampling during high flow events, were more likely to indicate that the wetland increased nutrient loadings. Swamps and marshes differed from riparian zones in their nutrient function characteristics by being slightly more effective at nutrient reduction than riparian zones. The attributes that enable wetlands to be effective in reducing N and P loadings need consideration when constructing or managing wetlands to reduce nutrient loadings. Their wise use will be an important strategy for meeting the Water Framework Directive requirements for many water bodies.

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146. Wetland plants: More than just a pretty face?

Nuttall, C. A.

Land Contamination & Reclamation 11(2): 173-180. (2003);

ISSN: 0967-0513

Descriptors: aesthetic value/ aluminium/ aquatic plants/ artificial wetlands/ habitats/ iron/ manganese/ microbial activities/ organic matter/ polluted water/ reviews/ water quality/ Eriophorum/ Phragmites australis/ plants/ Typha latifolia/ Vallisneria americana/ Eriophorum angustifolium/ water treatment/ Cyperaceae/ Cyperales/ monocotyledons/ angiosperms/ Spermatophyta/ plants/ Eriophorum/ Phragmites/ Poaceae/ Typha/ Typhaceae/ Typhales/ Vallisneria/ Hydrocharitaceae/ Hydrocharitales

Abstract: Plants are an integral part of wetlands constructed to treat contaminated waters, including those emanating from abandoned mines and their associated spoil heaps. It has become generally accepted that, although plants provide an aesthetic covering to wetlands, they do not play an important role in the remediative processes that occur within the wetland system. Rather the geochemical and microbiological processes that convert soluble metals into immobile forms are by far the most important constituents of the wetlands. We have provided a detailed review of the current knowledge of plant growth within wetlands and the possible roles that they perform in the treatment of mine waters. It is evident from the literature that plants add significantly to the performance of wetland systems through a variety of means. These include the addition of organic matter (maintaining the carbon source for microorganisms), stabilization of sediment surfaces, maintenance of flow patterns, and surfaces for microbial activity. In addition, recent research has shown that in systems receiving low concentrations of metals, as occurs in 'polishing wetlands', plants may actually constitute an important sink for metals. In this situation the majority of metals (iron, manganese and aluminium) are precipitated around root surfaces as plaque deposits, which has important implications for the cycling of metals within these systems. The concentrations of metals in root plaque extracts in field-grown wetland plant species (viz., *Eriophorum angustifolium*, *Phragmites australis*, *Typha latifolia* and *Vallisneria americana*) are given. Finally, plants may also provide a vital resource for other wildlife and as such can encourage the inhabitation of treatment wetlands by invertebrates, birds and mammals. Thus plants as part of treatment wetlands are certainly more than just a pretty face.

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147. Wetland rice soils as sources and sinks of methane: A review and prospects for research. Kumaraswamy, S.; Rath, A. K.; Ramakrishnan, B.; and Sethunathan, N.

Biology and Fertility of Soils 31(6): 449-461. (2000)
NAL Call #: QH84.8.B46; ISSN: 0178-2762

Descriptors: flooded rice/ rice soils/ paddy soils/ soil bacteria/ anaerobes/ methane production/ methane/ oxidation/ emission/ oryza sativa/ roots/ pollution control/ fertilizers/ pesticides/ nitrification inhibitors/ community ecology/ biological activity in soil/ literature reviews/ methanotrophy

This citation is from AGRICOLA.

148. Wetlands.

Mitsch, William J. and Gosselink, James G.
New York: John Wiley (3rd); xiii, 920 p.: ill., maps; 26 cm. (2000)

NAL Call #: QH104 .M57 2000; ISBN: 047129232X

Descriptors: wetland ecology---United States/ wetlands---United States/ wetland management---United States

This citation is from AGRICOLA.

149. Wetlands: An overview in relation to conservation strategy.

Wanganeo, A. and Wanganeo, R.

Nature, Environment and Pollution Technology 3(3): 307-316. (2004); ISSN: 0972-6268

Descriptors: wetlands/ conservation/ municipal wastes/ fodder/ foods/ niches/ wastewater pollution/ municipal wastewater/ sluices/ literature reviews/ habitat improvement/ environmental protection/ classification/ wastewater treatment/ water pollution/ wastes/ vulnerability/ biodiversity/ techniques of planning/ water Resources and supplies/ habitat community studies/ conservation, wildlife management and recreation/ water and wastewater treatment

Abstract: In spite of the global attention currently focused on the wetlands there is no recognizable conservation strategy or any law governing their management. These highly productive ecological niches supporting rich biodiversity have been perceived as future resources of food and fodder. Their quality of ameliorating pollution has made them more vulnerable as these systems are also treated as places for tertiary treatment of municipal wastewater besides other wastes. Since no logical segregation of these systems has been done as such, a lot of confusion has been created as to what is their main function and how these systems should be categorized. Present paper categorizes wetlands into three categories viz., Douse, Sluice and Plashy types for their better utilization, management and conservation.

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150. Wetlands and water quality: A regional review of recent research in the United States on the role of freshwater and saltwater wetlands as sources, sinks, and transformers of nitrogen, phosphorus, and various heavy metals.

Nixon, S. W. and Lee, V.

Vicksburg, Miss. Army Corps of Engineers, Waterways Experiment Station, 1986. 229 p. Technical Report.

Descriptors: wetlands/ water quality/ limnology/ estuaries/ saline water/ sinks/ nitrogen/ phosphorus/ heavy metals/ literature review/ nutrients

Abstract: This report is the first in a series of four literature reviews on wetland functions and values. Each review covers one of the following four broad wetlands functions and values: (1) water quality, (2) fish and wildlife habitat, (3) socioeconomics, and (4) hydraulics. The four reports, along with other information, were used to develop a multiyear wetlands functions and values research study plan implemented by the US Army Engineer Waterways Experiment Station. This report examines the literature on water quality functions of wetlands. Study results indicated considerable diversity in the quantity and quality of wetlands water quality literature between and within each geographic region of the coterminous United States and Alaska. In general, wetlands water quality has been studied most intensely in the estuarine marshes of the Gulf and North Atlantic coasts. Water quality in freshwater wetlands has not received attention commensurate with the wide distribution of these wetland types. Most previous wetlands water quality research has been fragmented into site-specific or function-specific studies. Very few mass balance studies have been conducted. Two complementary approaches to addressing wetlands water quality research data gaps are recommended. The first approach is to

develop mass balances or budgets of carbon, nutrients, heavy metals, and other possible pollutants. The mass balance studies should be determined at carefully selected field sites over several annual cycles. The second approach would focus on the design, construction, and use of experimental wetland microcosms. The microcosms would permit assessment of the fates and effects of various materials under highly controlled conditions. (Lantz-PTT) © CSA

151. Wetlands classification.

Detenbeck, Naomi Elizabeth.; United States. Environmental Protection Agency. Office of Science and Technology; and United States. Environmental Protection Agency. Office of Wetlands, Oceans and Watersheds.

In: *Methods for evaluating wetland condition*; Washington, D.C.: U.S. Environmental Protection Agency, Office of Water, 2002.

Notes: Original title: Wetlands classification (#7); Title from web page. "March 2002." "EPA-822-R-02-017." "Prepared jointly by the U.S. Environmental Protection Agency, Health and Ecological Criteria Division (Office of Science and Technology) and Wetlands Division Office." Description based on content viewed April 10, 2003. Includes bibliographical references.

NAL Call #: QH541.5.M3 D47 2002

<http://www.epa.gov/waterscience/criteria/wetlands/7Classification.pdf>

Descriptors: wetlands---United States/ wetlands---United States---classification

This citation is from AGRICOLA.

152. Wetlands: History, current status, and future.

Hook, D. D.

Environmental Toxicology and Chemistry 12(12): 2157-2166. (Dec. 1993)

NAL Call #: QH545.A1E58; ISSN: 0730-7268 [ETOC DK].

Notes: Annual Review Issue: Wetland Ecotoxicology and Chemistry. Includes references.

Descriptors: wetlands/ bogs/ fens/ moorland/ history/ uses/ environmental protection/ projections/ literature reviews

This citation is from AGRICOLA.

153. Wetlands losses in the United States, 1780's to 1980's.

Dahl, Thomas E.

Washington, D.C.: U.S. Dept. of the Interior, Fish and Wildlife Service, 1990. 13 p.

NAL Call #: QH76.D33 1990

<http://www.npwrc.usgs.gov/resource/wetlands/wetloss/wetloss.htm>

Descriptors: wetland conservation---United States/ wetlands---United States

This citation is from AGRICOLA.

154. Wetlands of Central America.

Ellison, Aaron M.

Wetlands Ecology and Management 12(1): 3-55. (2004)

NAL Call #: QH541.5.M3 W472; ISSN: 0923-4861

Descriptors: conservation/ estuarine ecology: ecology, environmental sciences/ freshwater ecology: ecology, environmental sciences/ marine ecology: ecology, environmental sciences/ Ramsar Convention on Wetlands of International Importance/ biological diversity support/ cultural framework/ development pressures/ ecological

research/ essential ecosystem services/ estuarine wetlands/ forest land conversion/ integrated planning/ intensive deforestation/ lacustrine wetlands/ marine wetlands/ palustrine wetlands/ population pressures/ primary productivity/ riverine wetlands/ social framework/ water quality maintenance/ wetland inventory/ wetland losses/ wetland management/ wetland refugia/ wetlands ecology

Abstract: The wetlands of seven Central American countries - Belize, Guatemala, Honduras, El Salvador, Nicaragua, Costa Rica, and Panama - are reviewed. The region's wetlands are classified into five systems: marine, estuarine, riverine, lacustrine, and palustrine. At a minimum, wetlands cover approximately 40,000 km² (approximately 8%) of the land area of Central America. These wetlands support high levels of biological diversity, especially of invertebrates, amphibians, and migratory birds. Because of intensive deforestation and conversion of forest lands to agriculture, many species of birds and mammals that formerly were abundant in upland forests now are restricted to wetland refugia. Annual primary productivity of some Central American wetlands equals or exceeds that of tropical rainforests, and wetlands also provide essential ecosystem services such as maintaining water quality. Population and development pressures formerly restricted to upland areas are expanding rapidly into wetlands, resulting in losses of wetlands at rates comparable to losses of rainforests. Since 1990, all seven Central American countries have become signatories to the Ramsar convention on wetlands of international importance, but integrated planning for management and conservation of wetlands in the region only began in 2002. A specific set of recommendations for wetland inventory, ecological research, and management is provided that would be feasible and effective within the social and cultural framework of the Central American countries.

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155. Wetlands of the United States: Current status and recent trends.

Tiner, R. W.

Washington D.C.: U.S. Government Printing Office, 1984.

NAL Call #: QH76.W48

Descriptors: wetlands/ marshes/ salt marshes/ conservation/ coastal zone management/ nature conservation/ USA

Abstract: This report identifies the current status of U.S. wetlands and major areas where wetlands are in greatest jeopardy from the national standpoint. It also presents existing regional and national information of wetland trends. The report is divided into six chapters: (1) Introduction, (2) What is a Wetland?, (3) Major Wetland Types of the United States, (4) Why are Wetlands Important?, (5) Current status and Trends of U.S. Wetlands, and (6) The Future of America's Wetlands. Wetlands include the variety of marshes, swamps and bogs that occur throughout the country. They range from red maple swamps and black spruce bogs in the northern states to salt marshes along the coasts to bottomland hardwood forests in the southern states to prairie potholes in the Midwest to playa lakes and riparian wetlands in the western states to the wet tundra of Alaska. The future of the Nation's wetlands depends on the actions of public agencies, private industry, and private groups and individuals. Recent population and agricultural trends point to increased pressure for converting wetlands

to other use, especially cropland. Increased wetland protection efforts by all levels of government and by private parties are needed to halt or slow wetland losses and to enhance the quality of the remaining wetlands.
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156. Wetlands of the world: Inventory, ecology and management.

Whigham, Dennis F.; Dykijova, Dagmar; and Hejny, Slavomil
Dordrecht: Kluwer Academic; Series: Handbook of vegetation science 15/2; 768 p. (1993)
Notes: Covers: Africa, Australia, Canada, Greenland, Mediterranean, Mexico, Papua New Guinea, South Asia, tropical South America, United States.
NAL Call #: QK911 .A1H3 v. 15/2; *ISBN:* 0792316851
Descriptors: wetlands/ inventory/ wetland management/ wetland ecology

157. Wildlife responses to wetland restoration and creation: An annotated bibliography.

Rewa, C.
In: A comprehensive review of Farm Bill contributions wildlife conservation, 1985-2000/ Heard, L. P.; Hohman, W. L.; Halloum, D. J.; and Wildlife Habitat Management Institute (U.S.); Series: Technical Report USDA/NRCS/WHMI.
Madison, MS: USDA, NRCS, Wildlife Habitat Management Institute, 2000; pp. 135-150
NAL Call #: aS604.6 .C66 2000
Descriptors: wetlands/ constructed wetlands/ water quality/ wildlife habitats

Effects of Agricultural Conservation Practices on Wetlands

158. Agricultural activities affecting the functions and values of Ramsar wetland sites of Greece.

Gerakis, A. and Kalburtji, K.
Agriculture, Ecosystems & Environment 70(2-3): 119-128. (Oct. 1998)
NAL Call #: S601.A34; *ISSN:* 0167-8809
Descriptors: wetlands/ Greece/ agricultural practices/ environmental effects/ nutrients/ hydrology/ groundwater/ sedimentation/ flood control/ irrigation/ ecosystem management/ agriculture/ sustainable development/ nature conservation/ environment management/ federal policies/ agricultural runoff/ environmental impact/ sediment pollution/ eutrophication/ effects on water of human nonwater activities/ management/ environmental action/ mechanical and natural changes
Abstract: Agricultural activities in the agroecosystems neighbouring wetland ecosystems are considered a major threat to the latter in all Mediterranean countries. This threat was investigated in thirteen internationally important wetland sites (Ramsar sites) of Greece. The effects of ten activities commonly practised in the surrounding agroecosystems on four wetland functions and four wetland values were evaluated. The functions were: nutrient removal/transformation, sediment/toxicant retention, flood flow alteration, and ground water discharge. The values were: biodiversity, fishing, hunting, and recreation. It was found that the Adamus' Wetland Evaluation Technique is useful even in the little studied Ramsar sites of Greece. Irrigation is the most decisive activity negatively influencing all functions and values, followed by cropland expansion and overgrazing. Coastal lagoons are the least affected by agricultural activities. It is concluded that in Greece the sustainability of wetland ecosystems depends to a significant degree on the sustainability of agroecosystems. The reverse is also true because wetlands provide irrigation water, crop pollinators, some frost protection, and predators of crop pests. The two ecosystem types are functionally closely linked. Therefore, a national policy for the sustainable development of the soil, water, and genetic resources of Greece must integratively consider both these ecosystems types.
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159. Agricultural impacts on Mediterranean wetlands: The effect of pesticides on survival and hatching rates in copepods.

Parra, G.; Jimenez-Melero, R.; and Guerrero, F.
Annales de Limnologie 41(3): 161-167. (2005)
NAL Call #: QH98.A1A5; *ISSN:* 0003-4088
Descriptors: wetlands/ agriculture/ pesticides/ copper compounds/ water quality/ mortality/ herbicides/ trees/ aquatic organisms/ toxicology/ reproduction/ pollution tolerance/ Copepoda/ Arctodiaptomus salinus/ Olea europaea/ western Mediterranean/ copepods
Abstract: Wetlands are one of the most altered natural systems due to the creation and development of agricultural landscapes. Some of agriculture's impacts are in relation to water quality decreases, due to the use of potentially toxic herbicides or pesticides, and they are responsible of ecological alterations. This study shows the negative effect that two pesticides generate in a population of the copepod *Arctodiaptomus salinus* in an aquatic ecosystem that is surrounded by intensive olive tree cultivation. Adult females and egg sacs of that calanoid copepod were exposed to different concentrations of copper sulphate and the pesticide dimethoate, to examine their tolerance response. The adult lethal concentration obtained was lower than the regular dose of pesticide used in olive agriculture. These results also reflect the negative effect over *A. salinus* secondary production as a consequence of the increase in females and nauplii mortality and by the hatching rate reduction.
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160. Agricultural inputs of mecoprop to a salt marsh system: Its fate and distribution within the sediment profile.

Fletcher, C. A.; Bubb, J. M.; and Lester, J. N.
Marine Pollution Bulletin 30(12): 803-811. (1995)
NAL Call #: GC1000.M3; *ISSN:* 0025-326X
Descriptors: salt marshes/ sediment pollution/ agricultural runoff/ agricultural pollution/ herbicides/ pollution effects/ coast defences/ drainage water/ nonpoint pollution sources/ fate of pollutants/ agricultural chemicals/ British Isles, England, Essex/ mecoprop/ nonpoint pollution sources/ fate

of pollutants/ agricultural chemicals/ coast defences/ drainage water/ sediment pollution/ agricultural pollution/ pollution effects

Abstract: The mass of mecoprop discharged in agricultural drainage waters directly onto a salt marsh has been determined and the subsequent fate and distribution of mecoprop within the vegetated and mud flat sediments investigated. The results show the leaching of high mecoprop concentrations from the agricultural soils following heavy rain, with peak concentrations in drainage waters preceding peak water discharges. A direct increase in mecoprop concentration within salt marsh sediments was also identified and, consequently, a preliminary evaluation of the potential threat of the mecoprop loadings to the indigenous biota of the dynamic salt marsh system was made.

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161. Agriculture and wildlife: Ecological implications of subsurface irrigation drainage.

Lemly, A. Dennis

Journal of Arid Environments 28(2): 85-94. (1994)

NAL Call #: QH541.5.D4J6; ISSN: 0140-1963

Descriptors: farming and agriculture/ subsurface irrigation drainage impact on wetland fauna/ semiaquatic habitat/ subsurface agricultural irrigation drainage impact on fauna/ chemical pollution/ subsurface agricultural irrigation drainage impact on wetlands/ USA/ West/ subsurface agricultural irrigation drainage impact on wetland fauna/ review

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162. Aquaculture impacts on the water quality and plankton community in a mangrove ecosystem in Brazil.

Neumann Leitao, S.; Feitosa, F. A. N.; Moura, M. C. O.; Flores Montes, M. J.; Muniz, K.; Silva Cunha, M. G. G.; and Paranagua, M. N.

Advances in Ecological Sciences 18: 161-171. (2003)

NAL Call #: QH540.167; ISSN: 1369-8273

Descriptors: animals and man/ disturbance by man/ commercial activities/ ecology/ habitat/ brackish habitat/ marine zones/ Atlantic Ocean/ South Atlantic/ comprehensive zoology: farming and agriculture/ aquaculture/ plankton community structure effect/ community structure/ plankton/ mangrove swamp/ south west Atlantic/ Brazil/ Pernambuco/ Goias/ plankton community structure/ effect of aquaculture/ mangrove

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163. Artificial drainage of peatlands: Hydrological and hydrochemical process and wetland restoration.

Holden, J.; Chapman, P. J.; and Labadz, J. C.

Progress in Physical Geography 28(1): 95-123. (2004); ISSN: 0309-1333

Descriptors: drainage/ peat/ catchment areas/ geography/ hydrologic budget/ forestry/ floods/ attitudes/ ecosystems/ artificial wetlands/ risk

Abstract: Peatlands have been subject to artificial drainage for centuries. This drainage has been in response to agricultural demand, forestry, horticultural and energy properties of peat and alleviation of flood risk. However, there are several environmental problems associated with drainage of peatlands. This paper describes the nature of these problems and examines the evidence for changes in

hydrological and hydrochemical processes associated with these changes. Traditional black-box water balance approaches demonstrate little about wetland dynamics and therefore the science of catchment response to peat drainage is poorly understood. It is crucial that a more process-based approach be adopted within peatland ecosystems. The environmental problems associated with peat drainage have led, in part, to a recent reversal in attitudes to peatlands and we have seen a move towards wetland restoration. However, a detailed understanding of hydrological, hydrochemical and ecological process-interactions will be fundamental if we are to adequately restore degraded peatlands, preserve those that are still intact and understand the impacts of such management actions at the catchment scale.

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164. Bacteria as bioindicators in wetlands: Bioassessment in the Bonneville Basin Of Utah, USA.

Merkley, M.; Rader, R. B.; McArthur, J. V.; and Eggett, D.

Wetlands 24(3): 600-607. (Sept. 2004)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ marshes/ basins/ biodegradation/ genetic analysis/ indicator species/ grazing/ surface area/ comparative studies/ analytical techniques/ genetics/ bioassays/ degradation/ man-induced effects/ anthropogenic factors/ genetic diversity/ species diversity/ bacteria/ biodiversity/ organic compounds/ substrates/ ecosystems/ bioindicators/ USA, Utah, Bonneville Basin/ microorganisms/ ecological techniques and apparatus/ mechanical and natural changes/ identification of pollutants/ water pollution: monitoring, control & remediation/ habitat community studies

Abstract: Bacteria should be excellent indicators of the early signs of degradation caused by human intervention because they have the highest surface area to volume ratio of all organisms. We determined the utility of a simple procedure that measures aerobic bacterial metabolic diversity (BILOG EcoPlates) as a reliable tool for assessing the effects of cattle grazing on spring ecosystems of the Bonneville Basin, Utah, USA. Marshes disturbed by cattle could be distinguished from protected marshes using EcoPlate analyses. The diversity of organic compounds used by bacteria was greater in grazed versus ungrazed marshes. A separate genetic analysis (DGGE) provided corroborating evidence. Greater metabolic diversity (EcoPlates) corresponded to greater bacterial assemblage diversity in grazed versus protected marshes. Greater plant diversity at grazed sites might account for the greater diversity of organic substrates used by bacteria in grazed sites. However, the results were not conclusive. In some marshes, a greater diversity of organic substrate use occurred where there was greater plant diversity, whereas in other marshes the diversity of organic substrates used by bacteria was lower where plant diversity was greatest. Regardless of the mechanism, aerobic bacterial metabolic diversity (EcoPlates) is a potentially valuable tool for assessing the early signs of degradation in wetland ecosystems.

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165. Bioassays with a floating aquatic plant (Lemna minor) for effects of sprayed and dissolved glyphosate.

Lockhart, W. L.; Billeck, B. N.; and Baron, C. L.

Hydrobiologia 188/89: 353-359. (1989)

NAL Call #: 410 H992; ISSN: 0018-8158

Descriptors: agricultural runoff/ aquatic plants/ bioassay/ duckweed/ glyphosate/ herbicides/ toxicity/ water pollution effects/ agricultural chemicals/ Canada/ prairie wetlands
Abstract: Macrophytes in forested areas and in prairie wetlands furnish critical habitat for aquatic communities and for several species of birds and mammals. North American agriculture relies heavily on herbicides and these compounds are detected routinely in surface waters of Western Canada. Common duckweed has been used previously in efforts to detect effects of herbicides and other chemicals. Duckweed clones were developed from local collections and grown axenically. The plants were exposed to glyphosate herbicide either by dissolving formulated Roundup (Monsanto Canada Inc.) in the culture media or by spraying of the cultures in a laboratory spray chamber. Plant growth was monitored by counting the fronds present on several occasions over a 2-week period. Plant growth, as measured by increased numbers of fronds or increased wet or dry weights was relatively insensitive to glyphosate dissolved in the culture medium. However, the plants were killed by application of glyphosate as a spray. (Author's abstract)
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166. Bird communities of prairie uplands and wetlands in relation to farming practices in Saskatchewan.

Shutler, D.; Mullie, A.; and Clark, R. G.

Conservation Biology 14(5): 1441-1451. (Oct. 2000)

NAL Call #: QH75.A1C5; ISSN: 0888-8892

Descriptors: wetlands/ agricultural practices/ community composition/ prairies/ conservation/ agriculture/ chemical control/ man-induced effects/ ecological distribution/ habitat selection/ aquatic birds/ Aves/ Canada, Saskatchewan/ birds/ agricultural practices/ conservation/ behaviour
Abstract: Modern farm practices can vary in their emphasis on tillage versus chemicals to control weeds, and researchers know little about which emphasis has greater ecological benefits. We compared avifaunas of uplands and wetlands in four treatments: conventional farms, conservation farms (contrasting those that minimized frequency of tillage [minimum tillage] with those that eliminated chemical inputs [organic]), and restored or natural (wild) sites in Saskatchewan, Canada. Of 37 different upland bird species encountered during surveys, one made greater use of farms, four made greater use of wild sites, and the remaining species showed no preference. When all upland species were combined, higher relative abundance occurred on wild than on farm sites, and on minimum tillage than on conventional farms. Wild upland sites also had more species than did conventional farms. Of 79 different species encountered during surveys of wetlands and their margins, most had similar encounter probabilities among treatments, although seven were more common on either organic farms or wild sites. Higher relative abundances were documented in wetland habitat of wild sites and organic farms than of minimum tillage or conventional farms. Wetlands of wild sites had more species than did minimum tillage or conventional farms. Overall, in terms of both avifaunal density and diversity, small treatment effects could be

ascribed to differences between conventional and conservation farms, whereas larger effects were due to differences between farms and wild sites. Wetlands were heavily used by birds in all treatments, suggesting high conservation priority regardless of context.

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167. Carbon and N mineralization as affected by soil cultivation and crop residue in a calcareous wetland ecosystem in Central Iran.

Raiesi, F.

Agriculture, Ecosystems & Environment 112(1): 13-20. (Jan. 2006)

NAL Call #: S601 .A34; ISSN: 0167-8809

Descriptors: mineralization/ soil microorganisms/ tillage/ carbon nitrogen ratio/ wetland soils/ ecosystems/ carbon/ nitrogen/ calcareous soils/ soil analysis/ soil nutrient balance/ Iran

Abstract: Mineralization of soil organic matter plays a key role in supplying nutrient elements essential to plant growth. Soil cultivation and crop residue affect C mineralization and nutrient availability in wetland ecosystems. This study evaluated the combined impacts of soil cultivation and crop residue on C and N mineralization in a calcareous wetland soil (Luvic Calcisol) in Central Iran. Soil samples were collected from 0 to 15 cm depth in cultivated and uncultivated plots and analyzed for selected soil attributes. Wheat (*Triticum aestivum* L.) and alfalfa (*Medicago sativa* L.) residues were collected and analyzed for the chemical composition. Nitrogen and C mineralization rates were studied using laboratory incubations for 60 days. Results show that in this calcareous wetland soil, cultivation decreased soil total organic carbon and total N contents, while total organic carbon/total N ratio, bulk density, pH, and extractable P and available K levels remain unaffected. Cultivation resulted in a significant increase in soil C and N mineralization. Wheat residue had a significantly lower quality than alfalfa residue, and therefore decomposed more slowly. Results also indicate that plant residue has a significant impact on decomposition rate and nutrient cycling. Soil cultivation and residue quality had a significant influence on C and N cycling and nutrient contents. The combined effects of soil cultivation and crop residue play a significant role in changing the nutrient balance and availability in calcareous wetland soils with conventional agricultural practices. In summary, significant differences occurred in soil attributes and residue decomposition affecting C and nutrient dynamics, and therefore crop productivity.

This citation is from AGRICOLA.

168. Changes in some physical and chemical characteristics of peat following reseeded and grazing.

Williams, B. L.; Boggie, R.; Cooper, J.; and Mitchell, J. W.

Irish Journal of Agricultural Research 24(2/3): 229-236. (1985)

NAL Call #: 10.5 IR45; ISSN: 0578-7483

Descriptors: peat soils/ peatlands/ physicochemical properties/ shrinkage/ soil compaction/ soil profiles/ bogs/ islands/ grazing/ Ireland

This citation is from AGRICOLA.

169. Changes in water and physical properties of peaty-bog soils induced by drainage and agricultural use.

Baranovskii, A. Z.

Eurasian Soil Science 31(4): 418-421. (1998)

NAL Call #: S590.P612; ISSN: 1064-2293

Descriptors: physical properties/ peat bogs/ soil water/ drainage/ agriculture/ cultivated lands/ moisture content

Abstract: Twenty-four years of soil cultivation resulted in the following wastes of organic matter: 104 t/ha for permanent herbs; 159 t/ha for cereal crops; 168 t/ha for intertilled crops; 131 t/ha for crop rotation; and 110 t/ha for virgin lands. The depth of the peat deposit was reduced by 16.8, 29.5, 31.7, 29.1, and 17.9 cm, respectively. Wastes of soil organic matter were reduced together with the depth of peat under the herbs and increased under the crops. The outstripping effect of drainage and cultivation affected peat water and physical properties. The ash content and compaction of peat were raised significantly, while its water-holding capacity decreased.

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170. Community attributes of Atlantic white cedar (*Chamaecyparis thyoides*) swamps in disturbed and undisturbed pinelands watersheds.

Laidig, Kim J. and Zampella, Robert A.

Wetlands 19(1): 35-49. (1999)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: biodiversity/ biogeography: population studies/ conservation/ freshwater ecology: ecology, environmental sciences/ agricultural development/ biological invasion/ overbank flooding/ phytogeography/ pineland watershed disturbance/ plant community attributes/ plant species composition/ residential development/ seedbed conditions/ seedling density/ species richness/ surface water conditions: nutrient concentration, ph, specific conductance/ understory composition/ wetlands habitat/ Atlantic white cedar swamp

Abstract: We assessed the effect of regional watershed conditions on plant community attributes, seedbed and seedling density, and environmental conditions in New Jersey Pinelands Atlantic white cedar (*Chamaecyparis thyoides*) swamps under three disturbance regimes (high, moderate, and low). High regional watershed disturbance, defined by the percentage basin cover of combined residential and agricultural development, was associated with elevated pH, specific conductance, and nutrient concentrations in surface waters adjacent to our study sites. High disturbance sites generally had lower understory species richness and differed from other sites in overall understory species composition. High canopy red maple (*Acer rubrum*) cover and high canopy closure were also associated with swamps in high disturbance basins. Because other environmental variables did not differ significantly between disturbance types and red maple is a common associate of cedar throughout the Pinelands, differences in species richness and composition may be related to canopy conditions rather than the effects of watershed disturbance. Regional differences in biogeography may also be a factor. We found no exotic species in our study sites. Only one species considered uncharacteristic of the Pinelands was associated with high disturbance basin sites. Unlike previous, similar studies in the Pinelands, the high disturbance sites did not support a unique group of plants. Although Sphagnum cover (typically associated with optimal cedar seedbed conditions) was

lowest in disturbed basin sites, there were no significant differences in overall seedbed conditions and cedar seedling density. Cedar swamps located a distance from upgradient watershed disturbances and not affected by overbank flooding seem to be buffered from the impacts of these regional disturbances.

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171. Conservation of Mediterranean temporary ponds under agricultural intensification: An evaluation using amphibians.

Beja, P. and Alcazar, R.

Biological Conservation 114(3): 317-326. (2003)

NAL Call #: S900.B5; ISSN: 0006-3207

Descriptors: abundance/ crayfish/ exotic species/ fish/ habitat modeling/ hydroperiod/ irrigation/ reservoirs/ species richness/ tadpoles/ Amphibia/ forestry/ agriculture/ conservation/ intercontinental region/ Mediterranean Region/ *Triturus marmoratus*/ insertae/ sedis/ *Triturus boscai*/ *Pelobatidae*/ *Elodytes punctatus*

Abstract: This study examined responses of amphibians breeding in Mediterranean temporary ponds to a gradient of agricultural intensification, aiming to identify land uses and management prescriptions favouring the conservation of these habitats in farmed landscapes. Larval amphibian assemblages and habitat attributes were sampled at 57 ponds, 10 of which had been converted into permanent irrigation reservoirs. Species richness increased with area and hydroperiod in temporary ponds, with the addition of rare species to ponds with long hydroperiods resulting in a tendency for the less widespread species (e.g. *Triturus marmoratus* and *T. boscai*) to occur in the most species-rich ponds, while species-poor ponds consisted predominantly of widespread species only (nested pattern). However, one species (*Pelodytes punctatus*) was largely restricted to the most ephemeral ponds, whereas permanent irrigation reservoirs were species-poor and lacked most species occurring in temporary waters. The strongest negative correlates of amphibian abundances were the intensification of agricultural land uses, the transformation of ponds into permanent reservoirs and the introduction of exotic predators (fish and crayfish) from the irrigation channels. The results suggest that conservation of temporary pond amphibian assemblages in Mediterranean farmland requires networks of ponds with diverse hydroperiods, where the natural hydrologic regimes, less intensive land uses and isolation from irrigation waters should be preserved.

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172. Degradation of persistent herbicides in riparian wetlands.

Stoeckel, D. M.; Mudd, E. C.; and Entry, J. A.

In: *Phytoremediation of soil and water contaminants/ Kruger, E. L.; Anderson, T. A.; and Coats, J. R.; Series: ACS symposium series 664.*

Washington, DC: American Chemical Society, 1997; pp. 114-132.

Notes: Conference: 212. National Meeting of the American Chemical Society, Orlando, FL (USA), 25-29 Aug 1996

NAL Call #: QD1.A45 no.664

Descriptors: wetlands/ herbicides/ riparian environments/ atrazine/ trifluralin/ agrochemicals/ phytoremediation/ biodegradation/ agricultural chemicals/ riparian land/ agricultural practices/ trifluralin/ fluometuron/ agricultural

chemicals/ riparian land/ agricultural practices/ riparian environments/ agrochemicals/ phytoremediation
Abstract: Modern agricultural practices make extensive use of herbicides to increase crop yields. Persistent herbicides (recalcitrant to degradation) are often preferentially used for season-long protection. The persistence of these herbicides makes them environmentally hazardous if they leach or are carried by surface runoff and erosion to pollute surface- or ground-waters. Three heavily used persistent herbicides are presented for illustration: atrazine (a triazine), fluometuron (a substituted urea), and trifluralin (a dinitroaniline). Vegetated border strips between agricultural fields and adjoining streams are sometimes cleared and protected from flooding to increase the amount of cultivable land. These areas, left in their natural state as seasonally-flooded riparian wetlands, contain micro-environments conducive to immobilization and degradation of persistent herbicides. While natural riparian wetlands should not be used to treat point-source herbicide pollutants, the literature indicates that maintenance of riparian wetlands can help to slow migration of and to enhance degradation of herbicides from non-point sources.

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173. Destruction of wetlands and waterbird populations by dams and irrigation on the Murrumbidgee River in arid Australia.

Kingsford, R. T. and Thomas, R. F.

Environmental Management 34(3): 383-396. (2004)

NAL Call #: HC79.E5E5; ISSN: 0364-152X

Descriptors: channels/ dams/ floodplain development/ floodplain vegetation communities/ hydroelectricity/ irrigation/ levee banks/ river diversions/ water resource development: ecological consequences/ wetlands destruction

Abstract: The Lowbidgee floodplain is the Murrumbidgee River's major wetland in southeastern Australia. From more than 300,000 ha in the early 1900s, at least 76.5% was destroyed (58%) or degraded (18%) by dams (26 major storages), subsequent diversions and floodplain development. Diversions of about 2,144,000 ML year⁻¹ from the Murrumbidgee River come from a natural median flow of about 3,380,000 ML year⁻¹ providing water for Australia's capital, hydroelectricity, and 273,000 ha of irrigation. Diversions have reduced the amount of water reaching the Lowbidgee floodplain by at least 60%, from 1888 to 1998. About 97,000 ha of Lowbidgee wetland was destroyed by development of the floodplain for an irrigation area (1975-1998), including building of 394 km of channels and 2,145 km of levee banks. Over 19 years (1983-2001), waterbird numbers estimated during annual aerial surveys collapsed by 90%, from an average of 139,939 (1983-1986) to 14,170 (1998-2001). Similar declines occurred across all functional groups: piscivores (82%), herbivores (87%), ducks and small grebe species (90%), large wading birds (91%), and small wading birds (95%), indicating a similar decline in the aquatic biota that formed their food base. Numbers of species also declined significantly by 21%. The Lowbidgee floodplain is an example of the ecological consequences of water resource development. Yanga Nature Reserve, within the Lowbidgee floodplain, conserved for its floodplain vegetation communities, will

lose these communities because of insufficient water. Until conservation policies adequately protect river flows to important wetland areas, examples such as the Lowbidgee will continue to occur around the world.

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174. Diatoms as indicators of wetland salinity in the Upper South East of South Australia.

Taffs, K. H.

Holocene 11(3): 281-290. (2001); ISSN: 0959-6836

Descriptors: wetlands/ agricultural inputs/ diatoms/ European settlement/ human impact/ palaeoecology/ salinity/ South Australia/ Australia, Upper South East

Abstract: Wetland degradation in the Upper South East of South Australia is an urgent management concern. Scant recent environmental data is available for the region and long-term monitoring data is lacking. Usually a palaeoecological analysis is able to reveal environmental change in the medium- to long-term past. However, the region is not conducive to palaeoecological investigation due to a fluctuating upper groundwater aquifer and alkaline soils which have destroyed most microfossils. It was found that the diatom assemblage was preserved in the wetlands of the region for the period of European settlement.

Analysis of the diatom assemblage enabled production of an inferred salinity curve. In combination with a small amount of historical information that was available, the salinity trend for the wetlands, for the period of European agricultural activities, was identified. It was found that, while groundwater salinity has been increasing, the wetland areas have experienced a freshening of surface water. This is due to an increase of throughflow of surface water, a result of constructed drainage systems flushing salts from the wetlands. Despite the freshening of wetlands they continue to degrade due to the changed hydrology, an impact of the drainage structures.

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175. Diffuse geographic distribution of herbicides in northern prairie wetlands.

Donald, D. B.; Gurprasad, N. P.; Quinnett-Abbott, L.; and Cash, K.

Environmental Toxicology and Chemistry 20(2): 273-279. (2001)

NAL Call #: QH545.A1E58; ISSN: 0730-7268

Descriptors: wetlands/ herbicides/ pollution surveys/ agricultural pollution/ evapotranspiration/ pollution effects/ path of pollutants/ prairies/ agriculture/ distribution/ water analysis/ volatility/ rainfall/ distribution (mathematical)/ volatile materials/ precipitation (atmospheric)/ geography/ pesticides/ water pollution/ USA/ Canada, Saskatchewan

Abstract: The concentrations of herbicides in water from wetlands on landscapes where herbicides are not used should be less than on farms with moderate (conventional farms) and intense (minimum-till farms) herbicide use. In general, this hypothesis was not supported for wetlands situated in the Boreal Plains Ecozone of central Saskatchewan, Canada. The overall detection frequency of 10 commonly used herbicides was not significantly different among wildlife habitat with no pesticide use (44.4%), farms with no pesticide use (51.6%), conventional farms (54.9%), and minimum-till farms (56.5%, $\chi^2_{(2)} = 5.64$, $p =$

0.13). The herbicides (4-chloro-2-methylphenoxy) acetic acid (MCPA), 2,4-dichlorophenoxyacetic acid (2,4-D), bromoxynil, dicamba, mecoprop, and diclorprop accounted for 87% of all detections. In general, detection frequencies and concentrations of individual herbicides were similar on all land-use types. For example, the mean concentration of 2,4-D in water on the four land types ranged from 0.12 plus or minus 0.104 to 0.26 plus or minus 0.465 $\mu\text{g/L}$, and MCPA ranged from 0.08 plus or minus 0.078 to 0.19 plus or minus 0.166 $\mu\text{g/L}$. However, in the year of application, mean concentrations of MCPA and bromoxynil, but not 2,4-D, were significantly higher by about twofold in wetlands situated in fields where these herbicides were applied compared with all other wetlands. We propose that many agricultural pesticides are rapidly lost to the atmosphere at the time of application by processes such as volatilization from soil and plant evapotranspiration. Then, the herbicides used throughout the region may be directly absorbed to the surface of wetlands from the atmosphere, or they become entrained in local convective clouds, and are redistributed by rainfall in a relatively homogenous mixture over the agricultural landscape. The low levels of individual herbicides we found in most of the wetland waters would not cause chronic effects to aquatic biota.

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176. Direct and indirect exogenous contamination by pesticides of rice-farming soils in a Mediterranean wetland.

Gamon, M.; Saez, E.; Gil, J.; and Boluda, R.
Archives of Environmental Contamination and Toxicology 44(2): 141-151. (2003)

NAL Call #: TD172.A7; ISSN: 0090-4341

Descriptors: wetlands/ rice fields/ pesticides/ soil contamination/ surface water/ pollution detection/ rice/ water pollution/ soils/ sediment pollution/ agricultural runoff/ temporal variations/ spatial variations/ Spain, Valencia, Albufera Natural Park/ organophosphorous

Abstract: It is known that the sources of soil contamination can be endogenous or exogenous and that exogenous contamination may be direct or indirect. In this work, an environmental pesticide fate study was conducted in soil profiles collected from 23 rice field sites in an important Mediterranean wetland (Albufera Natural Park, Valencia, Spain) from April 1996 to November 1997. Temporal and spatial distribution of 44 pesticide residues in an alluvial Mediterranean soil (gleyic-calcaric Fluvisol, Fluvaquent) were monitored. During this period, the levels of pesticide residues in different soil horizons (Ap1 0-12 cm, Ap2 12-30 cm, ApCg 30-50 cm, C1gr 50-76 cm, and C2r 76-100 cm) were investigated. In addition, information was collected on agricultural pesticide application practices and soil characteristics. Distribution throughout the soil profile showed that pesticide concentrations were always higher in the topsoil (Ap1 horizon), in the autumn season, and in the border with citrus-vegetable orchard soils (calcaric Fluvisol, Xerofluent). Chlorpyrifos (organophosphorus), endosulfan (organochlorine), and pyridaphenthion (organophosphorus) insecticides were, respectively, the most detected of all the pesticides investigated. These results were associated with processes, such as nonleaching, transport by movement into surface waters, retention, volatilization, and chemical and biological degradation in the topsoil, as well as with direct and indirect exogenous contamination sources.

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177. Drainage effects in marsh soils: I. Effects on water table and drainflow.

Ibrahim, S. M.

In: Drainage and water table control: Proceedings of Sixth International Drainage Symposium. (Held 13 Dec 1992-15 Dec 1992 at Nashville, Tennessee.)

St. Joseph, Michigan: American Society of Agricultural Engineers; pp. 169-176; 1992.

Descriptors: soil water regimes/ groundwater level/ drainage/ spacing/ wetland soils/ depth/ soil water movement/ flow to drains

Abstract: Drainage effects in marsh soils caused by ditches and pipes were studied in long term field experiments (1982/90) in the Elbe river coastal region of Northern Germany. Three fields were selected to demonstrate the effects of drainage on the groundwater table and drainflow comparing ditch drainage and pipe drainage with 7 m, 14 m or 28 m drain spacing and 0.9 m, 1.0 m or 1.2 m drain depths. The results show that without pipe subdrainage the groundwater table remains near the soil surface during heavy rainfall periods. Under favourable hydraulic and topographic conditions, pipe drainage with a moderate drain intensity with open main outfalls (ditches) is recommended. The results also show that with closer drain spacing greater drainflow and a deeper groundwater table result. The calculated drain spacing of 14 m is not necessary. With a drain depth of 1.0 m, an optimum drain spacing of 13-20 m was determined. If the outlet ditch is deep enough and no outside water influence exists, a 28 m drain spacing is proposed for this site. Instead of grassland and traditional ditch drainage, arable use with subsurface drainage has become possible.

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178. Ecology and management of moorland pools: Balancing acidification and eutrophication.

van Dam, H. and Buskens, R. F. M.

Hydrobiologia 265(1-3)(1993)

NAL Call #: 410 H992; ISSN: 0018-8158.

Notes: Conference: Symp. on Netherlands-Wetlands, Arnhem (Netherlands), Dec 1993

Descriptors: acidification/ eutrophication/ ecosystem management/ hydrology/ community composition/ agricultural pollution/ pollution effects/ acid rain/ Netherlands/ moorland pools/ agricultural pollution/ ecosystem management/ ecosystems and energetics/ conservation, wildlife management and recreation/ management/ freshwater pollution

Abstract: Moorland pools originally are shallow, often hydrologically isolated, soft-water bodies, with a low productivity. Some thousands of moorland pools originated from the late Pleistocene onwards in the heathland landscape in The Netherlands and adjacent areas, where soils have a poor buffering capacity. As the pools are largely fed by atmospheric precipitation, they are very vulnerable to changes in the environment, e.g. eutrophication and acidification. Acidification by acid atmospheric deposition and eutrophication by agricultural acidification are the main threats to the moorland pool ecosystems and affect the species composition of assemblages of aquatic macrophytes, desmids, diatoms, macrofauna, fishes and amphibians, as has been shown by comparison of old and recent records on their distribution and paleolimnological methods. Afforestation exacerbates acidification and also reduces wind dynamics. Particularly

the decrease of isoetids and desmids by both processes indicate the biological impoverishment of the pools. Reductions of (potential) acid atmospheric deposition to less than 40 mmol m⁻²/yr and of ammonia to less than 30 mmol m⁻²/yr are necessary for recovery of the moorland pools. Methods for the addition of buffering material to a number of moorland pools, to counteract acidification until these deposition rates have lowered sufficiently, are given, as well as other methods for restoring the biological quality of moorland pools.
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179. Effect of agricultural and residential development on aquatic macrophytes in the New Jersey Pine Barrens.

Morgan, M. D. and Philipp, K. R.
Biological Conservation 35(2): 143-158. (Mar. 1986)
NAL Call #: S900.B5; ISSN: 0006-3207
Descriptors: wetlands/ regional development/ agricultural development/ residential development/ aquatic plants/ macrophytes/ New Jersey pine barrens/ water pollution effects/ agriculture/ water pollution/ water pollution sources/ species diversity/ hydrogen ion concentration/ nitrates/ effects of pollution/ effects on water of human nonwater activities

Abstract: The impact of residential and agricultural development as the cause of water pollution on aquatic macrophyte communities in the New Jersey Pine Barrens was examined by comparison with unpolluted communities. The only major physical and chemical differences between stream types were greatly elevated pH values and NO₃(-) concentrations at the polluted sites. A total of 59 aquatic macrophyte species were identified during the study. Only a few more species (41) occurred at the polluted sites (38). Twentytwo species were confined to polluted sites, and 19 to unpolluted sites. Classification of all species as either typical or non-typical Pine Barrens species revealed that the primary effect of pollution was the replacement of a distinctive Pine Barrens flora (e.g., *Carex walteriana*, *Eleocharis olivacea*, *E. tuberculosa*, *Eriocaulon compressum*, and *Utricularia fibrosa*) with one containing many marginal or non-indigenous species common to wetlands throughout the Eastern US (e.g., *Callitriche heterophylla*, *Galium tinctorium*, and *Polygonum punctatum*). (Doria-PTT)
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180. The effect of cattle and sheep grazing on salt-marsh vegetation at Skallingen, Denmark.

Jensen, A.
Vegetatio 60(1): 37-48. (1985)
NAL Call #: 450 V52; ISSN: 0042-3106
Descriptors: cattle/ sheep/ vegetation/ flora/ plant communities/ plant ecology/ grazing/ salt marshes/ Denmark
This citation is from AGRICOLA.

181. Effect of farming practices on wetlands of Kish District, Kenya.

Mironga, J. M.
Applied Ecology and Environmental Research 3(2): 81-91. (2005)
NAL Call #: QH540.A67; ISSN: 1785-0037
Descriptors: water quality/ farming practice

Abstract: Effect of farming practices on wetlands in Kisii District was determined through assessment of farmers' environmental awareness. Effective conservation of wetlands in the district cannot depend on prohibitions but should be based on users' knowledge and attitudes of wetlands. The present study examined farmers' knowledge of the environmental effect of agricultural expansion to wetlands; absence of knowledge of characteristics of farming activities and the attitudes of farmers with respect to planning mechanisms that might be used to support wetland protection in the area. The majority of farmers ignored the effect of agriculture on wetlands. Those who occupied wetland areas practiced intensive agriculture and were ignorant of the effect of this on water quality, soil and landscape. The government should implement training programmes for all wetland users in Kisii District to make them more environmentally aware of the impacts of farming practices on wetlands. This is meant to make them become more environmentally aware of the effects of farming practices on these ecosystems and eventually change their behavior. There is a need to build a conservation ethic among wetland users by educating them to sustainably utilize wetland resources and training them to practise sustainable agriculture.
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182. Effect of forest management practices on southern forested wetland productivity.

Conner, W. H.
Wetlands 14(1): 27-40. (1994)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: wetlands/ forest industry/ biological production/ hydrology/ flooding/ resource management/ water levels/ environmental effects/ logging/ forest management/ water level/ drainage/ USA, Southeast/ USA/ forest management/ water level/ drainage/ forest industry/ biological production/ resource management/ water levels
Abstract: In the interest of increasing productivity of forested wetlands for timber production and/or wildlife value, management schemes that deal mainly with water-level control have been developed. The three forest types in the southeastern U.S. most commonly affected are cypress/tupelo forests, bottomland hardwood forests, and wet pine sites (including pocosins). In forested wetlands, hydrology is the most important factor influencing productivity. In bottomland and cypress/tupelo forests, water-level control can have mixed results. Alterations in natural hydrologic patterns leading to increased flooding or drainage can cause decreased growth rates or even death of the forest. Bottomland hardwoods respond favorably in the short term to water-level management, but the long-term response is currently under study. In wet pine sites, timber volume can be increased significantly by water-level management, but the impact upon other ecological functions is less understood. It is difficult to adequately describe productivity relations in wetland forests because of the great diversity in habitat types and the lack of data on how structure and function might be affected by forestry operations. There is a definite need for more long-term, regional studies involving multidisciplinary efforts.
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183. Effect of winter cutting on the passerine breeding assemblage in French Mediterranean reedbeds.

Poulin, Brigitte and Lefebvre, Gaetan

Biodiversity and Conservation 11(9): 1567-1581. (2002)

NAL Call #: QH75.A1 B562; ISSN: 0960-3115

Descriptors: passeriformes/ Emberizidae/ Panuridae/ Sylviidae/ Acrocephalus arundinaceus/ Acrocephalus melanopogon/ Acrocephalus scirpaceus/ Emberiza schoeniclus/ Panurus biarmicus/ arthropod distribution/ biomass/ breeding assemblage/ commercial enterprises/ communities/ conservation/ density/ disturbances/ ecosystems/ Eurasia/ Europe/ food supply/ France/ habitat management/ habitat use/ land zones/ management/ management practices/ nutrition/ palaeartic region/ population ecology/ population studies/ reed bed cutting/ reed bed habitat/ reedbeds/ south/ status/ terrestrial ecology/ vegetation structure/ water regime/ wildlife/ wildlife-human relationships/ winter cutting/ wetland vegetation/ food/ brood/ eggs

Abstract: Common reed is increasingly harvested from the Mediterranean region to provide thatching material to north European countries. The impact of these management practices on the fauna is poorly known. The aim of this study was to quantify the effect of reed cutting in the Mediterranean region through a comparative analysis of water regime, vegetation structure, arthropod distribution and passerine assemblage at cut and uncut reedbeds in southern France. Cut reedbeds were characterised by a lower salinity, higher water level in spring, and higher reed biomass than uncut reedbeds. Arthropod distribution differed consistently between cut and uncut sites, leading to a higher index of food available to passerines in cut reedbeds. Cut reedbeds had a similar bird species richness but a lower bird abundance, due to the significant decrease in Moustached Warblers and Bearded Tits at cut sites. The mild Mediterranean winter favoured early growth of reed in spring, making harvested reedbeds suitable for breeding of long-distance migrants such as the Great Reed Warbler and Reed Warbler. However, for the resident species that breed earlier in the season, cut reedbeds presumably lack sufficient vegetation cover to provide adequate nesting and feeding sites. Although biennial cutting (double wale) is considered as a good compromise between conservation and commercial interests in the UK, the juxtaposition of annually cut and never cut reed patches appears as the only sustainable alternative for the Mediterranean region. We further hypothesise that an optimal mosaic design of cut/uncut reed patches could provide as high a conservation value as unmanaged reedbeds.

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184. Effectiveness of constructed overland flow areas in decreasing diffuse pollution from forest drainages.

Liljaniemi, Petri; Vuori, Kari-Matti; Tossavainen, Tarmo; Kotanen, Juho; Haapanen, Merja; Lepistö, Ahti; and Kenttämies, Kaarle

Environmental Management 32(5): 602-613. (Nov. 2003)

NAL Call #: HC79.E5E5; ISSN: 0364-152X

Descriptors: wetlands/ drainage/ peatlands/ metals/ forests/ nutrients/ water quality/ pollution effects/ seasonal variations/ chemical oxygen demand/ sulfur dioxide/ environment management/ phosphorus/ finland/ freshwater pollution/ water pollution: monitoring, control & remediation

Abstract: Forestry is the largest scale human impact affecting catchments in Finland and a prominent source of

diffuse pollution in many water courses. Among the forestry activities, draining of wetlands had the most pronounced impacts on sediment, nutrient, and metal loading in the past. At present, renovation of old ditches and fertilization of peatlands constitute the major risk of forestry-induced diffuse pollution. Contemporary forestry aims at decreasing this risk with various riparian buffer strip designs. Among such designs, creation of overland flow areas by plugging the outlet ditches is increasingly used. Our objectives were to evaluate the potential of constructed overland flow areas to function as riparian buffers and estimate the quality and quantity of diffuse pollution from old versus recent forest drainages. We studied retention and release of pollutants from 20 constructed, 2- to 10-m-wide overland flow areas receiving drainage water from forested peatlands. Drainage waters were sampled above and below the plugged ditches three times per year from 1998 to 1999. Chemical oxygen demand and nutrient and metal loads and concentrations varied strongly between seasons, years, and drainage areas. Areas subjected to recent ditch renovations and fertilizations had clearly elevated seasonal loads and concentrations of total phosphorus (TP), PO₄³⁻, Fe, and Al in comparison to old treatment areas. Especially TP loads were high above the national average values measured for forestry-induced diffuse pollution. In general, water quality above and below the buffer strips did not differ significantly. Our results indicate that plugged outlet ditches and associated narrow overland flow areas do not function as proper buffers in peatland areas. We suggest that wider buffers with extensive overland flow areas are needed in order to control diffuse pollution from forested and drained peatlands.

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185. The effects of adjacent land use on wetland amphibian species richness and community.

Houlahan, J. E. and Findlay, C. S.

Canadian Journal of Fisheries and Aquatic Sciences 60(9): 1078-1094. (2003)

NAL Call #: 442.9 C16J; ISSN: 0706-652X

Descriptors: wetlands/ aquatic animals/ forests/ habitats/ land use/ marshes/ nature conservation/ nitrogen/ plant communities/ polluted water/ population density/ roads/ roots/ species richness/ vegetation types/ water pollution/ water quality/ animal communities

Abstract: Habitat destruction and fragmentation have been identified as possible causes of large-scale amphibian declines. Here, we examine the effects of adjacent land use and water quality on wetland amphibian species richness, abundance, and community composition in 74 Ontario wetlands. Species richness was positively correlated with wetland area, forest cover, and the amount of wetlands on adjacent lands and negatively correlated with road density and nitrogen levels. The land-use effects peak at 2000-3000 m. Amphibian abundance was positively correlated with forest cover, distance to wetlands >20 ha, and amount of marsh habitat and negatively correlated with road density. The effects of adjacent land use were strongest at around 200 m. Land-use and water quality effects varied widely across species, although most species are positively correlated with forest cover and amount of wetlands on adjacent lands and negatively correlated with road density and water quality. These results suggest that the effects of adjacent land use on amphibian communities can extend over comparatively large distances. As such, effective

wetland conservation will not be achieved merely through the creation of narrow buffer zones between wetlands and intensive land uses, but rather will require maintaining a heterogeneous regional landscape containing relatively large areas of natural forest and wetlands.

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186. Effects of agricultural change on abundance, fitness components and distribution of two arctic-nesting goose populations.

Fox, A. D.; Madsen, J.; Boyd, H.; Kuijken, E.; Norriss, D. W.; Tombre, I. M.; and Stroud, D. A.

Global Change Biology 11(6): 881-893. (2005)

NAL Call #: QC981.8.C5G6323; ISSN: 1354-1013

Descriptors: wetlands/ Anser/ population ecology/ population growth/ habitat preferences/ agricultural land/ winter/ seasonal migration/ zoogeography/ grain crops/ foraging/ fields/ spring/ Scandinavia/ Western European region/ Greenland/ Irish Republic/ Great Britain/ Iceland
This citation is from AGRICOLA.

187. The effects of agricultural irrigation on wetland ecosystems in developing countries: A literature review.

Galbraith, Hector; Amerasinghe, Priyane; and Huber-Lee, Annette

Colombo, Sri Lanka: International Water Management Institute, 2005. CA Discussion Paper.

<http://www.iwmi.cgiar.org/assessment/files%5Fnew/publications/Discussion%20Paper/CADiscussionPaper1.pdf>

Descriptors: wetlands/ irrigation/ developing countries/ environmental impact/ literature reviews

188. Effects of agriculture development on vole dynamics and conservation of Montagu's harrier in western French wetlands.

Butet, A. and Leroux, A. B. A.

Biological Conservation 100(3): 289-295. (2001)

NAL Call #: S900.B5; ISSN: 0006-3207

Descriptors: change of agriculture/ harrier's breeding success/ raptor conservation/ specialist raptors/ vole cyclic pattern/ agricultural development/ population decline/ prey availability/ raptor/ reproductive success/ rodent/ France/ Circus pygargus/ Microtus arvalis

Abstract: Nesting populations of Montagu's harrier (*Circus pygargus*) are declining in most parts of Europe; in France, western marshes remain the most important nesting sites in terms of breeding pairs. In this open field landscape dominated by grasslands, the common vole (*Microtus arvalis*) displays regular population outbreaks and constitutes a favourite prey of this raptor. Twelve years of field data indicate significant variations in nesting population size and young harriers produced, which correlate with yearly differences in vole densities. Up to 10 years ago, these marshes were traditionally used as extensive pastures but recent agricultural changes have resulted in almost 50% of the pastures being converted to drained agricultural production, as already observed in many localities of this region next to our study area. Our data, together with previous data collected from 1968 in this region, demonstrate that agricultural changes have resulted in a decrease of frequency and intensity of vole population peaks. A summer density of 100 voles/ha appears as a threshold value to support a good breeding success of harriers. These modifications of the vole fluctuation pattern

suggest that nesting populations of Montagu's harrier from western French marshes could be endangered in future under these current trends in agricultural changes.

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189. The effects of cattle grazing on tall-herb fen vegetation and molluscs.

Ausden, M.; Hall, M.; Pearson, P.; and Strudwick, T.

Biological Conservation 122(2): 317-326. (2005)

NAL Call #: S900.B5; ISSN: 0006-3207

Descriptors: wetlands/ habitat/ interspecific interactions/ species richness/ vegetation/ molluscs/ forestry/ agriculture/ Poaceae/ Phragmites australis/ Glyceria maxima/ Vertigo moulinsiana/ Cyperaceae/ Carex riparia

Abstract: The effects of light year-round cattle grazing on tall-herb fen vegetation and wetland molluscs were compared to the effects of non-intervention over a period of four years using grazing exclosures. The distribution of cattle within the area of fen was investigated by plotting the position of the herd at 3-4 day intervals throughout the year. Cattle distributed themselves randomly throughout the fen in spring, autumn and winter, but showed a more aggregated distribution in summer. Grazing reduced the biomass of *Phragmites australis* and increased stem densities of *Glyceria maxima*, resulting in a shift of dominance from *Phragmites* to *Glyceria*. Plant species-richness was also significantly higher in areas open to grazing. Grazing decreased total densities of molluscs and substantially reduced densities of the rare snail *Vertigo moulinsiana*. *V. moulinsiana* was particularly associated with areas of fen that had a high water table and high biomass of ungrazed *Carex riparia*. However, because of the patchy nature of the grazing, *V. moulinsiana* survived at reasonably high densities in patches of ungrazed vegetation within the grazing unit.

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190. Effects of climate change and land use on duck abundance in Canadian prairie-parklands.

Bethke, Raymond W. and Nudds, Thomas D.

Ecological Applications 5(3): 588-600. (1995)

NAL Call #: QH540.E23; ISSN: 1051-0761

Descriptors: climatology: environmental sciences/ mathematical biology: computational biology/ models and simulations: computational biology/ systematics and taxonomy/ wildlife management: conservation/ agriculture/ drought/ habitat/ mathematical model/ precipitation/ survey
Abstract: Recent declines in the number of breeding ducks in the Canadian prairie-parklands have been hypothesized to be due to loss of habitat to agriculture. However, prairie-parkland also has experienced wetland loss to drought as well as to agriculture. If habitat restoration is to be implemented and monitored successfully, it is important to separate the effects of anthropogenic changes to the landscape on duck populations from those caused by changes in climate. We used data from annual air-ground surveys and from precipitation records to develop relationships between indices of abundance of each of 10 species of ducks and indices of wetland conditions during 1955-1974. We used these relationships to predict annual abundance of each species during 1975-1989. We compared predicted and observed abundances over the period 1975-1989 to distinguish declines in duck abundance greater than those accounted for by drought alone and to determine the magnitude and location of real

"deficits" in duck abundance. Average annual deficits within Canadian prairie-parkland over the period 1975-1989 were estimated at 1.2 times 10⁶ birds for both Mallard (*Anas platyrhynchos*) and Northern Pintail (*A. acuta*), 480 000 for Blue-winged Teal (*A. discors*), 190 000 for American Wigeon (*A. americana*), 175 000 for Northern Shoveler (*A. clypeata*), 50 000 for Gadwall (*A. strepera*), 10 000 for Green-winged Teal (*A. crecca*), 40 000 for Canvasback (*Aythya valisineria*), 25 000 for Lesser Scaup (*A. affinis*), and 5000 for Redhead (*A. americana*). Overall, the effect of agricultural expansion in the east on prime waterfowl habitat since 1951 appears to have been negligible. There, as much as 90% had been already lost prior to 1951. In the west, however, where prime waterfowl habitat was still relatively abundant in 1951, agricultural development has encroached substantially. The relationship between the lost area of the best breeding habitats and the size of population deficits for Mallards and Northern Pintails in the entire Canadian prairie-parkland region was significant for both species ($P < 0.0027$ and $P < 0.0001$, respectively). Consequently, habitat restoration programs located where the highest quality waterfowl habitat and the lowest quality agricultural lands overlap most should have the greatest potential to affect recovery of breeding duck populations in the Canadian prairie-parklands.

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191. Effects of cropping practices on the use of rice fields by waterbirds in the Camargue, France.

Tourenq, Christophe; Sadoul, Nicolas; Beck, Nicolas; Meslard, Francois; Martin, Jean-Louis; and Martin J. *Agriculture, Ecosystems and Environment* 95(2/3): 543-549. (2003)

NAL Call #: S601.A34; ISSN: 0167-8809

Descriptors: Anseriformes/ Charadriiformes/ Ciconiiformes/ rice fields/ waterbirds/ agricultural practices/ waterfowl/ waders gulls and auks/ herons and allies/ agriculture/ wetland/ habitat management/ abundance/ dispersion/ abundance/ France

Abstract: The abundance of waterbirds was compared in 46 rice fields in relation with the age of the field and the planting practices in spring. Of the 29 species censused, Charadriiformes represented some 73%, Ciconiiformes 6%, and Anseriformes less than 15.5% of the total number of individuals, flamingos and moorhens being also observed. Insectivorous species were the main component of the waterbird community. Bird numbers decreased with increasing field age and were lower in dry-sown than in wet-sown fields. The present results suggest that intensive and/or repetitive soil management and pesticide use may decrease the food resources available to waterbirds.

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192. Effects of drainage, tilling and PK-fertilization on bulk density, total N, P, K, Ca and Fe and net N-mineralization in two peatland forestry sites in Newfoundland, Canada.

Wells, E. D. and Williams, B. L.

Forest Ecology and Management 84(1-3): 97-108. (1996)

NAL Call #: SD1.F73; ISSN: 0378-1127

Descriptors: bog/ bulk density/ calcium/ drainage/ fen/ field method/ forestry/ iron/ net nitrogen mineralization/ nitrogen/ peatland forestry/ phosphorus/ phosphorus potassium fertilization/ potassium/ soil science/ tilling

Abstract: Bulk density, total contents of N, P, K, Ca and Fe and field- and laboratory-incubated mineral-N were determined for a bog and fen site 3 years after drainage treatments (3 m and 15 m ditch spacings), tilling treatments (untilled, tilled) and fertilization treatments (unfertilized, PK-fertilized), as well as for adjacent untreated (undisturbed) areas of the bog and fen. Tilling of the surface or fertilization did not significantly affect total nutrient contents in either bog or fen, although nutrient contents were generally higher in fertilization or drainage treatments that included tilling. As a result of decreased ditch spacing (from 15 m to 3 m), bulk density was significantly increased in the bog site (from 44.9 to 63.5 mg cm⁻³) and decreased (nonsignificant) in the fen site (from 105 to 89 mg cm⁻³). Total P and K were increased where PK was applied as fertilizer. In bog peats, bulk density (mg cm⁻³), total N concentrations (mg g⁻¹) and total contents (kg ha⁻¹) of N, P, K, Ca and Fe were significantly higher in the 3 m ditch spacing than in the 15 m ditch spacing. Thus, increases in total nutrient contents in bog peats can be attributed mainly to increased bulk density as a result of drainage treatment. In contrast, bulk densities and most nutrient contents of fen peats were not significantly affected by treatments.

However, total N concentrations and total N contents were significantly reduced by more intensive ditching (3 m ditch spacing). Contents of mineral-N in fresh peat and field-incubated and laboratory anaerobically incubated (30 degree C) peat consisted entirely of NH₄-N. Laboratory incubations over a 20-week period demonstrated a high potential for release of NH₄-N in peat from treated sites of bog and fen. During four 28-day field incubation periods, production of mineral-N varied from 0.1 to 1.2 kg ha⁻¹ (net mineralization) to -0.1 to -0.3 kg ha⁻¹ (net immobilization) for bog peat. Similarly, on the fen site production ranged from 0.1 to 2.7 kg ha⁻¹ (net mineralization) and -0.1 to -1.7 kg ha⁻¹ (net immobilization). In the unfertilized and PK-fertilized treatments of the fen, as well as the PK-fertilized treatment of the bog, net immobilization predominated during the first incubation period, followed by net mineralization during the next three incubation periods. In the unfertilized treatment of the bog, net mineralization predominated early in the growing season, followed by net immobilization thereafter.

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193. Effects of herbicides on two submersed aquatic macrophytes, *Potamogeton pectinatus* L. and *Myriophyllum sibiricum* komarov, in a prairie wetland.

Forsyth, D. J.; Martin, P. A.; and Shaw, G. G.

Environmental Pollution 95(2): 259-268. (1997)

NAL Call #: QH545.A1E52; ISSN: 0269-7491

Descriptors: wetlands/ macrophytes/ aquatic plants/ *Potamogeton pectinatus*/ clopyralid/ picloram/ 2,4-dichlorophenoxyacetic acid/ Canada, Saskatchewan/ herbicides/ growth/ toxicity testing/ submerged plants/ plant growth/ plant physiology/ water pollution effects/ toxicity tests/ indicator species/ *Myriophyllum sibiricum*

Abstract: Clopyralid, picloram, 2,4-D and a mixture of 2,4-D plus picloram (Tordon registered 202C) were added to the water of 1 m square enclosures in a prairie wetland in Saskatchewan, Canada to produce concentrations of 0.01 and 0.1 mg active ingredient litre super⁻¹. Effects on the submersed macrophytes, *Potamogeton pectinatus* and *Myriophyllum sibiricum*, were monitored by taking repeated measurements of plant weight, flower and tuber production

and inspecting for injuries at 30 and 60 days after application. Clopyralid did not inhibit weight gain (growth) in either species, but stimulated growth and flowering by *M. sibiricum* at 0.01 mg litre super(-1) and tuber production by *P. pectinatus* at both rates. The low rate of 2,4-D stimulated flowering by *M. sibiricum* and tuber production by *P. pectinatus*, whereas the high rate inhibited growth of *M. sibiricum* and injured both species. Picloram did not affect growth of either species, but injured *M. sibiricum* at both concentrations and inhibited flowering at 0.1 mg litre super(-1). Tordon registered 202C at 0.1 mg litre super(-1) caused reduced growth and flowering in *M. sibiricum* and injured both species; 0.01 mg litre super(-1) also injured *M. sibiricum*. Mortality resulted only from Tordon registered 202C and 2,4-D. Field data are lacking to assess the extent to which submerged macrophytes in prairie ponds are exposed to harmful concentrations of herbicide from aerial spraying, drift from ground application, runoff or wind erosion of soil.

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194. Effects of nitrogen fertiliser and pesticide management on floodwater ecology in a wetland ricefield: 3. Dynamics of benthic molluscs.

Simpson, Ian C.; Roger, Pierre A.; Oficial, Roberto; and Grant, Ian F.

Biology and Fertility of Soils 18(3): 219-227. (1994)

NAL Call #: QH84.8.B46; ISSN: 0178-2762

Descriptors: animals and man/ disturbance by man/ commercial activities/ ecology/ population dynamics/ habitat/ man made habitat/ abiotic factors/ chemical factors/ land and freshwater zones/ Oriental region/ Mollusca: farming and agriculture/ biomass/ population density/ management influences/ cultivated land habitat/ wetland rice field/ agricultural practices effect on benthon/ fertilizers and pesticides/ wetland rice field management effect on benthon dynamics/ Philippines/ benthon dynamics in wetland rice field/ agricultural management influence/ Mollusca/ invertebrates/ molluscs

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195. Effects of pesticides on soil and water microflora and mesofauna in wetland ricefields: A summary of current knowledge and extrapolation to temperate environments.

Roger, P. A.; Simpson, I.; Oficial, R.; Ardales, S.; and Jimenez, R.

Australian Journal of Experimental Agriculture 34(7): 1057-1068. (1994)

NAL Call #: 23 Au792; ISSN: 0816-1089

Descriptors: wetlands/ reviews/ pesticides/ bibliographies/ rice/ temperate zone/ invertebrates/ fertilizers/ agricultural practices/ microorganisms/ data collections/ rice fields/ pollution effects/ literature reviews/ agricultural pollution/ Invertebrata/ Invertebrata/ biodiversity/ rice fields/ pollution effects/ Invertebrata/ literature reviews/ agricultural pollution/ reviews/ rice/ temperate zone/ invertebrates/ agricultural practices/ data collections

Abstract: This review summarises information on the behaviour of pesticides and their impacts on microorganisms and non-target invertebrates that was collected in, or is applicable to, temperate wetland ricefields. An extensive bibliographic survey shows that current knowledge is fragmentary and partly outdated. Pesticides applied on soil at recommended levels rarely

had a detrimental effect on microbial populations or their activities. They had more effect on invertebrate populations, inducing the blooming of individual species of floodwater zooplankton and reducing populations of aquatic oligochaetes in soil. Available information raises concerns regarding the long-term effects of pesticides on (i) microorganisms, primary producers, and invertebrates of importance to soil fertility, (ii) predators of rice pests and vectors, and (iii) microbial metabolism of pesticides.

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196. Effects of silvicultural activities on wetland biogeochemistry.

Lockaby, B. G.; Trettin, C. C.; and Schoenholtz, S. H.

Journal of Environmental Quality 28(6): 1687-1698. (1999)

NAL Call #: QH540.J6; ISSN: 0047-2425

Abstract: The unique biogeochemistry of wetlands either causes or influences many landscape functions that are valued by society. Because of their critical ecological role and the importance of wetlands to commodity and noncommodity values, we have reviewed the current state of knowledge regarding influences of silviculture on nutrient circulation, transformation, and retention in forested wetlands. Our approach was to contrast riverine and depressional systems. Globally, there are few generalizations that can be made regarding the effects of silvicultural disturbance. This conclusion is primarily a result of too few studies on the mechanisms and processes controlling ecosystem responses. Most work to date has focused solely on characterizing responses of state variables, and therefore a basis for integration is often lacking. While studies do show that water quality functions are not degraded as a result of harvesting, many other aspects of ecosystem functionality are not clarified. As examples, there are significant gaps in our understanding of biogeochemical controls on net primary productivity, organic matter turnover, and hydrologic interactions. Considerable research is warranted to provide information for effective resource management and conservation.

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197. Effects of timber management on ecological functions of forest wetlands.

Shepard, James P.

In: TAPPI Proceedings: International Environmental Conference. (Held 7 May 1995-10 May 1995 at Atlanta, Ga.); Vol. 1.

Atlanta, Ga.; pp. 299-305; 1995.

NAL Call #: TD899.P3T36; ISBN: 0898529360

Abstract: Forest wetlands are valued for the many ecological functions they perform. They are also important sources of wood for the forest products industry. Forest wetlands can be managed for timber production while protecting valuable ecological functions. This paper reviews the literature on effects of timber management on ecological functions in wetlands. Timber management affects wetland functions primarily through its manipulation of vegetation species composition and structure. Effects of forest management are most pronounced immediately following disturbances such as timber harvesting. Effects are generally brief for hydrological and biogeochemical functions, but can be more long-lasting for plant and wildlife habitat.

198. Emerging effluent management strategies in marine fish-culture farms located in European coastal wetlands.

Hussenot, J. M. E.

Aquaculture 226(1-4): 113-128. (Oct. 2003)

NAL Call #: SH1 .A6; ISSN: 0044-8486

Descriptors: wetlands/ mariculture/ marine fish/ fish farming/ waste management/ aquaculture systems/ effluents/ water quality/ wastewater treatment/ ponds/ biological treatment/ microalgae/ aquatic plant culture/ bioreactors/ recirculating systems/ Europe/ France

Abstract: Coastal wetlands are suitable sites for land-based fish culture in ponds and tanks, but environmental constraints on effluent discharges are stringent for these areas. In order to limit effluent loading, different techniques have been proposed and are beginning to be implemented by aquaculturists. On the Atlantic coast of Europe (France, Portugal, Spain, etc.), growout farms for sea bass (*Dicentrarchus labrax*), sea bream (*Sparus aurata*) or turbot (*Scophthalmus maximus*) are often located in wetlands where salt ponds were previously built. Downstream from the rearing ponds, sedimentation ponds are used to reduce particulate matter exportation. Using fish farm effluents, the continuous mass culture of microalgae has been the subject of experiments converting ammonia and phosphates into diatoms, with the systematic addition of required amounts of limiting nutrients (silicon as sodium silicate, or phosphorus as phosphoric acid). New physical treatments may be added if partial recirculation systems are employed, such as immersed foam fractionators, specifically developed for aquaculture ponds. Integrated systems may be emergent practices for reducing the effluent pollutant discharge without additional cost, in addition to producing a complementary income to that resulting from the production of the main culture species. This citation is from AGRICOLA.

199. Environmental effects on wetlands of queletox registered applied to ploceid roosts in Kenya.

Keith, J. O.; Ngondi, J. G.; Bruggers, R. L.; Kimball, B. A.; and Elliott, C. C. H.

Environmental Toxicology and Chemistry 13(2): 333-341. (1994)

Descriptors: wetlands/ environmental effects/ chemcontrol/ pesticides/ water sampling/ water analysis/ birds/ insecticides/ organophosphates/ residues/ Aves/ nontarget organisms/ queletox registered/ Kenya, Nakuru/ organophosphates/ residues/ fenthion/ pesticides (organophosphorus)/ nontarget organisms/ environmental effects/ chemcontrol/ birds

Abstract: Queletox registered (Fenthion) is widely used in Africa to kill birds that eat cereal crops. Applications of Queletox have been reported to kill nontarget animals and contaminate areas used by livestock and humans. In 1988, we evaluated Queletox treatments to wetland roosts at the Njoro dam (2.88 kg/ha) and Gicheha farm (12.0 kg/ha) near Nakuru, Kenya. Fenthion deposits measured in the roosts ranged up to 1,100 g/ha, but were >1.0 g/ha at distances of 100 m or more from roosts. Following applications, 61 birds of 14 species at the Njoro dam and 22 birds of eight species at the Gicheha farm were found dead or severely debilitated. However, the general abundance of waterfowl, wading birds, plovers, doves, and passerines seemed unaffected. Residues in crop contents of 11 dead birds ranged up to 11.0 ppm, substantiating death from fenthion.

Fenthion residues (2.2-750 µg) recovered from skin and feathers of 36 dead birds were sufficient to have been hazardous to predators and scavengers. Neither amphibians nor fishes were affected by treatments. At the Njoro dam, scarabids, dytiscids, and notonectids were killed, and their numbers decreased; many insects also were killed at the Gicheha farm. The abundance of these groups, however, had increased within 6 d post-treatment. Fenthion residues of 1.8 to 17 ppb were found in positive water samples for up to 5 d post-treatment. All sampled vegetation had temporarily hazardous residues; levels ranged up to 83 ppm on grasses but had decreased to <1.0 after 3 d.

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200. Environmental hazards of nitrogen loading in wetland rice fields.

Ghosh, B. C. and Bhat, R.

Environmental Pollution 102(suppl. 1): 123-126. (1998)

NAL Call #: QH545.A1E52; ISSN: 0269-7491

Descriptors: nitrogen fertilizers/ environmental impact/ rice/ crop production/ pollution/ Asia

This citation is from AGRICOLA.

201. Environmental impacts of development on wetlands in arid and semi-arid lands.

Hollis, G. E.

Hydrological Sciences Journal 35(4): 411-428. (Aug. 1990)

NAL Call #: 292.9 As7; ISSN: 0262-6667

Descriptors: wetlands/ ecological effects/ ecosystems/ environmental impact/ land/ development/ water resources development/ agriculture/ arid lands/ Greece/ New Zealand/ semiarid lands/ United States/ urbanization/ water resources management/ ecological impact of water development/ effects on water of human nonwater activities/ lakes

Abstract: Wetlands, as defined by the Ramsar (Greece) Convention, are productive ecosystems providing goods and services for people. Negative effects from the 'development' of wetlands are exemplified through adverse climatic effects (Aral Sea, USSR), inadvertent environmental changes (Canadian Prairie Potholes), non-sustainable alternative uses (South Chad Irrigation Scheme, Nigeria), exacerbation of problems (Garaet El Haouaria, Tunisia), detrimental effects on rare species (Mikri Prespa, Greece), social disruption (Kissingin Fadama, Nigeria), international obligations (Ichkeul, Tunisia), and sub-optimal management (Weija-Panbros, Ghana). The functions and values of wetlands are described in the 'Adamus approach,' and are exemplified even for the 'dry' areas of the Hadejia- Nguru wetlands (Nigeria) and Lake Hula (Israel). Wetlands are threatened by agricultural intensification, pollution, engineering schemes, and urban development. Since the societies and institutions that degrade wetlands are themselves complex systems, an understanding of hydrology and ecology is insufficient for a wetland manager. Wetland destruction can be aided by misconceptions, public subsidy, international funds, local-scale planning, sectoral approaches, and narrow disciplinary thinking. National Wetland Strategies are needed, on the order of those presently developed in New Zealand and the United States. Hydrologists should be more involved in wetlands and their sustainable utilization. 'Political hydrology' must complement 'scientific hydrology.'

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202. Environmentally sensitive plot-scale timber harvesting: Impacts on suspended sediment, bedload and bank erosion dynamics.

Stott, T.; Leeks, G.; Marks, S.; and Sawyer, A.
Journal of Environmental Management 63(1): 3-25. (2001)
 NAL Call #: HC75.E5J6; ISSN: 0301-4797
Descriptors: wetlands/ logging/ forest management/ soil erosion/ monitoring/ clearcutting/ sediments/ Wales
 This citation is from AGRICOLA.

203. Establishment, growth and survival of natural regeneration after clearcutting and drainage on forested wetlands.

Roy, V.; Ruel, J. C.; and Plamondon, A. P.
Forest Ecology and Management 129(1-3): 253-267. (2000)
 NAL Call #: SD1.F73; ISSN: 0378-1127
Descriptors: wetlands/ clear cutting/ forest management/ ecosystem disturbance/ environment management/ logging/ forests/ regeneration/ growth rates/ clear-cutting/ plant growth/ survival/ drainage/ water table rise/ seedlings/ comparison studies/ soil types/ correlation analysis/ clear cutting
Abstract: Natural regeneration may be disrupted by the rise of the water table in surface layers after clearcutting forested wetlands. A study was initiated on eight forested wetlands that were successively clearcut and drained 3 years later. The objectives were (1) to assess conifer and deciduous regeneration on waterlogged clearcut sites, (2) to determine the effect of water table level changes after clearcutting and drainage on the growth rate of advance regeneration, and (3) to determine if sphagnum moss growth rate was influenced by clearcutting, drainage and microrelief. 3 years after strip clearcutting, the area based inventory showed that softwood regeneration was abundant in the clearcut, but 84% of the seedlings were smaller than 30 cm and vulnerable to suppression from the competition. Indeed, the opening of the forest cover promoted massive invasion of pioneer species such as trembling aspen (*Populus tremuloides* Michx.) and white birch (*Betula papyrifera* Marsh.). Black spruce (*Picea mariana* (Mill.) B.S.P.) and red spruce (*Picea rubens* Sarg.) had difficulties maintaining their presence after clearcutting. The ratio hardwood stems: softwood stems changed from 1.1 in the forest to 3.8 in the clearcut. Balsam fir (*Abies balsamea* (L.) Mill.), larch (*Larix laricina* (Du Roi) K. Koch) and cedar (*Thuja occidentalis* L.) represented 93% of the softwood regeneration. 3 years after clearcutting, balsam fir advance regeneration had a significantly lower growth rate in the middle of the clearcut than near the edges of the clearcut. 2 years after drainage, seedling growth at 10 m from the drainage ditch was significantly greater than at 70 m from ditch. No significant differences were found between mineral and organic soil types, but height growth was positively correlated to C: N ratios of the individual site types. Abundant competition on richer sites limits the development of softwood regeneration. On a short term basis, competition more than watering-up seems a threat to softwood regeneration. Sphagnum growth rates measured with the crank-wire method showed no effect of clearcutting or drainage, but a higher growth rate in hollows (3.2 cm per year) compared to hummocks (2.0 cm per year). These growth rates indicate that sphagnum should not affect regeneration but could overgrow yearlings of slow growing species.

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204. Fecal contamination of pastoral wetlands.

Collins, R.
Journal of Environmental Quality 33(5): 1912-1918. (2004)
 NAL Call #: QH540.J6; ISSN: 0047-2425
Descriptors: wetlands/ water pollution/ pollution control/ pastures/ streams/ hills/ slope/ fecal contamination/ coliform bacteria/ bacterial contamination/ *Escherichia coli*/ feces/ cattle/ grazing/ water quality/ statistical models/ runoff/ rain/ solar radiation/ winter/ air temperature/ New Zealand
Abstract: Near-channel hill-country wetlands draining steep pastoral land in New Zealand exhibit high levels of fecal contamination at a range of flows. This contamination is attributed to both the transport of bacteria into a wetland from the surrounding catchment and the direct excretion of fecal material onto wetlands by grazing cattle. *E. coli* concentrations observed at low to moderate flow at 20 sites varied between 0.5×10^1 and 2×10^4 most probable number (MPN) 100 mL⁻¹. High flow concentrations measured at two wetlands ranged up to 6×10^6 MPN 100 mL⁻¹ and yielded storm period bacterial loads of between 1×10^6 and 3×10^{10} MPN per event. Given the disproportionately large fraction of surface and subsurface flow from the catchment that passes through the wetlands, these yields represent a large proportion of the total loss of bacteria from steep grazed hillsides, across a range of storm events. Cattle are attracted to the smaller, shallower wetlands for grazing in both summer and winter. Excluding stock from shallow wetlands may therefore yield improvements in bacterial water quality, although accurately quantifying this improvement is difficult without long-term studies. Cattle are not attracted to larger, deeper wetlands, presumably for fear of entrapment, and fencing them is unlikely to realize significant improvements in bacterial water quality. A statistical model incorporating solar radiation and flow explains 87% of the variance in *E. coli* concentrations across five monitored rainfall events. A positive correlation was found between solar radiation and *E. coli* concentration. The study was conducted in winter when clear, sunny days are relatively cold. Solar radiation on these days appears to be too weak to promote die-off but the colder temperatures aid survival.
 This citation is from AGRICOLA.

205. Frog communities and wetland condition: Relationships with grazing by domestic livestock along an Australian floodplain river.

Jansen, A. and Healey, M.
Biological conservation 109(2): 207-219. (Feb. 2003)
 NAL Call #: S900.B5; ISSN: 0006-3207
Descriptors: wetlands/ man-induced effects/ environmental factors/ plant populations/ community composition/ water quality/ agriculture/ river basin management/ flooding/ habitat/ nature conservation/ flood plains/ management/ conservation/ Anura/ Australia, Murrumbidgee R./ livestock grazing intensity/ frogs/ toads/ conservation, wildlife management and recreation/ habitat community studies/ management
Abstract: Frogs are in decline worldwide, and are known to be sensitive indicators of environmental change. Floodplains of the Murray-Darling Basin in southeastern Australia have been altered in many ways by livestock grazing, by the introduction of exotic fish, and by changes to flooding regimes. These changes have led to declines in wetland condition and hence to the availability of habitat for wetland frogs. This study examined relationships between

frogs, wetland condition and livestock grazing intensity at 26 wetlands on the floodplain of the Murrumbidgee River. Frog communities, species richness, and some individual species of frogs declined with increased grazing intensity. Wetland condition also declined with increased grazing intensity, particularly the aquatic vegetation and water quality components. There were clear relationships between frog communities and wetland condition, with several taxa responding to aquatic and fringing vegetation components of wetland condition. Thus, grazing intensity appeared to influence frog communities through changes in wetland habitat quality, particularly the vegetation. Reduced stocking rates may result in improved wetland condition and more diverse frog communities. River management to provide natural seasonal inundation of floodplain wetlands may also enhance wetland condition, frog activity and reproductive success.

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206. Grassland ecotopes of the upper Meuse as references for habitats and biodiversity restoration: A synthesis.

Grevilliot, F. and Muller, S.

Landscape Ecology 17(Supplement 1): 19-33. (2002)

NAL Call #: QH541.15.L35 L36; ISSN: 0921-2973

Descriptors: biodiversity/ conservation/ terrestrial ecology/ environmental sciences/ biodiversity restoration/ remediation method/ water level measurement/ measurement method/ agricultural practices/ conservation value/ cutting frequency reduction/ environmental factors/ fertilizer use/ flood duration/ floodplain/ floristic diversity/ grassland ecotopes/ grazing/ ground water table depth/ high water bed/ hydrologic functioning/ hydrological fluctuations/ natural ecosystem/ phytosociological studies/ reference habitats/ species richness/ topographical gradient/ wetland ecotope

Abstract: The river valley of the French upper Meuse and its floodplain, constitutes a relatively natural ecosystem which still contains many endangered species of high conservation value. For example, several birds (*Crex crex*, *Numenius arquata*) as well as plant species (*Gratiola officinalis*, *Inula britannica*, *Teucrium scordium*, *Ranunculus lingua* and *Mentha pulegium*) which have declined seriously in France in recent times are found in the upper Meuse floodplain. Phytosociological studies and water level measurements have shown that the floristic diversity is mainly influenced by hydrological fluctuations and agricultural practices. The plant communities are structured along a topographical gradient in the high water bed reflecting the duration of floods and the ground water table depth. Agricultural practices have influenced the vegetation changes by selecting species adapted to particular management practices (e.g., fertiliser use, grazing, cutting regime). The data collected in this study from the upper Meuse as enabled 13 grassland and wetland ecotopes to be defined which are correlated with different environmental factors. Fertiliser use, grazing and reduction in the frequency of the cutting lead to a lower species richness because they encourage competitive species. However, it is also demonstrated, that maximum biodiversity is not always synonymous with high conservation value because some impoverished ecosystems, e.g., sedges and tall forb formations, may contain endangered plant and bird species. Knowledge of the boundaries between the different plant communities enables likely changes in

floristic composition after modification of one or more site factors to be forecasted. Such factors include, water table depth and flood frequency, cutting regime, fertiliser use and grazing pressure. Thus, the definition of these ecotopes, corresponding to correlations between water regime, agricultural practice and vegetation composition, could lead to the establishment of guidelines for water and agricultural managements that could be involved in restoration projects.
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207. Grazing regime as a tool to assess positive side effects of livestock farming systems on wading birds.

Tichit, M.; Renault, O.; and Potter, T.

Livestock Production Science 96(1 (Special Issue)): 109-117. (2005)

NAL Call #: SF1.L5; ISSN: 0301-6226

Descriptors: grazing intensity/ habitat conservation/ wading birds/ wet grasslands

Abstract: Wet grasslands support large populations of waders. As these birds are very sensitive to sward height and heterogeneity, grazing management is a key issue to their conservation. On a French coastal marsh consisting of 816 fields of wet grasslands, birds were monitored in spring and grazing regimes were assessed at three periods: year, spring, autumn. Each species was associated with a particular annual grazing index lower than the mean for all grazed fields. During spring, grazing intensity was significantly lower for fields occupied by birds than for those of the entire landscape. Different species of waders showed different preferences to grazing intensity with redshanks and curlews representing two extremes of a gradient going from low to high intensity. In early spring, the more precocious species selected fields with a significantly higher mean and variance in autumn stocking rate than for all grazed fields in previous autumn. These results highlight the need to maintain a variety of grazing regimes if conservation of the waders is to be achieved at the community level. On the basis of our analysis, useful indicators related to thresholds on livestock density and turn-out date can be derived to assess positive side effects of livestock farming systems.

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208. Human-environment interactions in agricultural land use in a South China's wetland region: A study on the Zhujiang Delta in the Holocene.

Weng, Qihao

Geojournal 51(3): 191-202. (2000)

NAL Call #: QE1; ISSN: 0343-2521

Descriptors: wetlands/ population-environment relations/ agriculture/ land use/ climate/ sea level/ environmental changes/ population growth/ agricultural practices/ cultivation/ population dynamics/ water quality/ water level/ geologic time/ climatic data/ palaeo studies/ holocene/ deltas/ rice field aquaculture/ resource management/ environment management/ environmental conditions/ climatic changes/ palaeoclimate/ eustatic changes/ sea level changes/ flooding/ flood control/ embankments/ river engineering/ man-induced effects/ ecosystem disturbance/ land reclamation/ coastal zone management/ *oryza sativa*/ China, People's Rep., Guangdong Prov., Zhujiang Delta/ land pollution/ sources and fate of pollution/ conservation, wildlife management and recreation/ soil pollution: monitoring, control & remediation

Abstract: The formation and evolution of agricultural land uses in the Zhujiang Delta of South China are examined in the light of the dynamics of people and the environment and their interplay. The origin and propagation of agriculture are found to have a close relationship with the climate and sea level changes in the Holocene era. The development of rice cultivation, horticulture, and dike-pond system exemplifies human-environment interactions in a specified geographical and social context, which are manifested by the impact of environmental changes and population growth on agricultural innovations. The technologies of dike building and land reclamation, which represent local farmers effort to build a new and harmonious relationship with the changed environment, were critical to the agricultural success and sustainability. Imprudent use of a new agricultural technology could damage the environment, as evidenced by a frequent flooding that followed inappropriate dike building and premature reclamation. Diverse agricultural land uses are as a result of the adaptation of agricultural technology innovations to the environmental conditions.

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209. Hydrology of an acid wetland before and after draining for afforestation, western New Zealand.

Jackson, R. J.

In: Forest Hydrology and Watershed Management/ Swanson, R. H. Bernier P. Y. Woodard P. D. Wallingford, Oxfordshire, England: IAHS Press, 1987; pp. 465-474

NAL Call #: GB842.F67

Descriptors: wetlands/ forest hydrology/ land reclamation/ New Zealand/ acid streams/ planting management/ pine trees/ drainage/ precipitation/ runoff/ flood peak/ sediment yield/ effects on water of human nonwater activities/ conservation in agricultural use

Abstract: An intensive surface drainage system is used to improve establishment of plantations of *Pinus radiata* on wetlands in western South Island, New Zealand.

Downstream impacts of such drainage were assessed by comparing undisturbed and drained wetland basins in an area with 2440 mm/yr rainfall. Stream water is brown, naturally acid (pH c. 4.0), and has high concentrations of dissolved organic C (25-55 mg/L). The water table on undisturbed wetland was nearly always at <0.5 m depth and rose rapidly during rainfall to give widespread overland flow. Quickflow contributed 70% of the 1580 mm/yr runoff. The ridges formed by surface drainage works provided elevated, drier sites for trees, but the water table remained high beneath and between ridges. Drainings have higher flood peaks, and the frequency of peaks >10 L/s/ha increased greatly. Annual sediment yield increased from <1 to c. 10 t/ha. Increased peak flows caused instability of the channel downstream from the drained area.

(Author 's abstract)

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210. The hydrology of wetlands and man's influence on it.

Verry, E. S.

Suomen Akatemian Julkaisuja 5: 41-61. (1988); ISSN: 0358-9153.

Notes: In: Symposium on the Hydrology of Wetlands in Temperate and Cold Regions, Joensuu, Finland, 6-8 June 1988, Vol. 2

Descriptors: wetlands/ hydrology/ floods/ drainage/ land types

Abstract: Wetlands form where flat physiography or climate causes slow water movement, and where water is available at the surface of the earth. Water source determines wetland type. The quality, quantity, and periodicity of water at the site drives the ecologic development of wetlands. Climate determines wetland form (Aapa, Palsa, raised, etc.), but in both cold and temperate regions, groundwater can substitute for direct precipitation and ameliorate marginal climate. Wetlands evapotranspire at maximum potential rates when the water table is within 30 cm of hollow bottoms, and at a fraction of potential rates when the water table is greater than 40 cm below the hollow bottoms. Wetlands reduce flood peaks up to 75% compared to rolling topography when they occupy only 20% of the total basin. Streamflow response to tree harvest or growth is a function of whether the growing season water table is above or below the 30-40 cm depth-to-water-table norm prior to harvest. Drainage of wetlands with closed drains (tile or mole drains) will decrease flood peaks as much as 30% more. Drainage of wetlands with open channel ditches will not change, reduce (-30%), or greatly increase (up to +300%) flood peaks depending on the percent of total basin area drained. Significant increases begin when more than 30% of the total basin is drained with open channels. Downstream flood damage must be considered from the regional landscape perspective. This includes increased flood peaks from the conversion of mineral-soil mature forests to young forests (1-15 years old) or agricultural land; the nature of flood plains; amount and changes in reservoir capacity; and the relative amount of open straight channels in relation to drains and meandering channels.

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211. Impact of different sheep grazing intensities on salt marsh vegetation in northern Germany.

Kiehl, K.; Eischeid, I.; Gettner, S.; and Walter, J.

Journal of Vegetation Science 7(1): 99-106. (1996)

NAL Call #: QK900.J67; ISSN: 1100-9233

Descriptors: plant ecology/ ecological succession/ halophytes/ vegetation/ species diversity/ salt marshes/ sheep/ grazing intensity/ natural resource management/ guidelines/ range management/ Germany

This citation is from AGRICOLA.

212. The impact of grazing on plant communities, plant populations and soil conditions on salt marshes.

Bakker, J. P.

Vegetatio 62(1/3): 391-398. (1985)

NAL Call #: 450 V52; ISSN: 0042-3106

Descriptors: plant density/ grazing/ mowing/ natural resource management/ soil analysis/ salt marshes/ Western European region

This citation is from AGRICOLA.

213. Impact of immigrant pastoral herds to fringing wetlands of lake victoria in Magu District Mwanza Region, Tanzania.

Hongo, H. and Masikini, M.

Physics and Chemistry of the Earth 28(20-27): 1001-1007. (2003)

NAL Call #: QE500.P5; ISSN: 1474-7065

Descriptors: immigrant pastoralists/ overgrazing/ wetland degradation lake pollution/ agriculture/ erosion/ soils/

vegetation/ pastoral herds/ agricultural practice/
environmental impact/ land degradation/ livestock farming/
overgrazing/ wetland/ Tanzania

Abstract: The assessment of impacts of pastoral herds to the fringing wetlands of Lake Victoria in Magu district in Mwanza region was carried out in 1999/2000. Lamadi village located along Speke Gulf of Lake Victoria was chosen. The main farming systems in the area are agriculture, agro-pastoralism, and pastoralism. The wetlands are heavily used for livestock grazing during the dry season. Since 1990s the area has been experiencing a high influx of immigrant pastoral herds from drought prone districts. The increasing livestock numbers have led into serious degradation of wetlands. The type of damages includes: soil erosion, loss of vegetation cover and deforestation. This led to pollution of Lake Victoria along the Speke gulf in particular as the wetlands was buffering a lot of pollutants from the catchments. The range condition at Lamadi was rated fair. The carrying capacity of rangelands was estimated at 3.57-6.75 ha/LU and the wetlands were seriously degraded causing heavy soil erosion and environmental pollution during rainy season. It was recommended to raise people's awareness on conservation of environment and mobilise communities to take responsibility on management of the environmental resources.

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214. Impact of land disturbance on the fate of arsenical pesticides.

Renshaw, C. E.; Bostick, B. C.; Feng, X.; Wong, C. K.; Winston, E. S.; Karimi, R.; Folt, C. L.; and Chen, C. Y. *Journal of Environmental Quality* 35(1): 61-67. (2006)
NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: wetlands/ orchards/ orchard soils/ disturbed soils/ soil pollution/ polluted soils/ arsenic/ lead/ lead arsenate/ bioavailability/ tillage/ streams/ sediment contamination/ soil erosion/ macroinvertebrates/ leaching/ water pollution/ New Hampshire
This citation is from AGRICOLA.

215. Impacts of drainage for forestry on runoff and water chemistry.

Lundin, L.

In: Proceedings of the International Symposium on the Hydrology of Wetlands in Temperate and Cold Regions. (Held 6 Jun 1988-8 Jun 1988 at Joensuu, Finland.); Vol. 1. Helsinki, Finland: Academy of Finland; pp. 197-205; 1988.

Descriptors: wetlands/ forest management/ drainage ditches/ drainage effects/ runoff/ water quality/ chemical properties/ peat bogs/ sweden/ hydrologic budget/ peat/ hydrogen ion concentration/ fens/ alkalinity/ phosphorus/ nitrogen/ sulfates/ nutrients/ forestry

Abstract: Drainage in forestry concerns both peatlands and wet mineral soils. In Sweden this drainage today is concentrated on mineral soils, i.e., clear-cut areas more or less waterlogged after clearfelling. The areas of interest to forest drainage often have organic soil horizons with peat character, and true peat areas often exist in connection with these areas. Drainage of larger peatlands is also performed. The drainage activities affect, among other things, the quantity and chemical composition of runoff. Effects of drainage on runoff and chemical composition of streamwater were studied together with calculations of water balance and chemical budgets. The investigations

were performed at a bog, a calcareous fen and two small sedge fens. These sedge fens showed similarities to mineral soil areas while the many small peatland units required many ditches penetrating the mineral soil. The investigations were performed as comparative studies before and after drainage between two peatland basins, of which one comprised a control area and the other was drained. The results show some similar effects of drainage at the different sites and some effects varying with both site and time. The distribution of precipitation and snowmelt influenced the results. Drainage influenced runoff with both increasing and decreasing mean and high discharges while the low discharges mainly increased. During some winters the low flow ceased. The changes of chemical composition of runoff were affected by the lagg-ditches penetrating the mineral soil beneath the peat. This often resulted in increased pH, alkalinity and concentrations of cations but also of sulfate. Effects on phosphorus and nitrogen varied with site. Nitrogen increased at the fens but decreased at the bog. Increases in the leachates of total-P and total-N were often found. Chemical budgets revealed net losses of HCO₃, K, Ca, Cl, Al and organic C and retentions of H and N whereas variations occurred for SO₄ and P.

(Author 's abstract)

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216. Impacts of grazing on wetlands and riparian habitat: A review of our knowledge.

Skovlin, J. M.

In: Developing Strategies for Rangeland Management/ National Research Council; Series: Westview special studies in agriculture science and policy.

Boulder, Colo.: Westview Press, 1984; pp. 1001-1103
NAL Call #: SF85.3.D48

Abstract: In the context of western North America, discusses the effects of range livestock grazing on vegetation, watershed, and fish and wildlife. Grazing strategies to improve habitats are proposed for better decisions in allocating riparian zone uses. Comments are given by W.S.Platts & R.F.Raleigh, pp 1105-1117, L.H.Carpenter, pp 1119-1128, J.C.Malechek, pp 1129-1158, L.R.Rittenhouse, pp 1159-1166. -from Author
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217. Impacts on wetlands of large-scale land-use changes by agricultural development: The Small Sanjiang Plain, China.

Liu, H.; Zhang, S.; Li, Z.; Lu, X.; and Yang, Q. *Ambio* 33(6): 306-310. (2004)

NAL Call #: QH540.A52; ISSN: 0044-7447

Abstract: The Small Sanjiang Plain (SSP), was formerly the largest wetland complex in China, located in the Northeastern part of Heilongjiang Province, China. Home to vast numbers of waterfowls, fish, and plants, the SSP is globally significant for biodiversity conservation. The loss and fragmentation of wetlands as a result agricultural development over 50 years has impacted wetland communities and their biodiversity. We used GIS to inventory large-scale land-use changes from 1950 to 2000, together with other statistical data. We found that 73.6% of the wetlands were lost due to agricultural development. Consequences of these land-use changes included: i) a rapid decline in waterfowl and plant species with the loss and fragmentation of natural wetlands and wetland ecosystem degradation; ii) greater variation in wetland

water levels as the result of land-use changes over the years; iii) disruption of the dynamic river-floodplain connection by construction of drainage ditches and levees; and iv) a decrease in floodplain area that caused increased flooding peak flows and runoff. Here we show how these changes affect wetland biodiversity and impact important wetland species.

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218. The importance of farmland for ortolan buntings nesting on raised peat bogs.

Dale, Svein

Ornis Fennica 77(1): 17-25. (2000)

NAL Call #: 413.8 OR66; ISSN: 0030-5685

Descriptors: Fringillidae/ Passeriformes/ Emberiza hortulana/ agricultural crops/ behavior/ birds/ bogs/ breeding/ ecosystems/ farmland/ foods/ feeding/ home range/ territory/ microhabitat/ nests/ nesting habitat/ interactions with man/ conservation status/ threats/ social pattern: territory/ home range/ ortolan bunting/ microhabitat/ Europe/ Norway

Abstract: The majority of the Norwegian population of the endangered Ortolan bunting, *Emberiza hortulana*, breeds on raised peat bogs. The author studied whether their breeding site selection was affected by the availability of another habitat (farmland) close to bogs. At the landscape level, Ortolan buntings always chose peat bogs that had farmland <or= 50 m away. At the individual peat bog level, Ortolan buntings had territories in those parts of the bog that were closest to farmland, and territories were usually <or= 100 m from farmland. These results indicate that bog-breeding Ortolan buntings require farmland in close proximity to their territories. This conclusion was further supported by observations at the behavioral level. Ortolan buntings were frequently seen flying between territories on the peat bogs and adjacent farmland (oat fields), often returning with food in the bill. The author also analysed the distribution of Ortolan buntings in relation to peat bog size, availability of different bog microhabitats, and human use of peat bogs (peat extraction), but the effect of distance to farmland remained significant also in multiple analyses. Ortolan buntings apparently do not have the classical all-purpose territory typical of most passerine birds, but have more or less separated nesting and feeding areas. He discusses possible reasons for this pattern and also the conservation implications of the habitat selection of the Ortolan bunting.

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219. Improved harvesting systems for wet sites.

Stokes, Bryce J. and Schilling, Alvin

Forest Ecology and Management 90(2-3): 155-160. (1997)

NAL Call #: SD1.F73; ISSN: 0378-1127

Descriptors: bottomland hardwood/ timber harvesting/ wet site

Abstract: Environmentally acceptable and economical forest operations are needed for sustainable management of forest resources. Improved methods for harvesting and transporting timber are especially needed for wet sites. As the demand for hardwood lumber continues to increase, improved and alternative methods are needed to ensure acceptance of timber harvesting for the wet site conditions that are typical of bottomland hardwoods. Some alternative technological developments include grapple saw feller-bunchers, wide tires, larger forwarders, clambunk skidders,

two-stage hauling, mats, cable systems, helicopters and towed vehicles and air-cushioned vehicles. These developments have the potential to improve the performance of the harvesting system and to reduce the negative effects of conventional operations on conventional sites and on difficult sites such as wet areas. Although many of these new alternatives are now operational, others are just concepts or evolving prototypes. More research is still needed to optimize these alternative technologies and to reduce costs associated with their implementation.

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220. The influence of different grazing regimes on Phragmites- and shrub vegetation in the well-drained zone of a eutrophic wetland.

Vulink, J. T.; Drost, H. J.; and Jans, L.

Applied Vegetation Science 3(1): 73-80. (2000)

NAL Call #: QK900 .A66; ISSN: 1402-2001

Descriptors: grazing/ vegetation/ range management/ Phragmites australis/ Cirsium arvense/ Urtica dioica/ Poa trivialis/ Sambucus nigra/ cattle/ horses/ conservation areas/ ecological succession/ species diversity/ colonizing ability/ stocking rate/ Netherlands

This citation is from AGRICOLA.

221. Influence of groundwater development on the Donana National Park ecosystems (Spain).

Suso, J. and Llamas, M. R.

Journal of Hydrology (Amsterdam) 141(1-3)(1993)

NAL Call #: 292.8 J82; ISSN: 0022-1694.

Notes: Conference: 28th Int. Geol. Congr. Symp., Washington, DC (USA), Jul 1989; Issue editors: Winter, T. C. and Llamas, M. R.

Descriptors: wetlands/ development projects/ agriculture/ environmental impact/ water table/ Spain, Guadalquivir R. Estuary, Donana Natl. Park/ groundwater/ mechanical and natural changes

Abstract: The Donana National Park (DNP) is located on the estuary of the Guadalquivir River. The functioning of the DNP's ecosystems is closely related to the geohydrology of the area. Under the central marshy area the aquifer system is confined below low-permeability estuary deposits. Around most of the marshland the aquifer crops out and is recharged by rainfall. The DNP has an area of 730 km super(2); part of it is in the marshland and part in the recharge area where the aquifer is phreatic. In the 1970s Spain's largest irrigation project using groundwater, covering a surface area of 240 km super(2), was planned in an area bordering the national park. The initial project has been scaled down to 100 km super(2), mainly as a result of protests by conservation groups. A review is presented of the various evaluations of the influence of groundwater extraction on the functioning of the wetlands. The authors consider that the water table decline as a result of pumpage for current irrigation could cause a large part of the ecotone -- situated at the contact-line between the marshland and the phreatic aquifer - to deteriorate. This ecotone exists because it is a natural groundwater discharge area. The small streams feeding the marshland will also be depleted by groundwater extraction.

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222. Interactions of an insecticide, herbicide, and natural stressors in amphibian community mesocosms.

Boone, M. D. and James, S. M.

Ecological Applications 13(3): 829-841. (2003)

NAL Call #: QH540.E23; ISSN: 1051-0761

Descriptors: wetlands/ insecticides/ herbicides/ body mass/ development/ survival/ food webs/ larval development/ biological stress/ ponds/ life cycle/ metamorphosis/ mesocosms/ chlorophylls/ environmental impact/ ecosystem disturbance/ *Rana sphenoccephala*/ *Bufo americanus*/ *Ambystoma maculatum*/ *Ambystoma texanum*/ Amphibia/ American toad/ spotted salamander/ small-mouthed salamander/ carbaryl

Abstract: Amphibians developing in wetlands embedded within or near agricultural lands may frequently encounter chemical mixtures. The objectives of our study were to determine the effects that post-application concentrations of an insecticide (carbaryl) and an herbicide (atrazine) have on body mass, development, and survival of two anuran species (southern leopard frog, *Rana sphenoccephala*; American toad, *Bufo americanus*) and two caudate species (spotted salamander, *Ambystoma maculatum*; small-mouthed salamander, *A. texanum*) reared in outdoor cattle tank mesocosms. In one experiment, we manipulated tadpole density (low or high), carbaryl exposure (0, 3.5, 7.0 mg/L), and atrazine exposure (0 or 200 µg/L) to test for effects on development, mass, and survival of larvae. In a second experiment, we manipulated pond hydroperiod (constant or drying), carbaryl exposure (0 or 5 mg/L), and atrazine exposure (0 or 200 µg/L) to test for effects on mass, time, and survival to metamorphosis. Salamanders were virtually eliminated in carbaryl treatments, indicating that at realistic levels, this insecticide could cause population declines for salamanders in contaminated habitats. Carbaryl also had negative effects on toad survival. Exposure to atrazine had negative effects on body size, development, and time to metamorphosis in anuran species, which were associated with reduced chlorophyll levels. Both chemicals interacted significantly with density or hydroperiod, indicating that the environmental conditions could influence the impact of a contaminant. A significant atrazine-by-carbaryl interaction resulted in smaller and less developed spotted salamander larvae than in control ponds. Atrazine exposure, however, appeared to moderate negative effects of carbaryl for spotted salamanders. Our research suggests that important changes in the community's food web result from chemical exposure, which influence the susceptibility of amphibian species to contaminants.

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223. Landscape controls on phosphorus loading to boreal lakes: Implications for the potential impacts of forest harvesting.

Devito, K. J.; Creed, I. F.; Rothwell, R. L.; and Prepas, E. E.

Canadian Journal of Fisheries and Aquatic Sciences

57(10): 1977-1984. (2000)

NAL Call #: 442.9 C16J; ISSN: 0706-652X

Descriptors: wetlands/ landscape/ nutrient loading/ lakes/ forests/ harvesting/ groundwater/ phosphorus/ groundwater flow/ nutrients/ boreal forests/ forest hydrology/ groundwater movement/ forest management/ Canada

Abstract: For 12 low-order lakes in the Western Boreal Forest of Canada, lake position in the groundwater flow

system and surface hydrologic connection to wetlands accounted for 57% of the variation in the change in postharvest (1997) relative to preharvest (1996) open-water median total phosphorous concentration ([TP]). Changes in [TP] decreased with calcium and magnesium concentrations, indicating that the largest increases in [TP] are likely to occur in lakes located in areas of groundwater recharge or shallow local discharge. Changes in [TP] increased with the area of wetland connected to the lake, a measure of near-surface hydrologic flushing of TP to the lake. However, the remaining variation (43%) in the TP response of lakes to harvest was not explained by landscape-based criteria. This study illustrates that in landscapes with complex hydrogeology, factors controlling the chemical responses of lakes to disturbance are complex, remain poorly understood, and require further study.

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224. Livestock wastes as a source of estrogens and their effects on wildlife of Manko tidal flat, Okinawa.

Tashiro, Y.; Takemura, A.; Fujii, H.; Takahira, K.; and Nakanishi, Y.

Marine Pollution Bulletin 47(1-6): 143-147. (2003)

NAL Call #: GC1000.M3; ISSN: 0025-326X

Descriptors: estrogens/ livestock/ wastes/ wildlife/ animal wastes/ rural areas/ water sampling/ marine pollution/ pollution effects/ migratory species/ manure/ animal manures/ mud flats/ piggeries waste waters/ livestock/ farms and farming/ birds (marine)/ sewages/ agricultural pollution/ organic wastes/ sex hormones/ tidal flats/ water analysis/ pollution detection/ nature conservation/ water pollution sources/ agricultural runoff/ data collections/ sediment contamination/ water pollution effects/ wilderness areas/ Aves/ Japan, Okinawa, Manko/ birds/ estrogens/ xeno-estrogens/ endocrine disruptors/ endocrine disruptors/ hormones

Abstract: The Manko tidal flat in the southern part of Okinawa Island is an important visiting and wintering area for migratory birds and was added to the Ramsar Convention Register of Wetlands in 1999. This area used to be an inlet extending to the inner part of Naha Port, but recent reclamation projects have restricted its connection to the East China Sea. As is typical in rural regions of subtropical islands, the inhabitants in the Manko basin raise livestock, especially pigs, without employing sufficient waste treatment methods. As sewage treatment works are considered to be one of the main sources of environmental estrogens in urban areas, the significance of livestock farming as a source of estrogens in rural area is examined in this study. In the present study, total estrogenic activities in water and sediment samples from the Manko tidal flat and its basin were measured using a recombinant yeast screen method. Estrogenic activities (equivalent to 17 beta-estradiol, E2) were around 10 ng l super(-1) in water samples and more than 10 µg kg super(-1) in some sediment samples. In addition, the concentrations of estrone (E1) and E2 in water samples measured using LC/MS/MS indicated a high contribution of environmental estrogens from livestock wastes.

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225. Local and regional macroinvertebrate diversity in the wetlands of a cleared agricultural landscape in south-western Victoria, Australia.

Robson, B. J. and Clay, C. J.

Aquatic Conservation: Marine and Freshwater Ecosystems 15(4): 403-414. (2005)

NAL Call #: QH541.5.W3A67; ISSN: 1052-7613

Descriptors: macroinvertebrates/ diversity/ agriculture/ seasonal wetlands/ biodiversity/ copepods/ ostracods/ collembolans/ arachnids/ notostracans/ chironomids/ beetles/ species lists/ aquatic environments/ fieldwork/ field experiments/ monitoring/ freshwater environments/ ecology/ invertebrates/ geography/ distribution/ biogeography/ Australia/ Victoria

Abstract: 1. Seasonal pasture wetlands are a common freshwater habitat in many agricultural landscapes, but their invertebrate diversity has rarely been examined compared with other freshwater habitats. Few studies have examined the role of seasonal wetlands for regional biodiversity or the pattern of change in assemblage composition across landscapes. 2. Invertebrates were sampled from 16 naturally occurring seasonal wetlands and three perennial wetlands in south-western Victoria, Australia. The wetlands were arranged in three clusters, separated by at least 20 km: two clusters each contained one perennial and four seasonal wetlands surrounded by pasture; the remaining cluster consisted of one perennial wetland and four seasonal wetlands on a property that has not been cleared of native vegetation, and four adjacent seasonal pasture wetlands cleared of native vegetation. 3. Presence/absence data showed that seasonal wetlands had fewer taxa than perennial wetlands, but both were taxon rich. Turnover of taxa was high at all three scales, i.e. between samples within a wetland, between wetlands, and between wetland clusters, but each cluster did not have a characteristic assemblage composition. Up to two-thirds of the invertebrate taxa found in perennial wetlands were also found in seasonal wetlands, showing that seasonal pasture wetlands could provide an expanded area of winter-spring habitat for many taxa. 4. Seasonal pasture wetlands contribute to biodiversity in highly managed and depauperate agricultural landscapes. There was little regionalization of the fauna, taxon turnover was high and ranges appeared relatively continuous. Biodiversity in pasture wetlands was comparable to perennial non-pasture wetlands elsewhere, despite being used for grazing livestock. This suggests that pasture wetlands may have substantial conservation value and should be managed to protect them from threatening processes such as drainage.
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226. Long-term changes in agricultural practices and wildfowling in an internationally important wetland, and their effects on the guild of wintering ducks.

Duncan, P.; Hewison, A. J. M.; Houte, S.; Rosoux, R.; Tournebize, T.; Dubs, F.; Burel, F.; and Bretagnolle, V.

Journal of Applied Ecology 36(1): 11-23. (1999)

NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: wetlands/ Anas/ waterfowl/ habitat destruction/ agriculture/ grasslands/ water management/ France
This citation is from AGRICOLA.

227. Long-term changes of salt marsh communities by cattle grazing.

Andresen, H.; Bakker, J. P.; Brongers, M.; Heydemann, B.; and Irmiler, U.

Vegetatio 89(2): 137-148. (1990)

NAL Call #: 450 V52; ISSN: 0042-3106

Descriptors: invertebrates/ vegetation/ sedimentation/ population density/ species diversity/ immigration/ succession/ food web/ dominance

Abstract: Over a period of 9 years a grazing experiment was carried out in the mainland salt marsh of the Leybucht (Niedersachsen) with three stocking rates, namely, 0.5 ha⁻¹, 1 ha⁻¹, and 2 cattle ha⁻¹. These were also compared with an abandoned area. The results are based on sampling of the invertebrates in 1980, 1981, 1982, and 1988, and of the vegetation in 1980 and 1988. The rate of sedimentation is highest in the Puccinellia maritima-zone and decreases with the increase of stocking rates. The Elymus pycnanthus vegetation type becomes dominant in the higher salt marsh in the abandoned site. The canopy height decreases with increasing stocking rate, whereas a gradient in the structure of the vegetation develops with the lowest stocking rate. The population densities, the species-richness and the community diversity of invertebrates increases after the cessation of grazing. The high rate of sedimentation in the abandoned site promotes the immigration of species from higher salt marsh levels and adjacent grasslands, and eventually halotophilous species and communities may disappear. On the other hand grazing reduces numerous species living both in or on upper parts of the vegetation or being sensitive to trampling by cattle. The community structure shows that the salt marsh ecosystem changed from a food web dominated by plant feeding animals to a food web dominated by animals foraging on detritus. The salt marsh management has to be differentiated into both ungrazed and lightly grazed areas (each 50%) of an overall grazing in large areas with less than 0.5 cattle ha⁻¹.

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228. Long-term dynamics of vegetation and disturbance of a southern boreal spruce swamp forest.

Segerstrom, U.

Journal of Vegetation Science 8(2): 295-306. (1997)

NAL Call #: QK900.J67; ISSN: 1100-9233

Descriptors: wetlands/ biodiversity/ nature conservation/ grazing/ swamps/ pollen analysis/ plant succession/ seral stages/ dynamics/ vegetation/ palynology/ charcoal/ peat/ bogs/ human activity/ effects/ forest fires/ agriculture/ cutting/ burning/ browsing/ felling/ fire effects/ dead wood/ vegetation types/ boreal forests/ palaeoecology/ pines

Abstract: Analysis of pollen, charcoal and loss-on-ignition in peat cores from a Picea abies-dominated swamp forest in central Sweden showed the vegetation changes and disturbance patterns over 9500 yr. Six major sequences of local vegetation development were identified: (A) Pinus period, ca. 9500-7000 cal. (calibrated years) BP; (B) open mire period, ca. 7000-4500 cal. BP; (C) Betula period, ca. 4500-2300 cal. BP; (D) Picea period, ca. 2300-1000 cal. BP; (E) human impact period, ca. 1000-100 cal. BP; and (F) period of human abandonment during the last ca. 100 yr. The swamp forest has been highly dynamic in response to various natural and anthropogenic disturbance agencies. Several fires have heavily influenced the vegetation development. During the last ca. 900 yr human influence

has been important, initially from grazing and trampling by domesticated animals (ca. 1000-500 cal. BP), and subsequently small-scale cereal growing (ca. 400-100 BP). Cutting, burning and animal browsing influenced the structure and dynamics of the swamp forest by creating a more open stand and suppressing tree regeneration. Recent cessation of human impact has led to increased tree regeneration and a denser swamp forest stand. The present high biodiversity, and subsequent conservation interest does not result from long-term stability or absence of fire and human impact. However, in spite of repeated disturbances, a continuity of old and senescent trees produced a forest type with abundant dead wood. With the relatively minor importance of fire over long periods of time, the swamp forest developed a structure maintaining a high biological diversity. An important issue for maintaining long-term biodiversity in the boreal landscape must be to create a mosaic where different forest types are present, with a variety of structures, substrates and processes, to provide a certain degree of freedom for species to move around in the landscape.

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229. Long-term response of northern pintails to changes in wetlands and agriculture in the Canadian Prairie Pothole Region.

Podruzny, Kevin M.; DeVries, James H.; Armstrong, Llwellyn M.; and Rotella, Jay J.

Journal of Wildlife Management 66(4): 993-1010. (2002)
NAL Call #: 410 J827; ISSN: 0022-541X

Descriptors: animals and man/ disturbance by man/ commercial activities/ ecology/ population dynamics/ habitat/ land and freshwater zones/ Nearctic region/ North America/ *Anas acuta* (Anatidae): farming and agriculture/ population size/ semiaquatic habitat/ Canada/ Canadian Prairie Pothole region/ long term response to changes in wetlands and agriculture/ Anatidae/ Anseriformes/ Aves/ birds/ chordates/ vertebrates

Abstract: From 1955 through the late 1970s, northern pintail (*Anas acuta*) populations closely tracked the abundance of spring ponds. Declines in numbers of both northern pintails (hereafter, pintails) and ponds were evident during years of drought. However, since the early 1980s, the strength of the relationship between pintails and ponds has weakened greatly. Agricultural expansion on primary breeding grounds has been implicated as the cause of sustained pintail declines, but previous studies investigated pintail response only at large geographic scales (e.g., prairie-wide, stratum level). Potentially important effects of localized or multiscale changes in wetlands and agriculture on pintails are not well understood. Using data from the Canadian Prairie Pothole Region for 1961 to 1996, we investigated spatial and temporal covariation of pintail numbers with environmental factors (pond numbers and wetness indices) and agriculture at various scales. Models best supported by the data indicated that pintails responded positively to winter precipitation but with important regional variation and positively to pond numbers in some locations (southwestern Saskatchewan and southern Alberta). Results also indicated that pintail settling was better explained (increases in R² values of 0.05-0.06) using information about specific agricultural practices than about overall increases in farmed area. At a prairie-wide scale, we detected a negative association between settling and

increased cropland area. At regional scales, settling was positively associated to various degrees with area in fallow (i.e., summerfallow - land tilled but not planted to crop in a given year). Both associations were strengthened with higher winter precipitation. Because cropland stubble is used readily as a nesting habitat by pintails and spring tillage of fields not used for summerfallow destroys nests, a shift from summerfallow to continuous cropping in the Prairie Pothole Region of Canada may have reduced the reproductive capacity of pintails in important breeding areas. In regions with characteristics that historically have attracted pintails to settle, we encourage land managers to promote agricultural practices that minimize use of spring tillage, convert cropland to perennial forages and pasture, and protect and restore wetland and upland habitat.
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230. Managing water quality in wetlands with forestry BMP's.

Rummer, Bob

Water, Air, and Soil Pollution 4: 55-66. (2004)

NAL Call #: TD172 .W36; ISSN: 0049-6979

<http://www.srs.fs.usda.gov/pubs/viewpub.jsp?index=6412>

Descriptors: wetlands/ water quality/ nonpoint source pollution/ best management practices/ soil erosion

Abstract: Forested wetlands are uniquely critical areas in forest operations that present special challenges to protect water quality. These locations are a direct interface between the impacts of forest operations and water. BMP's are designed to minimize nonpoint source pollution, but much of the science behind current guidelines is based on an understanding of erosion processes in upland situations. In wetlands and around temporary stream crossings, redirection of flow, sedimentation processes, and alterations of flow velocity become important. Existing forested wetland BMP's appear to adequately address water quality protection. If existing BMP's became prescriptive regulations, however, there is potential for mis-application and unintended ecological impacts.

231. Mechanical deep placement of nitrogen in wetland rice.

Bautista, E. U.; Koike, M.; and Suministrado, D. C.

Journal of Agricultural Engineering Research 78(4): 333-346. (2001)

NAL Call #: 58.8 J82; ISSN: 0021-8634

Descriptors: *Oryza sativa*/ nitrogen fertilizers/ losses from soil/ pollution control/ rice/ flooded conditions/ literature reviews/ Asia

Abstract: Deep placement of nitrogenous fertilizer (N) is an alternative for increasing the N use efficiency of wetland rice besides minimizing the adverse effects of fertilizers on the environment. It has been found to limit the loss of N due to surface runoff, leaching, volatilization and denitrification that lead to reduction in applied N. Different machines as well as N materials (granular, urea supergranules or briquettes, liquid N) have been introduced for this method. Although deep placement of fertilizer increased N use efficiency in rice-growing countries, the machines meant for this purpose have not been well accepted due to problems in performance consistency and commercial unavailability or extra cost of recommended materials. Despite these problems, however, several prototypes have shown potential but their acceptance maybe limited unless these promising mechanisms are adapted into a system that

addresses the field and socio-economic conditions of Asian farmers. A fertilizer management system that combines machine deep placement, crop establishment and farmers' timing of application using the commercially available materials could enhance adoption of the technology. Further refinements of the promising devices as well as addressing farmers' constraints are, thus, recommended for a better acceptance of deep placement in the rice-growing countries of Asia.

This citation is from AGRICOLA.

232. Microbial communities in the phyllosphere of grasses on fenland at different intensities of management.

Behrendt, U.; Stauber, T.; and Muller, T.

Grass and Forage Science 59(2): 169-179. (June 2004)

NAL Call #: 60.19 B773; ISSN: 0142-5242

Descriptors: pasture management/ harvest date/ extensive farming/ fen soils/ fens/ forage quality/ energy content/ phyllosphere/ microbial ecology/ microorganisms/ population density/ Germany

Abstract: The effects of changes from conventional grassland management on fenland in Germany to extensification due to reduced fertilizer inputs and cutting frequency on the microbial colonization in the phyllosphere were investigated. A delay in the first cut for silage and hay, required by a nature conservation programme, was accompanied by the senescence of grasses which significantly influenced certain microbial groups. Heterotrophic bacteria, aerobic and anaerobic spore-formers, as well as filamentous fungi, showed an increase in population densities on the mature herbage of the later cuts. Differences in the rate of fertilizer application and cutting frequency, which had an effect on the dry-matter yield, also influenced the population density of heterotrophic bacteria and, in certain circumstances, that of filamentous fungi. Chemical measures of forage quality were highly correlated with the population density of microbial groups and with the maturity of the herbage. In contrast to these results, the population dynamics of further groups of micro-organisms (yeasts, Micrococcaceae, listeria) did not show any relationship with pasture management.

This citation is from AGRICOLA.

233. The microdistribution of three uncommon freshwater gastropods in the drainage ditches of British grazing marshes.

Watson, Alisa M. and Ormerod, S. J.

Aquatic Conservation: Marine and Freshwater Ecosystems 14(3): 221-236. (2004)

NAL Call #: QH541.5.W3A67; ISSN: 1052-7613

Descriptors: wetlands/ spatial distribution/ grazing/ drainage systems/ habitat changes/ vegetation changes/ drainage ditches/ gastropods/ marshes/ benthos/ snails/ habitat selection/ drainage water/ freshwater molluscs/ rare species/ microhabitats/ ecological distribution/ dissolved oxygen/ plant populations/ vegetation cover/ environment management/ aquatic plants/ nature conservation/ environmental factors/ *Segmentina nitida*/ *Anisus vorticulus*/ *Valvata macrostoma*/ British Isles, England/ grazing marshes/ drainage ditches/ molluscs/ streamflow and runoff/ water resources and supplies/ behaviour/ conservation, wildlife management and recreation

Abstract: The gastropods *Segmentina nitida*, *Anisus*

vorticulus and *Valvata macrostoma* occur in drainage ditches on grazing marshes that are now among the most threatened wetland systems in western Europe. Although each of these species is listed in the UK Red Data Book (RDB) and Biodiversity Action Plan, influences on their distribution are poorly understood. 2. To improve management information, the within-channel distributions of the three snails were examined in 20 ditches in southeast England. Abundance, vegetation cover and other environmental factors were recorded across the ditch profile near the surface (<0.2m) and at depth (<0.15m from the benthos). 3. All three species were significantly more abundant near the surface than at depth. Below 0.6m, ditches had significantly reduced concentrations of dissolved oxygen (<0.6 mg L super(-1), <5% saturation), possibly sufficient to limit the occurrence of gastropods dependent wholly or partly on aqueous gas exchange. 4. There were no other systematic variations in abundance between the ditch margins and centre channel. However, across all ditches and samples in the survey, each species' abundance varied significantly with vegetation structure. *S. nitida* was most numerous where there was least open water and hence most vegetation, *V. macrostoma* among emergent stands and *A. vorticulus* in ditches with floating vegetation but few submerged plants. 5. These microdistributional data support large-scale surveys in illustrating the potential importance of vegetation management for these snails; providing that other requirements are satisfied, ditch management could favour each RDB species by optimizing particular vegetation features. Apparent preferences for vegetation structure rather than particular channel locations suggest that refuges left during ditch clearance could be located anywhere in the ditch. Factors that reduce oxygen concentrations below 1mg L super(-1), such as eutrophication, might be detrimental.

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234. Mineralization of norflurazon in a cranberry bog soil: Laboratory evaluations of management practices.

Savin, M. C. and Amador, J. A.

Journal of Environmental Quality 27(5): 1234-1239. (1998)

NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: wetlands/ bog soils/ herbicides/ organic compounds/ environment/ mineralization/ norflurazon/ soil/ management/ soil water/ fertilizers/ sand/ amendments/ respiration/ application rates/ chemical control/ weed control/ fruit crops/ temperate fruits

Abstract: The herbicide norflurazon is used in cranberry (*Vaccinium macrocarpon*) cultivation to control annual grasses, sedges, and broadleaf weeds, in New England, Wisconsin, and other parts of the northern USA. The potential effects of cranberry cultivation practices, soil moisture control, fertilization, sand addition, and herbicide application rate, on mineralization of norflurazon in a bog soil were evaluated in a laboratory study. Optimal soil moisture for norflurazon mineralization was between 80 and 90% of water-holding capacity (WHC) in soil from the Oi and A horizons. Saturating the soil reduced the rate of norflurazon mineralization significantly. By contrast, soil respiration was maximal at 25% of WHC in both horizons. Addition of inorganic P increased soil respiration, but did not affect norflurazon mineralization significantly. Addition of inorganic N plus P increased soil respiration in the A, but not Oi, horizon and significantly decreased norflurazon

mineralization in the Oi horizon. Sand addition had no significant effect on norflurazon mineralization. Mineralization was affected by herbicide application rate, with the rate of mineralization increasing proportionally with increasing concentration from 0.75 to 7.5 mg norflurazon/kg soil. The mineralization of ¹⁴C-norflurazon was slow for all of the agronomic practices evaluated, indicating that the potential for norflurazon to accumulate in cranberry bog soils may be high.

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235. Mobilization of pesticides on an agricultural landscape flooded by a torrential storm.

Donald, David B.; Hunter, Fraser G.; Sverko, Ed; Hill, Bernard D.; and Syrgiannis, Jim

Environmental Toxicology and Chemistry 24(1): 2-10. (2005)

NAL Call #: QH545.A1E58; ISSN: 0730-7268

Descriptors: natural disasters/ agrochemicals [analysis]/ herbicides [analysis]/ insecticides [analysis]/ water pollutants, chemical [analysis]/ ecosystem/ rain [chemistry]/ Saskatchewan/ solubility/ time factors

Abstract: Mobilization of pesticides into surface waters of flooded agricultural landscapes following extreme precipitation events has not been previously investigated. After receiving 96 mm of rain in the previous 45 d, the Vanguard area of southeastern Saskatchewan, Canada, was subjected to a torrential storm on July 3, 2000, that produced as much as 375 mm of rain in 8 h. The majority of herbicides, but no insecticides, would have been applied to crops in the Vanguard area during the four weeks preceding the storm. After the storm, 19 herbicides and insecticides were detected in flooded wetlands, with 14 of them detected in 50% or more of wetlands. Average concentrations ranged from 0.43 ng/L (endosulfan) to 362 ng/L (2,4-dichlorophenoxyacetic acid). The pesticides probably were from long-range transport, followed by deposition in rain, and from herbicides applied to crops within the area subjected to the storm (1,700 km²). In the following year, when only 62 mm of rain fell in the same 45 d, only five pesticides were detected in 50% or more of wetlands. We estimated that for the 1,700-km² storm zone, 278 kg of herbicide were mobilized into rain and by runoff into surface waters, and 105 kg were removed from the Vanguard area by discharge into Notukeu Creek.

Significant quantities of herbicides are mobilized to aquatic environments when prairie agricultural landscapes are subjected to torrential storms. In these circumstances, flooded wells and small municipal reservoirs used as sources of drinking water may be compromised by 10 or more pesticides, some at relatively high concentrations.

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236. Modeling impacts of management on carbon sequestration and trace gas emissions in forested wetland ecosystems.

Li, Changsheng and Cui, Jianbo

Environmental Management 33(Supplement 1): S176-S186. (2004)

NAL Call #: HC79.E5E5; ISSN: 0364-152X

<http://www.srs.fs.usda.gov/pubs/21358>

Descriptors: wetlands/ silvicultural practices/ lowland forests/ carbon sequestration/ gas emissions

Abstract: A process-based model, Wetland-DNDC, was modified to enhance its capacity to predict the impacts of

management practices on carbon sequestration in and trace gas emissions from forested wetland ecosystems. The modifications included parameterization of management practices (e.g., forest harvest, chopping, burning, water management, fertilization, and tree planting), inclusion of detailed anaerobic biogeochemical processes for wetland soils, and utilization of hydrological models for quantifying water table variations. A 150-year management scenario consisting of three stages of wetland forest, deforestation/drainage, and wetland restoration was simulated with the Wetland-DNDC for two wetlands in Minnesota and Florida, USA. The impacts of the management scenario on carbon ecosystem exchange, methane emission, and nitrous oxide emission were quantified and assessed. The results suggested that: (1) the same management scenario produced very different consequences on global warming due to the contrast climate conditions; and (2) methane and nitrous oxide fluxes played nonnegligible roles in mitigation in comparison with carbon sequestration. This citation is from Treeseearch.

237. Modelling water allocation between a wetland and irrigated agriculture in the Gediz Basin, Turkey.

De Voogt, K.; Kite, G.; Droogers, P.; and Murray-Rust, H.

International Journal of Water Resources Development 16(4): 639-650. (2000)

NAL Call #: TD201.I56; ISSN: 0790-0627

Descriptors: wetlands/ irrigation/ birds/ wildlife management/ bromides/ agriculture/ water allocation/ base flow/ rivers/ water supply/ irrigation/ birds/ flow/ streams (in natural channels)/ water supplies/ Turkey

Abstract: The Kus Cenneti is a wetland in the Gediz River Delta in Turkey. Part of it needs a large supply of low saline water to ensure the survival of endangered bird species. Any increase must be supplied at the expense of the upstream irrigated agriculture. The effects of basin water reallocation on water availability and crop productivity were evaluated using a semi-distributed hydrological model (SLURP). It was found that, during the irrigation season, increased wetland water demand causes increased loss in yield to irrigated agriculture and, outside this period, the water supply is limited by the Gediz River minimum base flow.

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238. Monitoring the hydrology of Canadian prairie wetlands to detect the effects of climate change and land use changes.

Conly, F. M. and Van Der Kamp, G.

Environmental Monitoring and Assessment 67(1-2): 195-215. (Feb. 2001-Mar. 2001)

NAL Call #: TD194; ISSN: 0167-6369

Descriptors: environmental monitoring/ climatic changes/ hydrology/ prairies/ land use/ semi-arid environments/ agriculture/ environmental management/ prairie/ climate/ monitoring/ man-induced effects/ ecosystems/ water balance/ habitats/ waterfowl/ water level/ ecology/ climatic change influences on wetlands/ land use effects on wetlands/ wetlands hydrology/ Canada/ management/ environmental action/ water resources and supplies/ protective measures and control/ swamps, marshes

Abstract: There are millions of small isolated wetlands in the semi-arid Canadian prairies. These 'sloughs' are refuges for wildlife in an area that is otherwise intensively

used for agriculture. They are particularly important as waterfowl habitat, with more than half of all North American ducks nesting in prairie sloughs. The water levels and ecology of the wetlands are sensitive to atmospheric change and to changes of agricultural practices in the surrounding fields. Monitoring of the hydrological conditions of the wetlands across the region is vital for detecting long-term trends and for studying the processes that control the water balance of the wetlands. Such monitoring therefore requires extensive regional-scale data complemented by intensive measurements at a few locations. At present, wetlands are being enumerated across the region once each year and year-round monitoring is being carried out at a few locations. The regional-scale data can be statistically related to regional climate data, but such analyses cast little light on the hydrological processes and have limited predictive value when climate and land use are changing. The intensive monitoring network has provided important insights but it now needs to be expanded and revised to meet new questions concerning the effects of climate change and land use.

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239. Movement and retention of propanil n-(3,4-dichlorophenyl)propanamide in a paddy-riverine wetland system in Sri Lanka.

Perera, Ajantha; Burleigh, James R.; and Davis, Craig B. *Agriculture Ecosystems and Environment* 72(3): 255-263. (1999)

NAL Call #: S601.A34; ISSN: 0167-8809

Descriptors: agronomy: agriculture/ freshwater ecology: ecology, environmental sciences/ pesticides/ pollution assessment control and management/ paddy soil chemistry/ paddy riverine wetland system/ plant tissue chemistry/ water chemistry/ wetland biota safety/ wild edible plant contamination

Abstract: Propanil N-(3,4-dichlorophenyl)propanamide is commonly used as a post-emergent herbicide in paddy rice cultivation in Sri Lanka. This study examined propanil concentrations in paddy soil and water, in water and substrate of adjacent wetlands receiving runoff from the paddy and in tissues of two wetland macrophytes common in those wetlands. Field sampling was carried out during the wet season of 1993-1994 and the 1994 dry season. Propanil was detected in paddy soil and in paddy and wetland water samples as late as 14 days after treatment (DAT). It was not detected in the wetland substrate, but relatively high concentrations were found in leaf and stem tissues of the edible plants *Ipomoea aquatica* and *Limncharis flava* 52 DAT in the wet season, but it was not detectable by 132 DAT. Tissue concentrations during the dry season were less consistent. This accumulation and retention by macrophytes may be important factors in reducing propanil concentrations in the wetland water below levels shown to be acutely toxic to other wetland biota. But, propanil so retained may pose a danger to humans who gather and eat these wetland plants regularly and who may, over several months, accumulate sufficient propanil to be harmful to their health.

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240. Nitrate behaviour in the groundwater of a headwater wetland, Chiba, Japan.

Tang, Changyuan; Azuma, Kazuaki; Iwami, Yoshifumi; Ohji, Baku; and Sakura, Yasuo

Hydrological processes 18(16): 3159-3168. (2004)

NAL Call #: GB651.H93; ISSN: 0885-6087

Descriptors: chemistry of groundwater/ nitrate in groundwater/ chemistry of wetlands/ water pollution sources/ groundwater pollution/ nitrates/ seepage/ piezometers/ denitrification/ wastewater disposal/ groundwater basins/ fertilizers/ spring water/ groundwater recharge/ path of pollutants/ groundwater discharge/ Japan, Honshu, Chiba Prefect./ chemical and physico-chemical properties: hardness, taste and odour, salinity, chemical content/ sources and fate of pollution/ water pollution: monitoring, control & remediation

Abstract: A wetland is an important part of the headwater in the discharge area of a basin. It controls not only groundwater discharge such as seepage or springs, but also the migration of chemical matter from the basin. In order to make clear how and where natural attenuation processes happen in wetlands, a typical headwater in Chiba, Japan, was chosen for an investigation of the behaviour of nitrate in groundwater. From the viewpoint of hydro-geomorphology, the wetland in the study site can be divided into three zones: the shallow water-table zone, the seepage zone, and the spring zone along the downstream direction. There were six piezometer groups; each group contained four piezometers, individually set at depths of 1, 2, 3 and 4 m. Major ions and NO_3^- of groundwater from piezometers, wells and springs were analysed. It was found that nitrate in groundwater mainly came from the fertilizers used in the upstream recharge area of the study site. When the groundwater moved up across the wetland, nitrate concentration in the groundwater decreased rapidly in the shallow water-table zone due to denitrification. Nitrate-free water can be found at the seepage zone. However, the behaviour of nitrate in the spring water was different from that in the seepage zone, since both dilution and denitrification processes were involved in the decrease of nitrate concentration in groundwater. In particular, the dilution process mainly controlled the decline of nitrate at the location where the nitrate-free groundwater flowing horizontally from the seepage zone mixed with the high-nitrate groundwater flowing upward before emerging as a spring. It was also found that denitrification only occurs suddenly in a narrow zone or a thin layer of the order of a few metres.

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241. Nutrient removals associated with harvesting peatland black spruce forest.

Teng, Y.; Foster, N. W.; Hazlett, P.; and Morrison, I. K.

In: *Northern Forested Wetlands: Ecology and Management*/ Trettin, C. C.; Jurgensen, M. F.; Grigal, D. F.; Gale, M. R.; and Jeglum, J. K. Boca Raton, Fla.: CRC Lewis, 1997; pp. 341-352.

Notes: ISBN: 1566701775

NAL Call #: SD410.9.N67 1997

Descriptors: *Picea mariana*/ Ontario

This citation is from AGRICOLA.

242. Occurrence of aquatic invertebrates of the wheatbelt region of western Australia in relation to salinity.

Pinder, A. M.; Halse, S. A.; McRae, J. M.; and Shiel, R. J. *Hydrobiologia* 543(1): 1-24. (2005)

NAL Call #: 410 H992; ISSN: 0018-8158

Descriptors: aquatic invertebrates/ salinisation/ salinity tolerance/ western Australia/ groundwater/ plants (botany)/ saline water/ surveying/ vegetation/ dryland salinity/ halophilic species/ salinization/ biodiversity/ conservation status/ wetland/ Australia/ fresh water/ ground water/ plants/ salinity/ surveying/ water animals/ water biology/ Australasia/ Eastern Hemisphere/ Animalia/ Invertebrata

Abstract: The wheatbelt region of Western Australia has been extensively cleared of indigenous vegetation for agriculture and is now severely affected by dryland salinity. Wetlands that were once freshwater are now saline and others are under threat, as are the animals and plants that inhabit them. Rising groundwater is also affecting the many naturally saline playas. To provide a framework for setting conservation priorities in this region a biological survey was undertaken, including sampling of aquatic invertebrates at 230 wetlands. In this paper, we have used data from the survey to summarise occurrence of species in relation to salinity. Total species richness at a wetland showed no response to salinity below 4.1 g l⁻¹ and then declined dramatically as salinity increased. When halophilic species were excluded from consideration, species richness was found to decline from 2.6 g l⁻¹. These patterns are compared to previous studies of richness-salinity relationships. There is some evidence that the freshwater invertebrate fauna of the wheatbelt may be comparatively salt tolerant, with 46% of freshwater species collected at salinities above 3 g l⁻¹ and 17% above 10 g l⁻¹, though these proportions differed between various invertebrate groups. While this tolerance will provide a buffer against the effects of mild salinisation, many species are at risk of regional extinction as salinisation becomes more widespread. © Springer 2005.

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243. Odonates as biological indicators of grazing effects on Canadian prairie wetlands.

Foote, A. L. and Hornung, C. L. R.

Ecological Entomology 30(3): 273-283. (2005)

NAL Call #: QL461 .E4; ISSN: 0307-6946

Descriptors: Odonata/ aquatic invertebrates/ bioindicators/ grazing/ environmental impact/ prairies/ species diversity/ vegetation/ wetland plants/ emergent plants/ water quality/ Alberta

This citation is from AGRICOLA.

244. Perspectives for incorporating biomass from non-intensively managed temperate flood-meadows into farming systems.

Donath, Tobias W.; Hoelzel, Norbert; Bissels, Stephanie; and Otte, Annette

Agriculture Ecosystems and Environment 104(3):

439-451. (2004)

NAL Call #: S601.A34; ISSN: 0167-8809

Descriptors: agriculture/ biogeography: population studies/ climatology: environmental sciences/ soil science/ terrestrial ecology: ecology, environmental sciences/ biomass incorporation/ forage quality/ grassland restoration/

temperate flood meadow/ vegetation alliance
arrhenatherion/ vegetation alliance cnidion/ vegetation alliance magnocaricon

Abstract: Due to their high value for biodiversity preservation, flood mitigation and nutrient retention, the re-creation of flood-meadows is presently one of the main targets in restoration projects along large central European lowland rivers. Like other semi-natural grasslands, flood-meadows depend on adequate agricultural management to fulfil these important ecological functions. To achieve this in an ecologically and economically sensible way, the prospects for incorporating management and biomass utilisation in farming systems appears to be a key issue. Differences in yield and forage quality in extensively-managed flood-meadows were studied with respect to vegetation type, site conditions, management history, species-richness and nature conservation value. The study covers the most important alluvial grassland communities in the floodplain of the northern Upper Rhine (alliances Arrhenatherion, Cnidion, Magnocaricion), which are typically ordered along an elevational gradient of increasing flooding frequency. Gradients in flooding frequency between the different grassland communities and difference between classes were clearly reflected by floristic composition in Detrended Correspondence Analysis. In contrast, there were only minor differences in terms of soil nutrient status, which are consistent with relatively small differences in yield and forage quality, particularly in the drier Arrhenatherion-communities. In Cnidion meadows, yield and fodder quality were both raised in classes of higher nature conservation value, most likely due to a shift in functional groups towards sedges, herbs and legumes. However, in contrast to hypotheses recently made by several authors, no general relationship between species-richness and productivity was found. We discuss the implications of the results for restoration practice, management strategies and agricultural utilisation of species-rich flood-meadows. Copyright 2004 Elsevier B.V. All rights reserved.

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245. Pesticide inputs and risks in coastal wetlands.

Clark, J. R.; Lewis, M. A.; and Pait, A. S.

Environmental Toxicology and Chemistry 12(12): 2225-2233. (1993)

NAL Call #: QH545.A1E58; ISSN: 0730-7268

Descriptors: wetlands/ pesticide pollution/ pesticides/ environmental effects/ ecosystems/ risks/ environmental impact/ coastal zone/ agricultural runoff/ ecological effects/ ecotoxicology/ agricultural runoff/ ecological effects/ coastal zones/ pesticide pollution/ risks/ environmental impact/ coastal zone/ environmental effects/ environmental impact/ sources and fate of pollution/ freshwater pollution/ environment/ characteristics, behavior and fate

Abstract: Coastal wetland habitats may receive pesticide inputs indirectly from agricultural and forest control of weeds and insects in upland drainage areas; indirectly or directly from weed, insect, and biofouling control from development of adjacent lands for agricultural, recreational, or residential uses; and directly from control activities practiced within wetlands for protection of public health or for nuisance abatement. Persistent and bioaccumulative pesticides used at upland sites have threatened coastal wetland biota. For more biodegradable contemporary pesticides, concerns for ecological impact are more a

function of the proximity of the site of application relative to the wetland, and time available for degradation and sorption. In addition, the rate and extent of localized mixing, flushing, and stratification within the wetland can greatly affect exposure concentrations and durations for wetland biota. The short-term, direct toxic effects of pesticides on aquatic biota inhabiting coastal wetlands have been characterized in laboratory and field studies; however, assessment of the cumulative and indirect effects of repeated exposures to multiple chemicals at sublethal concentrations is a major research need.

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246. Pesticides in Esteros del Ibera (AR): Evaluation of impacts and proposal of guidelines for water quality protection.

Silva, C.; Boia, C.; Valente, J.; and Borrego, C. *Ecological Modelling* 186(1): 85-97. (July 2005)
NAL Call #: QH541.15.M3E25; ISSN: 0304-3800

Descriptors: wetlands/ pesticides/ insecticides/ models/ endosulfan/ water quality/ carbofuran/ aquatic ecosystems/ standards/ cultures/ model studies/ protection/ rice/ aquatic life/ mass spectrometry/ regulations/ ecosystems/ monitoring/ gas chromatography/ physicochemical properties/ lagoons/ evaluation/ modelling/ pollution monitoring/ chromatographic techniques/ rice fields/ man-induced effects/ *Oryza sativa*/ Argentina/ rice/ modeling, mathematics, computer applications/ identification of pollutants/ characteristics, behavior and fate

Abstract: This work is within the framework of a project where the overall objective is to create the methodology for a sustainable management of an important wetland in Argentina, "Esteros del Ibera". Rice culture has been identified as the main anthropogenic activity, being necessary to evaluate the impacts of pesticides used in rice culture on the aquatic ecosystem. The purpose of this paper is to evaluate the impacts of pesticides used in rice culture through the use of a Mackay's model, to identify the potentially more contaminated environmental compartments, and identify their toxicological and physicochemical properties. Based on the results of the model, water samples were collected and two insecticides (endosulfan and carbofuran) were analysed using the solid-phase microextraction (SPME) extraction technique with detection by gas chromatography with mass spectrometry (GC-MS). To create a decision tool based on monitorization results, pesticide guidelines for water quality (drinking and for aquatic life protection) were calculated and compared with the available international regulations for pesticides; conservative guidelines are recommended. The results of pesticides analysis were compared with these guidelines; some results exceeded the international guidelines (mainly the values for protection of aquatic life) in particular those from samples taken close to the discharge points and due to the presence of the more toxic insecticide endosulfan; however, the impact of pesticides on most waters of the lagoon Ibera seems not yet to be very significant, but monitoring of impacts and careful use of pesticides, specially insecticides, should be observed in the future.

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247. Phosphorus concentration and forms in surface and subsurface drainage water from wetland rice fields in the Shaoxing plain.

Zhang, Mingkui; Jiang, Hong; and Liu, Xingmei
Pedosphere 13(3): 239-248. (Aug. 2003)

NAL Call #: S590 .P43; ISSN: 1002-0160

Descriptors: wetlands/ subsurface drainage/ rice/ drought/ phosphorus/ surface drainage/ fertilization/ cultivated lands/ surface water/ limiting factors/ subsurface irrigation/ rapid flow/ agricultural runoff/ fertilizers/ soil profile/ preferential flow/ China, People's Rep./ sources and fate of pollution

Abstract: Phosphorus (P) is the limiting factor for eutrophication in most freshwater ecosystems. In China, P transported from intensively cultivated land has been reported as an important source of P in surface waters. In this study, we investigated P concentration and forms in surface and subsurface drainage from wetland rice fields in the Shaoxing plain, Zhejiang Province, China. From selected rice fields, surface drainage samples were collected at rice-growing, non-growing and fertilization periods, and subsurface drainage samples at drought and rewetting (irrigation or precipitation after 5-10 d drought period in the surface soils) and wet (drainage under long-term wet soil condition) periods. Water samples were characterized for their total reactive P (TRP), dissolved reactive P (DRP) and particulate reactive P (PRP). Concentrations of the TRP and DRP in the surface drainage ranged from 0.08 to 1.50 and 0.06 to 1.27 mg L super(-1), respectively. The TRP and DRP were dependent on field operation activities, and decreased in the order of fertilization period > rice-growing period > non-growing period. Phosphorus concentration of runoff receiving P fertilizer can be an environmental concern. The PRP concentration in the surface drainage, ranging from 0.01 to 0.57 mg L super(-1), accounted for 8%-78% of the TRP. Concentration of the TRP in the subsurface drainage was from 0.026 to 0.090 mg L super(-1), consisting of 29%-90% of the DRP and 10%-71% of the PRP. In the drought and rewetting period, the PRP accounted for, on average, 63% of the TRP, much higher than in the wet period (23%), suggesting that there was transport of P in preferential flow during drainage events after a short-term drought period in the surface soils. Therefore, P losses in particulate form may be important in the subsurface drainage from rice fields when surface soils form cracks and favor rapid flow downward through the soil profiles, suggesting the important role of water-dispersible colloid particles in mediating and co-transporting P in the subsurface drainage of rice fields.

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248. Post-fire vegetation change and bird use of a salt marsh in coastal Argentina.

Isacch, J. P.; Holz, S.; Ricci, L.; and Martinez, M. M.
Wetlands 24(2): 235-243. (2004)

Descriptors: wetlands/ marshes/ burns/ fires/ salt marshes/ habitat/ vegetation/ biosphere reserves/ burning/ plant populations/ environmental impact/ community composition/ aquatic plants/ food availability/ man-induced effects/ fire/ ecosystem management/ biodiversity/ ecological succession/ coastal zone/ habitat selection/ *Spartina*/ structure/ birds/ habitats/ forages/ incineration/ species composition/ *Juncus*/ *Spartina*/ *Spartina densiflora*/ *Aves*/ *Juncus acutus*/ Argentina/ Argentina, Pampa/ birds

Abstract: Vegetation structure is an integral component of avian habitat selection. Therefore, structure changes caused by management practices can influence avian communities. The salt marshes of the pampas region of Argentina have experienced an increase in fire use as a management tool to improve cattle forage and to avoid accidental fires. A spring burn of 200 ha of salt marsh in Mar Chiquita Biosphere Reserve, Argentina, in September 1995, allowed us to compare the response of birds associated with two vegetation communities, one dominated by *Spartina densiflora* (Spartina marsh) and another dominated by *Juncus acutus* (Juncus marsh) from one month to one year post-burn. We recorded changes in plant species composition and vegetation structure (height and cover) at 40 days after the burn and every season for the subsequent year. Fire reduced total cover of both plant communities. *Juncus* marsh recovered pre-burn structure and bird community by one year post-fire. However, *Spartina* marsh recovery was incomplete in that period. Relative abundances of bird species that used unburned *Juncus* marsh were similar to those in burned *Juncus* marsh in the spring period one year after the burn. Plant height at the burned *Spartina* marsh did not reach that of the unburned *Spartina* in 12 months; red-capped wren-spinetail (*Spartonacoica maluroides*), a rare tall-grass-dependent species, settled burned parcels at lower relative abundances than in unburned habitat. Because species that first use the burned patches are very common and widespread in other habitats, and excessive burning may reduce available habitat for endangered or rare species, prescribed burns should be avoided in this region.

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249. Potential mineralization of four herbicides in a ground water-fed wetland area.

Larsen, L.; Joergensen, C.; and Aamand, J. *Journal of Environmental Quality* 30(1): 24-30. (2001)
NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: wetlands/ herbicides/ mineralization/ groundwater/ agriculture/ catchment areas/ atrazine/ anaerobically/ pollution (groundwater)/ aerobic conditions/ groundwater pollution/ water pollution sources/ slurries/ aquifers/ mecoprop/ metsulfuron-methyl/ redox potential/ isoproturon

Abstract: Herbicides may leach from agricultural fields into ground water feeding adjacent wetlands. However, only little is known of the fate of herbicides in wetland areas. The purpose of the study was to examine the potential of a riparian fen to mineralize herbicides that could leach from an adjacent catchment area. Slurries were prepared from sediment and ground water collected from different parts of a wetland representing different redox conditions. The slurries were amended with O sub(2), NO sub(3) super(-), SO sub(4) super(2-), and CO sub(2), or CO sub(2) alone as electron acceptors to simulate the in situ conditions and their ability to mineralize the herbicides mecoprop, metsulfuron-methyl, isoproturon and atrazine. In addition, the abundance of bacteria able to utilize O sub(2), NO sub(3) super(-), SO sub(4) super(2-) + CO sub(2), and CO sub(2) as electron acceptors was investigated along with the O sub(2)-reducing and methanogenic potential of the sediment. The recalcitrance to bacterial degradation depended on both the type of herbicide and the redox conditions pertaining. Mecoprop was the most readily degraded herbicide, with 36% of [ring-U-

super(14)C]mecoprop being mineralized to super(14)CO sub(2) under aerobic conditions after 473 d. In comparison, approximately 29% of [phenyl-U- super(14)C]metsulfuron-methyl and 16% of [ring-U- super(14)C]isoproturon mineralized in aerobic slurries during the same period. Surprisingly, 8 to 13% of mecoprop also mineralized under anaerobic conditions. Neither metsulfuron-methyl nor isoproturon were mineralized under anaerobic conditions and atrazine was not mineralized under any of the redox conditions examined. The present study is the first to report mineralization of mecoprop in ground water in a wetland area, and the first to report mineralization of a phenoxyacetic acid herbicide under both aerobic and anaerobic conditions.

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250. A preliminary study of the effects of drainage and harvesting on water quality in ombrotrophic bogs near Sept-Iles, Quebec.

Moore, T. R.

Water Resources Bulletin 23(5): 785-791. (1987)

NAL Call #: 292.9 AM34; ISSN: 0043-1370

Descriptors: wetlands/ bogs/ drainage/ peat/ harvesting/ water quality/ runoff/ groundwater/ nutrients/ acidity/ Quebec

This citation is from AGRICOLA.

251. Regional biodiversity in an agricultural landscape: The contribution of seminatural habitat islands.

Duelli, P. and Obrist, M. K.

Basic and Applied Ecology 4(2): 129-138. (2003)

NAL Call #: QH540 .B37

Descriptors: arthropods/ biological diversity/ dispersal/ ecological compensation/ fauna/ greenveining
Abstract: An important goal of ecological compensation measures in agricultural areas is the conservation and enhancement of regional species diversity. However, some current European agri-environment schemes seem to be rather ineffective. A likely explanation is the lack of source populations in intensely cultivated landscapes. Remnants of natural and seminatural habitats can contribute to regional biodiversity in various ways: as essential habitats for specialised species, as stepping stones, and as temporary habitats for hibernation, larval development, or preovipository feeding. The overall percentage of arthropod species, for which seminatural habitats are an essential prerequisite for living in an agricultural landscape, was assessed with a 5 km long transect of 18 standardised trapping stations. The transect extended from an isolated area of wetland through intensely managed crop fields and grassland to an isolated semiarid meadow bordered by mixed forest. For more than 1000 arthropod species the spatial and temporal distribution of a one year's catch along the transect was interpreted with regard to their affinity to seminatural habitats. Experts were asked to judge questionable cases of apparent ubiquitous species. All in all, more than 63% of all animal species (except for soil and water fauna) living in the agriculturally managed areas of the Limpach valley seem to depend on the presence of seminatural habitats. We conclude that remnant islands of natural or seminatural habitats provide the most important source populations for agri-environment schemes in order to enhance biodiversity in an otherwise depleted agricultural landscape.

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252. Response of advance regeneration to intensity of harvest and fertilization on boreal wetlands.

Teng, Y.; Bailey, S. E.; Foster, N. W.; and Hazlett, P. W.

Forestry Chronicle 79(1): 119-126. (2003)

NAL Call #: 99.8 F7623; ISSN: 0015-7546

Descriptors: black spruce/ clearcut/ nitrogen/ phosphorus/ potassium

Abstract: Post-harvest nutrient status and growth of understory black spruce (*Picea mariana* [Mill.] B.S.P.) advance regeneration during the first seven years after harvest with advance regeneration protection (HARP) was evaluated on two boreal wetlands in northeastern Ontario. Three intensities of HARP were investigated: light, medium and heavy, corresponding to 35, 50, 100% basal area removal of merchantable trees. Limiting nutrients were diagnosed with a nitrogen (N), phosphorus (P) potassium (K) fertilization trial. Release by HARP significantly improved foliar N by 43-214%, and P by 40-317%, stimulated needle mass by 13-114% and annual height increment of spruce by 6-50% on all three HARP treatments. Growth of spruce was statistically greater after heavy release than the other two HARP treatments by the sixth year. Fertilization with a combination of N and P further increased needle biomass and height increment by 23-46% and 16-26%, respectively. Nitrogen and, secondly, P were limiting for rapid natural reestablishment of black spruce stands on boreal peatlands.

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253. Restoration of riparian habitat using experimental flooding.

Sprengrer, M. D.; Smith, L. M.; and Taylor, J. P.

Wetlands 22(1): 49-57. (Mar. 2002)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ USA, New Mexico, Rio Grande River/ reservoirs/ riparian vegetation/ vegetation regrowth/ trees/ species composition/ survival/ mechanical control/ chemcontrol/ comparison studies/ drawdown/ environmental restoration/ riparian environments/ flooding/ herbicides/ pesticide applications/ habitat/ seedlings/ chemical treatment/ imazapyr/ impoundments/ endemic species/ water levels/ habitat improvement/ Tamarix ramosissima/ Populus deltoides/ USA, New Mexico, Rio Grande Valley/ saltcedar trees/ Eastern cottonwood/ control of water on the surface/ reclamation/ environmental action/ mechanical and natural changes/ general environmental engineering/ water and plants

Abstract: We evaluated treatments designed to remove saltcedar (*Tamarix ramosissima*) monocultures from riparian habitats using root plows (mechanical treatment) and aerial applications of the herbicide imazapyr (chemical treatment) within twelve 4-ha impoundments in the Middle Rio Grande Valley in central New Mexico, USA. Following these treatments, impoundments were flooded and water levels were reduced to stimulate native species re-establishment from seed. Water manipulations within saltcedar-removal areas consisted of stage drawdowns of 5 cm/day and 10 cm/day. Mechanically cleared areas had fewer saltcedar resprouts (26 resprouts/ha) than chemically treated areas (2,500 resprouts/ha). Saltcedar and cottonwood (*Populus deltoides* subsp. *wislizini*) seedling density and cottonwood survival were greater in mechanically treated areas than in chemically treated areas. This effect is attributed to soil disturbance resulting from root plowing. Cottonwood seedling density and

survival did not differ between 5 cm/day and 10 cm/day stage drawdowns and decreased throughout summer as a result of excessive moisture stress. The absence of a drawdown treatment effect indicates that both drawdowns were too fast for seedling roots to keep up with declining water tables. Seedlings that survived were using moisture from the unsaturated zone.

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254. A review of the effects of agricultural and industrial contamination on the Ebro Delta biota and wildlife.

Manosa, S.; Mateo, R.; and Guitart, R.

Environmental Monitoring and Assessment 71(2): 187-205. (2001)

NAL Call #: TD194; ISSN: 0167-6369

Descriptors: wildlife/ pesticides (organochlorine)/ pesticides (carbamates)/ industrial pollution/ pollution effects/ PCB/ pesticides/ pollution/ plants/ reviews/ contamination/ biota/ organochlorine compounds/ PCB compounds/ biological diversity/ rice fields/ aquatic birds/ deltas/ marine birds/ pollution monitoring/ pollution dispersion/ river discharge/ industrial wastes/ agricultural pollution/ agricultural runoff/ insecticides/ chlorinated hydrocarbons/ organic compounds/ phosphorus compounds/ water pollution sources/ polychlorinated biphenyls/ ecological effects/ aquatic populations/ water birds/ accumulation/ species diversity/ pollutants/ agriculture/ aquatic organisms/ environmental pollution/ wetlands pollution/ agricultural effects on surface waters/ industrial pollutants/ river water pollution/ pesticide environmental pollution/ herbicides in runoff/ polychlorinated biphenyls in soil/ Spain, Ebro R.

Abstract: The Ebro Delta (NE Spain) is a 320 km super(2) wetland area of international importance for conservation. The area is devoted to rice farming and receives large amounts of pesticides. Industrial pollutants are also carried to the delta by the river. The information accumulated during the last 25 year on the effect of such pollution on the biota is reviewed in order to identify the existing gaps and needs for management. Organochlorine pesticides were legally used until 1977, which has resulted in the widespread presence of these compounds in the Ebro Delta biota. Lethal, sublethal or other detrimental effects of these pesticides on wildlife in the area were poorly investigated, but negative effects on the reproduction of ducks and herons were reported. Nowadays, polychlorinated biphenyls (PCBs) are the main responsible of organochlorine pollution in the area: concentrations in biota samples are higher than levels observed in nearby coastal areas, as a result of the significant PCB inputs by the river which, in 1990, were evaluated at 126 kg yr super(-1). The massive use of herbicides is thought to have contributed to the elimination of macrophyte vegetation in the lagoons during the eighties, which had strong consequences on diving ducks and coot populations. Weed control is also related to the loss of biodiversity held by rice fields. The massive and inadequate use of organophosphorus and carbamate pesticides (involving more than 20 000 t yr super(-1)) has produced some waterbird mortality events, and may have direct and indirect effects on other non-target organisms. The accumulation in the soil of lead pellets used in waterfowl shooting is estimated to kill some 16 300 waterbirds in the Ebro delta every year.

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255. The role of grazing in creating suitable sward structures for breeding waders in agricultural landscapes.

Tichit, M.; Durant, D.; and Kerneis, E.
Livestock Production Science 96(1): 119-128. (2005)
 NAL Call #: SF1.L5; ISSN: 0301-6226
Descriptors: wetlands/ animal production/ coastal areas/ grass sward/ grazing/ habitats/ marshes/ nitrogen fertilizers/ plant height/ stand structure/ stocking rate
Abstract: French wet grasslands support important populations of lapwings and other waders. Grazing management is a key issue in the use of grasslands by these birds since they are very sensitive to sward structure (height and heterogeneity). To assess the impact of different grazing regimes on sward structure during spring, sward height was repeatedly measured in a coastal marsh for 2 years. Sward structure was characterised by variables related to height classes and an index of heterogeneity. Grazing regimes were described by stocking rates per period and N fertilisation level. Heterogeneity index was quadratically related to mean sward height both years. Four types of sward structures were characterised through principal component analysis. Co-inertia analysis showed a strong relationship between grazing regimes and sward structure. However, during spring, the relationship between stocking rate and sward structure differed according to year, impact of grazing being greater during drought year. Suitable sward structures were observed for both lapwings and redshanks. Wader habitat management through grazing calls for more attention to be paid to the delayed effects of autumn and winter grazing regimes. Sward heterogeneity emerges as a new characteristic to control, because it may introduce new constraints for livestock production.
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256. The role of herbicides in the erosion of salt marshes in eastern England.

Mason, C. F.; Underwood, G. J. C.; Baker, N. R.; Davey, P. A.; Davidson, I.; Hanlon, A.; Long, S. P.; Oxborough, K.; Paterson, D. M.; and Watson, A.
Environmental Pollution 122(1): 41-49. (2003)
 NAL Call #: QH545.A1E52; ISSN: 0269-7491
Descriptors: agricultural development/ photosynthesis/ growth/ vegetation/ herbicides/ agriculture/ saltmarsh habitat/ impact of forestry or agriculture/ pollution, toxicity/ laboratory experiments/ fieldwork, field experiments/ Europe/ United Kingdom/ England
Abstract: Laboratory studies and field trials were conducted to investigate the role of herbicides on saltmarsh vegetation, and their possible significance to saltmarsh erosion. Herbicide concentrations within the ranges present in the aquatic environment were found to reduce the photosynthetic efficiency and growth of both epipellic diatoms and higher saltmarsh plants in the laboratory and in situ. The addition of sublethal concentrations of herbicides resulted in decreased growth rates and photosynthetic efficiency of diatoms and photosynthetic efficiency of higher plants. Sediment stability also decreased due to a reduction in diatom EPS production. There was qualitative evidence that diatoms migrated deeper into the sediment when the surface was exposed to simazine, reducing surface sediment stability by the absence of a cohesive biofilm. Sediment loads on leaves severely reduced photosynthesis in *Limonium vulgare*.

This, coupled with reduced carbon assimilation from the effects of herbicides, could have large negative consequences for plant productivity and over winter survival of saltmarsh plants. The data support the hypothesis that sublethal herbicide concentrations could be playing a role in the increased erosion of salt marshes that has occurred over the past 40 years.
 © NISC

257. The role of the Conservation Reserve Program in relation to wildlife enhancement, wetlands and adjacent habitats in the northern Great Plains.

Higgins, K. F.; Nomsen, D. E.; and Wentz, W. A.
 In: General Technical Report RM; Vol. 159.
 Fort Collins, Colo.: Rocky Mountain Forest and Range Experiment Station, 1987
Descriptors: Conservation Reserve Program/ regional conservation programs/ northern Great Plains
Abstract: Focused on the value of CRP grasslands directly related to wetlands and their associated wildlife (primary migratory birds).

258. Sampling of agrochemicals for environmental assessment in rice paddies: Dry tropical wetlands, Costa Rica.

Loaiciga, H. A. and Robinson, T. H.
Ground Water Monitoring & Remediation 15(3): 107-118. (1995)
 NAL Call #: GB1001.G76; ISSN: 1069-3629
Descriptors: wetlands/ paddy soils/ pesticides/ fertilizers/ water quality/ water pollution/ soil pollution/ sampling/ tropics/ Costa Rica
Abstract: This paper presents results from a preliminary sampling strategy developed to track agricultural contaminants found in surface and subsurface media and used commonly in rice paddy cultivation in the dry, tropical forest coastal region of Guanacaste, Costa Rica. The emphasis is on the impact of eight indicator pesticides, five forms of nitrogen and phosphorus that are common nutrients found in fertilizers. After the field sampling strategy was developed, soil and water samples were collected twice: once during the beginning of the wet season and once during the initiation of the dry season. Hydrological parameters, soil classifications, agricultural product toxicology, irrigation and drainage networks, cultivated areas, land ownership, and pristine environments have been studied, mapped, and entered into a database in order to understand the spatial and temporal distribution of potential contaminants and their pending ecological degradation. Alternative crops and agricultural practices are suggested to reduce or eliminate impacts on biological preserves. Database development and basin characteristics have been entered into a Geographic Information System (GIS) that is capable of fully integrating suggested site modeling. Field sampling results indicate that proposed rice paddy cultivation in a relatively undisturbed basin is likely to have minimal impact on downstream biological preserves.
 This citation is from AGRICOLA.

259. Simulating the impact of irrigation management on the water and salt balance in drained marsh soils (Marismas, Spain).

Andreu, L.; Jarvis, N. J.; Moreno, F.; and Vachaud, G. *Soil Use and Management* 12(3): 109-111. (1996)
Descriptors: marshes/ wetland soils/ clay soils/ drained conditions/ irrigation/ water management/ irrigation water/ irrigation scheduling/ soil water balance/ soil salts/ chlorides/ leaching/ water table/ simulation models/ application rate/ Spain
Abstract: Using the simulation model MACRO, this paper investigates the likely consequences of reduced irrigation inputs on the water and salt balance and crop growth in a drained, saline clay in a Mediterranean climate (Marismas, SW Spain). The model was first successfully validated against field measurements of the soil water and chloride balance, water table depths and drain outflows in the 1989 growing season. Three-year simulations were then performed assuming two different irrigation applications (60 and 75% reductions from the 1989 amount) and two different frequencies (12 or 6 irrigations per growing season). The model predictions suggested that reduced irrigation may lead to up to a 15% increase in the chloride content of the soil profile after 3 years. Also, despite overall reductions in water discharge, slight increases in chloride leaching via field drains (c. 4 to 8%) were predicted. The model demonstrated that encroachment of salt into the soil profile may be exacerbated by the non-equilibrium nature of water flow and solute transport ('by-passing flow') in structured clays. With reduced water supply for irrigation, more frequent applications may give marginally better crop yields for the same quantity of irrigation but at the expense of slightly increasing salt concentration in the root zone. This citation is from AGRICOLA.

260. Soil carbon in northern forested wetlands: Impacts of silvicultural practices.

Trettin, C. C.; Jurgensen, M. F.; Gale, M. R.; and McLaughlin, J. W.
 In: Carbon Forms and Functions in Forest Soils/ McFee, W. W. and Kelly, J. M.
 Madison, Wis.: Soil Science Society of America, 1995; pp. 437-461
NAL Call #: SD390.N67 1993
Abstract: This paper has three objectives: (i) review the distribution and function of C in northern forested wetlands, (ii) review how different silvicultural practices affect soil C levels, and (iii) consider the potential for recovery of soil C following disturbance by silvicultural practices. -Authors

261. Soil physical behaviour and crop responses to tillage in lowland rice soils of varying clay content.

Mambani, B.; De Datta, S. K.; and Redulla, C. A. *Plant & Soil* 126(2): 227-235. (1990); *ISSN:* 1573-5036
Abstract: The influence of various tillage methods on two wetland rice soils in the Philippines is reported. The soils differed principally in clay content, 38% for the clay loam, while 56% for the clay. This had a marked effect on their response to tillage and varying water regime. The clay soil, under field conditions, showed little change in pore size distribution or soil water behaviour with different tillage methods. Crop yields were unaffected by tillage. In contrast, tillage effects were very marked in the clay loam soil, which consisted of a greenhouse and a field trial.
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262. Soil, surface water and ground water phosphorus relationships in a partially harvested Boreal Plain aspen catchment.

Macrae, M. L.; Redding, T. E.; Creed, I. F.; Bell, W. R.; and Devito, K. J. *Forest Ecology and Management* 206(1-3): 315-329. (2005)
NAL Call #: SD1.F73; *ISSN:* 0378-1127
Descriptors: aspen/ Boreal Plain/ forest/ ground water/ phosphorus/ soil/ sub-humid/ surface-water/ timber harvest/ topography
Abstract: Soil phosphorus (water-extractable) measured in harvested and forested areas of a headwater aspen forested catchment in north-central Alberta was related to surface and ground water total dissolved phosphorus (TDP). No differences in water-extractable soil phosphorus concentrations ([ext-P]) were observed between harvested and forested areas. Topographic position explained most of the variance in the [ext-P] of surface soils. Soil [ext-P] in surface horizons was large in upslope areas compared to low-lying areas, ephemeral draws, and wetlands. Forest floor and surface organic soils (0-10 cm) had greater concentrations of ext-P (>70 ?g g⁻¹) and total P (tot-P) (>1000 ?g g⁻¹) than mineral soils ([ext-P] <2 ?g g⁻¹ and [tot-P] <300 ?g g⁻¹). Phosphorus buffering capacity was small in organic surface soils (EPC0 > 5000 ?g L⁻¹) and large in mineral soils (EPC0 A horizon = 100-400 ?g L⁻¹; EPC0 B horizon < 100 ?g L⁻¹). This was reflected in greater levels of TDP in surface water (range = 2-2350 ?g L⁻¹, median = 85 ?g L⁻¹) and soil water (range = 22-802 ?g L⁻¹, median = 202 ?g L⁻¹) which flowed through organic soils, compared with small concentrations of TDP in ground water which flowed through mineral soils (range = 0-1705 ?g L⁻¹, median = 23 ?g L⁻¹). Our results indicate that increases in ground water TDP following harvest are unlikely due to the large adsorption affinity of mineral soils. Phosphorus-rich surface soils have a large potential for phosphorus release to surface water but this does not differ between harvested and forested areas. Sub-humid climatic conditions and rapid aspen regeneration lead to soil moisture deficits and limited surface runoff which may reduce harvesting effects on P mobilization on the Boreal Plain.
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263. Temporal changes in macroinvertebrate assemblages following experimental flooding in permanent and temporary wetlands in an Australian floodplain forest.

Hillman, T. J. and Quinn, G. P. *River Research and Applications* 18(2): 137-154. (Mar. 2002-Apr. 2002)
NAL Call #: TC530 .R43; *ISSN:* 1535-1459
Descriptors: wetlands/ flooding/ community composition/ forests/ rivers/ regulated rivers/ flood plains/ ecological effects/ macroinvertebrates/ species composition/ temporal distribution/ habitats/ comparison studies/ floodplains/ floods and flooding/ ecology/ animals (invertebrates)/ time dependent/ habitat/ comparative studies/ environmental impact/ fauna/ Animalia/ Australia, New South Wales, Murray R./ temporal variations/ aquatic entomology/ ecological impact of water development/ water resources and supplies/ habitat community studies
Abstract: The River Murray, Australia, is a highly regulated river from which almost 80% of mean annual flow is removed for human use, primarily irrigated agriculture.

Consequent changes to the pattern and volume of river flow are reflected in floodplain hydrology and, therefore, the wetting/drying patterns of floodplain wetlands. To explore the significance of these changes, macroinvertebrate samples were compared between permanent and temporary wetlands following experimental flooding in a forested floodplain of the River Murray. Weekly samples from two permanent wetlands and four associated temporary sites were used to track changes in macroinvertebrate assemblage composition. Non-metric multidimensional scaling was used to ordinate the macroinvertebrate data, indicating consistent differences between the biota of permanent and temporary wetlands and between the initial and later assemblages in the temporary sites. There were marked changes over time, but little sign that the permanent and temporary assemblages were becoming more alike over the 25-week observation period. The apparent heterogeneity of these systems is of particular importance in developing river management plans which are likely to change flooding patterns. Such plans need to maintain a mosaic of wetland habitats if floodplain biodiversity is to be supported.

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264. Timber harvest in wetlands: Strategies and impact assessment.

Prenger, Joseph P. and Crisman, Thomas L.
In: Bioassessment and management of North American freshwater wetlands/ Rader, Russell B.; Batzer, Darold P.; and Wissinger, Scott A.

New York: John Wiley & Sons, 2001; pp. 429-449.

Notes: ISBN: 0471352349

NAL Call #: QH77.N56 B56

Descriptors: animals and man/ disturbance by man/ commercial activities/ habitat/ terrestrial habitat/ land and freshwater zones/ Nearctic region/ North America/ comprehensive zoology: forestry/ timber harvesting/ ecological impact/ semiaquatic habitat/ forest and woodland/ USA, Southeast/ ecological impact of timber harvesting/ forested wetlands

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265. Toxicity assessment of water from lakes and wetlands receiving irrigation drain water.

Dickerson, K. K.; Hubert, W. A.; and Bergman, H. L.

Environmental Toxicology and Chemistry 15(7): 1097-1101. (1996)

NAL Call #: QH545.A1E58; ISSN: 0730-7268

Descriptors: wetlands/ drainage water/ irrigation water/ contaminants/ toxicity/ Ceriodaphnia dubia/ Pimephales promelas/ mortality/ water quality/ lakes/ water pollution/ Colorado/ Wyoming/ Montana

Abstract: A method for reconnaissance-level assessments of the potential toxicity of water in lakes and wetlands that receive irrigation drain water is needed. We evaluated a model that predicts toxicity to aquatic organisms due to major ionic composition as a primary means of assessing water quality. The model was used in conjunction with acute toxicity tests and trace element analyses. Mortality of *Ceriodaphnia dubia* and fathead minnows (*Pimephales promelas*) observed in acute toxicity tests was compared to mortality predicted by the model. The method was applied at 22 lakes and wetlands on federally administered lands in Colorado, Montana, Utah, and Wyoming. Fourteen of 22 locations had water that was not toxic to test organisms. Six

locations had undiluted water that was toxic to *C. dubia* due to major ionic composition, and two locations had undiluted water that showed toxic effects caused by factors other than elevated levels of major ions. The model for *C. dubia* seemed to be sufficiently accurate for future application using our approach to assess lakes and wetlands receiving irrigation drain water.

This citation is from AGRICOLA.

266. The transport of the pesticide atrazine from the fresh water of the wetlands of Brittany to the salt water of the bay of Mont St. Michel (France).

Gueune, Y. and Winnett, G.

Journal of Environmental Science and Health, Part A: Environmental Science and Engineering & Toxic and Hazardous Substance Control A29(4): 753-768. (1994)
NAL Call #: TD172.J6; ISSN: 0360-1226

Descriptors: wetlands/ pesticides/ water pollution/ agricultural chemicals/ fate of pollutants/ atrazine/ seawater/ agrochemicals/ sediment pollution/ freshwater pollution/ pollution dispersion/ agricultural pollution/ pollutant persistence/ fate/ France, Brittany/ atrazine

Abstract: This paper is concerned with possible environmental hazards connected with the use of agricultural chemicals (pesticides) in the agriculture of the reclaimed lands of northeastern Brittany (France). The transport of atrazine from the site of use in the polders of Brittany by freshwater and sediment to the salt water of the Bay of Mont St. Michel is examined.

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267. Tree community diversity of lowland swamp forest in northeast Costa Rica, and changes associated with controlled selective logging.

Webb, E. L. and Peralta, R.

Biodiversity and Conservation 7(5): 565-583. (1998)

NAL Call #: QH75.A1 B562; ISSN: 0960-3115

Descriptors: *Carapa nicaraguensis*/ Costa Rica/ diversity/ logging/ swamp/ tree community

Abstract: In the Atlantic lowlands of Northeast Costa Rica, logging occurs in tracts of poorly drained wet forest ('swamp forest'), yet little is known about factors affecting swamp forest diversity or the potential for biodiversity retention during harvest. This paper quantitatively describes the species composition and diversity of the swamp forest habitat, and reports the immediate impact of controlled, selective logging on tree community diversity. *Pentaclethra macroloba* (Leguminosae), *Carapa nicaraguensis* (Meliaceae) and *Pterocarpus officinalis* (Leguminosae) accounted for >70% of the primary swamp forest basal area. Nevertheless, 225 species from 53 families with individuals >10 cm dbh were encountered in 16.4 ha; most species had very low abundances. Gamma diversity is a component of overall swamp forest diversity. Extraction of 49.2 m³ ha⁻¹ (5.5 trees ha⁻¹) of timber from a 4 ha plot reduced species richness by 14, supporting assertions that random mortality during logging can affect the distribution of rare species. However, tree community diversity as measured by rarefaction was not greatly affected by selective logging. Total post-logging stem recruitment over a 3-year period was greater in logged plots than in undisturbed plots; the recruitment of the ruderal species *Ochroma lagopus* (Bombacaceae) was the most clearly affected by logging. Any localized dominance by this species will be limited in space and time in a carefully

managed forest. The results suggest that controlled selective logging can be consistent with biodiversity conservation, and complement protected areas in Northeast Costa Rica.

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268. The use of fertilizer-free grass buffer strips to attenuate nitrate input to marshland dykes.

White, S. K.; Cook, H. F.; and Garraway, J. L.

Water and Environmental Management 12(1): 54-59. (1998)

NAL Call #: TD420.W374; ISSN: 0951-7359

Descriptors: nitrates/ nutrient uptake/ alluvial soils/ pollution control/ wetland soils/ drainage/ nitrate nitrogen/ saturated flow/ unsaturated flow/ groundwater/ groundwater flow/ groundwater contamination

Abstract: Fertilizer-free buffer strip establishment has proved to be effective in attenuating nitrates which are mobile in shallow water-tables feeding watercourses of conservation potential. This paper demonstrates their effectiveness on reclaimed alluvial marshland soils. This citation is from AGRICOLA.

269. Using the shelterwood method to mitigate water table rise after forest harvesting.

Pothier, D.; Prevost, M.; and Auger, I.

Forest Ecology and Management 179(1-3): 573-583. (2003)

NAL Call #: SD1.F73; ISSN: 0378-1127

Descriptors: wetlands/ water table/ harvesting/ forest management/ forest industry/ ecosystem disturbance/ forests/ environmental impact/ restoration/ logging/ Canada/ shelterwood/ shelterwood method

Abstract: The groundwater level of a conifer stand established on a lowland in eastern Canada was periodically measured using water wells installed in an experimental design composed of four completely randomized blocks and five levels of cutting (0, 40, 50, 60, and 100% of basal area (BA) removed). The three partial cutting treatments were applied following the principles of low thinning, but with the seed cutting objectives of the shelterwood method. Before cutting, highly similar values for groundwater level were recorded for plots targeted to receive the planned treatments. During the first growing season after cutting, the water table rise was linearly related to the percentage of cutting, and this effect was more apparent at the lower levels recorded for the control water table. This finding is partly explained by the leaf biomass of residual trees that intercepted an increasing proportion of rainfall with decreasing cutting intensity. Five years after cutting, although the water table of clearcut experimental units (EU) was still higher than that of the controls, it was no longer related to cutting intensity. During the 5 years following cutting, the slopes of the relationship between the water table depth of the control plots and those of any treatment gradually approached the value calculated before cutting. This water table recovery was related to the increasing leaf biomass of the regeneration stratum over time, rather than to the crown expansion of residual trees. The shelterwood method should be considered for forest management of wetlands, since it mitigates water table rise after the first cut and promotes a vigorous regeneration stratum which should also mitigate water table rise following the final cut.

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270. Vegetation and threatened plant dynamics of wet abandoned rice fields in Nakaikemi, Fukui Prefecture, Japan.

Shimoda, M. and Nakamoto, M.

Japanese Journal of Ecology 53(3): 197-217. (Dec. 2003)

NAL Call #: 410 J272; ISSN: 0021-5007

Descriptors: wetlands/ plant communities/ vegetation patterns/ vegetation changes/ succession/ old fields/ rice fields/ environment management/ ecological succession/ nature conservation/ rare species/ soils/ water content/ community composition/ plant populations/ species diversity/ marshes/ seeds/ vegetation cover/ environmental conditions/ dominant species/ agriculture/ herbicides/ aquatic plants/ Typha/ Phragmites/ Zizania/ Oryza sativa/ Japan, Honshu, Fukui Prefect./ rice/ conservation, wildlife management and recreation/ other aquatic communities

Abstract: Nakaikemi, in Fukui Prefecture, central Japan, is a basin with an area of about 25 hectares. Rice has been cultivated in wet paddy fields throughout Nakaikemi since the Edo period (1603-1867). The traditional wet fields always supported a diversity of aquatic and wetland plants, including threatened species. Recently, abandoned rice fields have continued to increase because the environmental conditions they provide are inconvenient for modern agriculture. A four-year vegetation survey (1997-2000) of Nakaikemi confirmed that the area of cultivated fields decreased from 1.2 ha to 0.3 ha. A wide distribution of tall reedy communities dominated by Phragmites, Zizania and Typha, and short herbaceous communities were observed on the abandoned wet rice fields. Non-wetland communities dominated by Solidago and creeper plants (Pueraria and Humulus) increased on drier habitats. The tall reedy communities usually developed within two to five years after abandonment. In some fields, no tall reedy communities developed during the survey period. The distribution of plant communities changed with time and soil moisture conditions. A continuous survey of threatened plant habitats showed that in cultivated and young abandoned fields, tall perennial plants succeeded and dominated the small plant species. The number of threatened species was higher in plowed plots than in non-plowed plots. These survey results suggest that the factors affecting Nakaikemi's vegetation and flora are the period elapsed after abandonment, soil moisture, management tasks and surrounding vegetation. Seed bank species composition and use of herbicides also affect plants in both the cultivated and young abandoned fields. To conserve the diverse wetland flora of Nakaikemi, appropriate land management is needed to control the vegetation.

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271. Vegetation change in a man-made salt marsh affected by a reduction in both grazing and drainage.

Esselink, P.; Fresco, L. F. M.; and Dijkema, K. S.

Applied Vegetation Science 5(1): 17-32. (2002)

NAL Call #: QK900 .A66; ISSN: 1402-2001

Descriptors: salt marshes/ vegetation/ grazing/ drainage/ botanical composition/ ecological succession/ conservation areas/ cattle/ plant communities/ soil water content/ grazing intensity/ flooded conditions/ frequency/ Netherlands

This citation is from AGRICOLA.

272. Vegetation change in an ombrotrophic mire in northern England after excluding sheep.

Smith, R. S.; Charman, D.; Rushton, S. P.; Sanderson, R. A.; Simkin, J. M.; and Shiel, R. S.

Applied Vegetation Science 6(2): 261-270. (2003)

NAL Call #: QK900.A66; ISSN: 1402-2001

Descriptors: wetlands/ bogs/ grassland management/ grasslands/ grazing/ moorlands/ nature conservation/ plant succession

Abstract: The role of sheep grazing on vegetation change in upland mires removed from livestock farming and surrounded by conifer plantation was investigated with a grazing trial at Butterburn Flow in northern England. Paired grazed and ungrazed plots from central and peripheral locations were compared over 14 years (1988-2002). Vegetation data from 34 mires in Kielder Forest provided an ordination framework within which vegetation trends were investigated. A gradient from dry moorland/hummock to wet mire/hollow vegetation dominated this framework and may reflect hydrological variability and structural vegetation differences between the mires. Some species were significantly affected by change in grazing intensity and there were differences between the edge and the centre of the mire. Overall vegetation change depended upon the grazing management and the position of the plots such that the removal of sheep grazing decreased the cover of species typical of wet ombrotrophic conditions, but only at the periphery of the mire. The vegetation in one plot became very similar to that of mires elsewhere in Kielder Forest where sheep were removed several decades ago. Cessation of grazing on upland mires is likely to lead to slow structural and species change in vegetation at the mire edge with a long-term loss of ombrotrophic species. The nature conservation significance of these changes will depend upon whether or not management objectives target natural conditions or wish to maximize ombrotrophic vegetation. The context of external factors such as climate and pollution may, however, be more important in determining site condition on the wettest mires.

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273. Vegetation dynamics and plant species interactions under grazed and ungrazed conditions in a western European salt marsh.

Tessier, M.; Vivier, J.-P.; Ouin, A.; Gloaguen, J.-C.; and Lefeuvre, J.-C.

Acta Oecologica 24(2): 103-111. (2003)

NAL Call #: QH540.A27; ISSN: 1146-609X

Descriptors: exclosures/ halophyte/ nitrogen addition/ plant interactions/ plant succession

Abstract: Experiments in exclosures were conducted on a salt marsh in a macrotidal system in western France. The aim of this study was threefold: (1) to compare vegetation dynamics over a period of 8 years in grazed and ungrazed conditions (2) to investigate the response of annual species to grazing duration during seedling establishment (3) to test the effect of an increase in soil nitrogen availability after cessation of grazing on interactions between *Suaeda maritima* and *Puccinellia maritima*. In grazed conditions, during all the survey, vegetation was dominated by a short *P. maritima* sward with the annual *Salicornia europaea* in the lower and middle marshes. However, after cessation of grazing in 1994, a homogeneous matrix of the forb *Halimione portulacoides*, quickly replaced *P. maritima* in the well drained lower marsh. At the middle marsh level, fine

sediment and poor drainage maintained *P. maritima* while the annual *S. maritima* which tolerates taller and denser vegetation replaced *S. europaea*. *Elymus pungens* cover was limited till 2000 but its rising in 2001 let expect its dominance in the future. While *P. maritima* abundance remained high, spring abundance of annual species such as *S. europaea* and *S. maritima* globally decreased with sheep grazing duration on the salt marsh between February and June. Experiments with monocultures of *P. maritima* and *S. maritima* demonstrated that nitrogen was a limiting factor on the salt marsh. In a mixed community, a moderate application of nitrogen (15 g N m⁻² year⁻¹ as NH₄-NO₃) promoted growth of *P. maritima* and limited the biomass of *S. maritima*, but growth of the latter was enhanced by a high application of nitrogen (30 g N m⁻² year⁻¹). An increase in the abundance of annuals such as *S. maritima* on the salt marsh is discussed.

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274. Water quality effects of irrigation with drain water.

Faulkner, B. R. and Guitjens, J. C.

Applied Engineering in Agriculture 17(3): 293-301. (2001)

NAL Call #: S671.A66; ISSN: 0883-8542

Descriptors: wetlands/ irrigation/ drainage water/ irrigation water/ irrigated farming/ *Triticum aestivum*/ soil chemistry/ cations/ leaching/ geochemistry/ salinity/ evaporation/ aquifers/ Nevada

Abstract: Wetlands that receive drainage from irrigated agriculture are often adversely affected by elevated salinity. Management of drain water salinity from irrigated areas requires an understanding of the thermodynamic effects of evapoconcentration and the subsurface geochemical and hydrodynamic setting. This article presents results from a demonstration of a Lahontan Valley field irrigated conjunctively with drain water and canal water, and an evaluation of the potential effects of irrigating with drain water on the existing aqueous environment. Major ions of soil saturation paste measurements during an irrigation season provide insight into the geochemical and hydrodynamic processes that control the salinity of drain water. Data demonstrate that use of drain water for irrigation is a viable alternative to conventional irrigation solely with canal water, that should produce few adverse effects in well-drained soils of the Lahontan Valley while providing water quality mitigation of wetlands receiving saline outflows from the shallow aquifer recharged by irrigation drainage.

This citation is from AGRICOLA.

275. Wetland and aquatic habitats.

Mathias, M. E. and Moyle, P.

Agriculture, Ecosystems & Environment 42(1-2): 165-176. (1992)

NAL Call #: S601.A34; ISSN: 0167-8809.

Notes: Special issue: Integrating conservation biol. & agric. production.

Descriptors: wetlands/ riparian environments/ dispersal/ agricultural practices/ biological diversity/ species diversity/ ecosystem management/ environmental impact/ agriculture/ dispersion/ man-induced effects/ man-induced effects/ dispersal/ agricultural practices/ biological diversity/ mechanical and natural changes

Abstract: Riparian wetland areas often represent critical corridors for animal and plant dispersion in wildland watersheds and downstream river systems. It is essential that integrated management of riparian wetland areas be developed to reverse the loss of biological diversity. Agricultural and urban uses, and related water developments, have led to a marked decline of stream-side wetland habitats. Six major ways are discussed in which conventional agriculture alters wetlands and aquatic habitats: wetland drainage, water diversions, stream channelization, bank stabilization, grazing, and the release

of agricultural pollutants. This article discusses these practices and suggests ways biological diversity can be protected, or even enhanced. In addition, aquaculture is discussed as a new force which affects the diversity of aquatic organisms. Aquaculture methods range in intensity of management from low to high. Management for biological diversity as well as for food production should be encouraged.

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Wetlands as Agricultural Conservation Practices

276. **Agricultural drainage and wetland management in Ontario.**

Walters, D. and Shrubsole, D.

Journal of Environmental Management 69(4): 369-379. (2003)

NAL Call #: HC75.E5J6; ISSN: 0301-4797

Descriptors: agricultural drainage/ policy analysis/ wetland management

Abstract: Land drainage is recognized as an integral part of agricultural activity throughout the world. However, the increase in agricultural production has resulted in the loss of wetland functions and values. Therefore, wetland management and agricultural drainage illustrate the conflict between economic development and natural values. This research assesses the approval process for agricultural land drainage in Ontario, Canada, to determine how the benefits of increased agricultural production are balanced against the loss of wetland values. A permit review of drainage applications was conducted from 1978 to 1997 in Zorra Township, Ontario, Canada. Data collection also included the document reviews, interviews with government agencies and wetland evaluation files. The selected criteria include efficiency, equity, consistency and adequacy. The results indicate that while the process is efficient, fundamental problems remain with the bargaining process. © 2006 Elsevier B.V. All rights reserved.

277. **Agricultural reuse of the secondary effluent polished by an algal pond system coupled with constructed wetland.**

Kim, Y.; Lee, D. R.; and Giokas, D.

Water Science and Technology 50(6): 79-86. (2004)

NAL Call #: TD420.A1P7; ISSN: 0273-1223

Descriptors: effluents/ artificial wetlands/ coliforms/ organic matter/ bacterial/ water reuse/ nutrient removal/ phosphorus/ wastewater irrigation/ secondary wastewater treatment/ water quality/ irrigation water/ recycling/ secondary treatment/ nutrients/ irrigation/ agriculture/ nitrogen/ Korea, Rep./ wastewater treatment processes/ protective measures and control/ waste management/ water & wastewater treatment

Abstract: In this paper, reuse potentials of the secondary effluents as irrigation water was evaluated through field sampling trips. Water quality parameters significantly deviating from its guidelines were Total coliform bacteria and organic matter. Even though nutrients are not regulated in Korea, their removal would be required because they have been a barrier for secondary effluent irrigation through

governmental intervention. The results of treatment study with aquatic ponds show that in spite of its poor biodegradability, organic matter in soluble form was reduced by 20% during 10 days of HRT. On the other hand, reduction of nutrients was remarkable. On average 85% of total nitrogen and 89% of total phosphorus were removed, respectively, which abates the worries of farmers for overgrowth or reduction in crop yield. However, coliform bacteria, although slightly reduced due to their propagation at the constructed wetlands still need further treatment.

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278. **Ammonia effects on the biomass production of five constructed wetland plant species.**

Hill, D. T.; Payne, V. W. E.; Rogers, J. W.; and Kown, S. R.

Bioresource Technology 62(3): 109-113. (1997)

NAL Call #: TD930.A32; ISSN: 0960-8524

Descriptors: waste treatment/ biological treatment/ aquatic plants/ animal manures/ excreta

Abstract: The effect of four levels of ammonia concentration on the biomass production of *Sagittaria latifolia* (arrowhead), *Phragmites australis* (common reed), *Scirpus acutus* (bullrush), *Typha latifolia* (cattail), and *Juncus roemerianus* (common rush) was studied using field scale constructed wetland ponds of 3.05 x 0.6 m. These species of plants are common in constructed wetlands treating animal waste lagoon effluent. Twenty ponds were constructed to accommodate the five species and four ammonia levels. The experiment had three repetitions in time. Effluent from the second cell of a two cell anaerobic lagoon system treating flushed swine waste was utilized at four dilution levels, providing mean ammonia concentrations of 20.5, 41.1, 61.6 and 82.4 mg NH₃-N/L for the study. Biomass production was determined by harvesting the plants at specified time intervals and measuring dry weight production. The ponds were operated as standard constructed wetlands with a water depth of 10-15 cm. After the 3 month field study was completed, statistical analysis of the data was performed. This analysis showed that the only species affected by ammonia concentration was *Scirpus acutus*. The remaining four species were statistically unaffected. Data from the study also shows a significant difference in the biomass production between species.

This citation is from AGRICOLA.

279. Aquaculture sludge removal and stabilization within created wetlands.

Summerfelt, S. T.; Adler, P. R.; Glenn, D. M.; and Kretschmann, R. N.

Aquacultural Engineering 19(2): 81-92. (1999)

NAL Call #: SH1.A66; ISSN: 0044-8486

Descriptors: wetlands/ wastewater treatment/ sludge/ aquaculture effluents/ pollution control/ environmental protection/ prevention and control/ aquaculture/ pollution: control and prevention

Abstract: The objective of this research was to investigate treatment of the concentrated solids discharge produced during clarifier backwash within an aquaculture facility. Solids removal and stabilization were investigated within two types of created wetlands where water flowed either: (1) vertically, down through a porous substrate; or (2) horizontally, over soil and through plant hedges. Six 3.7 x 1.2 x 0.8-m (L x W x H) wetland cells were used to provide three replicates for both types of wetland. Approximately equal numbers of vetiver grass (*Vetiveria zizanioides*) tillers were planted on both wetlands types in November of 1994. Sludge (7500 mg 1 super(-1) solids) was loaded onto both wetland types six times day super(-1), with no scheduled drying cycle, from 12 May 1995 until 28 February 1996. Sludge was applied at a rate of about 1.35 cm day super(-1), or about 30 kg dry solids m super(-2) year super(-1). Results from this short study indicated that the vertical flow and horizontal flow wetlands, respectively, removed 98 and 96% TSS, 91 and 72% total COD, and 81 and 30% dissolved COD. Both types of wetland cells removed most (82-93%) of the total kjeldahl nitrogen, phosphorus, and dissolved phosphate. Measurements of sludge depths and TVS at the end of the study indicated considerable mineralization occurred in the wetlands; stored sludge at the end of the study had 50% less TVS than untreated sludge.

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280. Assessing sediment removal capacity of vegetated and non-vegetated settling ponds in prawn farms.

Halide, H.; Ridd, P. V.; Peterson, E. L.; and Foster, D.

Aquacultural Engineering 27(4): 295-314. (2003)

NAL Call #: SH1.A66; ISSN: 0144-8609

Descriptors: wetlands/ prawn culture/ warm-water aquaculture/ wastewater treatment/ mangroves/ ponds/ sedimentation/ shellfish culture/ shellfish culture

Abstract: Sediment removal capacity is assessed for a constructed mangrove wetland, and a non-vegetated settling pond that are both used for filtering water in tropical aquaculture. The assessment is performed through sediment budget analysis using data of suspended sediment concentration collected from optical backscatter sensors. The sensors were deployed at the pond's inlet and outlet. These data sets provide a measure of trapping efficiency of each pond with different flow regimes and settling areas. The tides influenced flow in the wetland but none was felt in the settling pond. The average trapping efficiency obtained for the vegetated and the non-vegetated ponds was (40 + or - 33) and (70 + or - 36)%, respectively. The deposition rate calculated for the vegetated and non-vegetated pond ranges between 13-174 g/m super(2) per h (average = 63 g/m super(2) per h) and 10-19 g/m super(2)

per h (average = 14 g/m super(2) per h), respectively. The efficiency of vegetated and non-vegetated ponds is likely to be improved by decreasing the aspect ratio (length/width) from the current value of 6 to 1 and of 5 to 1, respectively.
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281. The assessment of herbaceous plant cover in wetlands as an indicator of function.

Cole, C. A.

Ecological Indicators 2(3): 287-293. (2002);

ISSN: 1470-160X

Descriptors: wetlands/ function/ mitigation/ structure

Abstract: In the United States, wetlands are often created (as compared with restored) as mitigation for damage done to natural wetlands by development or other activities. There is increasing concern that these created sites do not function as do natural wetlands, even after a period of years. Monitoring of these created wetlands often consists of an assessment of the percent herbaceous plant cover as some indicator of the functional success of the wetland. However, it is not at all clear that assessment of herbaceous cover translates into an accurate indicator of wetland function. In this paper I review several functions commonly ascribed to wetlands and assess the reported relationship of percent herbaceous cover to those functions (if any). Of six functions reviewed, only one has a probable (though indirect) positive relationship with the percent herbaceous plant cover on a site. More useful assessments of wetland function might be made with other structural indicators, such as basin morphometry, tree density, or basal area.

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282. Atrazine degradation by bioaugmented sediment from constructed wetlands.

Runes, H. B.; Jenkins, J. J.; and Bottomley, P. J.

Applied Microbiology and Biotechnology 57(3):

427-432. (Oct. 2001)

NAL Call #: QR1.E9; ISSN: 0175-7598

Descriptors: wetlands/ atrazine/ pesticides/ herbicides/ biodegradation/ sediments/ water pollution/ water pollution treatment/ microorganisms/ sediment chemistry/ sediment contamination/ bacteria/ atrazine/ bacteria/ microbial degradation/ waste treatment, environment, pollution/ freshwater pollution/ protective measures and control/ physiology, biochemistry, biophysics/ water quality control/ water & wastewater treatment

Abstract: The potential to establish pesticide biodegradation in constructed wetland sediment was investigated. Under microcosm conditions, bioaugmentation of sediment with small quantities of an atrazine spill-site soil (1:100 w/w) resulted in the mineralization of 25-30% of super(14)C ethyl atrazine (1-10 mu g g super(-1) sediment) as super(14)CO sub(2) under both unsaturated and water-saturated conditions; atrazine and its common metabolites were almost undetectable after 30 days incubation. By comparison, unbioaugmented sediment supplemented with organic amendments (cellulose or cattail leaves) mineralized only 2-3% of super(14)C ethyl atrazine, and extractable atrazine and its common metabolites comprised approximately 70% of the original application. The

population density of atrazine-degrading microorganisms in unbioaugmented sediment was increased from similar to 10^2 super(2)/g to 10^4 super(4)/g by bioaugmentation (1:100 w/w), and increased by another 60-fold (6.0×10^5 super(5) g super(-1)) after incubation with 10^6 g super(-1) of atrazine. A high population of atrazine degraders (similar to 10^6 g super(-1)) and enhanced rates of atrazine mineralization also developed in bioaugmented sediment after incubation in flooded mesocosms planted with cattails (*Typha latifolia*) and supplemented with atrazine (3.2 mg l super(-1), 10^6 g super(-1) sediment). In the absence of atrazine, neither the population of atrazine degraders, nor the atrazine mineralizing potential of bioaugmented sediment increased, regardless of the presence or absence of cattails. Bioaugmentation might be a simple method to promote pesticide degradation in nursery run-off channeled through constructed wetlands, if persistence of degraders in the absence of pesticide is not a serious constraint.
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283. Atrazine remediation in wetland microcosms.

Runes, Heather B.; Bottomley, Peter J.; Lerch, Robert N.; and Jenkins, Jeffrey J.

Environmental Toxicology and Chemistry 20(5): 1059-1066. (2001)

NAL Call #: QH545.A1E58; ISSN: 0730-7268

Descriptors: freshwater ecology: ecology, environmental sciences/ pesticides/ pollution assessment control and management/ toxicology/ most probable number assay/ bioassay method: sediment sample analysis/ analytical method/ field scale constructed wetland/ laboratory wetland microcosms

Abstract: Laboratory wetland microcosms were used to study treatment of atrazine in irrigation runoff by a field-scale- constructed wetland under controlled conditions. Three experiments, in which 1 ppm atrazine was added to the water column of three wetland, one soil control, and one water control microcosm, were conducted. Atrazine dissipation from the water column and degradate formation (deethylatrazine (DEA); deisopropylatrazine (DIA); and hydroxyatrazine (HA)) were monitored. Atrazine dissipation from the water column of wetland microcosms was biphasic. Less than 12% of the atrazine applied to wetland microcosms remained in the water column on day 56. Atrazine degradates were observed in water and sediment, with HA the predominant degradate. Analysis of day 56 sediment samples indicated that a significant portion of the initial application was detected as the parent compound and HA. Most probable number (MPN) assays demonstrated that atrazine degrader populations were small in wetland sediment. Wetland microcosms were able to reduce atrazine concentration in the water column via sorption and degradation. Based on results from this study, it is hypothesized that plant uptake contributed to atrazine dissipation from the water column.

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284. Bacterivory in ciliates isolated from constructed wetlands (reed beds) used for wastewater treatment.

Decamp, O. and Warren, A.

Water Research 32(7): 1989-1996. (July 1998)

NAL Call #: TD420.W3; ISSN: 0043-1354

Descriptors: artificial wetlands/ wastewater treatment/ bacterial/ protozoa/ root zone/ grazing/ food webs/ trophic relationships/ food preferences/ pollution control/

pathogenic bacteria/ Ciliata/ constructed wetlands/ bacterial/ wastewater treatment processes/ nutrition and feeding habits/ protozoa

Abstract: The bacterivorous activity of ciliates, isolated from constructed wetlands employing the root zone method of wastewater treatment, was investigated by measuring their grazing rates upon fluorescently-labelled bacteria (FLB), specifically *Escherichia coli*. The highest mean grazing rates were recorded for *Paramecium* spp (1.85 FLB/cell/min), which was the largest ciliate used in the study, followed by oxytrichids (1.104 FLB/cell/min), *Halteria* (0.648 FLB/cell/min) and scuticociliates (0.433 FLB/cell/min), the smallest ciliates used in the study. Lowest feeding rates were found in the anaerobes *Plagiopyla* and *Caenomorpha*, although the experimental conditions are likely to have adversely affected these forms. Large variations in grazing rates between individual cells from the same populations were observed. The proportion of empty cells, i.e. those without ingested FLB, and the decrease in the proportion of empty cells with incubation time, showed large differences between taxa. The present study indicates that ciliates are capable of all observed *E. coli* removal from wastewaters treated in constructed wetlands using the root zone method. However, it is unlikely that ciliates in situ continuously maintain maximum feeding rates. A variety of other processes, biotic and abiotic, are thought to be involved in the removal of pathogenic and indicator bacteria such as *E. coli*.
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285. Benefits to downstream flood attenuation and water quality as a result of constructed wetlands in agricultural landscapes.

De Laney, T. A.

Journal of Soil and Water Conservation 50(6): 620-626. (1995)

NAL Call #: 56.8 J822; ISSN: 0022-4561

Descriptors: water quality/ flood control/ agricultural practices/ watershed management/ water policy/ flood plain management/ nonstructural alternatives/ benefits/ hydrology/ river basin management/ USA/ constructed wetlands/ agricultural practices/ watershed management/ flood plain management/ nonstructural alternatives/ benefits/ streamflow and runoff/ dynamics of lakes and rivers

Abstract: The evolution of agricultural practices in America has a direct correlation with improvements in the mechanization of farm equipment and the development of transportation routes. As artificially constructed systems evolved, they were rigorously imposed on the natural landscape with little thought to their effect on the hydrologic system. Soggy fields and drowned crops were viewed as problems needing remediation. Flat, forested, fertile, bottomland was assumed to be unproductive and needed to "pay its way." Deforestation, stream channelization, levees, field terracing, and drainage systems (drain tiles) have become testaments to our corrective actions. The cumulative effect of these corrective measures has been to significantly reduce the ability of most watersheds to absorb water, detain sediments, and remove nutrients. Our command and control approach to watershed management cannot necessarily be viewed as a success as evidenced by the flood of 1993 and 1995 in the Midwest and the fact that today, 30 percent of assessed U.S. surface waters do not "fully support" their designated uses (USEPA 1988).

Because of our inadequate watershed management, the Federal Emergency Management Agency (FEMA) and other agencies have hinted that America's flood and water quality policies must change. The purchase of flood-prone property and the rebuilding of levees away from the immediate river bank are signals that nontraditional approaches are being considered. Although these alternative strategies have occurred only on a small scale, this new philosophy in floodplain management is encouraged by the federal government's report "Sharing the Challenge: Floodplain Management into the 21st Century." It recommends that nonstructural measures be incorporated into America's flood management policies. Although many of the nonstructural measures may take the shape of property purchases, new agricultural practices, and incentive payments, the net effect will be the reinstatement of biological and hydraulic processes that reduce flooding and improve water quality.

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286. Beta-HCH mobilization in polluted wetland soils as influenced by dissolved organic matter.

Kalbitz, Karsten; Popp, Peter; Geyer, Wolfgang; and Hanschmann, Guenter

Science of the Total Environment 204(1): 37-48. (1997)

NAL Call #: RA565.S365; ISSN: 0048-9697

Descriptors: biochemistry and molecular biophysics/ freshwater ecology: ecology, environmental sciences/ pest assessment control and management/ pollution assessment control and management/ soil science/ analytical method/ beta isomer/ dissolved organic matter/ grassland soils/ HCH/ lindane/ pesticides/ pollution/ soil pollution/ synchronous fluorescence spectroscopy/ water logging/ wetland soils/ 1,2,3,4,5,6 hexachlorocyclohexane

Abstract: The beta isomer of 1,2,3,4,5,6-hexachlorocyclohexane (beta-HCH) which is formed during synthesis of the pesticide lindane shows high mobility in polluted soils despite its low water solubility. Therefore, we studied the correlation between the quantity and quality of dissolved organic matter (DOM) and the mobilization and transport of beta-HCH in two soil profiles used as grassland and in incubation experiments. From our results we conclude that beta-HCH was mobilized and transported to deeper soil horizons probably by coupling between beta-HCH and DOM. The interaction of beta-HCH with DOM as indicated by the measured high partition coefficient between beta-HCH and DOM ($\log K_{DOC} = 4.39$) was much higher than would be expected from the physicochemical properties of beta-HCH. As suggested from synchronous fluorescence spectroscopy data, the capacity of DOM to bind beta-HCH increases as the more extended aromatic regions of DOM are accessible in the aqueous extracts. The addition of lime and fresh organic matter to the grassland soils did not affect the measured coupling between beta-HCH and DOM. Long drying periods increased the coupling up to 9.9 μg beta-HCH per mg DOC. Water-logging destroyed the binding between DOM and beta-HCH despite increasing DOC contents. Our main conclusion is that qualitative differences in DOM due to changed environmental conditions can drastically change the coupling of hydrophobic organic pollutants to DOM and greatly affect pollutant mobilization and translocation.

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287. Biological responses to wetland restoration: Implications for wildlife habitat development through the Wetlands Reserve Program.

Rewa, C.

In: A comprehensive review of Farm Bill contributions wildlife conservation, 1985-2000/ Heard, L. P.; Hohman, W. L.; Halloum, D. J.; and Wildlife Habitat Management Institute (U.S.); Series: Technical Report USDA/NRCS/WHMI.

Madison, MS: U.S. Department of Agriculture, 2000; pp. 95-116

NAL Call #: aS604.6 .C66 2000

Descriptors: Wetland Reserve Program/ riparian areas/ wildlife habitats/ California/ Mississippi

288. Can constructed wetlands reduce the diffuse phosphorus loads to eutrophic water in cold temperate regions?

Braskerud, B. C.; Blankenberg, A.-G. B.; Tonderski, K. S.; Wedding, B.; Bakke, R.; Ulén, B.; and Koskiaho, J.

Journal of Environmental Quality 34(6): 2145-2155. (2005)

NAL Call #: QH540.J6; ISSN: 0047-2425

Abstract: Construction of wetlands is a possible supplement to best management practices (BMP) at the field level to mitigate phosphorus (P) pollution from agricultural areas. In this paper, annual results from 17 intensively studied wetlands in the cold temperate or boreal climatic zone are reported and analyzed. Surface areas varied from 0.007 to 8.7% of the catchment area. The average total phosphorus (TP) retention varied from 1 to 88%, and the dissolved reactive phosphorus (DRP) retention from -19 to 89%. Retention varied substantially from site to site, indicating the existence of site-specific factors in the catchment and wetlands that influenced the P removal. Factors important for P retention in wetlands were evaluated through multiple statistical analyses by dividing P into two fractions: particulate phosphorus (PP) and DRP. Both relative (%) PP and DRP retention increased with wetland surface area. However, PP retention was not as sensitive as DRP in terms of wetland size and retention: specific PP retention (gram P retention per m² and year) decreased as wetland area (AW) increased, suggesting the existence of a site-specific optimal wetland to catchment area (Ac) ratio. Particulate P retention decreased with increasing DRP to TP ratio, while the opposite was found for DRP. Dissolved reactive P retention was higher in new than in old wetlands, while increasing age did not influence PP retention negatively. Effective BMP in the catchment is important to keep the P loss low, because the outlet concentration of P from wetlands is often positively correlated to the input concentration. However, wetlands act as the last buffer in a catchment, since the retention often increases as the P concentration in streams increases. © ASA, CSSA, SSSA.

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289. Carbon, plant, and temperature control of nitrate removal from wetland mesocosms.

David, Mark B.; Gentry, Lowell E.; Smith, Karen M.; and Kovacic, David A.

Transactions of the Illinois State Academy of Science 90 (3-4): 103-112. (1997)

NAL Call #: 500 I16; ISSN: 0019-2252

Descriptors: biochemistry and molecular biophysics/ conservation/ pollution assessment control and

management/ wildlife management: conservation/ agricultural non point source pollution/ bioprocess engineering/ carbon availability/ constructed wetlands/ nitrate/ pollution/ temperature/ tile drainage waters

Abstract: Constructed wetlands have been developed to remove agricultural non-point source pollution from tile drainage waters in the Midwest, but their effectiveness and function are not known. This study investigated the interaction of C availability and temperature on NO₃- removal from water columns in a constructed wetland. Experimental mesocosms (20.32 cm diameter PVC pipes) were buried upright to a depth of 15 cm into wetland sediments to enclose a 7.5 L water column (23 cm depth). Six mesocosms were placed in areas with bare soil and six were placed in areas supporting reed canary grass (*Phalaris arundinacea*). Treatments were either NO₃- additions (10 mg NO₃-N L⁻¹ increase in concentration in water column) or NO₃- Plus glucose additions (10 mg NO₃-N L⁻¹ and 50 mg C L⁻¹ increases in water column) to the mesocosms during April and June. In April, (11- 12 degree C water temperature) over a 7 day time span, NO₃- concentrations in the overlying water decreased approximately 50% in non-grass treatments, with or without glucose additions. All or nearly all of the NO₃- was removed from the grass mesocosms in April, and glucose additions did not increase the removal rate. In June (27 degree C water temperature) NO₃- concentrations decreased to zero for all treatments in 48 hours or less. Presence of grass did not affect the rate of NO₃- decrease; however, glucose additions increased the rate to 24 hours. When calculated on a mass basis in the NO₃- only mesocosms, removal of NO₃- was 0.25 and 0.42 g NO₃-N m⁻² d⁻¹ in the April non-grass and grass treatments, respectively, and 1.6 and 1.4 g NO₃-N m⁻² d⁻¹ in the June corresponding treatments. Calculated Q₁₀ values of NO₃- removal per day for non-grass and grass treatments were 3.3 and 2.2, respectively. Depending on amounts and seasonal timing of inputs of NO₃- to the wetlands, mesocosm results suggest that large amounts of NO₃- can be removed from the overlying water by a combination of sediment and plant mechanisms.

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290. Characterization of microbial communities and composition in constructed dairy wetland wastewater effluent.

Ibekwe, A. M.; Grieve, C. M.; and Lyon, S. R.
Applied and Environmental Microbiology 69(9): 5060-5069. (2003)
 NAL Call #: 448.3 Ap5; ISSN: 0099-2240
Descriptors: agricultural wastes/ ammonia oxidisers/ artificial wetlands/ BOD [biochemical oxygen demand]/ characterisation/ COD [chemical oxygen demand]/ community composition/ contaminant removal/ dairy waste water/ DGGE [denaturing gradient gel electrophoresis]/ faecal coliforms/ microbial communities/ monooxygenase gene/ nitrates/ PCR amplification/ proteobacteria/ soil samples/ SS [suspended solids]/ water processing/ water treatment/ microbiology/ biotechnology/ ecology/ waste water/ rivers/ lakes/ impacts of forestry or agriculture/ water quality/ Insertae/ Sedis/ Bacillus spp./ Gymnamoebia/ Clostridium spp./ Insertae/ Sedis/ Mycoplasma spp./ Insertae/ Sedis/ Eubacterium spp.
Abstract: Constructed wetlands have been recognized as a removal treatment option for high concentrations of

contaminants in agricultural waste before land application. The goal of this study was to characterize microbial composition in two constructed wetlands designed to remove contaminants from dairy washwater. Water samples were collected weekly for 11 months from two wetlands to determine the efficiency of the treatment system in removal of chemical contaminants and total and fecal coliforms. The reduction by the treatment was greatest for biological oxygen demand, suspended solids, chemical oxygen demand, nitrate, and coliforms. There was only moderate removal of total nitrogen and phosphorus. Changes in the total bacterial community and ammonia-oxidizing bacterial composition were examined by using denaturing gradient gel electrophoresis (DGGE) and sequencing of PCR-amplified fragments of the gene carrying the a subunit of the ammonia monooxygenase gene (*amoA*) recovered from soil samples and DGGE bands. DGGE analysis of wetlands and manure samples revealed that the total bacterial community composition was dominated by bacteria from phylogenetic clusters related to *Bacillus*, *Clostridium*, *Mycoplasma*, *Eubacterium*, and *Proteobacteria* originally retrieved from the gastrointestinal tracts of mammals. The population of ammonia-oxidizing bacteria showed a higher percentage of *Nitrosospora*-like sequences from the wetland samples, while a higher percentage of *Nitrosomonas*-like sequences from manure, feces, raw washwater, and facultative pond was found. These results show that the wetland system is a natural process dependent upon the development of healthy microbial communities for optimal wastewater treatment.

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291. A constructed vertical macrophyte system for the retention of nitrogen in agricultural runoff.

Farahbakhshazad, N. and Morrison, G. M.
Environmental Technology 21(2): 217-223. (Feb. 2000)
 NAL Call #: TD1.E59; ISSN: 0959-3330
Descriptors: wetlands/ macrophytes/ wastewater treatment/ nitrogen/ phosphorus/ agricultural runoff/ ammonia/ agriculture/ runoff (agricultural)/ nutrients/ *Phragmites australis*/ wastewater treatment processes/ water treatment/ freshwater pollution
Abstract: Recent evidence for the importance of luxury rhizome accumulation of N by the common reed *Phragmites australis* opens the possibility for N retention in constructed vertical wetlands. The removal of nutrients (N and P) from agricultural runoff was investigated in columns planted with *P. australis* in a sand bed. Nitrate demonstrated a linear removal with detention time (60-300 min) and was accounted for by membrane-limited root uptake. Ammonia was effectively removed from agricultural runoff, with nitrate removed at longer detention times. Detention time based on a targeted nitrate removal therefore represents a suitable design parameter for a vertical macrophyte system. On the other hand, ammonia was more effectively removed at low concentrations, but ineffectively removed at higher concentrations. Nitrogen is effectively accumulated in rhizomes which could be mechanically ground, composted and returned to agriculture.

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292. Constructed wetland attenuation of nitrogen exported in subsurface drainage from irrigated and rain-fed dairy pastures.

Tanner, C. C.; Nguyen, M. L.; and Sukias, J. P. S. *Water Science and Technology* 51(9): 55-61. (2005)
 NAL Call #: TD420.A1P7; ISSN: 0273-1223.
 Notes: Conference: 9. IWA Intl. Specialised Conf. on Wetland Systems for Water Pollution Control, Avignon (France), 26-30 Sep 2004; ISBN: 1843394987; Issue editor: Lienard, A.

Descriptors: drainage/ catchment areas/ artificial wetlands/ subsurface drainage/ hydraulic loading/ export/ pastures/ water pollution control/ sampling/ rainfall/ soil water/ continuous flow/ nitrogen removal/ irrigation water/ nitrates/ nitrogen compounds/ catchments/ nitrogen/ pasture/ dairies/ irrigation/ seasonal variations/ New Zealand, North I.

Abstract: Nitrogen removal performance is reported for constructed wetlands treating subsurface drainage from irrigated and rain-fed dairy pastures in North Island, New Zealand. Flow-proportional sampling of inflow and outflow concentrations were combined with continuous flow records to calculate mass balances for the wetlands. Drainage flows from the irrigated catchment were 2.5-4 fold higher and N exports up to 5 fold higher per unit area than for the rain-fed catchment. Hydraulic and associated N loadings to the wetlands were highly pulsed, associated with rainfall, soil water status, and irrigation events. Transient pulses of organic nitrogen were an important form of N loss from the rain-fed landscape in the first year, and were very effectively removed in the wetland (> 90%). Median nitrate concentrations of similar to 10 g m^{super(-3)} in the drainage inflows were reduced by 15-67% during passage through the wetlands and annual nitrate-N loads by 16-61% (38-317 g N m^{super(-2)} y^{super(-1)}). Generation in the wetlands of net ammoniacal-N and organic-N (irrigated site) partially negated reduction in nitrate-N loads. The results show that constructed wetlands comprising 1-2% of catchment area can provide moderate reductions in TN export via pastoral drainage, but performance is markedly influenced by variations in seasonal loading and establishment/maturation factors.

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293. Constructed wetlands for animal waste treatment: A manual on performance, design, and operation with case histories.

CH2M Hill, Inc.; Payne Engineering; Gulf of Mexico Program (U.S.); Nutrient Enrichment Committee; Alabama Soil and Water Conservation Committee; and National Council of the Paper Industry for Air and Stream Improvement (U.S.).

Washington, D.C.: U.S. Environmental Protection Agency, Gulf of Mexico Program. (1997)

Notes: "Prepared for the Gulf of Mexico Program Nutrient Enrichment Committee, under a contract to the Alabama Soil and Water Conservation Committee (ASWCC) and National Council of the Pulp and Paper Industry for Air and Stream Improvement (NCASI)." "June 1997." Includes bibliographical references.

NAL Call #: TD930.2.C64 1997

Descriptors: animal waste---management/ constructed wetlands/ Mexico, Gulf of---nutrients

This citation is from AGRICOLA.

294. Constructed wetlands for livestock wastewater management.

Knight, R. L.; Payne, V. W. E.; Borer, R. E.; Clarke, R. A.; and Pries, J. H.

Ecological Engineering 15(1-2): 41-55. (2000)

NAL Call #: TD1.E26; ISSN: 0925-8574

Descriptors: agricultural engineering/ confined animal feeding operation/ livestock/ nutrient reduction/ treatment wetland/ water quality management

Abstract: In 1995, the Gulf of Mexico Program (GMP) sponsored efforts by the Alabama Soil and Water Conservation Committee and the National Council of the Pulp and Paper Industry for Air and Stream Improvement (NCASI) to conduct a review of the literature concerning the use of constructed wetlands for treating concentrated livestock wastewaters. The scope of the literature review and summary of design/operation data included all of North America. Both published and unpublished data have been provided by researchers to be included in the database. The database format used for the GMP project is only slightly modified from the format developed for the US Environmental Protection Agency (EPA) North America Treatment Wetland Database, which includes information from municipal, industrial and stormwater treatment wetlands. The GMP Livestock Wastewater Treatment Wetland Database includes information from 68 sites with a total of 135 pilot and full-scale wetland systems (systems include parallel units at individual research facilities). Types of livestock wastewater being treated by constructed wetlands include dairy manure and milkhouse wash water, runoff from concentrated cattle-feeding operations, poultry manure, swine manure and catfish pond water. Over 1300 operational data records are summarized in the database. These data indicate that removal rates for 5-day biochemical oxygen demand (BOD₅), total suspended solids (TSS), ammonium nitrogen (NH₄-N), total nitrogen (TN), total phosphorus (TP), chemical oxygen demand (COD) and fecal coliforms are potentially very high in constructed wetlands receiving animal wastewaters. Average concentration reduction efficiencies were: BOD₅ 65%, TSS 53%, NH₄-N 48%, TN 42%, and TP 42%. Removals are a function of inlet concentrations and hydraulic loading rates. Successful wetland design must include adequate pretreatment to protect the health of the wetland biota and must include adequate wetland area to meet the quality goals.

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295. Constructed wetlands for livestock wastewater management: Literature review, database, and research synthesis.

Gulf of Mexico Program (U.S.); Nutrient Enrichment Committee; CH2MHILL (Firm); and Payne Engineering (Firm)

Washington, D.C.: U.S. Environmental Protection Agency; 1 v. (various pagings): ill. (1997)

Notes: "Prepared under contract to National Council of the Paper Industry for Air and Stream improvement (NCASI) and Alabama Soil and Water Conservation Committee." "January 1997." Includes bibliographical references.

NAL Call #: TD930.2.C65 1997

Descriptors: animal waste---management/ constructed wetlands

This citation is from AGRICOLA.

296. Constructed wetlands for wastewater treatment in cold climates.

Mander, U. and Jenssen, P. D.

Southampton, UK: WIT Press; Series: Advances in ecological sciences 1369-8273 11; 325 p. (2003)

NAL Call #: QH540 .I67 v. 11; ISBN: 1853126519

Descriptors: constructed wetlands---cold weather conditions/ sewage---purification---biological treatment/ sewage---purification---cold weather conditions

This citation is from AGRICOLA.

297. Constructed wetlands for water treatment in aquaculture.

Massingill, M. J.; Kasckow, E. M.; Carlberg, J. M.; Chamberlain, R. J.; and Van Olst, J. C.

In: Proceedings of the 2nd International Conference on Recirculating Aquaculture. (Held 16 Jul 1998-19 Jul 1998 at Roanoke, VA (USA).) Libey, G. S. and Timmons, M. B. (eds.); Vol. VSGCP-C-00-001; VSG-98-02.: Virginia Sea Grant; 2002.

Descriptors: wetlands/ aquatic plants/ removal/ aquaculture effluents/ recirculating systems/ water quality control/ wastewater treatment/ pollution control/ aquaculture/ aquatic macrophytes/ effects of aquaculture on the environment/ effects of aquaculture on the environment/ prevention and control/ aquaculture/ industrial effluents/ water & wastewater treatment/ conservation and environmental protection

Abstract: Natural wetlands have long been regarded as important ecosystems that provide habitat for many types of aquatic and riparian plants and animals. In addition, natural wetlands play an important role in restoring the quality of the water that passes through them by reducing suspended solids, removing nitrogen and phosphorous nutrients, and trapping or converting other natural or man-made pollutants. Considerable interest has developed in trying to understand the mechanisms at work within natural wetlands, and to model and incorporate their positive water treatment features into artificial or "constructed" wetlands. Within the last decade, numerous constructed wetlands have been built to replace the loss of natural wetlands, to provide additional plant and animal habitat, to provide new aesthetic and recreational environments for people, and for use as water treatment systems for several types of municipal, industrial, and agricultural wastewater.

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298. Constructed wetlands to treat wastewater from dairy and swine operations: A review.

Cronk, J. K.

Agriculture, Ecosystems & Environment 58(2-3): 97-114. (July 1996)

NAL Call #: S601 .A34; ISSN: 0167-8809

Descriptors: dairy industry/ wastewater treatment/ waste management/ barn wastewater/ eutrophication/ design standards/ cost analysis/ maintenance/ artificial wetlands/ dairies/ constructed wetlands/ dairy industry/ artificial wetlands/ Wastewater treatment processes/ Pollution control/ Sewage & wastewater treatment

Abstract: Animal wastewater can be a major contributor to the cultural eutrophication of surface waters. Constructed wetlands are under study as a best management practice to treat animal wastewater from dairy and swine operations. Preliminary results are promising when wetlands are a component of a farm-wide waste management plan, but

they are ineffective without pretreatment of the wastewater. The feasibility of constructed wetlands varies with waste characteristics and climate. While the cost of wetland construction is low, the site must be maintained in order for the initial investment in the wetland to be worthwhile. In addition, several design iterations may be necessary before effective treatment is obtained. The design of animal wastewater treatment wetlands is still being researched and a number of the present projects will help provide recommendations for the use of constructed wetlands at animal operations.

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299. Constructing wetlands in the Intermountain West: Guidelines for land resource managers.

Olson, Richard Arnold

Laramie, Wyo.: University of Wyoming; Series: B (Laramie, Wyo.) 1078. (1999)

Notes: Title from title page of source document. Includes bibliographical references.

NAL Call #: 100 W99 (1) no. 1078

<http://www.uwyo.edu/ces/PUBS/B-1078.pdf>

Descriptors: constructed wetlands---West---United States/ constructed wetlands---Rocky Mountains

This citation is from AGRICOLA.

300. Control of microbial methane production in wetland rice fields.

Conrad, Ralf

Nutrient Cycling in Agroecosystems 64(1-2): 59-69. (2002)

NAL Call #: S631 .F422; ISSN: 1385-1314

Descriptors: agronomy: agriculture/ climatology: environmental sciences/ pollution assessment control and management/ soil science/ nitrogen fertilization/ applied and field techniques/ organic carbon fertilization/ water management/ anaerobic degradation process: carbon flow, electron flow/ microbiological data/ microscopic processes/ reaction thermodynamic constraints/ rice straw/ soil redox potential/ soil type/ syntrophy/ temperature/ wetland rice fields

Abstract: Methane emission rates are a function of production, transport and oxidation of CH₄ in the rice field. Production of CH₄ is the prerequisite for any flux. The most important variables that control CH₄ production include soil type, rice variety, temperature, soil redox potential, water management and fertilization with organic carbon or nitrogen. The effects of these variables have empirically been assessed on a macroscopic scale. However, the actual mechanisms by which these variables affect the microbial CH₄ production on a microscopic scale are little understood. The purpose of the present contribution is to review existing knowledge of microbiological data and microscopic processes that are relevant for the control of CH₄ production. These include the flow of carbon and electrons during the anaerobic degradation process, thermodynamic constraints of reactions in-situ and changes in the composition of the microbial community.

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301. Controlled drainage and wetlands to reduce agricultural pollution: A lysimetric study.

Borin, M.; Bonaiti, G.; and Giardini, L.

Journal of Environmental Quality 30(4): 1330-1340. (2001)
NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: wetlands/ water quality (natural waters)/ pollution (water)/ pollution control/ case study/ environmental issues/ samples/ ground-water quality/ pollution (groundwater)/ water pollution control/ agricultural runoff/ controlled drainage/ experimental data/ lysimeters/ water table/ water management/ nitrates/ dissolved solids/ agricultural pollution/ nitrogen/ drainage/ irrigation/ groundwater pollution/ Itay/ water table

Abstract: Controlled drainage and wetlands could be very effective practices to control nitrogen pollution in the low-lying agricultural plains of northeast Italy, but they are not as popular as in other countries. An experiment on lysimeters was therefore carried out in 1996-1998, with the double aim of obtaining local information to encourage the implementation of these practices and to gain more knowledge on the effects involved. Controlled drainage + subirrigation and wetlands were all considered as natural systems where alternative water table management could ameliorate water quality, and were compared with a typical water management scheme for crops in the open field. Eight treatments were considered: free drainage on maize (*Zea mays* L.) and sugarbeet (*Beta vulgaris* L.), two treatments of controlled drainage on the same crops, and five wetland treatments using common reed [*Phragmites australis* (Cav.) Trin. ex Steud.], common cattail (*Typha latifolia* L.), and tufted sedge (*Carex elata* All.), with different water table or flooding levels. Lysimeters received about 130 g m⁻² of N with fertilization and irrigation water, with small differences among treatments. The effects of treatments were more evident for NO₃⁻-N concentrations than for the other chemical parameters (total Kjeldahl nitrogen, pH, and electrical conductivity), with significantly different medians among free drainage (33 mg L⁻¹), controlled drainage (1.6 and 2.6 mg L⁻¹), and wetlands (0.5-0.7 mg L⁻¹). Referring to free drainage, NO₃⁻-N losses were reduced by 46 to 63% in controlled drainage and 95% in the average of wetlands. Wetlands also reduced losses of total dissolved solids from 253 g m⁻² (average of crop treatments) to 175 g m⁻² (average of wetlands).

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302. Cycling and retention of nitrogen and phosphorous in wetlands: A theoretical and applied perspective.

Howard-Williams, C.

Freshwater Biology 15(4): 391-431. (1985)
NAL Call #: QH96.F6; ISSN: 0046-5070

Descriptors: wetlands/ cycling nutrients/ nutrient removal/ wastewater disposal/ limnology/ nitrogen/ phosphorous/ ecosystems/ ecology/ groundwater/ nutrients/ fauna/ literature review/ detritus/ sediments/ evapotranspiration/ vegetation/ hydrology/ floods/ microorganisms

Abstract: This review considers the internal fluxes and transformations of nitrogen and phosphorous in wetland ecosystems. Emphasis is placed on the dynamic nature of nutrient cycling and the review stresses the possible use of wetlands as sinks for unwanted nutrients. Successional time scales, exchange equilibria and the concepts of storage and throughflow, resource consumption and supply

are explained. Descriptions of the basic pathways of nutrients through different types of wetland systems are given with the emphasis placed on the movement into and out of the major storage compartments of wetland systems. The problems of conversion of qualitative information on nutrient movements and transformations, into data on mass flows are then discussed. The review then considers the effects of adding nutrients to wetlands. The concept of the loading capacity is discussed in relation to the length of time a wetland can continue to remove nutrients from throughflow. Recent studies show that artificially created wetlands can be effective systems for nutrient removal only if their internal removal mechanisms are understood and if these are optimized by management techniques. (Author's abstract)

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303. Denitrification in constructed free-water surface wetlands: II. Effects of vegetation and temperature.

Bachand, P. A. M. and Horne, A. J.

Ecological Engineering 14(1-2): 17-32. (Jan. 2000)
NAL Call #: TD1.E26; ISSN: 0925-8574.

Notes: Special Issue: Nitrogen & phosphorus retention in wetlands

Descriptors: wetlands/ denitrification/ vegetation cover/ temperature effects/ wastewater treatment/ aquatic plants/ North America/ free surfaces/ artificial wetlands/ productivity/ vegetation effects/ databases/ cattails/ cost analysis/ dissolved oxygen/ grazing/ decomposition/ organic carbon/ evapotranspiration/ dissolved solids/ vegetation/ temperature/ organic matter/ aquatic macrophytes (Typhaceae)/ economics/ oxygen (dissolved)/ dissolved solids/ *Scirpus*/ *Typha*/ North America/ characteristics, behavior and fate/ wastewater treatment processes/ sewage and wastewater treatment/ water treatment/ water and wastewater treatment

Abstract: Constructed wetlands are increasingly being used for treating nitrogen-rich wastewaters. Of the 115 treatment wetlands listed in the North American Treatment Wetland Database which record nitrogen data, a large portion are used for treating secondary treated or lower quality (e.g. primary, agricultural runoff, stormwater) wastewater. Twenty-five percent treat agricultural and stormwater runoff, and only seven are used for either advanced secondary or tertiary treatment. Yet constructed wetlands may provide an attractive and economical alternative to conventional treatment plants for denitrifying high quality, nitrified wastewater. In populated areas where this is most needed, high land costs will increase the capital costs of this technology. Moreover, in semi-arid regions like the western and southwestern USA, high evaporation and evapotranspiration rates may hinder this technology by concentrating total dissolved solids (TDS) and dissolved organic carbon (DOC) concentrations. Implementation of management and design practices for denitrification may be one method to increase efficiencies, reduce costs and increase reliability. One relatively unknown variable in denitrification is the role of different plant species. If one plant provides substantially better conditions for denitrification, wetlands designed for denitrification could be smaller and less expensive. Three commonly used free-surface marsh vegetation treatments (bulrush *Scirpus* spp., cattail *Typha* spp., and a mixed stand of macrophytes and grasses) were used in replicated macrocosms to determine nitrate removal rates. Nitrate removal rates between

vegetation types were large and differed significantly ($P < 0.001$; cattails = 565 mg N m super(-2) day super(-1), bulrush = 261 mg N m super(-2) day super(-1), and mixed = 835 mg N m super(-2) day super(-1)). Mass balance calculations demonstrated that bacterial denitrification rather than plant uptake was the main mechanism for nitrate removal. Both water temperature (temperature-activity coefficient $\theta = 1.15$ -1.22) and organic carbon availability affected denitrification rates whereas surface water dissolved oxygen (DO) and nitrogen concentrations did not. This experiment could not distinguish why the different vegetation types resulted in different denitrification rates. Plant productivity differed between treatments. Plant physical structure, waterfowl grazing pressures and wind disturbance affected the rate litter entered the water column. The literature reports that plant decomposition rates depend upon the plants C:N sub(litter) ratio and the plant fiber content. All these factors likely affected the rate bioavailable organic carbon was made available to microbial denitrifiers. Based on our study and a literature review, in organic carbon-limited free-surface wetlands, a mixture of labile (submergent, floating) and more recalcitrant (emergent, grasses) are recommended for improving denitrification rates.

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304. Denitrification variability and control in a riparian fen irrigated with agricultural drainage water.

Ambus, P. and Christensen, S.

Soil Biology and Biochemistry 25(7): 915-923. (1993)

NAL Call #: S592.7.A1S6; ISSN: 0038-0717

Descriptors: wetlands/ riparian environments/ soil/ denitrification/ reduction/ agricultural land/ runoff/ sediment chemistry/ nitrogen cycle/ pore water/ irrigation/ agricultural wastes/ recycling/ chemical analysis/ soils/ riparian vegetation/ Denmark/ nitrate/ soils/ riparian vegetation/ soil/ agricultural land/ agricultural wastes/ recycling/ riparian environments/ reduction/ sediment chemistry/ pore water/ nitrogen cycle/ prevention and control/ geochemistry of sediments/ ecosystems and energetics/ use of water of impaired quality

Abstract: Denitrification was measured by the C sub(2)H sub(2) inhibition technique in a riparian fen irrigated with agricultural drainage water. 16 h after C sub(2)H sub(2) treatment 88% of the total N sub(2)O contained in water-saturated cores could be accounted for by assuming equilibrium between the gas phase and the liquid phase. The denitrification activity averaged 2.8 and 8.8 mg N sub(2)O-N/m super(2)/day in the control plot and 1.6 and 21.9 mg N sub(2)O-N/m super(2)/day in the irrigated plot during the dry and the runoff periods respectively. Four percent of the incoming NO sub(3) super(-) was reduced to gaseous N. The spatial variability was often high, with coefficients of variation $>100\%$ and was independent of seasonal changes in soil anaerobiosis. Soil NO sub(3) super(-) and denitrification were poorly related, and bulk concentrations of NO sub(3) super(-) below 200 μ M suggested that the process was strongly limited by diffusion of NO sub(3) super(-) into the soil during periods of flooding. Mean denitrification and water-filled pores correlated positively, $r = 0.71^{***}$ for the control and $r = 0.68^{***}$ for the irrigated plots. Water-soluble C was not related to denitrification. Multiple regression models including soil water, 2NO sub(3) super(-), soluble C and temperature as independent variables, predicted between

21 and 55% of the denitrification, the highest value found when only mean data was considered. Water-filled pores was the most important variable. The observations on which 2 variables controlled denitrification were supported by laboratory experiments with manipulated cores. Water additions increased denitrification only in samples collected during the dry period. Anaerobic incubation of saturated cores did not affect the process. Restricted NO sub(3) super(-) availability was clearly illustrated by the 25-41-fold increase obtained when NO sub(3) super(-) was injected into cores at ambient and high carbon respectively. A response of up to 13-fold was observed when substrate-amended cores were made into slurries. Glucose did not increase denitrification by more than a factor of three.

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305. Denitrifying sites in constructed wetlands treating agricultural industry wastes: A note.

Russell, J. M.; van Oostrom, A. J.; and Lindsey, S. B.

Environmental Technology 15(1): 95-99. (1994)

NAL Call #: TD1.E59; ISSN: 0959-3330

Descriptors: wetlands/ construction/ wastewater treatment/ nitrates/ industrial wastes/ waste disposal/ denitrification/ agricultural wastes/ denitrification/ agricultural wastes/ nitrates/ ultimate disposal of wastes/ sewage & wastewater treatment/ characteristics, behavior and fate/ non-patents/ pollution control

Abstract: The denitrification potential (rate of denitrification under anoxic conditions and in the presence of excess nitrate and glucose) was measured in different zones of constructed wetlands receiving anaerobic/aerobic treated meat processing and dairy-shed effluents. The wetland receiving meat processing effluent was of the surface flow type and about 67% of the influent nitrogen was in the nitrate form. Most of the denitrifying potential in this wetland was in the surface mat of decaying plant material. The dairy-shed wetland was of the subsurface flow type and received an effluent that contained little nitrate ($< 1\%$). In this wetland denitrifying potential increased from the inlet to the outlet. The patterns of denitrifying activity suggest that nitrogen removal in wetland systems may be improved by better contact between the effluent and decaying plant material on the wetland surface.

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306. Depth-area-volume and hydroperiod relationships of ephemeral (vernal) forest pools in southern New England.

Brooks, Robert T. and Hayashi, Masaki

Wetlands 22(2): 247-255. (2002)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: freshwater ecology: ecology, environmental sciences/ depth are volume relationship/ ephemeral forest pools/ evapotranspiration/ groundwater exchange/ hydroperiod/ pool morphometry/ precipitation/ vernal forest pools/ wetlands ecology

Abstract: Ephemeral or "vernal" pools occur commonly throughout the forests of the northeastern United States and adjacent eastern Canada. These pools are critical breeding habitat for a number of amphibian species and support a diverse invertebrate community. The hydroperiod or duration of surface water of vernal pools affects faunal composition and reproduction. We conducted bathymetric surveys of 34 vernal pools located in central Massachusetts in early spring when the pools were at maximum extent

after receiving snowmelt runoff. With these data, we estimated maximum pool depths, surface areas, perimeters, volumes, and basin profile coefficients. We calculated relative hydroperiod indices for the pools based on the presence or absence of surface water during periodic pool visits over the three-year study. The ranges of estimated pool morphological parameters were 0.11-0.94 m for maximum depth, 68-2941 m² for maximum surface area, 6-506 m³ for maximum volume, and 30-388 m for maximum perimeter. Basin profile coefficients ranged between 0.60 (convex) and 2.24 (concave), with a median value of 1.02 (straight slope). Maximum pool depth was positively correlated with area and perimeter, but the correlations were only moderately strong, and there were many shallow pools with large surface areas. Correlations between basin profile coefficients and other morphological parameters were weak or non-significant. Maximum pool volume was proportional to the product of area and depth, but the proportionality constant was dependent on the basin profile coefficient. Relative hydroperiod was weakly correlated with pool morphometry; the strongest relationship was found between hydroperiod and maximum pool volume. In general terms, pools with a maximum depth greater than 0.5 m, a maximum surface area larger than 1000 m², or a maximum volume greater than 100 m³ had surface water more than 80% of the times they were visited. In contrast, shallower pools, smaller pools, or pools with lesser volumes had varying hydroperiods. The weak relationships between pool morphometry and hydroperiod indicate that other factors, including temporal patterns of precipitation and evapotranspiration and ground-water exchange may have significant influence on vernal pool hydrology and hydroperiod.

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307. Design considerations for increased sedimentation in small wetlands treating agricultural runoff.

Braskerud, B. C.

Water Science and Technology 45(9): 77-85. (2002)

NAL Call #: TD420.A1P7; ISSN: 0273-1223.

Notes: Conference: 5. International Conference on Diffuse Pollution, Milwaukee [USA], 10-15 Jun 2001; Source: Diffuse/Non-Point Pollution and Watershed Management; ISBN: 1843394154

Descriptors: Norway/ water pollution control/ nonpoint pollution sources/ artificial wetlands/ agricultural runoff/ sedimentation/ optimization/ design criteria/ water depth/ vegetation/ data collections/ reviews/ pollution (nonpoint sources)/ runoff (agricultural)/ design data/ water quality control/ water quality/ water pollution: monitoring, control & remediation

Abstract: Some suggestions to increase the sedimentation of non-point source pollution in small surface flow wetlands are presented. The recommendations are based on results from seven Norwegian constructed wetlands (CWs) after 3-7 years of investigation, and a literature review. The wetlands were located in first and second order streams. Surface areas were 265-900 m², corresponding to 0.03-0.4% of the watershed. Each CW had a volume proportional composite sampler in the inlet and outlet, in addition to sedimentation plates. The mean annual retention of soil particles, organic particles and phosphorus was 45-75%, 43-67% and 20-44%, respectively. Results showed that erosion and transportation processes in arable

watersheds influenced the retention. Sedimentation was the most important retention process, and increased with runoff, because the input of larger aggregates increased. Retention of nitrogen did not follow the same pattern, and was only 3-15%. Making CWs shallow (0-0.5 m) can optimize sedimentation. The hydraulic efficiency can be increased by aquatic vegetation, large stones in the inlet, baffles and water-permeable, low dams. Vegetation makes it possible to utilize the positive effect of a short particle settling distance, by hindering resuspension of sediments under storm runoff conditions. As a result, the phosphorus retention in shallow CWs was twice that of deeper ponds.

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308. Designing constructed wetlands systems to treat agricultural nonpoint source pollution.

Hammer, D. A.

Ecological Engineering 1(1-2): 49-82. (1992)

NAL Call #: TD1.E26; ISSN: 0925-8574.

Notes: Conference: US EPA Workshop on the Role of Created and Natural Wetlands in Controlling Nonpoint Source Pollution, Arlington, VA (USA), 10-11 Jun 1991

Descriptors: wetlands/ pollution control/ agricultural pollution/ environmental engineering/ agricultural pollution/ environmental engineering/ modeling, mathematics, computer applications/ freshwater pollution/ prevention and control/ reclamation/ pollution control

Abstract: Increasingly concentrated animal husbandry practices and more intensive row crop farming have expanded agricultural pollution problems. Implementing accepted best management practices (BMPs) for erosion control and waste handling along with a combination of (1) onsite constructed wetlands, (2) nutrient-sediment control systems in small watersheds, and (3) natural wetlands along streams and at strategic locations in large watersheds may provide low-cost, efficient control. Design recommendations and examples are included.

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309. Designing constructed wetlands to remove phosphorus from barnyard runoff: A comparison of four alternative substrates.

Hill, Cynthia M.; Duxbury, John; Geohring, Larry; and Peck, Theodore

Journal of Environmental Science and Health, Part A: Toxic Hazardous Substances and Environmental Engineering A35(8): 1357-1375. (2000)

NAL Call #: TD172.J6; ISSN: 1093-4529

Descriptors: terrestrial ecology: ecology, environmental sciences/ pollution assessment control and management/ waste management: sanitation/ constructed wetland/ design, wastewater treatment method/ norlite: wetland substrate/ agricultural ecosystems/ crushed limestone: wetland substrate/ dairy farm/ mesic Glossic Hapludalf: wetland substrate/ Wollastonite mining tailings: wetland substrate

Abstract: While constructed wetlands can be a cost-effective method for reducing the export of P from agricultural ecosystems, removal rates vary widely. The objective of this research was to evaluate substrates that could consistently improve P treatment in these wetlands. We built eight 55 m² subsurface wetland cells on an 800-head dairy farm in Newark, NY, USA, to test alternative substrates for removing soluble P from dairy barnyard runoff. The four media were (1) a fine loamy, mixed, mesic

Glossic Hapludalf, (2) crushed limestone, (3) Norlite, lightweight coarse aggregates of fired shale, and (4) wollastonite (calcium metasilicate) mining tailings. Based on this research, we recommend Norlite for P removal in agricultural ecosystems. The native soil retained more soluble P but could not sustain subsurface flow. Wollastonite tailings warrant further research. They adsorbed 2 mg P/g in the laboratory but performed less well in the field, probably because of preferential flow.

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310. Deterministic and stochastic aspects of constructed wetland performance and design.

Kadlec, Robert H.

Water Science and Technology 35(5): 149-156. (1997)

NAL Call #: TD420.A1P7; ISSN: 0273-1223

Descriptors: biochemistry and molecular biophysics/ climatology: environmental sciences/ mathematical biology: computational biology/ models and simulations: computational biology/ waste management: sanitation/ chemical oxygen demand/ constructed wetlands/ deterministic modeling/ hydraulic loading/ irrigation requirement/ models and simulations/ Monte Carlo modeling/ organic nitrogen/ parametric variation/ seasonal growth pattern/ temperature/ waste management/ wetland design

Abstract: Potato processing wastewater contains high concentrations of COD, TSS and TKN. A combination of surface flow wetlands, intermittent vertical flow wetlands, ponds and land application has been used for treatment. This engineered natural system balances irrigation requirements, nitrogen supply and seasonal growth patterns to provide effective year-round operation. A first pilot wetland was operated to determine operability, effectiveness, and plant survival at high COD and nitrogen concentrations. A second pilot system of four wetlands in series was operated to obtain design and operating information. Two surface flow wetlands provided TSS and COD reduction, and ammonified the organic nitrogen. Subsequently, nitrification occurred in the vertical flow wetlands, followed by denitrification in a surface flow wetlands. The design target was a balanced nitrogen and irrigation supply for application to crops. Winter storage as used to match the crop application period to the growing season. Both pilot projects met design objectives, and a full scale system has begun operation.

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311. Developing design guidelines for constructed wetlands to remove pesticides from agricultural runoff.

Rodgers, J. H. and Dunn, A.

Ecological Engineering 1(1-2): 83-95. (1992)

NAL Call #: TD1.E26; ISSN: 0925-8574.

Notes: Conference: US EPA Workshop on the Role of Created and Natural Wetlands in Controlling Nonpoint Source Pollution, Arlington, VA (USA), 10-11 Jun 1991

Descriptors: wetlands/ pollution clean-up/ pesticides/ runoff/ pollution control/ environmental engineering/ agricultural pollution/ environmental engineering/ agricultural pollution/ pollution clean-up/ modeling, mathematics, computer applications/ freshwater pollution/ prevention and control/ reclamation/ pollution control

Abstract: This paper presents a research strategy for evaluating the capability of constructed, restored, and natural wetlands to assimilate and process pesticides

associated with agricultural runoff from croplands. A modeling approach that is central to this research strategy is presented and the mathematical foundation is explicitly stated. This approach generates predictions that can be experimentally and rigorously tested. Criteria for selection of "model" pesticides for experimentation include factors such as use patterns and amounts as well as intrinsic characteristics of the pesticide. The design of the experimental constructed wetlands cells for this research includes water flow and depth control, clay liners to prevent infiltration, and wetland vegetation as a variable. The experimental strategy should permit optimal transfer of study results from site to site and ultimately provide recommendations for pesticides that are compatible with wetlands as well as design characteristics for constructed wetlands to be used with specific crop-pesticide combinations.

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312. Distribution of soil carbon stocks in Canada's forests and wetlands simulated based on drainage class, topography and remotely sensed vegetation parameters.

Ju, W. and Chen, J. M.

Hydrological Processes 19(1): 77-94. (2005)

NAL Call #: GB651.H93; ISSN: 0885-6087

Descriptors: drainage class/ forest carbon/ remote sensing/ soil carbon/ topography/ wetland

Abstract: A quasi-three-dimensional hydrological model was developed and integrated into the integrated terrestrial ecosystem carbon-budget model (InTEC V3-0) to improve the estimation of the carbon (C) dynamics in Canadian forests and wetlands. Climate, soil, digital elevation map, and drainage class data, in conjunction with remotely sensed vegetation parameters, including leaf area index, land cover type, and stand age, are used to drive the model. Soil is divided into three layers, for which temperature and moisture dynamics are simulated. Individual 1 km × 1 km pixels are hydrologically linked with neighbouring pixels through subsurface saturated base-flow, which is simulated using a TOPMODEL-based scheme. Soil C and nitrogen (N) dynamics are simulated using the soil submodel of CENTURY suitably modified for forests and wetlands. The interannual variation in net primary productivity is iteratively computed after integrating the effects of N, climate, stand age and atmospheric CO₂ concentration on productivity. Compared with data in the Soil Landscape of Canada, the newly updated InTEC V3-0 can capture 66-6% of spatial variations in soil C and effectively alleviate soil C underestimation in wetland areas from its predecessor (InTEC V2-0) by considering the lateral water flow and the water table variation. Copyright 2005 John Wiley & Sons, Ltd.

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313. Ecodepuration performances of a small-scale experimental constructed wetland system treating and recycling intensive aquaculture wastewater.

Panella, S.; Cignini, I.; Battilotti, M.; Falcucci, M.; Hull, V.; Milone, N.; Monfrinotti, M.; Mulas, G. A.; Pipornetti, G.; Tancioni, L.; and Cataudella, S.

Annals of the New York Academy of Sciences 879: 427-431. (1999)

NAL Call #: 500 N484; ISSN: 0077-8923.

Notes: Issue title: Tempos in science and nature:

Structures, relations, and complexity; Meeting Information: Conference, Siena, Italy; September 23-26, 1998; Publisher: New York Academy of Sciences; Other number: 15733119601573311979

Descriptors: aquaculture/ waste management: sanitation/ aquaculture self depurating system/ aquaculture wastewater: recycling, treatment/ experimental constructed wetland system/ book chapter/ meeting paper/ meeting poster

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314. Ecological restoration of aquatic and semi-aquatic ecosystems in the Netherlands (NW Europe).

Nienhuis, P. H. and Gulati, R. D.; Series: Developments in Hydrobiology 166; 256- pp. (2003)

Notes: ISSN: 0167-8418

Descriptors: wetlands/ habitat improvement/ environment management/ grazing/ colonization/ restoration/ aquatic communities/ marshes/ ecosystem resilience/ seeds/ transplantation/ historical account/ Salmonidae/ Plantae/ Netherlands/ Europe/ salmonids/ other aquatic communities/ protective measures and control

Abstract: This work presents the state of the art of aquatic and semi-aquatic ecological restoration projects in The Netherlands. Starting from the conceptual basis of restoration ecology, the successes and failures of hundreds of restoration projects are described. Numerous successful projects are mentioned. In general ecological restoration endeavours greatly benefit from the progressive experience achieved in the course of the years. Failures mainly occur through insufficient application of physical, chemical or ecological principles. Spontaneous colonization by plants and animals, following habitat reconstruction, is preferred. However, sometimes the re-introduction of keystone species (e.g. eelgrass, salmon, beaver) is necessary in case the potential habitats are isolated or fragmented, or if a seed bank is lacking, thus not allowing viable populations to develop. Re-introducing traditional management techniques (e.g. mowing without fertilization, low intensity grazing) is important to rehabilitate the semi-natural and cultural landscapes that are so characteristic for The Netherlands.

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315. Effect of loading rate and planting on treatment of dairy farm wastewaters in constructed wetlands: 1. Removal of oxygen demand, suspended solid and faecal coliforms.

Tanner, C. C.; Clayton, J. S.; and Upsdell, M. P.

Water Research 29(1): 17-26. (1995)

NAL Call #: TD420.W3; *ISSN:* 0043-1354

Descriptors: dairy wastes/ wastewater treatment/ artificial wetlands/ coliforms/ agriculture/ water quality/ suspended solids/ chemical oxygen demand/ biological oxygen demand/ retention time/ biochemical oxygen demand/ suspended load/ dairies/ suspended particulate matter/ fecal coliforms/ constructed wetlands/ dairy wastes/ dairies/ suspended particulate matter/ fecal coliforms/ artificial wetlands/ suspended solids/ retention time/ suspended load/ coliforms/ biological oxygen demand

Abstract: The effect of influent loading rate on mass removal of BOD, SS and faecal coliforms (FC) from dairy parlour wastewaters was compared in four pairs of planted (*Schoenoplectus, validus*) and unplanted gravel-bed wetlands (each 19 m super(2)). The wetlands were

operated at nominal retention times of 7, 5.5, 3 and 2 days, with in and outflows sampled fortnightly over a 20 month period. Hydraulic flows were monitored to enable calculation of the mass flows of pollutants. Influent water quality varied markedly over the trial period (CBOD sub(5) 20-300 g m super(-3); SS, 60-250 g m super(-3); FC, 10 super(3)-10 super(6) MPN (100 ml super(-1)). NBOD was an important component of total BOD, being around 1.5 times higher than the influent CBOD sub(5), and 2-10 times higher than the effluent CBOD sub(5). Outflow levels of CBOD sub(5), SS and faecal coliforms rapidly mirrored changes in influent loadings. Mean mass removal of CBOD sub(5) increased from 60-75% to 85-90%, total BOD (CBOD sub(5) + NBOD) from 50 to 80% and FC from 90-95 to >99% with increasing wetland retention time during the first 12 months of monitoring. Mean annual SS removals of 75-85% were recorded irrespective of loading rate. High levels of dissolved humic colour in the wastewaters were little affected by passage through the wetland at short retention times, but were reduced by up to 40% at longer retentions. Mass removals of CBOD sub(5), SS and FC showed monotonic relationships to mass loading rates, with little difference between the performance of planted and unplanted wetlands, except for CBOD sub(5) at high loadings (> 3 g m super(-2) d super(-1)). The planted wetlands showed significantly improved removal rates for CBOD sub(5) at higher loadings, and 1.3 to 2.6 fold higher mass removals of total BOD.

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316. Effect of loading rate and planting on treatment of dairy farm wastewaters in constructed wetlands: 2. Removal of nitrogen and phosphorus.

Tanner, C. C.; Clayton, J. S.; and Upsdell, M. P.

Water Research 29(1): 27-34. (1995)

NAL Call #: TD420.W3; *ISSN:* 0043-1354

Descriptors: dairy wastes/ wastewater treatment/ artificial wetlands/ nitrogen removal/ phosphorus removal/ plants/ retention time/ agriculture/ nutrients/ water pollution/ dairies/ pollution control/ nutrients (mineral)/ artificial wetlands/ dairy wastes/ dairies/ pollution control/ nutrients (mineral)/ retention time/ nitrogen removal/ phosphorus removal/ plants/ nutrients

Abstract: The effect of influent loading rate on mass removal of nitrogen and phosphorus from dairy parlour wastewaters was compared in four pairs of planted (*Schoenoplectus, validus*) and unplanted gravel-bed wetlands (each 19 m super(2)). The wetlands were operated at nominal retention times of 7, 5.5, 3 and 2 days, with in and outflows sampled fortnightly over a 20 month period. Hydraulic flows were monitored to enable calculation of the mass flows of nutrients, and plant biomass and tissue nutrient levels sampled to evaluate plant nutrient uptake. Influent water quality varied markedly during the trial period (TN, 10-110; NH sub(4)-N, 5-70; and TP 8-18 g m super(-3)). As theoretical wastewater retention times increased from 2 to 7 days, mean reduction of TN increased from 12 to 41% and 48 to 75% in the unplanted wetlands and planted wetlands, respectively, and TP removal increased from 12 to 36% and 37 to 74% respectively. In the planted wetlands, mean annual removal rates of TN (0.15-1.4 g m super(-2) d super(-1)) and TP (0.13-0.32 g m super(-2) d super(-1)), increased gradually with mass loading rates. The unplanted wetlands showed a marked decline in TN and TP removal at high loadings. Net

storage by plants in the first year of monitoring accounted for between 3 and 20% of the greater N removal and between 3 and 60% of the greater P removal in the planted wetlands.

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317. Effectiveness of a constructed wetland for retention of nonpoint-source pesticide pollution in the Lourens River Catchment, South Africa.

Schulz, R. and Peall, S. K. C.

Environmental Science and Technology 35(2): 422-426. (Jan. 2001)

Descriptors: wetlands/ nonpoint sources/ pollution/ surface water/ agrochemicals/ runoff/ pesticides/ catchment areas/ water pollution/ pollution control/ stormwater runoff/ bioassays/ nonpoint pollution/ catchments/ agricultural pollution/ nitrates/ endosulfan/ chlorpyrifos/ freshwater environments/ nontarget organisms/ south africa/ pollution (nonpoint sources)/ precipitation (atmospheric)/ pesticides/ aurelia/ toxicity/ bioassay/ toxicity/ aquatic insects/ water pollution effects/ nonpoint pollution sources/ artificial wetlands/ Chironomus/ Chironomidae/ South Africa, Lourens R./ constructed wetlands/ Diptera/ midges/ environmental impact/ prevention and control/ freshwater pollution/ aquatic entomology/ water quality/ sources and fate of pollution

Abstract: Constructed wetlands have been widely used to control both point- and nonpoint-source pollution in surface waters. However, our knowledge about their effectiveness in retaining agricultural pesticide pollution is limited. A 0.44-ha vegetated wetland built along a tributary of the Lourens River, Western Cape, South Africa, was studied to ascertain retention of runoff-related agricultural pollution. Total suspended solids, orthophosphate, and nitrate were retained in the wetland in the proportions 15, 54, and 70%, respectively, during dry weather conditions (with rainfall less than 2 mm/d) and 78, 75, and 84% during wet conditions (with rainfall between 2 and 35 mm/d). Retention of water-diluted azinphos-methyl introduced via runoff at a level of 0.85 $\mu\text{g/L}$ was between 77 and 93%. Chlorpyrifos and endosulfan were measured during runoff in inlet water at 0.02 and 0.2 $\mu\text{g/L}$, respectively. However, both pesticides were undetectable in the outlet water samples. During a period of 5 months, an increased concentration of various insecticides was detected in the suspended particles at the wetland inlet: azinphos-methyl, 43 $\mu\text{g/kg}$; chlorpyrifos, 31 $\mu\text{g/kg}$; and prothiofos, 6 $\mu\text{g/kg}$. No organophosphorus pesticides were found in the outlet suspended-particle samples, highlighting the retention capability of the wetland. A toxicological evaluation employing a Chironomus bioassay in situ at the wetland inlet and outlet revealed an 89% reduction in toxicity below the wetland during runoff.

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318. The effectiveness of a small constructed wetland in ameliorating diffuse nutrient loadings from an Australian rural catchment.

Raisin, G. W.; Mitchell, D. S.; and Croome, R. L.

Ecological Engineering 9(1-2): 19-35. (Sept. 1997)

Descriptors: wetlands/ nutrient loading/ catchments/ hydrology/ nitrogen/ phosphorus/ nonpoint pollution/ environment management/ catchment area/ eutrophication/ storms/ agricultural runoff/ catchment areas/ artificial wetlands/ nonpoint pollution sources/ Australia, Victoria/

freshwater pollution/ characteristics, behavior and fate/ sources and fate of pollution/ reclamation

Abstract: This paper assesses the capacity of a small (450 m super(2)) constructed wetland in Victoria, Australia, to decrease nutrient loads generated by both background flows and storm events within the period March 1993 to January 1995. Under Australian conditions the effectiveness of wetlands in controlling diffuse pollution is influenced by extreme hydrological events which often carry a large proportion of the annual load from the catchment. The wetland retained a varying proportion of the nitrogen and phosphorus load over a range of hydrological events and seasonal conditions. The wetland also acted as a source of these nutrients on occasions. An annual nutrient budget was calculated for the period February 1994 to January 1995 by measuring all loads between and during storm events entering and leaving the wetland. The wetland 'retained' 10 kg N yr super(-1) (23 g N m super(-2) yr super(-1)) of nitrogen and 1.24 kg P yr super(-1) (2.80 g P m super(-2) yr super(-1)) of phosphorus, representing 11 and 17%, respectively of the incoming nutrient loads for the budget period. Storm event size influenced the impact of the wetland on the nutrient loads generated in these events. Increasing event volumes generally resulted in decreased nutrient interception. The results of this study indicate that for significant load reduction to occur the scale of the wetland should be such that there is sufficient residence time to enable wetland processes to operate. Small strategically located wetlands high up in catchments which will have a cumulative impact on runoff generated in large storm events are likely to be more effective in intercepting nutrient loads than larger downstream structures.

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319. Effects of encapsulated calcium carbide on dinitrogen nitrous oxide methane and carbon dioxide emissions from flooded rice.

Bronson K. F. and Mosier, A. R.

Biology and Fertility of Soils 11(2): 116-120. (1991)

NAL Call #: QH84.8.B46; *ISSN:* 0178-2762

Descriptors: agronomy: agriculture/ metabolism/ nutrition/ soil science/ Oryza sativa/ nitrogen/ fertilizer use efficiency/ nitrification inhibitor/ wetland rice/ greenhouse gas/ urea

Abstract: The efficiency of N use in flooded rice is usually low, chiefly due to gaseous losses. Emission of CH₄, a gas implicated in global warming, can also be substantial in flooded rice. In a greenhouse study, the nitrification inhibitor encapsulated calcium carbide (a slow-release source of acetylene) was added with 75, 150, and 225 mg of 75 atom % 15N urea-N to flooded pots containing 18-day-old rice (Oryza sativa L.) plants. Urea treatments without calcium carbide were included as controls. After the application of encapsulated calcium carbide, 3.6 μg , N₂, 12.4 μg N₂O-N, and 3.6 μg CH₄ were emitted per pot in 30 days. Without calcium carbide, 3.0 mg N₂, 22.8 μg N₂O-N, and 39.0 mg CH₄ per pot were emitted during the same period. The rate of N added had a positive effect on N₂ and N₂O emissions, but the effect on CH₄ emissions varied with time. Carbon dioxide emissions were lower with encapsulated calcium carbide than without. The use of encapsulated calcium carbide appears effective in eliminating N₂ losses, and in minimizing emissions of the "greenhouse gases" N₂O and CH₄ in flooded rice.

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320. Effects of seasonal flooding and grazing on the vegetation of former ricefields in the Rhone delta (southern France).

Mesleard, F.; Lepart, J.; Grillas, P.; and Mauchamp, A. *Plant Ecology* 145(1): 101-114. (1999)
 NAL Call #: QK900.P63; ISSN: 1385-0237
Descriptors: wetlands/ abandoned land/ *Oryza sativa*/ seasonal variation/ grazing/ vegetation/ water management/ ecological succession/ salinity/ rain/ cattle/ land management/ horses/ plant communities/ irrigation/ botanical composition/ France
Abstract: Six management regimes were tested during 5 years in 18 abandoned ricefields in the Rhone delta, France: two artificial floodings for 6 months (winter and summer flooding, 10 cm deep) and a control only flooded by rain, each flooding treatment either with or without grazing by cattle and horses. In the absence of artificial flooding and in presence of grazing by domestic herbivores (i.e., maintaining the initial management since the abandonment) no significant change in plant communities was recorded after 5 years. The vegetation was mainly composed of halophytes (*Salicornia fruticosa* and *Inula crithmoides*). The removal of grazing led to the dominance of a salt tolerant grass: *Aeluropus litoralis*. Flooding favoured the dominance of clonal plants and led to a decrease in the number of species. In the ungrazed fields, changes in plant communities were related to the height of species with *Bolboschoenus maritimus* and *Phragmites australis* becoming dominant. When grazing was combined with summer flooding, *B. Maritimus* dominated the first two years of the experiment, but with a low cover, and was replaced in the 3rd year by *Typha angustifolia*. When grazing was combined with winter and early spring flooding the competitive exclusion of *B. maritimus* by *Juncus gerardii* slowed the establishment of the former. The management of former ricefields led to the establishment and dominance of emergent species common to Mediterranean wetlands. Although it is subordinate to the maintenance of artificial flooding, the project may be considered a restoration (or a rehabilitation) of seasonally flooded marshes as original functions existing before the land was put under cultivation are re-established. This citation is from AGRICOLA.

321. Enhanced prairie wetland effects on surface water quality in Crowfoot Creek, Alberta.

Ontkcan, G. R.; Chanasyk, D. S.; Riemersma, S.; Bennett, D. R.; and Brunen, J. M. *Water Quality Research Journal of Canada* 38(2): 335-359. (2003); ISSN: 1201-3080
Descriptors: wetlands/ water quality/ surface water/ habitat/ aquatic birds/ watersheds/ nutrient concentrations/ fecal coliforms/ surface water/ water quality (natural waters)/ catchment areas/ nutrients/ bacteria (faecal)/ birds (waterfowl)/ monitoring/ fate of pollutants/ prairies/ data collections/ spatial distribution/ temporal distribution/ suspended solids/ bacteria/ Canada, Alberta, Crowfoot Creek
Abstract: A three-year study was conducted to examine the effects of a prairie wetland enhanced for waterfowl habitat on surface water quality in the Crowfoot Creek watershed in southern Alberta, Canada. Monitoring was carried out at the Hilton wetland from mid-March to the end of October in 1997 to 1999 at two inflow sites and one outflow site. Data were collected on flow, total phosphorus (TP), total nitrogen

(TN), total suspended solids (TSS), and fecal coliform (FC) bacteria. Nutrient concentrations were highest in the spring, and decreased during the remainder of the monitoring period each year. Nutrient concentrations did not change significantly within the wetland due to the form of nutrient, reduced retention times for nutrient uptake, and the addition of nutrients to the water through sediment release and decomposition of organic matter. The wetland acted as both a source and a sink for nutrients, depending on flow volumes. TSS concentrations decreased significantly from inflow to outflow, indicating sedimentation occurred in the wetland. FC bacteria levels were lowest in the spring and increased during the post-spring runoff (PSRO) period. FC bacteria counts decreased significantly within the wetland throughout the entire year. The Hilton wetland was effective in reducing the amounts of TSS and FC bacteria exported from the wetland; however, there was no significant change in nutrient status.
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322. Estimating inorganic and organic nitrogen transformation rates in a model of a constructed wetland purification system for dilute farm effluents.

Mcgechan, M. B.; Moir, S. E.; Sym, G.; and Castle, K. *Biosystems Engineering* 91(1): 61-75. (2005)
 NAL Call #: S671 .B567; ISSN: 1537-5129
Descriptors: ammonium/ BOD/ biochemical oxygen demand/ dairy farms/ denitrification/ hydrology/ kinetics/ nitrates/ nitrogen cycling models/ nitrous oxides/ reedbeds/ wetland systems/ microbiology/ biotechnology/ forestry/ agriculture/ mathematical models/ equations
Abstract: This paper describes some of the concepts that are being built into a model of a subsurface flow constructed wetland system based on reedbeds. A nitrogen (N) cycling submodel has been adapted from a soil N model, with pools representing organic material with high biological oxygen demand (BOD), ammonium and nitrate. Microbiologically controlled transformations between pools are represented by first-order exponential kinetics, with N finally lost to the atmosphere either by ammonia volatilisation, or by denitrification to gaseous N₂ or nitrous oxide. Hydrology has been represented for both horizontal and vertical reedbeds, with contrasting partially anaerobic or fully aerobic conditions at each stage. The model has been set up to represent an experimental system with one horizontal and three vertical reedbeds, being tested for purification of dirty water from a dairy farm. Rate constant values have been selected so that simulated results are a reasonable approximation to measurements from the experimental system. The model has been developed to assist in optimising design parameters for new systems, including the numbers and sequence of reedbed types, dimensions and flowrates, for various incoming contaminant concentrations and target water purity standards.
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323. Evaluating sustainability of watershed resources management through wetland functional analysis.

Zalidis, G. C. and Gerakis, A. *Environmental Management* 24(2): 0193-0207. (1999)
 NAL Call #: HC79.E5E5; ISSN: 0364-152X
Descriptors: wetlands/ water management/ water supplies/ agricultural practices/ watersheds/ sustainable development/ soil conservation/ agriculture/ government

policies/ evaluation/ resources management/ watershed management/ groundwater/ hydrology/ drainage/ resource management/ ecosystem disturbance/ environmental restoration/ sustainable agriculture/ agricultural policy/ flood control/ ground water/ microclimate/ Greece/ Mediterranean Region/ Greece, Karla/ management/ environmental action/ evaluation process/ conservation, wildlife management and recreation/ land/ general environmental engineering

Abstract: Unsustainable agricultural policies and water and soil resource schemes have drained two thirds of Mediterranean wetlands since 1920. An outstanding example is Karla in Greece, a former internationally important wetland that was drained in 1962 causing environmental, social, and water and soil problems. The objective of this study was to assess the functions and values of Karla, at three periods of its history, and to relate them to major events in the management of the water and soil resources of its watershed. Information on wetland and watershed features was collected from historical records and field visits. The results showed that the wetland in its pristine state had performed five functions to a high degree, one (groundwater recharge) to a moderate degree, and one (flood storage) to a low degree. Flood-control works, uncontrolled pumping, etc., in 1936-1961 degraded all functions except microclimate modification while, the bird support function was moderately altered. Drainage works in 1962 left a very small artificially flooded wetland with only four functions performed to an insignificant degree. Value degradation followed function degradation. It was concluded that past resource management has been nonintegrated. No consideration was given to the multiple functions and values of Karla. Previous restoration proposals involved the reinstatement of one or two functions only. The appropriate restoration scheme for Karla must be multiobjective and based on the integrated resource management of its own and the neighboring watersheds.

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324. Fate of super(15) N-nitrate in unplanted, planted and harvested riparian wetland soil microcosms.

Matheson, F. E.; Nguyen, M. L.; Cooper, A. B.; Burt, T. P.; and Bull, D. C.

Ecological Engineering 19(4): 249-264. (2002)

NAL Call #: TD1.E26; ISSN: 0925-8574

Descriptors: wetlands/ riparian environments/ nutrient uptake/ nitrate/ environment management/ ecosystem management/ nutrients (mineral)/ uptake/ agricultural pollution/ agricultural runoff/ soils/ nitrogen isotopes/ denitrification/ plant populations/ riparian vegetation/ biogeochemical cycle/ nitrates

Abstract: Riparian wetlands are important for the protection of river water quality in agricultural landscapes by intercepting and removing nutrients, such as nitrate (NO sub(3) super(-)), in runoff. However, limited information is available on the relative importance of biological NO sub(3) super(-) removal processes in these ecosystems. In this study the fate of super(15)N-NO sub(3) super(-) was investigated for 32 days in three types of wetland soil microcosm (unplanted, planted, and planted with shoot harvest) in order to identify the key processes responsible for NO sub(3) super(-) removal, elucidate the role of the wetland plant and determine the effect of shoot harvest. super(15)N-NO sub(3) super(-) solution (7.9 mg N l super(-) 1), 99 at.% super(15)N) was added to each microcosm at a

rate of 0.5 mu g N g super(-1) soil every 2 days. In both types of plant-inhabited microcosm, similar proportions of added super(15)N-NO sub(3) super(-) were denitrified (61-63%), soil-immobilised (24-26%), plant-assimilated (11-15%) and reduced to ammonium (NH sub(4) super(+)) (<1%). However, in unplanted microcosms, 49% was reduced to NH sub(4) super(+), 29% denitrified and 22% immobilised. Elevated denitrification in the presence of the plant, glaucous sweetgrass (*Glyceria declinata*), was attributed to a higher degree of soil oxidation, which is considered to be the principal regulator of NO sub(3) super(-) partitioning between denitrification and DNRA. Shoot harvest did not affect the fate of super(15)N-NO sub(3) super(-), but it decreased new shoot production (by a factor of 3.9), inhibited new root production, and increased the NO sub(3) super(-) assimilation capacity of shoots (by a factor of 5.2). Although this study lasted for only 1 month, the results have important implications for riparian ecosystem management, restoration and design. The water quality protection afforded by riparian wetlands might be substantially enhanced by maximising vegetation cover with plants like *G. declinata* that promote high denitrification nitrogen (N) losses. In contrast, shoot harvest as a mechanism of permanent N loss may be much less important.

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325. The fate of traditional extensive (gei wai) shrimp farming at the Mai Po Marshes Nature Reserve, Hong Kong.

Cha, M. W.; Young, L.; and Wong, K. M.

Hydrobiologia 352(1-3): 295-303. (Sept. 1997)

NAL Call #: 410 H992; ISSN: 0018-8158.

Notes: Conference: Asia-Pacific Conf. on Science and Management of Coastal Environment, Hong Kong (People's Rep. China), 25-28 Jun 1996

Descriptors: wetlands/ extensive culture/ shrimp culture/ pond culture/ aquaculture techniques/ water quality/ pollution effects/ habitat improvement/ coastal zone/ mangrove swamps/ Hong Kong, Mai Po Marshes Nature Reserve/ shrimp/ aquaculture/ larval growth stage/ water pollution effects/ ponds/ marshes/ seasonal variations/ fish/ predation/ water birds/ wildlife management/ *Metapenaeus ensis*/ *Mugil cephalus*/ Hong Kong/ greasyback shrimp/ striped mullet/ shellfish culture/ shellfish culture/ aquaculture

Abstract: Extensive shrimp farming around Deep Bay, Hong Kong, began in the mid-1940's after the construction of intertidal ponds (gei wai) among the coastal mangroves. The ponds are increasingly being seen as an example of how wetlands can be used sustainably since they are naturally stocked with shrimp postlarvae (e.g. *Metapenaeus ensis*) and young fish (e.g. *Mugil cephalus*) flushed into the ponds from Deep Bay. Once inside, these shrimps and fish feed on naturally occurring detritus on the pond floor. The only gei wai remaining in the Territory, are those at the WWF Hong Kong Mai Po Marshes Nature Reserve, adjacent to Deep Bay. Analysis of the shrimp production between 1990-1995 showed that there were two seasonal peaks, from April-June (Recruitment-I) and from July-October (Recruitment-II). The second peak was significantly lower than the first ($p < 0.001$), especially from those gei wai in the southern part of the reserve which are much closer to a polluted river. The average harvest from each gei wai had also significantly declined from 40.9 plus

or minus 6.0 kg ha super(-1) yr super(-1) in 1990 to 15.1 plus or minus 3.6 kg ha super(-1) yr super(-1) in 1995 ($p < 0.01$). This decline can be attributed to the abundance of predatory fish in the gei wai, and increasing water pollution in Deep Bay which adversely affects the amount of shrimp larvae for stocking the gei wai, as well as the quality of water for flushing the ponds during the rearing and harvesting seasons. Despite this, those gei wai which are not-commercially viable can still support many non-commercial, more pollution tolerant fish and shrimp species. As a result, the management of these gei wai has been altered such that their objective is to provide feeding habitat for piscivorous waterbirds, which is also in line with the aims of the nature reserve.

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326. Gaseous carbon dioxide and methane, as well as dissolved organic carbon losses from a small temperate wetland under a changing climate.

Clair, T. A.; Arp, P.; Moore, T. R.; Dalva, M.; and Meng, F. R.

Environmental Pollution 116(Supplement 1): S143-S148. (2002)

NAL Call #: QH545.A1E52; ISSN: 0269-7491

Descriptors: freshwater ecology: ecology, environmental sciences/ pollution assessment control and management/ terrestrial ecology: ecology, environmental sciences/ changing climate/ climatic variables/ dissolved organic carbon [DOC]: wetland losses/ hydrologic variables/ poor fen: mixed hardwood softwood forest drainage/ precipitation/ small temperate wetland: carbon budget, passive carbon storage area, potential active greenhouse gas source/ temperate forests/ temperature

Abstract: Temperate forests can contain large numbers of wetlands located in areas of low relief and poor drainage. These wetlands can make a large contribution to the dissolved organic carbon (DOC) load of streams and rivers draining the forests, as well as the exchange of methane (CH₄) and carbon dioxide (CO₂) with the atmosphere. We studied the carbon budget of a small wetland, located in Kejimikujik National Park, Nova Scotia, Canada. The study wetland was the Pine Marten Brook site, a poor fen draining a mixed hardwood-softwood forest. We studied the loss of DOC from the wetland via the outlet stream from 1990 to 1999 and related this to climatic and hydrologic variables. We added the DOC export information to information from a previously published model describing CH₄ and CO₂ fluxes from the wetland as a function of precipitation and temperature, and generated a new synthesis of the major C losses from the wetland. We show that current annual C losses from this wetland amount to 0.6% of its total C mass. We then predicted that under climate changes caused by a doubling of atmospheric CO₂ expected between 2040 and 2050, total C loss from the wetland will almost double to 1.1% of total biomass. This may convert this wetland from what we assume is currently a passive C storage area to an active source of greenhouse gases.

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327. Growth and nutrient dynamics of soft-stem bulrush in constructed wetlands treating nutrient-rich wastewaters.

Tanner, C. C.

Wetlands Ecology and Management 9(1): 49-73. (2001)

NAL Call #: QH541.5.M3 W472; ISSN: 0923-4861

Descriptors: wetlands/ nutrient dynamics/ waste water/ nutrients/ vegetation/ nutrient removal/ wastewater treatment/ agricultural runoff/ agricultural pollution/ aquatic plants/ nutrients (mineral)/ nutrient cycles/ plant nutrition/ water pollution treatment/ environment management/ biochemical composition/ *Schoenoplectus tabernaemontani*/ reclamation/ wastewater treatment processes/ reproduction and development/ protective measures and control

Abstract: The growth characteristics and nutritional status of *Schoenoplectus tabernaemontani* (C.C. Gmelin) Palla (softstem bulrush or lake clubrush) were investigated during the second and third growth seasons in four equivalent subsurface-flow, gravel-bed constructed treatment wetlands. Each wetland was supplied with a different hydraulic loading rate of agricultural wastewater, covering the range commonly applied to such systems. Harvest and demographic techniques were combined to determine seasonal patterns and gradients of growth and nutrient allocation, and net annual primary productivity (NAPP). Marked seasonal patterns of early spring emergence, summer growth and autumn senescence were observed, with little over-wintering of live above-ground biomass. Starch, the dominant long-term storage substance, comprised similar to 20% of rhizome dry weight (DW) in autumn. Mobilization during spring reduced concentrations by around half, with a trend of increasing depletion in the higher loaded wetlands. NAPP, including above-ground mortality, during the second growth season ranged between similar to 2.5 and 3.5 kg DW m super(-2), with 10-23% allocated to below-ground growth. Mean above-ground live and dead biomass ranged between similar to 1.75 and 2.65 kg DW m super(-2) by mid-summer, with below to above-ground biomass ratios similar in all wetlands at between 0.6 and 0.7. Rhizomes, which comprised around 80% of the below-ground biomass, were generally restricted to the upper 10 cm of the substratum and over half the root biomass also occurred in this zone, with very few roots penetrating below 30 cm depth. High culm concentrations of N, P, Mg and Zn in spring declined markedly over the growth season, while S and Ca showed general increases, and K, Fe and Cu remained relatively stable. Gradients of decreasing tissue concentration of most macronutrients were noted with increasing distance from wastewater inflows. Plant accumulation of N rose by 20-35 g m super(-2) and P by 4-9 g m super(-2) with seasonal regrowth of above-ground shoots. Net plant N and P uptake rates rose to maximum values of 0.3 g N m super(-2) d super(-1) and 0.1 g P m super(-2) d super(-1) in early summer, declining markedly during late summer and autumn. Mass balance assessments of N and P accumulation in plants at near maximum seasonal biomass, after three growth seasons, showed that only 6 to 11% of the N removal and 6 to 13% of the P removal recorded from wastewaters applied to the wetlands could be ascribed to plant uptake and accumulation.

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328. Hydrological modelling of a drained grazing marsh under agricultural land use and the simulation of restoration management scenarios.

Al-Khudhairy, D. H. A.; Thompson, J. R.; Gavin, H.; and Hamm, N. A. S.

Hydrological Sciences Journal 44(6): 943-971. (1999)

NAL Call #: 292.9 As7; ISSN: 0262-6667

Descriptors: agriculture/ computer simulation/ drainage/ land use/ mathematical models/ moisture/ rain/ runoff/ soils/ watersheds/ catchments/ water resources management/ hydrology/ agricultural land/ hydrological modeling/ marsh/ restoration ecology/ wetland management/ United Kingdom

Abstract: The capability of the spatially-distributed, physically-based, rainfall-runoff modelling system, MIKE SHE, to simulate the hydrological behaviour of the natural and drained parts of the North Kent Grazing Marshes, UK, is investigated. The MIKE SHE code is applied to Bells Creek, a small, underdrained, agricultural catchment located within the marshes. The model is used to both provide insights into the essential parameters that control the hydrological processes in the catchment, and predict the influence of various, hypothetical, water management strategies (land use and drainage) on pumped discharge and soil moisture storage in the catchment. The water table model predictions arising from these hypothetical scenarios are also compared against field data obtained from on-going hydrological research on the neighbouring, natural, Elmley Marshes. The comparison is found to be favourable. The results of this study indicate the potential of the MIKE SHE system to simulate the hydrological regime of these wetlands, and hence to play an important role as a tool that can assist environmental and conservation agencies in the sound management of wetland resources. The capability of the spatially-distributed, physically-based, rainfall-runoff modelling system, MIKE SHE, to simulate the hydrological behaviour of the natural and drained parts of the North Kent Grazing Marshes, UK, is investigated. The MIKE SHE code is applied to Bells Creek, a small, underdrained, agricultural catchment located within the marshes. The model is used to both provide insights into the essential parameters that control the hydrological processes in the catchment, and predict the influence of various, hypothetical, water management strategies (land use and drainage) on pumped discharge and soil moisture storage in the catchment. The water table model predictions arising from these hypothetical scenarios are also compared against field data obtained from on-going hydrological research on the neighbouring, natural, Elmley Marshes. The comparison is found to be favourable. The results of this study indicate the potential of the MIKE SHE system to simulate the hydrological regime of these wetlands, and hence to play an important role as a tool that can assist environmental and conservation agencies in the sound management of wetland resources.

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329. An integrated constructed wetland to treat contaminants and nutrients from dairy farmyard dirty water.

Dunne, E. J.; Culleton, N.; O'Donovan, G.; Harrington, R.; and Olsen, A. E.

Ecological Engineering 24(3): 219-232. (2005)

NAL Call #: TD1.E26; ISSN: 0925-8574

Descriptors: artificial wetlands/ biochemical oxygen

demand/ dairy effluent/ dairy wastes/ eutrophication/ farmyard manure/ nutrients/ phosphorus/ pollutants/ polluted water/ runoff/ suspended solids/ water pollution/ water quality

Abstract: Water pollution by agriculture can include inappropriately managed dairy farmyard dirty water. In Ireland, dairy farmyard dirty water includes farmyard runoff, parlour washings, and silage/farmyard manure effluents. The objectives of this study were to determine (i) the quality and quantity of dirty water generated at a farm-scale and (ii) the seasonal effectiveness of a constructed wetland to treat farmyard dirty water. The wetland system was 4800 m² in area and treated dirty water from a 42-cow organic dairy unit with an open yard area of 2031 m². Monthly dirty water inflow rate to the wetland ranged between 3.6 and 18.5 m³ d⁻¹. Farmyard dirty water accounted for 27% of hydrological inputs to the wetland, whereas rainfall on wetland, along with wetland bank inflows accounted for 45 and 28%, respectively. Farmyard dirty water quality and quantity did not vary with season. Yearly mass loads discharged to the wetland were 47±10 kg yr⁻¹ of soluble reactive phosphorus (SRP), 128±35 kg yr⁻¹ of NH₄⁺, 5484±1433 kg yr⁻¹ of organic material as measured by five-day biological oxygen demand (BOD₅), and 1570±465 kg yr⁻¹ of total suspended solids (TSS). Phosphorus retention by the wetland varied with season (5-84%) with least amounts being retained during winter.

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330. Interactions between algae (*Selenastrum capricornutum*) and pesticides: Implications for managing constructed wetlands for pesticide removal.

Friesen-Pankratz, B.; Doebel, C.; Farenhorst, A.; and Goldsborough, L. G.

Journal of Environmental Science and Health, Part B: Pesticides, food contaminants and agricultural wastes B38(2): 147-155. (Mar. 2003)

NAL Call #: TD172.J61; ISSN: 0360-1234

Descriptors: wetlands/ aquatic plants/ pollution control/ agricultural runoff/ pesticides/ runoff/ atrazine/ lindane/ algae/ agrochemicals/ sorption/ biodegradation/ water treatment/ artificial wetlands/ *Selenastrum capricornutum*/ constructed wetlands/ atrazine/ lindane/ prevention and control/ pollution/ freshwater pollution/ water pollution: monitoring, control & remediation

Abstract: This laboratory study examined the interactions between an algal species found in wetlands (*Selenastrum capricornutum*) and two agricultural pesticides (atrazine and lindane). Pesticide additions had a positive effect on the chlorophyll a concentrations of the treatments. The presence of algae decreased the aqueous persistence of both pesticides. It is speculated that the algae either provided sites for pesticide sorption or facilitated pesticide degradation.

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331. Investigating dairy lagoon effluent treatability in a laboratory-scale constructed wetlands system.

Benham, B. L. and Mote, C. R.

Transactions of the ASAE 42(2): 495-502. (1999)

NAL Call #: 290.9 AM32T; ISSN: 0001-2351

Descriptors: water quality/ wastewater treatment/ design/ water pollution/ pollution control/ constructed wetlands

Abstract: Dairy lagoon supernatant treatability was evaluated using 10 laboratory-scale (1.5 m X 0.45 m)

constructed wetlands. Selected design and operational variables were examined. Tested treatments were combinations of three organic loading rates (high, medium, and low) and three types of microbial attachment sites (vegetated, inert, and none). Five combinations (two replications each) of organic loading rate and microbial attachment sites were tested. Removal efficiencies were based on analysis of influent/effluent waste constituent levels. Dominant nitrogen removal mechanisms were determined from an examination of influent/effluent nitrogen specialization. In addition, an analysis of waste degradation kinetics provided insight with respect to the applicability of a widely used design model. Results showed consistently high nitrogen-removal efficiencies (65 to 81%) for all treatments. Nitrogen specialization results indicate that nitrification/denitrification was the dominant nitrogen removal mechanism. Carbon removal was less efficient (6 to 39%), and varied with influent strength. Waste utilization kinetic rate-constants from the five treatments were not statistically different ($\alpha = 0.05$). The design model uses microbial attachment site parameters, such as specific surface area, to modify a base reaction rate-constant (i.e., a rate-constant for a system with no microbial attachment sites). In this case, the rate-constant for the control (treatments with no microbial attachment sites) was not statistically different from either the vegetated or the inert treatments.

This citation is from AGRICOLA.

332. Landscape planning to reduce coastal eutrophication: Agricultural practices and constructed wetlands.

Arheimer, B.; Torstensson, G.; and Wittgren, H. B.

Landscape and Urban Planning 67(1-4):

205-215. (Mar. 2004)

NAL Call #: QH75.A1L32; ISSN: 0169-2046

Descriptors: nitrogen/ eutrophication/ agriculture/ leaching/ mathematical models/ economics/ rivers/ catchments/ artificial wetlands/ models/ agricultural practices/ coastal zone/ water management/ fertilization/ wastewater treatment/ catchment area/ agricultural runoff/ ecosystem disturbance/ pollution control/ environment management/ river basin management/ soils/ catchment areas/ pollution load/ coastal waters/ economic impact/ Sweden/ marine pollution/ water pollution: monitoring, control & remediation/ planning/ development/ water/ protective measures and control/ water quality control

Abstract: Southern Sweden suffers from coastal eutrophication and one reason is the high nitrogen load through rivers. The major part of this load originates from diffuse land-based sources, e.g. arable soil leaching. Effective reduction of load from such sources demand careful landscape analysis, combined with changed behaviour of the stakeholders. This study describes a chain of methods to achieve trustworthy management plans that are based on numerical modelling and stakeholders participation and acceptance. The effect of some measures was unexpected when modelling their impact on the catchment scale. Management scenarios to reduce riverine nitrogen load were constructed in an actor game (i.e. role-play) for the Genevadsaan catchment in southern Sweden. The game included stakeholders for implementation of a loading standard for maximum nitrogen transport at the river mouth. Scenarios were defined after negotiation among involved actors and included changes in agricultural

practices, improved wastewater treatment, and establishment of wetlands. Numerical models were used to calculate the nitrogen reduction for different measures in each scenario. An index model (STANK) calculated the root zone leaching of nitrogen from crops at four type farms. This generated input to a catchment scale model (HBV-N) and farm economics. The economic impact of different sets of remedial measures was evaluated for each type farm and then extrapolated to the catchment. The results from scenario modelling show that possible changes in agricultural practices (such as tuning, timing of fertilisation and ploughing, changed crop cultivation) could reduce the nitrogen load to the sea by some 30%, while wetland construction only reduced the original load by some 5%. In the most cost-effective scenario agricultural practices could reduce the riverine load by 86 t per year at a cost of 1.0 million SEK, while constructed wetlands only reduced the load by 14 t per year at a cost of 1.7 million SEK. Thus, changed agricultural practices can be the most effective and less expensive way to reduce nitrogen transport from land to the sea, while constructed wetlands with realistic allocations and sizes may only have small impact on riverine nitrogen transport from land to sea. The overall experience is that actor games and numerical modelling are useful tools in landscape planning for analysing stakeholders' behaviour and the impact of measures to reduce coastal eutrophication.

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333. Macrofungi from six habitats over five years in Clayoquot Sound, Vancouver Island.

Roberts, Christine; Ceska, Oluna; Kroeger, Paul; and Kendrick, Bryce

Canadian Journal of Botany 82(10): 1518-1538. (2004)

NAL Call #: 470 C16C; ISSN: 0008-4026

Descriptors: wetlands/ habitat/ fungi/ dunes/ estuaries/ forests/ community composition/ ecological distribution/ rare species/ hygrophorus/ *Tricholoma apium*/ *Craterellus*/ *Craterellus tubaeformis*/ Canada, British Columbia, Vancouver I., Clayoquot Sound/ comparative studies/ bogs/ temperate rainforests/ geographical distribution

Abstract: Over 5 years, macrofungi from six habitats in Clayoquot Sound, Vancouver Island, British Columbia, were documented. Habitats were categorized as dune, spruce fringe, old-growth rainforest, second-growth forest, bog, or estuarine. All but the second-growth forest are natural ecosystems. A total of 551 taxa of macrofungi were recorded. Between 17% and 36% of the species in any one habitat were found only in that habitat. The most frequently encountered and ubiquitous species was *Craterellus tubaeformis* (Fr.) Quel., found in all years, habitats, and sites. Of the 551 taxa, only 28 were found every year, and 308 were found in only 1 year. Rare species that were recorded include *Cordyceps ravenelii* Berkeley & Curtis, *Hygrophorus inocybiformis* Smith, and *Tricholoma apium* Schaeffer in the dunes and *Stereopsis humphreyi* (Burt) Redhead in the spruce fringe. Similarities between habitats based on taxa in common showed that bog and estuarine habitats had only 9%-17% in common with each other and the other habitats, whereas dune, spruce fringe, and the two forest types shared 21%-31% of their species. Old-growth rainforest yielded approximately 4 times as many species as bog and estuarine habitats, and approximately 1.5 times as many as the other three habitats.

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334. Management optimization and sustainable technologies for the treatment and disposal/reuse of fish farm effluent with emphasis on constructed wetlands.

Negrone, G.

World Aquaculture 31(3): 16-19. (Sept. 2000)

NAL Call #: SH1.W62; ISSN: 1041-5602

Descriptors: wetlands/ aquaculture effluents/ technology/ effluent treatment/ wastewater treatment/ economics/ environmental impact/ recycling/ fish culture/ organic wastes/ pollution control/ water pollution control/ aquaculture/ fish farming/ effluents/ water reuse/ wastewater management/ wastewater disposal/ fish farming/ effluent/ reuse/ Pisces/ sewage & wastewater treatment/ effects of aquaculture on the environment/ effects of aquaculture on the environment/ protective measures and control/ wastewater treatment processes/ industrial effluents

Abstract: Disposal of fish farm effluent is not only a technical, but also a management problem. Many technologies are available to process and recycle the fish farm waste to meet the effluent standards of different countries, but costs are a limiting factor. In accordance with the available natural resources, constructed wetlands (CW) could be an attractive option. CW could greatly help to obtain certified "natural" fish production for concerned niche clients. The waste water treatment plant (WWTP) could be a center of production to complete the cycle that begins with feed, goes through fish, and then returns to agriculture. Aquaculture effluent is generally very diluted and expensive to treat. Where no control is needed, the water from fish ponds is simply discharged back to the original source or to another body of water. Many countries are concerned with the potential pollution effects, and strict regulations make it mandatory to treat the fish farm effluent. The effluent is a resource and should not be wasted but recycled. In this article, some "innovative" technologies and farm management practices are proposed whereby the efficiency of WWTP of the fish farms can be improved by recycling purposes. The problem of fish farm waste confronting intensive farms and, to some extent, semi-intensive fish farms is addressed.

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335. A method for coring inland, freshwater wetland soils.

Reinhardt, Carrie H.; Cole, Charles Andrew; and Stover, Lee R.

Wetlands 20(2): 422-426. (2000)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: methods and techniques/ soil science/ aluminum irrigation pipe corer/ field equipment/ hand operated soil corer/ incremental analysis/ analytical method/ radiochronologic dating/ dating method/ soil coring method/ field method/ bulk density measurement/ disturbance/ inland freshwater wetland soil/ seed bank/ soil contamination analysis: stratigraphic integrity/ wetland substrate type

Abstract: Currently, no method exists to core large volumes of inland freshwater wetland soils that maintains stratigraphic integrity, minimizes unnecessary disturbance, and cores up to a depth of 50 cm. Our objective was to create a large-volume soil coring device that could be applied with consistency to a variety of wetland substrates. The result is a hand-operated soil corer that resembles the

aluminum irrigation pipe corer that DeLaune et al. (1978) used to core soft marshy substrates. Instead of aluminum pipe, we used regular steel stovepipe and a variety of tools for insertion. After the sample is extracted from the sediment, the handle can be quickly removed for ease of transportation and storage of a core. The stovepipe can be cut open to expose the soil sample so that it can easily be sectioned for incremental analysis. The corer was used to take 130 samples in 18 different sites, spanning many different wetland substrate types. Our method has many applications, including radiochronologic dating, seed bank analysis, bulk density measurement, and soil contaminants analysis.

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336. Microbiological management of wetland rice fields.

Roger, P. A.; Zimmerman, W. J.; and Lumpkin, T. A.

In: *Soil Microbial Ecology: Applications in Agricultural and Environmental Management*/ Metting, F. B.

New York: Marcel Dekker, 1993; pp. 417-455.

Notes: ISBN: 0824787374

NAL Call #: QR111.S664 1992

Abstract: Presents a summary of the major environments of the wetland rice field ecosystem and the major microbial activities they host, and an overview of research on microbiological management of rice fields. The next sections discuss in detail potential and adopted practices, including 1) the utilization of symbiotic and free-living N₂-fixing blue-green algae as biofertilisers; 2) inoculation of rice with heterotrophic bacteria and the potential for rhizosphere microflora management; and 3) the utilization of bacterial and algal inhibitors to decrease N fertilizer losses. -from Authors

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337. Mitigation of chlorpyrifos runoff using constructed wetlands.

Moore, M. T.; Schulz, R.; Cooper, C. M.; Smith, S.; and Rodgers, J. H.

Chemosphere 46(6): 827-835. (2002)

NAL Call #: TD172.C54; ISSN: 0045-6535

Descriptors: pesticides/ agricultural runoff/ stormwater runoff/ artificial wetlands/ chlorpyrifos/ water pollution control/ nonpoint pollution sources/ best management practices/ sorption/ accumulation/ performance evaluation/ pollution (nonpoint sources)/ runoff (agricultural)/ pesticides/ sorption/ pollution control/ agricultural pollution/ wastewater treatment/ water pollution treatment/ plant populations/ bioaccumulation/ sediments/ South Africa, Cape Town/ South Africa, Lourens R./ chlorpyrifos

Abstract: Constructed wetlands have been proposed as a potential best management practice (BMP) to mitigate effects of pesticide-associated agricultural runoff. Wetland mesocosms (14 m x 59-73 m) were amended with chlorpyrifos to simulate a storm runoff event at concentrations of 73, 147 and 733 µg/l. Water, sediment and plant samples collected weekly for 12 weeks indicated that chlorpyrifos rapidly sorbed to sediment and plant material, with approximately 47-65% of measured chlorpyrifos mass retained within the first 30-36 m of wetland mesocosms. Of the measured mass, approximately 55% and 25% were retained by sediments and plants, respectively. A field-scale evaluation of a constructed wetland's mitigation capability was performed in the Lourens River watershed of Cape Town, South

Africa. Results indicate that the wetland was able to retain and considerably decrease the concentration (and hence toxicity) of chlorpyrifos and suspended sediment entering the receiving waterbody (Lourens River). This research provides fundamental answers concerning constructed wetland capabilities that are necessary for constructing field-scale systems within agricultural watersheds.

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338. Modelling nitrogen transformations in freshwater wetlands: Estimating nitrogen retention and removal in natural wetlands in relation to their hydrology and nutrient loadings.

Dorge, Jesper

Ecological Modelling 75-76(0): 409-420. (1994)

NAL Call #: QH541.15.M3E25; ISSN: 0304-3800

Descriptors: agronomy: agriculture/ conservation/ ecology: environmental sciences/ freshwater ecology: ecology, environmental sciences/ mathematical biology: computational biology/ metabolism/ models and simulations: computational biology/ nutrition/ pollution assessment control and management/ toxicology/ agriculture/ eutrophication/ groundwater/ mathematical model/ nitrates

Abstract: The agricultural utilization of the transition zone between the terrestrial and the aquatic system has strongly reduced these important buffer zones in the last 30 years. The reestablishment of wetlands in relation to the aquatic environment is getting more and more in focus in the debate on eutrophication. A general simulation model has been developed for freshwater wetlands to determine the retention and removal of nitrogen in wetlands as water flows from intensively cultivated farm land through wetlands and into the aquatic system. The model consists of a simple hydrological submodel and a more complex biological submodel including heterotrophic nitrogen dynamics and plant uptake. The whole biogeochemical pathway from mineralization of organic matter to ammonia and further to nitrate in the oxic microzone by nitrifiers. before denitrification, is explicitly modelled. The model has been calibrated with field data from three wetlands with different levels of NO₃-loading (587-1502 kg NO₃-N/ha cndtdot y) and vegetation. The calculated N-retention varies from 0 to 107 kg N/ha cndtdot y) and denitrification from 199 to 743 kg NO₃-N/ha cndtdot y with the lowest value in a Sphagnum-dominated wetland and the highest in a reed swamp. The wetland model can be applied to a model system describing the nitrogen turnover and transport from agricultural fertilization through soil and groundwater processes to the final washout into the aquatic environment. Moreover, the model can be used as a prognostic tool for an assessment of the potential effects on the aquatic ecosystem if relevant wetlands were reestablished.

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339. Multiobjective approach to water management system for wetlands in Biebrza River valley: Case study.

Okruszko, H.; Szuniewicz, J.; and Okruszko, T.

In: Proceedings of the International Symposium on the Hydrology of Wetlands in Temperate and Cold Regions. (Held 6 Jun 1988-8 Jun 1988 at Joensuu, Finland.); Vol. 1. Helsinki, Finland: Academy of Finland; pp. 10-15; 1988.

Descriptors: wetlands/ multiobjective planning/ peat bogs/ marsh management/ Poland/ river basins/ land use/

reclamation/ preservation/ case studies/ mires/ drainage effects/ computer models/ irrigation requirements/ water demand/ water management/ grasslands/ forest management/ lakes/ control of water on the surface

Abstract: A preliminary attempt has been made to develop a water management program for the Biebrza River Valley of Poland. This wetland territory is not reclaimed but partly drained due to some changes in natural hydrographic networks caused by the building of several canals in the 19th century. The areas in the valley of the middle Biebrza river have been divided into five types of sites: (1) the Red Bog reservation, a complex mire of transition and high moor, (2) areas surrounding the birch forests, (3) large consolidated complexes of birch forests, (4) grassland for agricultural use requiring irrigation, and (5) grassland for agricultural use without irrigation. In two of the five selected areas of the river valley, the water conditions are appropriate to levels of utilization. In three other areas, water conditions must be adjusted to the requirements associated with the methods of their planned management. The areas surrounding the Red Bog have been partially drained and designed for protection as wetlands. They must undergo renaturalization by increasing water inflow into these areas and by raising the groundwater level. This can be accomplished by raising the level of water and decreasing its outflow in the rivers Elk and Jegrznia and the canal joining them. Birch forests may also require water regulation due to evapotranspiration under the forest ecosystem. Grasslands will also require water management and a water balance involving probable deficiency of water from precipitation has been made on the basis of the meteorological conditions. An analysis of the water reserves and requirements in the Biebrza River Valley has shown that by utilizing water from the winter season all water demands can be met. Mathematical models have been used to regulate the water relations in the valley according to the needs of different ecosystems. Systematic observations of meteorological and hydrological conditions are required to make further calculations for water management in the Biebrza River Valley.

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340. Nitrogen cycling in wetland systems.

Hunt, P. G.; Poach, M. E.; and Liehr, S. K.

In: Nutrient management in agricultural watersheds: A wetlands solution/ Dunne, E. J.; Reddy, K. R.; and Carton, O. T.

Wageningen, Netherlands: Wageningen Academic Publishers, 2005; pp. 93-104.

Notes: International symposium on Nutrient Management in Agricultural Watersheds: A Wetlands Solution, Wexford, Ireland

Descriptors: wetlands/ aerobic treatment/ agriculture/ air quality/ ammonia/ anaerobic treatment/ artificial wetlands/ biodegradation/ biological treatment/ cycling/ dairy effluent/ denitrification/ ditches/ drainage/ ecological balance/ environmental protection/ microbial activities/ nitrification/ nitrogen/ nitrogen cycle/ oxidation/ oxygen/ piggery effluent/ riparian vegetation/ streams/ vegetated strips/ waste water/ waste water treatment/ water quality/ watersheds

Abstract: When considering the management of N on an agricultural watershed, the cycling of N is paramount because N exists in many different oxidative and physical states. The cycle is active in the biology of both aerobic and anaerobic processes. Furthermore, the cycling of N in both

natural and constructed wetlands is particularly dynamic and exceedingly valuable to N management for both productive agriculture and environmental quality. Nitrogen cycling is illustrated in the context of three types of wetlands - constructed, riparian, and in-stream. We present the higher than expected rates of denitrification in constructed wetland used for animal waste water treatment as an example of denitrification via new pathways such as ANAMMOX that require less oxygen in the precursor oxidation of ammonia. We show the effectiveness of different riparian zones for stream buffering and denitrification, particularly noting that they appear to provide a reasonable balance for protecting both water and air quality. We emphasize the importance of in-stream wetlands for assimilations and transformations of N that escapes agricultural watersheds.

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341. Nitrogen removal and cycling in restored wetlands used as filters of nutrients for agricultural runoff.

Comin, F. A.; Romero, J. A.; Astorga, V.; and Garcia, C. *Water Science and Technology* (1997)

NAL Call #: TD420.A1P7; ISSN: 0273-1223.

Notes: Conference: 5. Int. Conf. on Wetland Systems for Water Pollution, Vienna (Austria), 15-19 Sep 1996; Issue editors: Haberl, R.; Perfler, R.; Laber, J.; and Cooper, P.

Descriptors: wetlands/ nitrogen removal/ nitrogen cycle/ nutrients/ filters/ agricultural runoff/ aquatic plants/ rice/ denitrification/ rehabilitation/ water pollution control/ pollution control/ habitat improvement (biological)/ *Phragmites australis*/ *Typha latifolia*/ *Scirpus lacustris*/ Spain, Ebro R./ *Phragmites australis*/ *Typha latifolia*/ *Scirpus lacustris*/ pollution control/ habitat improvement (biological)/ Med, Spain, Tarragona, Ebro delta/ rice/ rehabilitation/ nitrogen removal/ nutrients/ water pollution control/ water quality control/ freshwater pollution/ prevention and control

Abstract: Four restored wetlands dominated by *Phragmites australis*, *Typha latifolia* and *Scirpus lacustris* were used to improve the quality of agricultural runoff in the Delta of the Ebro River (NE Spain) in 1993. The wetlands were continuously flooded with water from a ricefield irrigation network during the growing season and received water with between 0-270 mg m⁻² d⁻¹ of total nitrogen, 29-105 mg m⁻² d⁻¹ of dissolved inorganic nitrogen and 0-27 mg m⁻² d⁻¹ of dissolved organic nitrogen. Surface outflows contained between 0-80 mg m⁻² d⁻¹ of total nitrogen, 0-12 mg m⁻² d⁻¹ of dissolved inorganic nitrogen and 1-19 mg m⁻² d⁻¹ of dissolved organic nitrogen. The nitrogen retention efficiency was close to 100% of the input, except for dissolved organic nitrogen at the end of the growing season. The denitrification rates measured by the acetylene reduction in the sediment ranged between 0 and 3.46 mg N m⁻² d⁻¹ and represented between 0 and 12% of the inflowing dissolved inorganic nitrogen. Emergent macrophytes accumulated between 20 and 100 mg N m⁻² d⁻¹, which accounts for between 66 and 100% of the inflowing dissolved inorganic nitrogen. The wetland sediment accumulated between 111 and 250 mg N m⁻² d⁻¹ during the six month growing season. The removal rate constants calculated according to a first - order plug - flow kinetics, were between 0.01-0.075 m d⁻¹ for total nitrogen and 0.01-0.3 m d⁻¹ for dissolved inorganic nitrogen.

Plant uptake, detritus accumulation and decomposition, and nitrogen recycling in the sediment are major processes for nitrogen retention and recycling in the wetlands. This type of wetlands, restored from ricefields, act as highly efficient water polishing filters for agricultural runoff and, at the same time, can contribute to increase the habitat biodiversity of large areas where rice is cultivated extensively.

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342. Nitrogen spiraling in subsurface-flow constructed wetlands: Implications for treatment response.

Kadlec, R. H.; Tanner, C. C.; Hally, V. M.; and Gibbs, M. M. *Ecological Engineering* 25(4): 365-381. (2005)

NAL Call #: TD1.E26; ISSN: 0925-8574

Descriptors: 15N/ ammonia/ nitrogen/ spiralling/ stable isotope/ subsurface wetlands

Abstract: Nitrogen processing in treatment wetlands was investigated by use of the stable isotope 15N introduced as ammonium. Two small field-scale, gravel-bed wetlands with horizontal subsurface-flow (SSF) received primary meat processing water. Four SSF cascade mesocosms, each comprising five tanks in series, received primary meat processing water, primary dairy water, secondary dairy water or aerated secondary dairy water. The mesocosms and one of the field-scale wetland contained well-established bulrushes (*Schoenoplectus tabernaemontani*), and the other field-scale wetland remained unvegetated. The systems were operated at steady inflows, with a nominal detention times of 4-5 days. The incoming ammonium nitrogen ranged from 18.5 to 177 g m⁻³, and removals ranged from 15 to 90% for the various feed waters. Each system was dosed with a single pulse of 15N ammonium mixed into the feed wastewater, and the fate and transport of the isotopic nitrogen were determined. The 15N pulses took 120 days to clear the heavily loaded field-scale wetlands. During this period small reductions in 15N were attributable to nitrification/denitrification, and a larger reduction due to plant uptake. Mesocosm tests ran for 24 days, during which only 1-16% of the tracer exited with water, increasing with N loading. Very little tracer gas emission was found (?1%). The majority of the tracer was found in plants (6-48%) and sediments (28-37%). These results indicated a rapid absorption of ammonium into a large sediment storage pool, of which only a small proportion was denitrified during the period of the experiment. Plant uptake claimed a fraction of the ammonium, determined mainly by the plants requirement for growth rather than the magnitude of the nitrogen supply. A rapid return of ammonium to the water was also found, so that movement of 15N through the wetland mesocosms was comprised of a spiral of uptake and release along the flow path. A two compartment model was found to reasonably represent the isotope progress through the wetlands. First order exchanges and removals were employed in dynamic mass balances on water and solids. It is concluded that interpretation of nitrogen dynamics in wetlands must include the nitrogen spiral through the wetland, as well as plant uptake. This greatly increases the N residence time in treatment wetlands relative to the hydraulic detention time, resulting in long delays of treatment system response to changes in N loading and attenuation of short-term fluctuations in loading.

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343. Non-point source pesticide removal by a mountainous wetland.

Kao, C. M.; Wang, J. Y.; Chen, K. F.; Lee, H. Y.; and Wu, M. J.

Water science and Technology 46(6-7): 199-206. (2002)
NAL Call #: TD420.A1P7; ISSN: 0273-1223.

Notes: Conference: 2nd World Water Congress of the International Water Association: Integrated Water Resources Management, Berlin [Germany], 15-19 Oct 2001

Descriptors: wetlands/ nonpoint pollution sources/ fate of pollutants/ agricultural runoff/ pesticides/ atrazine/ biodegradation/ microbial degradation/ field tests/ data collections/ storm runoff/ pollution (nonpoint sources)/ runoff (agricultural)/ biodegradation/ field studies/ runoff sources and fate of pollution/ water treatment/ water pollution: monitoring, control & remediation

Abstract: Non-point source (NPS) pollution is believed to be one of the major causes of impairment of water bodies. Among NPS pollution, agricultural NPS pollution is considered to be the largest single category resulting in water quality deterioration. Pesticides are some of the most ubiquitous of these agricultural NPS pollutants. In this study, a mountainous wetland was selected to investigate the effects of the natural wetland system on the NPS pesticide (atrazine) removal to maintain the surface water quality. The selected wetland receives water from two unnamed creeks, which drain primarily upgradient agricultural lands. Wetland investigation and monitoring were conducted from November 1999 to March 2001. Major storm events and baseline water quality samples were analyzed. Field results indicate that the wetland was able to remove NPS atrazine flushed from the upgradient agricultural lands after the occurrence of storm events. Laboratory aerobic and anaerobic bioreactor experiments were conducted to evaluate the biodegradation of atrazine under the intrinsic conditions of the wetland system. Microbial enumeration was conducted for a quick screen of bacterial activity in the studied wetland. Results from the study suggest that the methanogenesis process was possibly the dominant biodegradation pattern, and atrazine can be degraded under reductive dechlorinating conditions when sufficient intrinsic organic matter was provided. Results from this study can provide us with further knowledge on pesticide removal mechanisms in natural wetlands and evaluate the role of wetlands in controlling pesticide pollutants from stormwater runoff.

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344. Nutrient removal by a constructed wetland treating subsurface drainage from grazed dairy pasture.

Tanner, C. C.; Nguyen, M. L.; and Sukias, J. P. S.

Agriculture Ecosystems and Environment 105(1-2): 145-162. (2005)

NAL Call #: S601.A34; ISSN: 0167-8809

Descriptors: flow proportional sampling: applied and field techniques/ grazed dairy pasture

Abstract: Nitrogen and phosphorus budgets over two annual periods are presented for an establishing surface-flow constructed wetland treating subsurface drainage from rain-fed, dairy cattle grazed pasture in the North Island of New Zealand. Drainage flows to the wetland (occupying approx 1% of the catchment area) were highly pulsed, associated with rainfall and soil water status, and differed between years (305 and 197 mm drainage). Flow-proportional sampling of inflow and outflow concentrations

were combined with continuous flow records to calculate mass balances for the wetlands. Influent nitrate concentrations were high (median 11 g m⁻³) in both years, but transient loads of organic N were also an important form of N in the first year. Mass removal of total nitrogen (TN) and its main constituent forms nitrate/nitrite and organic N was recorded for all seasons over both annual periods studied. TN mass removal efficiency of 79% (841 g m⁻² per year) in the first year, declined to 21% (40 g m⁻² per year) in the second year, associated with changes in the magnitude, speciation and seasonal pattern of N export from the catchment. Ammoniacal N (NH₄-N), which comprised <0.5% of TN loadings to the wetland, was generated in small amounts during passage through the wetland in both years. Total phosphorus (TP) in the drainage waters occurred at median concentrations of 0.1-0.2 g m⁻³, mainly in dissolved reactive forms (DRP 92% by mass). TP export rose by 101% (5.0 g m⁻² per year) after passage through the wetland in the first year, but decreased by 12% (0.2 g m⁻² per year) in the second year. The results show that constructed wetlands comprising approx 1% of catchment area can markedly reduce N export via pastoral drainage, but may be net sources of NH₄-N, DRP and TP during establishment. Performance of the wetland appeared to be affected by both establishment/maturation factors and year-to-year climatic variations. Longer-term studies, supplemented by process-based laboratory and mesocosm investigations, are required to evaluate sustainable nutrient removal rates over a range of climatic conditions, and identify the key factors regulating performance. Copyright 2004 Elsevier B.V. All rights reserved.

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345. Nutrient removal from aquaculture wastewater using a constructed wetlands system.

Lin, Y.; Jing, S.; Lee, D.; and Wang, T.

Aquaculture 209(1-4): 169-184. (June 2002)

NAL Call #: SH1 .A6; ISSN: 0044-8486

Descriptors: fish culture/ wastewater treatment/ nutrients (mineral)/ nitrogen/ phosphorus/ aquaculture effluents/ water purification/ uptake/ water quality control/ water reuse/ eutrophication/ nutrient removal/ artificial wetlands/ aquaculture/ hydraulic loading/ nitrogen removal/ phosphorus removal/ ammonium/ phosphates/ vegetation/ free water/ storm seepage/ pilot plants/ tin/ receiving waters/ effects of aquaculture on the environment/ effects of aquaculture on the environment/ protective measures and control/ sewage & wastewater treatment/ wastewater treatment processes/ water & wastewater treatment

Abstract: Nutrient removal is essential for aquaculture wastewater treatment to protect receiving waters from eutrophication and for potential reuse of the treated water. A pilot-scale wastewater treatment system consisting of a free water surface (FWS) and a subsurface flow (SSF) constructed wetlands arranged in series was operated for around 8 months. The study was conducted to examine system start-up phenomena and to evaluate system performance in removing inorganic nitrogen and phosphate from aquaculture wastewater under various hydraulic loading rates (1.8 to 13.5 cm day⁻¹). The wetlands system showed rapid start-up behaviors in which process stabilities were achieved in the following sequence: phosphate removal in the SSF without an adaptation period, nitrogen removal in the SSF after 1 month, nitrogen removal in the

FWS after 2 to 3 months, phosphate removal in the FWS after 3 months, and vegetation cover in both wetlands after 7 months of operation. Nitrogen removals were excellent, with efficiencies of 86% to 98% for ammonium nitrogen (NH₄-N) and 95% to 98% for total inorganic nitrogen (TIN). Removal efficiencies were affected little by the hydraulic loading trials. Phosphate removal of 32% to 71% occurred, with the efficiencies being inversely related to hydraulic loading. The FWS wetland removed most inorganic nitrogen, whereas the SSF wetland removed phosphate at a rate equal to or even greater than the FWS. Removal of ammonium and nitrite (effluent concentrations 0.3 mg NH₄-N l⁻¹ and 0.01 mg NO₂-N l⁻¹) were sufficient for recycle in the aquaculture system without danger of harming the fish.
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346. Nutrient removal from piggery effluent using vertical flow constructed wetlands in southern Brazil.

Sezerino, P. H.; Reginatto, V.; Santos, M. A.; Kayser, K.; Kunst, S.; Philippi, L. S.; and Soares, H. M.
Water Science and Technology 48(2): 129-135. (2003)
NAL Call #: TD420.A1P7; ISSN: 0273-1223.
Notes: Conference: 5th International Conference on Waste Stabilisation Ponds: Pond technology for the new millennium, Auckland, New Zealand, 2-5 Apr 2002; Issue editors: Shilton, A. N.; Craggs, R. J.; and Walmsley, N.
Descriptors: biological wastewater treatment/ artificial wetlands/ nutrient removal/ barn wastewater/ pilot plants/ experimental data/ performance evaluation/ piggeries waste waters/ wastewater treatment (biological)/ nutrients/ farm buildings/ agricultural wastewaters/ Brazil, Santa Catarina/ wastewater treatment processes/ industrial effluents/ water & wastewater treatment

Abstract: Santa Catarina State, southern Brazil, has the greatest swine breeding activities of Latin America. Generally, the piggery wastewater is treated in pond systems that are able to remove organic material according to local environmental legislation. However, these systems do not remove nitrogen and phosphorus efficiently. This work deals with a post-treatment system, using vertical flow constructed wetlands. The experiment was conducted in a swine production farm which has 45,000 animals. Although the pond system was able to partially remove the content of nutrients, their concentration in the effluent was high for environmental disposal. A four-bed vertical flow constructed wetland pilot plant, using *Typha* spp., was built. The pilot plant operated for 280 days for beds 2-4 (sand 2). However, the experiments with beds 1-3 (sand 1) were stopped after 111 days of operation, when a reduction in the wastewater drainage was observed. The beds with sand 2 showed a 33% COD removal, and about 49% of nitrification was observed from 111 days until the end of the operation. PO sub(4)-P removal was 45% with a loading rate of around 1.36 g m super(-2) d super(-1).
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347. Organic matter accumulation during maturation of gravel-bed constructed wetlands treating farm dairy wastewaters.

Tanner, C. C.; Sukias, J. P. S.; and Upsdell, M. P.
Water Research 32(10): 3046-3054. (Oct. 1998)
NAL Call #: TD420.W3; ISSN: 0043-1354
Descriptors: artificial wetlands/ accumulation/ retention/ hydraulic loading/ dairy wastes/ density/ plant growth/ gravel/ organic matter/ cores/ agricultural runoff/

wastewater treatment/ artificial lakes/ hydrology/ dairies/ agricultural wastes/ wastewater treatment processes/ prevention and control/ sewage & wastewater treatment
Abstract: The accumulation of organic matter (OM) was investigated after two and five years in a series of four gravel-bed constructed wetlands supplied with different hydraulic loading rates (21, 26, 46 and 72 mm d super(-1)) of farm dairy wastewaters. At these hydraulic loadings, mean wastewater loadings of particulate OM (determined as volatile suspended solids) to the wetlands ranged between similar to 1.7 and 5.8 g m super(-2) d super(-1). Vertical and horizontal gradients of OM accumulation, measured by "loss on ignition", were sampled by stratified coring at 18 sites in each wetland, and their impact on wastewater residence times investigated in three of the wetlands using bromide as a conservative tracer. Mean accumulations of OM in the wetlands after five years operation ranged between 6.8 and 14.9 kg m super(-2), increasing with wastewater loading rate. The annual rates of accumulation during the first two years were 1.2 to 2-fold higher than those in the subsequent three years. Around 50-60% of the OM occurred within the gravel substratum, the remainder forming surface sludges, commonly exceeding 50 mm depth over much of the wetland substratum. OM accumulation in the wetlands considerably exceeded that contributed from applied wastewaters, with wetland plant derived detritus supplying substantial additional quantities of OM. The effective void space of the wetland substrata was markedly reduced in the highest loaded wetland, with mean wastewater retention time reduced to similar to 50% of its theoretical value (corrected for evapotranspiration losses). In contrast, the lowest-loaded wetland exhibited retention times close to theoretical values. There was, however, no direct relationship between OM accumulation and the effective retention times of the wetlands, suggesting other factors, such as differences in OM bulk density, spatial patterns of accumulation and plant root growth, and inorganic accumulations, were also influencing their hydrology.
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348. Organic matter composition, microbial biomass and microbial activity in gravel-bed constructed wetlands treating farm dairy wastewaters.

Nguyen, L. M.
Ecological Engineering 16(2): 199-221. (Nov. 2000)
NAL Call #: TD1.E26; ISSN: 0925-8574
Descriptors: wetlands/ biomass/ farms/ dairies/ waste water/ wastewater treatment/ dairy industry/ microorganisms/ organic matter/ sediments/ respiration/ agricultural wastes/ microbial activity/ humic acids/ *Schoenoplectus tabernaemontani*/ *schoenoplectus tabernaemontani*/ environmental degradation/ non-patents/ sewage & wastewater treatment
Abstract: Organic matter (OM) composition, microbial biomass and microbial activity in a planted (*Schoenoplectus tabernaemontani*), gravel-bed wetland receiving cumulative OM (determined as volatile suspended solids) loadings over 5 years from farm dairy wastewater (8.2 kg OM m super(-2)) and in situ plant residues (8.4 kg OM m super(-2)) were investigated. Organic deposits above and within the gravel stratum (0-100- and 100-400 mm depths) were collected from six sites (with three transverse points per site) along the wetland channel. They were sequentially extracted for labile and stable OM fractions and determined

for total carbon (C), total nitrogen (N), biomass C, biomass N, and microbial activity (respiration rate). Over 90% of the OM accumulated in the wetland was present as stable OM fractions. Humic acid, fulvic acid and humin were the predominant stable OM fractions, accounting for similar to 63-96% of total C in surface deposits and the gravel substratum. The predominance of stable OM fractions in the wetland was attributed to the refractory nature of OM inputs (lignocellulose and humic compounds) from wetland plant litter and the applied dairy wastewater. Clogging of the gravel pore spaces over a 5-year wetland operation was therefore a result of the accumulation of refractory organic solids, originating from plant litter and applied dairy wastewater. Mineral aluminium (Al) and iron (Fe) compounds did not play a major role in OM stabilisation and accumulation in the wetland since organic C associated with Al and Fe accounted for <2% of the total C in surface deposits and the gravel substratum. Humic compounds were at least 2-fold higher in surface deposits and the top 100 mm of the gravel-bed than the lower gravel substratum, suggesting that pore clogging by these compounds was more prominent in the top layer of the gravel-bed. Microbial respiration rate and microbial biomass were significantly (P less than or equal to 0.001) correlated with sediment OM fractions, suggesting that these microbial parameters may be used to predict changes in the labile and stable fractions of OM accumulation in the wetland. Both quantitative assessment of OM content and qualitative determination of labile and stable OM fractions in surface deposits and the gravel substratum are equally important in the understanding of OM accumulation-decomposition and pore clogging in gravel-bed wetlands.

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349. Oxidation of the root zone by aquatic plants growing in gravel-nutrient solution culture.

Steinberg, S. L. and Coonrod, H. S.
Journal of Environmental Quality 23(5): 907-913. (1994)
NAL Call #: QH540.J6; ISSN: 0047-2425.

Notes: Conference: Symposium on Wetland Processes and Water Quality, Minneapolis, MN (USA), 3-4 Nov 1992

Descriptors: wetlands/ aquatic plants/ nutrients/ chemical reactions/ oxygen/ oxidation/ wastewater treatment/ roots/ redox reactions/ waste disposal sites/ redox potential/ wastewater aquaculture/ *Juncus alpinus*/ *Phalaris arundinacea*/ *Typha latifolia*/ redox potential/ waste disposal sites/ wastewater aquaculture/ root zone/ roots/ redox reactions/ nutrients/ chemical processes/ freshwater pollution/ methods and instruments/ plant culture

Abstract: The root zone oxidation state was monitored over a period of 87 d for alpine rush (*Juncus alpinus* Vill.), canarygrass (*Phalaris arundinacea* L.), and cattail (*Typha latifolia* L.) growing in gravel-nutrient solution culture. The dissolved oxygen concentration in the root zone of cattail and canarygrass was less than or equal to 1 mg/L, whereas in alpine rush it ranged from 0 to 2 mg/L. All planted treatments consistently had a dissolved oxygen concentration 1 to 2 mg/L lower than gravel without plants. Redox potentials in the root zone of alpine rush were normally between 400 and 700 mV, indicating an aerobic root zone. The root zone of cattail also tended to be aerobic, although redox potentials of < 400 mV were obtained 40% of the time. Canarygrass had the most reduced root zone with 85% of the redox potential measurements < 400 mV. Dissolved oxygen concentrations

and redox potentials in the root zone did not change significantly on a diurnal basis for any of the plant species. The results show that there was a plant species effect on the oxidation state of the root zone as measured by dissolved oxygen and redox potential.

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350. Performance of a constructed wetland treating intensive shrimp aquaculture wastewater under high hydraulic loading rate.

Lin, Y. F.; Jing, S. R.; Lee, D. Y.; Chang, Y. F.; Chen, Y. M.; and Shih, K. C.

Environmental Pollution 134(3): 411-421. (Apr. 2005)
NAL Call #: QH545.A1E52; ISSN: 0269-7491

Descriptors: artificial wetlands/ economics/ feasibility studies/ water quality control/ aquaculture effluents/ wastewater treatment/ hydraulics/ biochemical oxygen demand/ ammonia/ nitrites/ prawn culture/ intensive culture/ water management/ environmental impact/ suspended particulate matter/ recirculating systems/ water pollution treatment/ nitrogen compounds/ aquaculture economics/ feasibility/ culture effects/ Crustacea/ sewage & wastewater treatment/ effects of aquaculture on the environment/ effects of aquaculture on the environment/ protective measures and control/ water & wastewater treatment

Abstract: A water treatment unit, mainly consisting of free water surface (FWS) and subsurface flow (SF) constructed wetland cells, was integrated into a commercial-scale recirculating aquaculture system for intensive shrimp culture. This study investigated performance of the treatment wetlands for controlling water quality. The results showed that the FWS-SF cells effectively removed total suspended solids (55-66%), 5-day biochemical oxygen demand (37-54%), total ammonia (64-66%) and nitrite (83-94%) from the recirculating water under high hydraulic loading rates (1.57-1.95 m/day). This led to a water quality that was suitable for shrimp culture and effluent that always satisfied the discharge standards. The area ratios of wetlands to culture tank being demonstrated (0.43) and calculated (0.096) in this study were both significantly lower than the reported values. Accordingly, a constructed wetland was technically and economically feasible for managing water quality of an intensive aquaculture system.

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351. Phosphorus adsorption characteristics of a constructed wetland soil receiving dairy farm wastewater.

Jamieson, T. S.; Stratton, G. W.; Gordon, R.; and Madani, A.

Canadian Journal of Soil Science 82(1): 97-104. (2002)
NAL Call #: 56.8 C162; ISSN: 0008-4271.

Notes: Original Title: Adsorption du phosphore par une terre humide artificielle recevant les eaux usées d'une exploitation laitière

Descriptors: wetlands/ phosphorus removal/ adsorption/ dairy wastes/ wastewater disposal/ regression analysis/ farm wastes/ dairies/ agricultural wastes/ Canada, Nova Scotia/ wastewater treatment processes/ land pollution/ water & wastewater treatment

Abstract: Adsorption to soil has been identified as a key wastewater P removal mechanism in treatment wetlands. Batch incubation experiments were performed to measure the capacity of a constructed dairy farm wetland in Pictou County, Nova Scotia, to remove P from solution. The

constructed wetland had been receiving wastewater since 1996. Non-linear regression analysis was performed using the Langmuir adsorption model to describe the P adsorption characteristics for the wetland soil under study. The Langmuir model was adequate in describing the P adsorption characteristics of the system studied. The P adsorption maxima found were approximately 925, 924, and 1600 mg P kg super(-1) soil, for the deep zone soil, shallow zone soil, and a background soil (not receiving wastewater), respectively. The P adsorption maxima for the deep zone and shallow zone soils were not significantly different ($P > 0.05$) from one another, but were significantly lower ($P < 0.05$) than the background soil. These data, together with information on wastewater inflow and P loading, were used to predict a lifespan of 8 yr for this wetland, relative to P removal.

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352. Phosphorus biogeochemistry of wetlands in agricultural watersheds.

Dunne, E. J. and Reddy, K. R.

In: Nutrient management in agricultural watersheds: A wetlands solution/ Dunne, E. J.; Reddy, K. R.; and Carton, O. T.

Wageningen, Netherlands: Wageningen Academic Publishers, 2005; pp. 105-119.

Notes: International symposium on Nutrient Management in Agricultural Watersheds: A Wetlands Solution, Wexford, Ireland; ISBN: 9076998612

Descriptors: wetlands/ absorption/ acid soils/ adsorption/ agriculture/ alkaline soils/ aluminium/ artificial wetlands/ bioavailability/ biogeochemistry/ calcium/ chemical precipitation/ desorption/ eutrophication/ inorganic phosphorus/ iron/ nutrient content/ nutrients/ phosphate/ phosphorus/ retention/ reviews/ river water/ sediment/ soil types/ soil water/ solubility/ sorption/ sorption isotherms/ streams/ transport processes/ water pollution/ water quality/ watersheds/ wetland soils

Abstract: Within agricultural watersheds, wetlands are located at the interface between terrestrial uplands and truly aquatic systems. Therefore, the processes occurring within wetland systems affect down stream water quality as water and associated nutrients such as phosphorus (P) are typically transported from upland areas to aquatic systems. This review will describe some of the common forms of P found in wetland soils/sediments and the processes responsible for P transformation and translocation. Phosphorus forms that enter a wetland are typically grouped into: (i) dissolved inorganic P; (ii) dissolved organic P; (iii) particulate inorganic P; and particulate organic P. Calcium (Ca) compounds determine the availability of inorganic P in alkaline soils while, in acidic soils iron (Fe) and aluminium (Al) controls P solubility. Inorganic P has four main fractions of decreasing bioavailability (viz., exchangeable P, Fe and Al bound P, Ca and Mg bound P, and residual P). Phosphorus sorption is one of the main processes involved in inorganic P biogeochemistry in wetland soils/sediments. Sorption is controlled by the concentration of phosphate in soil porewater and solid phases. Maximum sorption capacity of a soil can be determined using empirical models. Typically, soils only sorb P when added P in solution has a higher concentration than soil porewater. Phosphorus precipitation involves the reaction of phosphate ions with metallic cations forming solid precipitate. Inorganic P forms dominate the

bioavailable fractions, whereas organic P fractions typically dominate the total P content of wetland soils/sediments. Organic P compounds can also be fractionated in decreasing order of bioavailability. At the wetland ecosystem-scale processes involved in long term P retention include: sorption on wetland substrates and the accumulation and subsequent accretion of new soil/sediment material.

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353. Phosphorus removal from trout farm effluents by constructed wetlands.

Comeau, Y.; Brisson, J.; Reville, J. P.; Forget, C.; and Drizo, A.

Water Science and Technology 44(11-12): 55-60. (2001) NAL Call #: TD420.A1P7; ISSN: 0273-1223.

Notes: Conference: 7th International Conference on Wetland Systems for Water Pollution Control 2000, Lake Buena Vista, FL [USA], 11-16 Nov 2000; Issue editors: Kadlec, R. H. and Reddy, K. R.; ISBN: 1843394073

Descriptors: wastewater treatment/ fish farming/ stage treatment/ filtration/ screens/ artificial wetlands/ suspended solids/ phosphorus removal/ performance evaluation/ feasibility studies/ phosphorus/ aquaculture effluents/ pollution control/ water quality control/ fish culture/ fish farming/ screens and screening/ freshwater fish/ limestone/ effluent treatment/ macrophytes/ Salmonidae/ Phragmites australis/ salmonids/ wastewater treatment processes/ effects of aquaculture on the environment/ effects of aquaculture on the environment/ prevention and control/ underground services and water use/ sewage & wastewater treatment/ water & wastewater treatment

Abstract: Freshwater trout farms need a high and continuous clean water flow to keep fish exposed to a non-toxic ammonium concentration. As a result, the concentration of effluents from these farms are even below standard effluent criteria for municipal wastewater effluent for solids, nitrogen and phosphorus. Nevertheless, the mass of pollutants discharged, originating mostly from excreta and undigested fish food, must be reduced by simple and economical treatment processes. We designed and operated a three-stage system aimed at retaining solids by a 60 µm nylon rotating microscreen followed by treatment with a phosphorus-retaining constructed wetland system. Washwater from the microscreen was pumped to a series of two horizontal flow beds of 100 m super(3) each (0.6 m deep). Coarse (2 mm) and finer (< 2 mm) crushed limestone were used in each bed, respectively, with the first one being planted with reeds (*Phragmites australis*) and the second one designed to remove even more phosphorus by adsorption and precipitation. Preliminary results indicated that the microscreen captured about 60% of the suspended solids and that greater than 95% of the suspended solids and greater than 80% of the total phosphorus mass loads were retained by the beds. The potential of constructed wetlands as an ecologically attractive and economical method for treating fish farm effluents to reduce solids and phosphorus discharge appears promising.

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354. Phosphorus removal in emergent free surface wetlands.

Kadlec, R. H.

Journal of Environmental Science and Health, Part A Toxic/Hazardous Substances and Environmental Engineering 40(6-7): 1293-1306. (2005)

NAL Call #: TD172.J6; ISSN: 1093-4529

Descriptors: wetlands/ agricultural runoff/ phosphorus/ surface flow/ treatment/ wastewater

Abstract: Constructed and natural wetlands are capable of absorbing new phosphorus loadings, and, in appropriate circumstances, can provide a low-cost alternative to chemical and biological treatment. Phosphorus interacts strongly with wetland soils and biota, which provide both short-term and sustainable long-term storage of this nutrient. Soil sorption may provide initial removal, but this partly reversible storage eventually becomes saturated. Uptake by biota, including bacteria, algae, and duckweed, as well as macrophytes, forms an initial removal mechanism. Cycling through growth, death, and decomposition returns most of the biotic uptake, but an important residual contributes to long term accretion in newly formed sediments and soils. Despite the apparent complexity of these several removal mechanisms, data analysis shows that relatively simple equations can describe the sustainable processes. Previous global first order removal rates characterize the sustainable removal, but do not incorporate any biotic features. This article reviews the relevant processes and summarizes quantitative data on wetland phosphorus removal. Copyright © Taylor & Francis Inc.

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355. Phytoremediation of toxic trace elements in soil and water.

LeDuc, D. L. and Terry, N.

Journal of Industrial Microbiology and Biotechnology 32(11-12): 514-520. (2005)

NAL Call #: QR53 .J68; ISSN: 1367-5435

Descriptors: constructed wetlands/ hyperaccumulators/ phytoremediation/ phytovolatilization/ selenium

Abstract: Toxic heavy metals and metalloids, such as cadmium, lead, mercury, arsenic, and selenium, are constantly released into the environment. There is an urgent need to develop low-cost, effective, and sustainable methods for their removal or detoxification. Plant-based approaches, such as phytoremediation, are relatively inexpensive since they are performed in situ and are solar-driven. In this review, we discuss specific advances in plant-based approaches for the remediation of contaminated water and soil. Dilute concentrations of trace element contaminants can be removed from large volumes of wastewater by constructed wetlands. We discuss the potential of constructed wetlands for use in remediating agricultural drainage water and industrial effluent, as well as concerns over their potential ecotoxicity. In upland ecosystems, plants may be used to accumulate metals/metalloids in their harvestable biomass (phytoextraction). Plants can also convert and release certain metals/metalloids in a volatile form (phytovolatilization). We discuss how genetic engineering has been used to develop plants with enhanced efficiencies for phytoextraction and phytovolatilization. For example, metal-hyperaccumulating plants and microbes with unique abilities to tolerate, accumulate, and detoxify metals and

metalloids represent an important reservoir of unique genes that could be transferred to fast-growing plant species for enhanced phytoremediation. There is also a need to develop new strategies to improve the acceptability of using genetically engineered plants for phytoremediation. © Society for Industrial Microbiology 2005. © 2006 Elsevier B.V. All rights reserved.

356. Plant community succession in a coastal wetland after abandonment of cultivation: The example of the Rhone Delta.

Mesleard, F.; Grillas, P.; and Lepart, J.

Vegetatio 94(1): 35-45. (1991)

NAL Call #: 450 V52; ISSN: 0042-3106

Descriptors: wetlands/ species richness/ environmental factors/ old fields/ coastal environments/ agriculture/ salinity effects/ ecological succession/ plant populations/ France, Camargue/ succession/ ecological succession/ plant populations/ Med, France, Camargue/ species richness/ old fields/ coastal environments/ coastal ecosystems/ habitat community studies

Abstract: A synchronous study was carried out of plant succession in land abandoned after cultivation in the Camargue (southern France) in relation to the main biotic and abiotic environmental factors. Correlations between environmental factors and species abundance were established using Canonical correspondence analysis. The most strongly correlated variables were those of the water regime. Abandonment of cultivation does not always imply abandonment of management, but a change in land use. Water level management (flooding in winter, or in summer, irrigation) creates and maintains communities suitable for grazing. In the absence of water level management, the soils become saline and stable plant communities similar to those present under natural conditions quickly develop. The salt generally limits the installation of woody plants; only *Phillyrea angustifolia* can develop and then only when the water table is quite deep. It appears that the forest stage can only be reached in the proximity of riverine gallery forest and irrigation canals where *Populus alba* is dominant. © CSA

357. Plant succession and greentree reservoir management: Implications for management and restoration of bottomland hardwood wetlands.

King, S. L. and Allen, J. A.

Wetlands 16(4): 503-511. (1996)

Descriptors: wetlands/ ecological succession/ resource management/ reclamation/ flood plains/ habitat improvement/ flooding/ forests/ water management/ environmental restoration/ hydrological regime/ hardwood/ waterfowl/ habitats/ USA/ bottomland hardwood forests/ environmental restoration/ hydrological regime/ hardwood/ waterfowl/ habitats/ ecological succession/ reclamation/ habitat improvement/ resource management

Abstract: Bottomland hardwood forests are distributed along rivers and streams throughout the central and eastern United States, with the greatest concentration in the Southeast. Past and projected losses of bottomland hardwoods and degradation of remaining stands suggest that habitat management and/or restoration strategies that target multiple species and multiple uses will be necessary to maintain, enhance, and restore flora and fauna within bottomland hardwood wetlands. A greentree reservoir is a current management strategy that entails manipulating

water regimes to provide habitat for wintering waterfowl. We conducted a literature review and synthesis to determine the potential impacts of greentree reservoir management on plant succession within bottomland hardwood wetlands. Greentree reservoirs can impact vegetation establishment through several processes. Despite shortcomings of greentree reservoirs, designs similar to them could be very beneficial in restoring bottomland hardwood plant and animal communities from degraded forests provided water-level control and maintenance are substantially improved. Emulation of natural hydrologic regimes, including natural variability, could produce diverse bottomland hardwood plant communities and provide habitat for a variety of wildlife species.

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358. The potential use of constructed wetlands in a recirculating aquaculture system for shrimp culture.

Lin, Y. F.; Jing, S. R.; and Lee, D. Y.

Environmental Pollution 123(1): 107-113. (2003)

Descriptors: aquaculture effluents/ effluent treatment/ wastewater treatment/ water quality/ physicochemical properties/ fisheries/ artificial wetlands/ shrimp culture/ aquaculture systems/ recirculating systems/ water quality control/ culture media/ aquaculture techniques/ *Litopenaeus vannamei*/ Taiwan/ whiteleg shrimp/ constructed wetlands/ sewage & wastewater treatment/ methods and instruments/ aquaculture/ shellfish culture/ shellfish culture/ water & wastewater treatment

Abstract: A pilot-scale constructed wetland unit, consisting of free water surface (FWS) and subsurface flow (SF) constructed wetlands arranged in series, was integrated into an outdoor recirculating aquaculture system (RAS) for culturing Pacific white shrimp (*Litopenaeus vannamei*). This study evaluated the performance of the wetland unit in treating the recirculating wastewater and examined the effect of improvement in water quality of the culture tank on the growth and survival of shrimp postlarvae. During an 80-day culture period, the wetland unit operated at a mean hydraulic loading rate of 0.3 m/day and effectively reduced the influent concentrations of 5-day biochemical oxygen demand (BOD sub(5), 24%), suspended solids (SS, 71%), chlorophyll a (chl-a, 88%), total ammonium (TAN, 57%), nitrite nitrogen (NO sub(2)-N, 90%) and nitrate nitrogen (NO sub(3)-N, 68%). Phosphate (PO sub(4)-P) reduction was the least efficient (5.4%). The concentrations of SS, Chl-a, turbidity and NO sub(3)-N in the culture tank water in RAS were significantly ($P \leq 0.05$) lower than those in a control aquaculture system (CAS) that simulated static pond culture without wetland treatment. However, no significant difference ($P \leq 0.05$) in BOD sub(5), TAN and NO sub(2)-N was found between the two systems. At the end of the study, the harvest results showed that shrimp weight and survival rate in the RAS (3.8±1.8 g/shrimp and 90%) significantly ($P \leq 0.01$) exceeded those in the CAS (2.3±1.5 g/shrimp and 71%). This study concludes that constructed wetlands can improve the water quality and provide a good culture environment, consequently increasing the shrimp growth and survival without water exchange, in a recirculating system. Constructed wetlands improved water qualities and consequently increased the shrimp growth and survival in a recirculating system.

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359. A proposed methodology for measuring incremental environmental benefits from using constructed wetlands to control agricultural non-point-source pollution.

Macdonald, H. F.; Bergstrom, J. C.; and Houston, J. E.

Journal of Environmental Management 54(4): 259-267.

(Dec. 1998)

NAL Call #: HC75.E5J6; ISSN: 0301-4797

Descriptors: water quality control/ pollution control/ wastewater treatment/ agricultural pollution/ agricultural runoff/ environment management/ water pollution treatment/ nonpoint pollution sources/ water pollution prevention/ environmental quality/ artificial wetlands/ benefits/ cultivated lands/ prevention and control/ water quality control

Abstract: A binary response estimation procedure using contingent valuation data is proposed for estimating the incremental environmental benefits associated with the use of constructed wetlands to control agricultural waste-water runoff. The model uses two binary responses per individual while circumventing the non-independence problems associated with follow-up valuation questions. Case study results suggest that the methodology provides a potentially effective means for measuring the non-market benefits of constructed wetlands in addition to water-quality maintenance.

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360. Quantification of P-flux through shallow, agricultural and natural waters as found in wetlands of the Camargue (S. France).

Golterman, H. L.

Hydrobiologia 392(1): 29-39. (1999)

NAL Call #: 410 H992; ISSN: 0018-8158.

Notes: Special Issue: "Sediment-Water Interaction 9".

Descriptors: wetlands/ phosphates/ pollution dispersion/ agricultural pollution/ hydrology/ path of pollutants/ agricultural runoff/ chemical reactions/ rice fields/ agriculture/ fertilizers/ marshes/ irrigation/ aquatic environment/ France, Camargue/ France, Etang de Vaccares/ France/ characteristics, behavior and fate/ sources and fate of pollution/ freshwater pollution

Abstract: The flux of phosphate in the aquatic ecosystems of the Camargue was modelled. The model developed for the hydrological unit, the water basin of the Aube de Bouic, is based on the hydrology of the system, the reaction equations of the adsorption of phosphate onto Fe(OOH) and the solubility product of apatite. The water basin consists of an inlet canal, the Aube de Bouic, ricefields and natural marshes, plus a drainage canal through which the excess water is pumped into the Etang de Vaccares. Phosphate is introduced into ricefields either with the irrigation water, taken from the Rhone, or as fertiliser. Most of the phosphate will be fixed on the ricefield soils either as iron-bound or as calcium-bound phosphate, depending on the pH. The o-phosphate concentration will slowly increase to an extent depending on the pH. From the ricefields water will flow towards the Etang de Vaccares; the amount of phosphate reaching the Etang de Vaccares depends on the pH of the system and the depth of the water outlet of the ricefields. In six different scenarios the amount of phosphate reaching the Etang de Vaccares is calculated depending on the quantity of fertiliser, the depth of the water outlet and the pH. For the Etang de Vaccares the model predicts the present concentration of o-P relatively

well and shows that the loading is considerable. This should cause concern; the danger of serious eutrophication is real. Part of the irrigation water is used to refill or keep under water the natural marshes in this hydrological unit, which without irrigation would dry out during summer. Again high P-concentrations are found in the marshes, but mostly in the form of Fe(OOH) approximately P or CaCO₃ approximately P, the ratio of which depends again on the pH of the sediments. The o-P concentration has remained low up to now.

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361. Removal of dimethyl disulfide and p-cresol from swine facility wastewater using constructed subsurface-flow wetlands.

Wood, S. L.; Wheeler, E. F.; and Berghage, R. D. *Transactions of the ASAE* 43(4): 973-979. (2000)
NAL Call #: 290.9 Am32T; ISSN: 0001-2351

Descriptors: odor control/ wastewater treatment/ pollution control/ pig manure/ constructed wetlands

Abstract: Anecdotal evidence suggests that constructed wetlands can remove odors from veal, dairy, and swine wastes (Murphy and George, 1997; McCaskey, 1995). However, the use of constructed wetlands as an odor control treatment will be more successful after malodor reduction in wetland systems has been quantified. This study quantified odor removal from swine facility wastewater (feces, urine, and flushwater) in constructed subsurface-flow wetlands. Four wetlands planted with wetland grasses and four unplanted wetlands received swine facility waste. The relationship between wetland treatments (planted vs unplanted) and reductions of malodorous dimethyl disulfide and p-cresol in wastewater were examined. Reductions in odor intensity and offensiveness as perceived by a human sensory panel were also studied. Gas chromatography analysis indicated that planted wetlands removed 80 and 83% of dimethyl disulfide (DMDS) and p-cresol, respectively. Unplanted wetlands removed 52 and 64% of dimethyl disulfide and p-cresol, respectively. The reductions in DMDS and p-cresol did not differ significantly ($p > 0.05$) between the two treatments. A human sensory panel, using the cloth swatch technique, assigned a median odor intensity and offensiveness rating of 4 (identifiable odor-offensive, but tolerable) to untreated swine facility wastewater. Median odor ratings for both planted and unplanted effluent were 1 (faint odor-nonidentifiable, not offensive). These median odor ratings were significantly ($p < 0.05$) lower than the median odor rating for untreated wastewater, indicating that constructed wetlands were effective in removing malodor from swine facility wastewater.

This citation is from AGRICOLA.

362. Removal of enteric bacteria in constructed treatment wetlands with emergent macrophytes: A review.

Vymazal, J.

Journal of Environmental Science and Health, Part A: Toxic/Hazardous Substances & Environmental Engineering 40(6-7): 1355-1367. (2005)

NAL Call #: TD172.J6; ISSN: 1093-4529

Descriptors: wastewater/ bacterial/ artificial wetlands/ macrophytes/ fecal coliforms/ hydraulics/ vegetation/ public health/ reviews/ environmental health/ environmental engineering/ biofiltration/ wastewater treatment/

microorganisms/ waste water/ colony-forming cells/ pollution/ sewage/ biofilters/ coliforms/ hydraulic loading/ pathogenic organism/ indicators/ enteric bacteria/ risk/ Escherichia coli/ water pollution sources/ catchment areas/ surveys/ domestic wastes/ sewage and wastewater treatment/ other water systems/ wastewater treatment processes/ sewage/ water and wastewater treatment

Abstract: Domestic and municipal sewage contains various pathogenic or potentially pathogenic microorganisms which, depending on species concentration, pose a potential risk to human health and whose presence must therefore be reduced in the course of wastewater treatment. The removal of microbiological pollution is seldom a primary target for constructed treatment wetlands (CWs). However, wetlands are known to act as excellent biofilters through a complex of physical, chemical and biological factors which all participate in the reduction of the number of bacteria. Measurement of human pathogenic organisms in untreated and treated wastewater is expensive and technically challenging. Consequently, environmental engineers have sought indicator organisms that are (1) easy to monitor and (2) correlate with population of pathogenic organisms. The most frequently used indicators are total coliforms, fecal coliforms, fecal streptococci and Escherichia coli. The literature survey of 60 constructed wetlands with emergent vegetation around the world revealed that removal of total and fecal coliforms in constructed wetlands with emergent macrophytes is high, usually 95 to >99% while removal of fecal streptococci is lower, usually 80-95%. Because bacterial removal efficiency is a function of inflow bacteria number, the high removal effects are achieved for untreated or mechanically pretreated wastewater. Therefore, the outflow numbers of bacteria are more important. For TC and FC the outflow concentrations are usually in the range of 10² to 10⁵ CFU/ 100 ml while for FS the range is between 10² and 10⁴ CFU/ 100 ml. Results from operating systems suggest that enteric microbe removal efficiency in CWs with emergent macrophytes is primarily influenced by hydraulic loading rate (HLR) and the resultant hydraulic residence time (HRT) and the presence of vegetation. Removal of enteric bacteria follows approximately a first-order relationship.

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363. Removal of solids and oxygen demand from aquaculture wastewater with a constructed wetland system in the start-up phase.

Lin, Y. F.; Jing, S. R.; and Lee, D. Y.

Water Environment Research 74(2)(Mar. 2002-Apr. 2002)

NAL Call #: TD419.R47; ISSN: 1061-4303

Descriptors: wastewater treatment/ aquaculture/ artificial wetlands/ performance evaluation/ suspended solids/ algae/ chemical oxygen demand/ hydraulic loading/ water pollution treatment/ aquaculture effluents/ suspended particulate matter/ ground water/ surface water/ aquatic plants/ pollution control/ hydrology/ biodegradation/ performance assessment/ wastewater treatment processes/ protective measures and control/ effects of aquaculture on the environment/ effects of aquaculture on the environment/ industrial effluents/ sewage & wastewater treatment/ water & wastewater treatment

Abstract: A pilot-scale, constructed wetland system consisting of a free water surface (FWS) and a subsurface flow (SF) wetland operated in series was set up for treating

aquaculture farm wastewater. This study examined the system start-up phenomena and evaluated its performance in removing suspended solids, algae, and chemical oxygen demand (COD) under various hydraulic loading rates (1.8 to 13.5 cm/d). The SF wetland achieved stable effluent qualities without an adaptation period, while the FWS wetland required approximately 5 months to reach consistent removal levels for suspended solids and algae. Macrophyte density was a critical factor affecting the reduction of suspended solids and chlorophyll for the FWS wetland, but not for the SF wetland. Suspended solids removals in both of the wetlands and the combined system (47 to 86%) decreased significantly as the hydraulic loading rate increased, strongly following the first-order mass-decrease equation. Phytoplankton solids (biomass and detritus) were a primary source of suspended solids in the aquaculture wastewater. Both chlorophyll reduction (76 to 95%) and COD removal (25 to 55%) in the constructed wetland system were apparently not affected by hydraulic loading. While algae died out because of limited sunlight in both wetlands, algae detritus probably still contributed fine particles that were difficult to remove from the water by either filtering or settling out. Removed suspended solids did not result in the increase of COD and nutrients, indicating that further solids stabilization occurred in the wetland system.

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364. Restoration experiments in middle European wet terrestrial ecosystems: An overview.

Pfadenhauer, J. and Kloetzli, F.

Plant Ecology 126(1-4): 101-115. (Sept. 1996)

NAL Call #: QK900.P63; ISSN: 0042-3106.

Notes: Conference: 6th International Congress of Ecology, Manchester (UK), Aug 1994

Descriptors: wetlands/ peat/ agriculture/ man-induced effects/ ecosystem management/ nature conservation/ restoration/ environmental effects/ flooding/ drainage/ Europe/ fens/ water retention/ environmental/ drainage/ man-induced effects/ ecosystem management/ nature conservation/ restoration/ habitat community studies/ protective measures and control/ reclamation/ effects on water of human nonwater activities

Abstract: Most wetlands in the central European lowlands have been severely altered by cultivation. As a consequence they no longer fulfil their function as habitats for specialised species and communities, nor as retention areas for water and solid materials. Therefore, a number of renaturation experiments are in progress, which intend to develop and test strategies and measures to improve this defect in landscape diversity. For this purpose experiments on re-wetting, nutrient depletion of eutrophicated areas and re-establishment of typical wetland plant species and phytocoenoses have been performed. An ecological development concept defining the aims and describing their feasibility precedes such experiments. Preliminary results indicate that the reconstruction of the former state (regeneration) is impossible within reasonable time spans. In drained raised bogs overgrown with heather, as well as in those which have been industrially exploited, the primary aim must always be to restore efficient peat formation as far as possible; as a rule one succeeds only with well-growing and nutrient-demanding fen and transitional bog species. In cultivated fens the aim is to reduce peat loss. As a first step this is accomplished by converting arable fields and sown

meadows into permanent grassland, if possible with reduced fertilization and low mowing or grazing frequencies, and accompanied by rewetting during winter. Many experiments have sought to impoverish eutrophicated fen soils and introduce typical fen species by sowing or planting, so well tested techniques are available. However, the total prevention of peat loss is only possible by permanent rewetting throughout the year, so that peat accumulation can start again. Only in this way could fens regain their former function as sinks in landscape processes.

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365. Restoration of a Canadian prairie wetland with agricultural and municipal wastewater.

White, J. S.

Environmental Management 24(1): 25-37. (1999)

NAL Call #: HC79.E5E5; ISSN: 0364-152X

Descriptors: wetlands/ environmental restoration/ prairies/ habitat/ species richness/ waste water/ municipal wastewater/ food processing industry/ land application/ land management/ land reclamation/ land disposal/ wildlife management/ birds/ water management/ habitat improvement/ waste utilization/ aquatic birds/ vegetation cover/ ecosystem management/ wildlife conservation/ marshes/ wastewater treatment/ Canada, Alberta

Abstract: A rapid development and approval process was employed by Ducks Unlimited Canada and other stakeholders to restore a 1246-ha (3079-acre) northern prairie wetland in southern Alberta, Canada, with 3640 m super(3)/day (800,000 US gallons) of municipal wastewater and beef processing wastewater. A large nongovernmental organization hastened restoration with a development process that outlined restoration goals and management objectives to satisfy a dual mandate of wastewater treatment and wildlife habitat creation. In 1995, after five years of wastewater additions, the basins had been refilled and the surrounding uplands had been acquired and restored. The Frank Lake Conservation Area currently provides high-quality habitat for a variety of wildlife in a region where many of the native plants and animals species have been lost due to habitat loss and fragmentation. The success of upland and water management strategies is reflected in the increase of target species' abundance and richness: 50 shorebird species, 44 waterfowl species, 15 raptor species, and 28 other new bird species have returned to the marsh since restoration. As well, significant N and P reduction occurs as waters flow through the first basin of the marsh. The management strategies of this project that satisfied a dual mandate serve as a model to guide managers of other large-scale wetland restoration projects.

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366. Restoration of Botshol (The Netherlands) by reduction of external load: Problem analyses and restoration methods.

Van Iersel, P. B. W. and Rip, W. J.

Hydrobiological Bulletin 25(3): 265-273. (1992)

NAL Call #: QH90.A1H9; ISSN: 0165-1404

Descriptors: wetlands/ botshol/ eutrophication/ lake restoration/ nutrient removal/ The Netherlands/ water pollution control/ water quality management/ agricultural drainage/ algal growth/ nutrients/ phosphorus

Abstract: Since 1960 the water quality of the Botshol

nature reserve in The Netherlands has been deteriorating due to an increase in the nutrient load that has caused increases in algal growth. The source of the nutrients is believed to be nutrient-rich agricultural water that flows into the area and the Nellestein polder which contains meadows, marshland, reedland, hayfields and roughlands, and open water. Interdisciplinary research has been conducted from 1980 to 1985 in order to analyze the causes of the changes. An integrated restoration plan was developed to reduce the eutrophication. In 1989 the plan was implemented: (1) agricultural areas were isolated from the reserve area; and (2) the inlet water was dephosphorized. These restoration measures resulted in a reduction of the external load from 0.6 to 0.1 g P/sq m/y. (Author's abstract)

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367. Restored wetlands as filters to remove nitrogen.

Romero, J. A.; Comin, F. A.; and Garcia, C.

Chemosphere 39(2): 323-332. (1999)

NAL Call #: TD172.C54; ISSN: 0045-6535.

Notes: Conference: XIII International Symposium on Environmental Biogeochemistry -- Matter and energy fluxes in the anthropocentric environment, Monopoli (Italy), 21-26 Sep 1997; Issue editors: Sensesi, N.; Rice, J. A.; and Miano, T. M.

Descriptors: wetlands/ filtration/ agricultural runoff/ nitrogen removal/ Spain, Ebro Delta/ water quality/ retention/ macrophytes/ bioaccumulation/ kinetics/ recycling/ rice/ filters/ water quality control/ biofilters/ nitrogen/ aquatic plants/ agricultural pollution/ land use/ rice fields/ sediment chemistry/ restoration/ nitrogen cycle/ *Typha latifolia*/ *Scirpus lacustris*/ *Phragmites australis*/ Spain, Cataluna, Tarragona, Ebro Delta/ nitrogen removal/ freshwater pollution/ water quality control/ protective measures and control

Abstract: Four wetlands established in abandoned ricefields and dominated by *Phragmites australis*, *Typha latifolia* and *Scirpus lacustris* were used to improve the quality of agricultural runoff in the Ebro Delta (NE Spain) in 1993, 1994 and 1995. The wetlands were continuously flooded with water from a ricefield irrigation network during the growing season and received water with between 5 and 200 mg N m^{super(-2)} d^{super(-1)} in the form of dissolved inorganic nitrogen (DIN), between 0 and 67 mg N m^{super(-2)} d^{super(-1)} in the form of dissolved organic nitrogen (DON) and between 1.2 and 225 mg m^{super(-2)} d^{super(-1)} in the form of particulate nitrogen (PN). Surface N outflows contained between 0 and 12 mg N m^{super(-2)} d^{super(-1)} of DIN, between 1 and 86 mg N m^{super(-2)} d^{super(-1)} of DON and between 1 and 40 mg m^{super(-2)} d^{super(-1)} of PN. The nitrogen retention efficiency was always positive 100% of the input, except for DON and PN at low inlet loadings. The emergent macrophytes accumulated between 20 and 100 mg N m^{super(-2)} d^{super(-1)}, which accounted for between 66 and 100% of the inflowing DIN. The removal rate constants calculated according to first-order plug-flow kinetics, were between 0.003-0.09 m day^{super(-1)} for total nitrogen, and 0.005-0.3 m day^{super(-1)} for DIN. Plant uptake, detritus accumulation and decomposition, and nitrogen recycling in the sediment are the major processes which could explain nitrogen retention in the wetlands. Wetlands restored from ricefields act as highly efficient water polishing filters for

agricultural runoff and, at the same time, can contribute to the habitat biodiversity of large areas where rice is cultivated extensively.

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368. Rice fields as temporary wetlands: A review.

Lawler, S. P.

Israel Journal of Zoology 47(4): 513-528. (2001)

NAL Call #: 410 IS7; ISSN: 0021-2210

Descriptors: wetlands/ animal ecology/ aquatic communities/ biodiversity/ biological control/ chemical control/ freshwater ecology/ habitats/ irrigation/ pest control/ pesticides/ plant pests/ ponds/ population dynamics/ predators/ rice/ species diversity/ species richness/ water management

Abstract: Rice fields are temporary wetlands that harbor many of the same species that breed in natural temporary ponds. Therefore the rice agroecosystem has the potential to help sustain the regional biodiversity of many invertebrates and vertebrates. Like natural areas of wetlands, rice cultivation provides a habitat mosaic of temporary and more permanent waters. Because of their low floral diversity and because their species composition will rarely overlap completely with that of natural ponds, rice fields are not substitutes for natural temporary ponds. However, they are important in sustaining populations of several species, including wading birds and frogs. Farming methods vary widely, and different practices can alter the suitability of rice fields as habitats. Farmers use water management, pesticides, and sometimes fish to control crop pests and mosquitoes, and other taxa may be affected as well. Farmers may irrigate rice intermittently to control pests, and intermittent habitat holds fewer species than areas that are flooded for longer periods. Broad-spectrum pesticides may harm invertebrates and other wildlife, and may even cause pest resurgences if they have greater effects on predator populations than on the pests. Fish often decrease the abundance of invertebrate predators, but fish farming in rice fields often discourages the use of harmful pesticides. Because farming practices can affect the conservation value of rice fields, ecologists are encouraged to work with farmers and study the role of rice fields in the population dynamics of temporary pond species, and how changing farming methods alter this role. © CAB International/CABI Publishing

369. Sediment and nutrient retention by freshwater wetlands: Effects on surface water quality.

Johnston, C. A.

Critical Reviews in Environmental Control 21(5-6):

491-565. (1991)

NAL Call #: QH545.A1C7; ISSN: 1040-838X

Abstract: Freshwater wetlands alter surface water quality in ways which benefit downstream use. This review summarizes the mechanisms of freshwater wetland interaction with sediment and nutrients that affect surface water quality. The mechanisms vary in magnitude and reversibility, and differ among wetland types. They include sedimentation, plant uptake, litter decomposition, retention in the soil, and microbial processes. Sedimentation is a relatively permanent retention mechanism whereby particulates and associated contaminants are physically deposited on the wetland soil surface. Plant uptake and litter decomposition provide short- to long-term retention of nutrients, depending on rates of leaching, translocation to

and from storage structures, and the longevity of plant tissues. Plant litter can also provide a substrate for microbial processing of nutrients. Wetland soils sorb nutrients, and provide the environment for aerobic and anaerobic microorganisms that process nutrients. Wetland storage compartments, fluxes, and net retention rates are discussed for nitrogen and phosphorus.
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370. Shrimp pond effluent: Pollution problems and treatment by constructed wetlands.

Sansanayuth, P.; Phadungchep, A.; Ngammontha, S.; Ngdngam, S.; Sukasem, P.; Hoshino, H.; and Tabucanon, M. S.

Water Science and Technology(1996)

NAL Call #: TD420.A1P7; ISSN: 0273-1223.

Notes: Conference: 18th Biennial Conf. of the International Association on Water Quality, (Singapore), 23-28 Jun 1996; Issue editors: Bally, D.; Asano, T.; Bhamidimarri, R.; Chin, K. K.; Grabow, W. O. K.; Hall, E. R.; Ohgaki, S.; Orhon, D.; Milburn, A.; Purdon, C. D.; and Nagle, P. T.

Descriptors: shrimp/ nutrient removal/ comparison studies/ gravel/ shellfish farming/ littoral environment/ effluents/ wastewater treatment/ aquaculture effluents/ shrimp culture/ intensive culture/ environmental impact/ Thailand/ constructed wetlands/ water pollution effects/ shrimp culture/ aquaculture effluents/ intensive culture/ environmental impact/ shrimp/ nutrient removal/ comparison studies/ shellfish farming/ littoral environment/ gravel/ wastewater treatment processes/ shellfish culture/ shellfish culture/ prevention and control/ sewage & wastewater treatment

Abstract: An intensive shrimp culture in Thailand has rapidly expanded especially along the coast during the last decade. Excessive feed basically given during the culture causes water and sediment in the pond to contain organic matter and nutrients in high concentration. After harvesting, discharging sediment is prohibited; however, pond water is mostly discharged directly to natural water resources without any effective treatment. The nutrient load discharged from shrimp ponds can form significant source of nutrients causing pollution and eutrophication in littoral areas of Thailand. The possibility of a subsurface-flow constructed wetlands application for treating shrimp pond effluent containing high salinity was studied. An experimental-scaled model planted with *Acrostichum aureum* (mangrove fern) in gravel was studied by comparison with one containing only gravel. The results showed that models can reduce suspended solids, biochemical oxygen demands, total organic carbon, total nitrogen (T-N) and total phosphorous (T-P) up to 84%, 91%, 46%, 48% and 31%, respectively. Higher removal efficiencies for TOC, T-N and T-P of the planted model compared with the gravel model were clearly found.

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371. Soil infiltration and wetland microcosm treatment of liquid swine manure.

Prantner, S. R.; Kanwar, R. S.; Lorimor, J. C.; and Pederson, C. H.

Applied Engineering in Agriculture 17(4): 483-488. (2001)

NAL Call #: S671.A66; ISSN: 0883-8542

Descriptors: wetlands/ pig manure/ waste treatment/ topsoil/ loam soils/ Typha/ ammonium nitrogen/ nitrate nitrogen/ phosphorus/ ammonia

Abstract: Management systems are needed to minimize water quality concerns associated with liquid swine manure from large swine production facilities. Experiments were conducted to investigate the removal of ammonium-N, nitrate-N, and total phosphorus from liquid swine manure through the use of a soil infiltration and wetland system. Experimental treatments applied directly to the soil infiltration areas included a full-rate application of liquid swine manure, a mixture of 3/4 manure and 1/4 water, and a control application of water only. For three months during both summers of 1998 and 1999, nutrient concentrations were determined in the infiltration area influent, the infiltration area effluent, and the wetland effluent on a weekly basis. Approximately 93% of the ammoniacal nitrogen (NH₃-N and NH₄-N) from the applied swine manure was removed by the soil infiltration areas with a corresponding 99% increase in the nitrate nitrogen (NO₃-N) concentrations were found. The wetland systems removed 94% of the remaining NH₃-N and NH₄-N and 95% of the NO₃-N. The total P levels were decreased in the soil infiltration areas and wetlands by 89 and 84%, respectively. This citation is from AGRICOLA.

372. Test of the first-order removal model for metal retention in a young constructed wetland.

Goulet, R. R.; Pick, F. R.; and Droste, R. L.

Ecological Engineering 17(4): 357-371. (Aug. 2001)

NAL Call #: TD1.E26; ISSN: 0925-8574

Descriptors: wetlands/ agricultural runoff/ heavy metals/ hydrology/ iron/ manganese/ zinc/ wastewater treatment/ environmental engineering/ water pollution control/ artificial wetlands/ urban runoff/ metals/ design criteria/ performance evaluation/ model studies/ model testing/ seasonal variations/ biotic factors/ temperature effects/ pollution control/ artificial wetlands/ sewage & wastewater treatment/ water quality control/ protective measures and control/ water & wastewater treatment

Abstract: The first-order removal model is widely used in constructed wetland design. The suitability of this model was tested to predict metal retention in a young constructed wetland receiving agricultural and urban runoff. During two years, water samples for total and dissolved metal analyses were collected every third day at both the inlet and the outlet. The wetland retained metals best during summer and fall whereas during winter the retention of metals was significantly lower. The first-order removal model predicted Fe and Mn retention in the spring and dissolved Zn retention from spring to fall in both years. During those periods, hydraulic retention times (HRTs) greater than 7 days provided maximum retention for Fe, Mn, and dissolved Zn. However, first-order removal models failed to fit summer, fall and winter data for almost every metal under investigation (Fe, Mn, dissolved Cu, dissolved As) suggesting that HRTs (< 1 - 25 days) did not affect metal retention during these seasons. The metal loading to the wetland was low and the input of metals through internal loading may be more significant consequently decreasing the metal retention. Therefore, the first-order removal model is inadequate to predict metal retention on a seasonal basis. Models used to design constructed wetlands under cold climates must consider seasonal changes that affect biological as well as hydrological variables.

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373. Treatment of agricultural wastewater in a pilot-scale tidal flow reed bed system.

Sun, G.; Gray, K. R.; and Biddlestone, A. J.
Environmental Technology 20(2): 233-237. (Feb. 1999)
 NAL Call #: TD1.E59; ISSN: 0959-3330
Descriptors: wetlands/ tides/ agricultural wastes/ slurries/ wastewater treatment/ reed beds/ agriculture/ animal wastes/ aeration/ biological treatment/ biochemical oxygen demand/ organic wastes/ water pollution treatment/ agricultural pollution/ oxygenation/ nitrification/ water motion/ pollution control/ agricultural runoff/ tidal flow reed beds/ "tidal" flow reed bed/ environmental applications/ impact/ sewage & wastewater treatment/ prevention and control

Abstract: Tidal flow reed bed treatment is a process consisting of alternately filling and draining the bed matrix with wastewater. During the draining process, air is positively drawn from the atmosphere into the bed so the aeration of the system is significantly improved. A pilot-scale tidal flow reed bed system was studied for the treatment of agricultural wastewater, which was prepared by diluting pig slurry. At an average influent BOD sub(5) of 649 mg l super(-1) and ammoniacal-nitrogen of 333 mg l super(-1), the BOD sub(5), COD, SS and PO sub(4)-P levels were reduced by 71.0, 58.3, 65.2 and 38.7%, respectively. The removals of BOD sub(5), COD, SS and PO sub(4)-P increased with their influent strengths in straight line correlations. The NH sub(4)-N was reduced by only 13.3% through the system; 69.0% of this removal resulted from nitrification into NO sub(2)-N and NO sub(3)-N, whereas 31% of the removal was due to other processes. The average oxygen consumption rate in this tidal flow system reached 203 gO sub(2) m super(-2) d super(-1), significantly higher than the rates obtainable in horizontal flow and downflow reed beds. The rhythmical air and water movement in the tidal flow system enhances the oxygenation ability of the beds and improves the efficacy of utilisation of the available bed volume. Accordingly, tidal flow reed beds appear to have much potential as initial treatment stages for small amounts of strong waste effluents where the bulk of the BOD sub(5) removal can take place.

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374. Treatment of freshwater fish farm effluent using constructed wetlands: The role of plants and substrate.

Naylor, S.; Brisson, J.; Labelle, M. A.; Drizo, A.; and Comeau, Y.
Water Science and Technology 48(5): 215-222. (2003)
 NAL Call #: TD420.A1P7; ISSN: 0273-1223
Descriptors: biological wastewater treatment/ fish farming/ artificial wetlands/ experimental data/ aquatic plants/ macrophytes/ substrates/ performance evaluation/ optimization/ feasibility studies/ aquatic macrophytes/ aquaculture effluents/ fish culture/ wastewater treatment/ phosphorus/ nitrogen/ organic matter/ substrata/ water pollution treatment/ *Phragmites communis*/ *Typha latifolia*/ wastewater treatment processes/ industrial effluents/ effects of aquaculture on the environment/ effects of aquaculture on the environment/ protective measures and control/ water & wastewater treatment

Abstract: Freshwater fish farm effluents have low nutrient concentrations but high flow rates, resulting in a pollutant load, especially phosphorus (P), causing eutrophication. The feasibility was tested of a treatment combining, within a

single constructed wetland, the contribution of macrophytes for reducing organic matter and nitrogen (N), with the high efficiency of steel slag and limestone for P removal. Twenty subsurface flow (SSF) basins of 280 L with different combinations of plants (*Phragmites communis* or *Typha latifolia*) and substrates (steel slag, limestone, gravel, peat) were fed with a reconstituted fish farm effluent in a greenhouse experiment. Pollutant removal was generally very good under all treatments. N and organic matter removal were correlated with plant biomass while P removal was better in substrates with steel slag and limestone. However, the high pH of the P-adsorbing substrate was detrimental to plant growth so that no combination of plants and substrates could maximise in one step the simultaneous removal of all evaluated pollutants. Therefore, the use of two sequential units is recommended, a first one consisting of a macrophyte planted basin using a neutral substrate to remove organic matter and N, followed by a second unplanted basin containing only a P-adsorbing substrate.

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375. Treatment of rainbow trout farm effluents in constructed wetland with emergent plants and subsurface horizontal water flow.

Schulz, C.; Gelbrecht, J.; and Rennert, B.
Aquaculture 217(1-4): 207-221. (Mar. 2003)
 NAL Call #: SH1 .A6; ISSN: 0044-8486

Descriptors: wetlands/ pollution control/ aquaculture effluents/ fish culture/ aquaculture facilities/ nutrients (mineral)/ aquatic plants/ effluent treatment/ chemical oxygen demand/ nitrogen/ phosphorus/ artificial wetlands/ nutrient removal/ *Oncorhynchus mykiss*/ rainbow trout/ effects of aquaculture on the environment/ effects of aquaculture on the environment/ pollution - control and prevention/ sewage & wastewater treatment/ water & wastewater treatment

Abstract: The objective of this research was to investigate treatment of aquaculture effluents of flow-through systems in created wetlands. The constructed wetlands types used in this study were subsurface root zone systems with emergent plants and horizontal effluent soil percolation. Three 1.401.000.70 m (LWH) root zone systems were filled with sands of 1-2 mm particle size and planted with 20 rooted shoots of reed per square meter (*Phragmites australis*). Nutrient removal of rainbow trout (*Oncorhynchus mykiss*) effluents flowing through the wetland was determined for hydraulic loading rates of 1, 3 and 5 l/min corresponding to very short hydraulic residence times (HRTs) of 7.5, 2.5 and 1.5 h, respectively. Inflowing nutrients were removed within every continuously flooded wetland. Total suspended solids (TSS) and chemical oxygen demand (COD) were reduced by 95.8-97.3% and 64.1-73.8%, respectively, and demonstrated no influence of HRT. Total phosphorus (TP) and total nitrogen (TN) removal rates varied from 49.0% to 68.5% and 20.6% to 41.8%, respectively, and were negatively correlated with HRTs. Effluent purification was best at HRT of 7.5 h, but sufficient removal rates were achieved for shorter HRTs.

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376. Use of constructed wetlands to process agricultural wastewater.

Peterson, H. G.

Canadian Journal of Plant Science 78(2): 199-210. (Apr. 1998)

NAL Call #: 450 C16; ISSN: 0008-4220

Descriptors: wastewater treatment/ artificial wetlands/ nutrient removal/ agriculture/ waste management/ land use/ water quality/ nutrients (mineral)/ agricultural runoff/ construction/ food processing industry wastes/ pollutant removal/ technology/ constructed wetlands/ wastewater treatment processes/ methods and instruments/ sewage & wastewater treatment

Abstract: Constructed wetlands are emerging as a serious challenge to conventional wastewater treatment because of lower construction and operating costs, less requirement for trained personnel, more flexibility, and lower susceptibility to variations in waste loading rates. Water quality improvements can be achieved by removal of plant nutrients, such as N and P, organics (natural and man-made) as well as inorganic contaminants. Wetland treatment is now advocated by regulatory agencies and has been determined as the technology of choice by municipalities and industries required to meet stringent discharge regulations. These same regulations have not usually been imposed on the agricultural community, but deteriorating water sources will likely change this regulatory anomaly. Use of this technology in treating agricultural wastewater is still in its infancy with few, although rapidly expanding, applications. This paper aims to highlight different aspects of wetland treatment by exploring its use for the treatment of agricultural run-off as well as wastewater from the agri-food industry. It is concluded that natural wetlands will be quite limited in absorbing agricultural wastewater while constructed wetlands can be designed for optimum pollutant removal.

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377. The use of constructed wetlands to treat aquacultural effluents.

Schwartz, M. F. and Boyd, C. E.

World Aquaculture 26(11): 42-44. (1995)

NAL Call #: SH1.W62; ISSN: 1041-5602

Descriptors: wetlands/ pollution control/ wastewater treatment/ water pollution treatment/ aquaculture effluents/ biofilters/ water quality control/ aquaculture/ effluents/ construction/ pollution control/ aquaculture effluents/ aquaculture: general/ prevention and control/ wastewater treatment processes

Abstract: Wetlands act as biological filters to remove pollutants from water, and natural and constructed wetlands sometimes are used for treatment of agricultural, municipal, and industrial waste-waters. There are several advantages to wetland wastewater treatment: wetlands are inexpensive to build and operate, chemical treatment of wastewater is eliminated, wetlands contribute stability to local hydrologic processes, and plant communities in wetlands are excellent wildlife habitat. However, there is concern over the feasibility of wetlands for treating aquaculture effluents, because large areas of land may be necessary.

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378. Using constructed wetland-pond systems to treat agricultural runoff: A watershed perspective.

Bouchard, R.; Higgins, M.; and Rock, C.

Lake and Reservoir Management 11(1): 29-36. (1995)

NAL Call #: TC401.L3; ISSN: 0743-8141

Descriptors: eutrophication/ lakes/ artificial wetlands/ agricultural runoff/ watersheds/ nonpoint pollution sources/ phosphorus/ phosphorus removal/ water quality control/ eutrophic lakes/ nonpoint pollution/ algal blooms/ USA, Maine, St. John Valley/ nonpoint pollution/ algal blooms/ artificial wetlands/ wastewater treatment processes/ freshwater pollution/ characteristics, behavior and fate

Abstract: Long and Cross Lakes in the St. John Valley watershed of northern Maine have exhibited chronic algae blooms in past years. Survey data and modeling determined agricultural runoff to be the main source of phosphorus and sediments in both watersheds. "Nutrient/Sediment Control Systems" (NSCS) are being used to treat runoff from target subwatersheds. The systems consist of a sedimentation basin, grass filter strip, wetland, and detention pond in series. Annual removal efficiencies for one system were 85-88% for total phosphorus and 96-97% for total suspended solids. Seasonal removals varied considerably, with spring flows exporting more phosphorus and sediment from the system than was imported. Phosphorus loadings to Long Lake will be reduced between 10-33% with 20 NSCS and diversion of municipal wastewater effluent to a nearby river.

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379. Waterbird communities and associated wetlands of the Colorado River Delta, Mexico.

Hinojosa Huerta, Osvel; Destefano, Stephen; Carrillo Guerrero, Yamilet; Shaw, William W.; and Valdes Casillas, Carlos

Studies in Avian Biology(27): 52-60. (2004)

NAL Call #: QL671.S8; ISSN: 0197-9922

Descriptors: biodiversity/ biogeography: population studies/ marine ecology: ecology, environmental sciences/ agricultural drain/ flood control measures/ guild composition/ species abundance/ species richness/ waterbird communities/ wetland habitat/ wetland management program

Abstract: Despite extensive losses of wetlands caused by water diversions upstream, the Colorado River Delta in northwestern Mexico remains an important wetland system in the Sonoran Desert. The purpose of our study was to describe waterbird communities across a variety of wetland habitat types and zones that exist in the Delta. We measured species richness and abundance of waterbirds from September 1999 to August 2000. We observed a total of 11,918 individuals of 71 species at sites within seven wetland areas. The waterbird communities differed with respect to guild composition and species abundances among the wetland zones. Wetlands along the eastern portion of the Delta (Cienega and Indio), which are supported by agricultural drains and managed under conservation initiatives, exhibited the highest species richness in our summer and winter censuses, and highest abundance in summer. Shorebirds were the dominant guild in the summer period, while waterfowl were dominant during winter. Breeding marshbirds were also abundant, with the Yuma Clapper Rail (*Rallus longirostris yumanensis*) being most notable. Wetlands along the western Delta (Hardy and Cucapa) were also supported by

agricultural drains, but were not managed specifically for wildlife. The Double-crested Cormorant (*Phalacrocorax auritus*) and American Coot (*Fulica americana*) were dominant during winter, while long-legged waders (*Ardeidae*) were dominant in summer. The composition of waterbird communities along the mainstem of the Colorado River was similar to that of wetlands along the western portion of the Delta. The shallow and ephemeral Laguna Salada, along the western boundary of the Delta, exhibited the highest waterbird abundance among our winter censuses when it was flooded in 2000. The results of our study suggest that even minimal levels of instream flows would lead to habitat improvements for waterbirds in the Delta floodplain. A bi-national wetland management program for the Delta should consider the impacts of flood control measures and diversions for agricultural and urban uses to the health of wetland habitats on both sides of the international border.

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380. The wetland constructed as a biological treatment system in an experimental recirculating aquaculture system in a tropical environment.

Sedeno-Diaz, J. E.; Lopez, E.; and Sedeno-Alvarez, D. E. In: Proceedings of the 4th International Conference on Recirculating Aquaculture. (Held 18 Jul 2002-21 Jul 2002 at Roanoke, VA (USA).); Vol. VSGCP-C-00-001.; 2002.

Descriptors: freshwater aquaculture/ fish culture/ experimental culture/ recirculating systems/ water quality control/ bioremediation/ aquatic plants/ uptake/ nitrogen/ phosphorus/ removal/ efficiency/ rearing/ culture tanks/ Poeciliidae/ constructed wetlands/ livebearers/ fish culture

Abstract: An experimental system of fish farming was designed utilizing recirculation and a constructed wetland. The efficiencies of N and P removal of the wetland were tested using three different species of macrophytes and utilizing the system for 2 different fish cultivation densities of the family Poeciliidae. The system functioned adequately, filtering the waste generated by the fish, the food not consumed and the metabolic wastes of the primary productivity that was generated in the tanks. Water quality variables were monitored including the nutrients, OD, pH, conductivity, TDS, TSS, sulfates, hardness, COD and turbidity. To measure the removal of nutrients by the macrophytes, they were weighed prior to being added to the constructed wetland and again at the end of the experiment with the purpose of determining the profit in biomass. The N and P concentrations were determined in vegetable tissue before and after the experiment. There were observed differences in absorption of N and P of the three species of macrophytes utilized.

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381. Xenobiotics removal from polluted water by a multifunctional constructed wetland.

Cheng, S.; Vidakovic-Cifrek, Z.; Grosse, W.; and Karrenbrock, F.

Chemosphere 48(4): 415-418. (July 2002)

NAL Call #: TD172.C54; *ISSN:* 0045-6535

Descriptors: water pollution treatment/ artificial wetlands/ pesticides/ herbicides/ performance evaluation/ chemical analysis/ toxicity/ bioassay/ water reuse/ irrigation water/ wastewater treatment/ biodegradation/ water quality/ endocrine disruptors/ water quality control/ water treatment/ protective measures and control/ water & wastewater treatment

Abstract: Removal efficiencies on xenobiotics from polluted water in a twin-shaped constructed wetland consisting of a vertical flow chamber with the crop plant *Colocasia esculenta* L. Schott and a reverse vertical flow one with *Ischaemum aristatum* var. *glaucom* Honda, were assessed by chemical analysis and bioassays. After a four-month period of application, removal efficiencies of the applied pesticides parathion and omethoate were 100% with no detectable parathion and omethoate in the effluent. For the applied herbicides, the decontamination was less efficient with removal efficiencies of 36% and 0% for 4-chloro-2-methyl-phenoxyacetic acid and dicamba, respectively. As shown by toxicity assay with duckweed *Lemna minor* L., growth retardation may occur if the water treated for herbicide removal is used in irrigation of sensitive cultivars in agriculture or horticulture. In contrast to *I. aristatum* var. *glaucom* Honda, the crop *C. esculenta* L. Schott has a high yield in biomass production as a valuable source of renewable energy.

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Appalachian Highlands Wetlands General Information

382. **Abundance of *Alnus incana* ssp. *rugosa* in Adirondack Mountain shrub wetlands and its influence on inorganic nitrogen.**

Kiernan, B. D.; Hurd, T. M.; and Raynal, D. J.
Environmental Pollution 123(3): 347-354. (2003)
NAL Call #: QH545.A1E52; ISSN: 0269-7491.

Notes: Environmental monitoring evaluation and protection in New York: Linking science and policy. Selected conference papers, Albany, New York, USA, 24-25 September 2001.

Descriptors: wetlands/ acidification/ ammonium/ biomass/ mountain areas/ nitrate/ nitrogen/ nitrogen fixation/ nitrogen fixing trees/ polluted water/ species richness/ surface water/ trees/ water pollution/ water quality/ *Alnus incana*

Abstract: The purpose of this research was to determine the abundance of the nitrogen-fixing shrub, *Alnus incana* ssp. *rugosa* (speckled alder), in shrub wetlands of the Adirondack Mountain region of New York State and to determine whether its abundance affects the concentration or accumulation of inorganic nitrogen in wetland substrates. Alder/willow wetlands are the second most common wetland type in the Adirondack region. The Adirondack Park Agency's digital GIS database of wetland types was used to determine the areal extent of alder/willow wetlands in the Adirondacks. Randomly selected wetlands were sampled to determine the size and abundance of alder. Alder densities averaged ~7000 stems ha⁻¹ and alder was present in 75% of the wetlands. As an indication of short-term accumulation of NO₃⁻ and NH₄⁺ in wetland substrates, ion exchange resins were used to sample ground water in high and low alder density wetlands as well as from wetlands lacking alder and dominated by conifers. Additionally, NO₃⁻ and NH₄⁺ concentrations in ground water samples were measured. NH₄⁺ accumulation levels from exchange resins were low for all wetland types while groundwater NH₄⁺ concentration was highest in the low-density alder sites. Wetlands with high alder density had approximately six times higher NO₃⁻ accumulation than other wetlands. Substrate groundwater NO₃⁻ concentrations in wetlands of high-density alder exceeded by three times levels in low or no alder wetlands, showing the importance of alder to local N budgets. To assess the recovery of shrub wetlands from acidification, future studies should determine the fate of fixed N in wetland systems.

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383. **Biogeochemical fate of coal mine drainage pollutants in constructed wetlands.**

Tarutis, W. J. and Unz, R. F.
Current Topics in Wetland Biogeochemistry 2: 40-51. (1996); ISSN: 1076-4674

Descriptors: wetlands/ pyrite/ biogeochemistry/ acid mine drainage/ wastewater treatment/ research priorities/ design criteria/ optimization/ economic aspects/ fate of pollutants/ iron/ manganese/ coal/ degradation/ biodegradation/ sulfur/ mining/ mine tailings/ pollution control/ sulphur/ USA, Appalachian Mts.

Abstract: Acidic mine drainage (AMD) is a chronic water pollution problem in the Appalachian region of the United States. The formation of AMD occurs when pyrite (FeS sub(2)), naturally present in coal seams, is exposed to air

and water through mining activities and often results in very high levels of acidity, iron, manganese, sulfate, and occasionally aluminum. The observation that natural (volunteer) wetlands are capable of improving mine water quality (Wieder and Lang, 1982) has prompted coal mine operators, chiefly in Pennsylvania and West Virginia (Wieder, 1989), to construct wetlands in an effort to reduce treatment costs. The characteristic features of wetlands (the presence of water, undrained hydric soil, and vegetation adapted to saturated conditions) make wetlands unique ecosystems and potentially valuable resources for wildlife as well as humans. Constructed wetlands have been used extensively as passive treatment systems for municipal wastewaters (Hammer, 1989), but only within the past decade have wetlands been used to treat AMD. The design and implementation of AMD treatment wetlands have, at least initially, been based on perceived economic benefits without regard to the biogeochemical processes important to the effluent removal and retention of the major mine water pollutants of concern. This "black-box" approach is useful to obtain necessary baseline data for input-output budgets, but does little to promote an understanding of the actual metal removal mechanisms involved. In order to achieve optimal pollutant removal over the long term, it is necessary to understand these processes in wetlands and to determine how wetlands can be designed so that the benefits of each removal mechanism are fully realized.

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384. **Carbon dynamics in Appalachian peatlands of West Virginia and Western Maryland.**

Yavitt, J. B.
Water, Air, and Soil Pollution 77(3-4)(1994)
NAL Call #: TD172 .W36; ISSN: 0049-6979.

Notes: Conference: Southern Appalachian Man and the Biosphere (SAMAB) Conference on Wetland Ecology, Management, and Conservation, Knoxville, TN (USA), 28-30 Sep 1993

Descriptors: wetlands/ peatlands/ carbon cycle/ organic matter/ peat/ peat bogs/ biological production/ peat bogs/ biological production/ peatlands

Abstract: Abundant production of organic matter that decomposes slowly under anaerobic conditions can result in substantial accumulation of soil organic matter in wetlands. Tedious means for estimating production and decomposition of plant material, especially roots, hampers our understanding of organic matter dynamics in such systems. In this paper, I describe a study that amended typical estimates for both production and decomposition of organic matter by measuring net flux of carbon dioxide (CO sub(2)) over the peat surface within a conifer swamp, a sedge-dominated marsh, and a bog in the Appalachian Mountain region of West Virginia and western Maryland, USA. The sites are relatively productive, with net primary production (NPP) of 30 to 82.5 mol C m super(-2)yr super(-1), but peat deposits are shallow with an average depth of about 1 m. In summer, all three sites showed net CO sub(2) flux from the atmosphere to the peat during the daytime (-20.0 to -30.5 mmol m super(-2) d super(-1)), supported by net photosynthesis, which was less than net CO sub(2) flux

from the peat into the atmosphere at nighttime (39.2 to 84.5 mmol m⁻² d⁻¹), supported by ecosystem respiration. The imbalance between these estimates suggests a net loss of carbon (C) from these ecosystems. The positive net CO₂ flux seems to be so high because organic matter decomposition occurs throughout the peat deposit and as a result concentrations of dissolved inorganic carbon (DIC) in peat pore waters reached 4,000 μmol L⁻¹ by late November, and concentrations of dissolved organic carbon (DOC) in peat pore waters reached 12,000 μmol L⁻¹. Comparing different approaches revealed several features of organic matter dynamics: (i) peat accretion in the top 30 cm of the peat deposit results in a C accumulation rate of about 15 mmol m⁻² d⁻¹; however, (ii) the entire peat deposit has a negative C balance losing about 20 mmol m⁻² d⁻¹.

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385. Characterization of high elevation central Appalachian wetlands.

Francl, K. E.; Ford, W. M.; and Castleberry, S. B. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station; RP-NE-725, 2004. 26 p.

NAL Call #: A99.9 F7622Un no. 725

http://www.fs.fed.us/ne/newtown_square/publications/research_papers/pdfs/2004/ne_rp725.pdf

Descriptors: bog/ central Appalachian Mountains/ fen/ geology/ hydric soils/ hydrophytic vegetation/ wetland characterization

Abstract: We characterized 20 high elevation wetlands in the central Appalachian Mountains in West Virginia and Maryland, in terms of vegetation, soils, hydrology, and geology. Plant species were distributed along soil chemical (pH, conductivity) and physical (organic matter depth) gradients across sites. Topography and geology appear to explain differences among these wetlands, as reflected by soil and chemistry measures and vegetation distribution. Our work provides substantial quantitative baseline data for these uncommon high elevation wetlands, emphasizing the importance and diversity of these isolated systems. This citation is from Treesearch.

386. Classification and inventory of wetlands in the southern Appalachian region.

Hefner, J. M. and Storrs, C. G.

Water, Air, and Soil Pollution 77(3-4)(1994)

NAL Call #: TD172 .W36; ISSN: 0049-6979.

Notes: Conference: Southern Appalachian Man and the Biosphere (SAMAB) Conference on Wetland Ecology, Management, and Conservation, Knoxville, TN (USA), 28-30 Sep 1993

Descriptors: wetlands/ mapping/ inventories/ classification systems/ habitat/ land classification/ maps/ vegetation/ publications/ biological surveys/ vegetation cover/ USA, Appalachian Mts./ biological surveys/ vegetation cover/ land classification/ vegetation/ publications/ inventories/ classification systems/ habitat

Abstract: The National Wetlands Inventory of the U.S. Fish and Wildlife Service has prepared large scale (1:24,000) wetland maps for nearly all of the Southern Appalachian Region. Traditional and digital cartographic products are available from the Earth Science Information Centers of the United States Geological Survey and from State-run

distribution outlets. Most of the materials prepared by the NWI within the region were cooperatively funded by the States and other Federal Agencies. NWI maps describe wetlands in terms of the life form of the dominant vegetation, substrata where vegetation is sparse or lacking, water chemistry, relative duration of inundation or saturation, and special modifiers. The maps display wetland polygons as small as 0.5 hectares in size and linear wetlands as narrow as 8 meters, showing the size, type of wetland, and relative position of the wetland on the landscape. The wetland inventory process is principally a remote sensing task, relying on the interpretation of high altitude color infrared aerial photography, supported with ground truth data and collateral information. The procedure has limitations related to scale, quality and timing of the aerial photography; experience and training of the photo interpreters; and the wetland types which are to be classified and delineated. Since wetland maps provide a static depiction of a dynamic resource, the NWI conducts periodic wetland status and trends studies to evaluate wetland change in aerial extent and the reasons for the change. Although trend surveys are routinely conducted nationally and selectively for regional and local areas, no study to specifically address the wetlands of the Southern Appalachian Region has been developed.

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387. Colonization and establishment of red maple (*Acer rubrum*) in a southern Appalachian wetland.

Warren, R. J.; Rossell, I. M.; and Moorhead, K. K.

Wetlands 24(2): 364-374. (June 2004)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ recruitment/ colonization/ canopies/ alternation learning/ seedlings/ trees/ understory/ flood plains/ age composition/ size/ temporal variations/ forests/ growth rings/ height/ ecosystem disturbance/ regression analysis/ water levels/ model studies/ maple trees/ canopy/ water level/ fluctuations/ streams/ habitats/ *Acer rubrum*/ USA, North Carolina, Tulula Creek/ USA, North Carolina/ red maple/ other angiosperms/ population dynamics/ water and plants

Abstract: We characterized the post-disturbance recruitment window for red maple (*Acer rubrum*) in a southern Appalachian wetland using size-class distributions and forest stand models. The DBH and core age of understory and overstory trees were measured in 108 plots in forested (closed) and unforested (open) fen and floodplain sites at the Tulula Creek wetland complex (a southern Appalachian wetland in Graham County, North Carolina) in 1994 and 2001 as part of a larger ecological study. In addition, the heights of red maple seedlings were measured in 379 quadrats in an unforested floodplain in 1996 and 2001. We examined the temporal patterning of wetland recruitment using red maple size-class data in order to determine (1) the recruitment window for seedling colonization and (2) temporal recruitment patterning based on the size/age structure of established tree stands. Diameter and height distributions were compared with power function, negative exponential and quadratic models in order to determine goodness of fit using the coefficient of determination (R²). Diameter distributions and stand models showed that recruitment continued (at a diminishing rate) at sites that were last cleared 7, 14, and approximately 30 years earlier and ceased at a fourth site cleared approximately 45 years earlier. While there were

minor recruitment fluctuations that possibly coincided with water-level changes, the unimodal size class distributions indicated that recruitment did not pulse subsequent to initial canopy disturbance. These results show that red maple readily colonized wetland habitats and that the recruitment window lasts at least twice as long as that reported in terrestrial systems. In addition, size-class distribution and regression analysis indicate that the colonization window is directly impacted by canopy disturbance and only indirectly influenced by water levels.

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388. A comparison of plant communities in mitigation and reference wetlands in the mid-Appalachians.

Balcombe, C. K.; Anderson, J. T.; Rentch, J. S.; Grafton, W. N.; Fortney, R. H.; and Kordek, W. S.
Wetlands 25(1): 130-142. (2005)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: constructed wetland/ hydrophytic vegetation/ man-made wetland/ mitigation wetland/ reference wetland/ wetland management/ wetland mitigation

Abstract: Wetland destruction has plagued the U.S. for decades, but the need to compensate for these losses has only been embraced within the last 20 years. Because so many compensatory mitigation wetlands have been created, there is a need to assess the function of these valuable ecosystems relative to natural wetlands. The goal of this study was to evaluate the functional equivalency of mitigation wetlands in West Virginia in supporting hydrophytic plant communities. A series of nested quadrats was used to compare plant community structure among eleven mitigation and four naturally occurring reference wetlands. For all species combined, mean total percent cover across all sampling quadrats per wetland was similar between mitigation and reference wetlands. Species richness, evenness, and diversity were greater in mitigation than in reference wetlands. Mean weighted averages of plant communities calculated using cover values and wetland indicator status were similar between mitigation and reference wetlands. There were, however, major differences in species composition. Mitigation sites tended to have more pioneer species, non-native dominants, and species with relatively lower conservation quality. Ordination analyses suggested that compositional differences become smaller as mitigation sites age. Both mitigation and natural wetlands met criteria for hydrophytic vegetation according to the 1987 U.S. Army Corps of Engineers Wetland Delineation Manual. These data suggest that the mitigation wetlands investigated in this study adequately support hydrophytic vegetation and appear to be developing vegetation similar to reference standards. © 2005, The Society of Wetland Scientists. © 2006 Elsevier B.V. All rights reserved.

389. Control of methane metabolism in a forested northern wetland, New York State, by aeration, substrates, and peat size fractions.

Coles, Janice R. P. and Yavitt, Joseph B.
Geomicrobiology Journal 19(3): 293-315. (2002);
ISSN: 0149-0451

Descriptors: freshwater ecology: ecology, environmental sciences/ soil science/ forested northern wetland/ soil factors: aeration, peat size fractions, substrate

Abstract: Although many northern peat-forming wetlands (peatlands) are a suitable habitat for anaerobic CH₄-

producing bacteria (methanogens), net CH₄ fluxes are typically low in forested systems. We examined whether soil factors (aeration, substrate availability, peat size fractions) constrained net CH₄ production in peat from a Sphagnum-moss dominated, forested peatland in central New York State. The mean rate of net CH₄ production measured at 24°C was 79 nmol g⁻¹d⁻¹, and the mean rate of CO₂ production (respiration) was 5.7 μmol g⁻¹d⁻¹, in surface (0 to 10 cm) and subsurface (30 to 40 cm) peat. Saturated peat (900% water content) exposed to oxic conditions for 2 days or 14 days showed no net CH₄ production when subsequently exposed to anoxic conditions. Rates of CO₂ production, measured concomitantly, were essentially the same under oxic and anoxic conditions, and net CH₄ consumption under oxic conditions was barely affected by short-term exposure to anoxic conditions. Therefore, methanogens were particularly sensitive to aeration. Net CH₄ production in whole peat increased within hours of adding either acetate, glucose, or ethanol, substrates that methanogens can convert directly or indirectly into CH₄, indicating that availability of these substrate might limit net CH₄ production in situ. In longer incubations of 30 days, only ethanol addition stimulated a large increase in net CH₄ production, suggesting growth in the population of methanogens when ethanol was available. We fractionated peat into size fractions and the largest sized fraction (>1.19 mm), composed mostly of roots, showed the greatest net CH₄ production, although net CH₄ production in smaller fractions showed the largest response to ethanol addition. The circumstantial evidence presented here, that ethanol coming from plant roots supports net CH₄ production in forested sites, merits more research.

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390. The effects of beaver-created wetlands on the benthic macroinvertebrate assemblages of two Appalachian streams.

Margolis, B. E.; Raesly, R. L.; and Shumway, D. L.
Wetlands 21(4): 554-563. (2001)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ zoobenthos/ macrofauna/ streams/ dams/ beavers/ environmental effects/ aquatic populations/ benthic fauna/ macroinvertebrates/ species composition/ spatial distribution/ data collections/ comparison studies/ impoundments/ environmental impact/ community composition/ aquatic mammals/ aquatic plants/ ecosystem disturbance/ *Castor canadensis*/ USA, Maryland, Herrington Creek/ USA, Appalachian Mts./ USA, Pennsylvania, Mountain Run/ USA, Maryland, Garrett Cty./ USA, Pennsylvania, Somerset Cty./ beaver dams/ American beaver

Abstract: We examined the effects of beaver impoundments on the benthic macroinvertebrate assemblages of two small Appalachian streams, Mountain Run (Somerset County, Pennsylvania) and a tributary to Herrington Creek (Garrett County, Maryland). Benthic macroinvertebrate assemblages above the impoundments were compared with assemblages within the impoundments and 1 m, 10 m, and 100 m below the impoundments. The results of our study indicate that beaver affect both within-impoundment and downstream benthic macroinvertebrate assemblages. Taxonomic and functional changes in benthic

macroinvertebrate assemblages of the beaver-altered streams were a result of direct (impoundment) and indirect (changes in temperature, water chemistry, plant growth) alterations of the stream environment.

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391. Effects of drought on the water-table dynamics of a southern Appalachian mountain floodplain and associated fen.

Moorhead, K. K.

Wetlands 23(4): 792-799. (2003)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ drought/ groundwater level/ hydrology/ water table fluctuations/ precipitation/ flood plains/ groundwater recharge/ hydraulic gradient/ piezometers/ seasonal variations/ evapotranspiration/ water depth/ droughts/ water table/ restoration/ river discharge/ temporal variations/ USA, North Carolina

Abstract: Annual and seasonal variations in precipitation have been shown to influence the hydrology of nontidal wetlands, including depth to water table. Water-table depth is assessed in wetlands for a variety of reasons, most notably for wetland delineations or determining the success of restoration projects. Many short-term assessment efforts probably occur during periods of abnormal precipitation and, as such, may not provide a thorough understanding of wetland hydrology. I have been evaluating water-table dynamics of a wetlands complex in western North Carolina for seven years in support of a wetlands restoration project. A series of water-table wells and piezometers were installed to determine the spatial and temporal patterns of the water table and vertical hydraulic gradient (VHG). For over three years, the area was classified as having conditions of moderate to severe drought. The drought lowered the average monthly water table by 26 cm in a mountain fen and 22 cm in the adjacent floodplain. The fen was a constant ground-water recharge area before the drought and a discharge area for three of 12 months during the drought. The drought also impacted a shallow, constant ground-water source to the fen on an adjacent hillslope. The impacts of the drought were greater during the active growing season, presumably due to increased evapotranspiration. The results support the need for long-term hydrologic assessment of wetlands and the need to relate wetland hydrology to annual, seasonal, and monthly precipitation patterns.

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392. An evaluation of vegetation and wildlife communities in mitigation and natural wetlands of West Virginia .

Balcombe, Collins K.

Morgantown, W. Va.: West Virginia University, 2003.

Notes: Thesis submitted to the Davis College of Agriculture, Forestry, and Consumer Sciences at West Virginia University in partial fulfillment of the requirements for the degree of Master of Science in Wildlife and Fisheries Resource Management

http://www.forestry.caf.wvu.edu/jAnderson/Balcombe_c_thesis.pdf

Descriptors: wetland mitigation/ wetland restoration/ wetland management/ mitigation wetland/ constructed wetland/ reference wetland

393. Identification of wetlands in the southern Appalachian region and the certification of wetland delineators.

Wakeley, J. S.

Water, Air, and Soil Pollution 77(3-4)(1994)

NAL Call #: TD172 .W36; ISSN: 0049-6979.

Notes: Conference: Southern Appalachian Man and the Biosphere (SAMAB) Conference on Wetland Ecology, Management, and Conservation, Knoxville, TN (USA), 28-30 Sep 1993

Descriptors: wetlands/ hydrology/ surveys/ classification systems/ land classification/ vegetation/ soil types/ site surveys/ USA, Appalachian Mts./ site surveys/ land classification/ vegetation/ soil types/ classification systems
Abstract: According to the Corps of Engineers Wetlands Delineation Manual, wetlands are identified by the presence of field indicators of hydrophytic vegetation, hydric soils, and wetland hydrology. In the southern Appalachian region, situations that present problems for wetland delineators include (1) wetlands developed on recently deposited alluvial soils that may show little evidence of hydric conditions, (2) areas occupied by FAC-dominated plant communities, (3) wetlands affected by past or present drainage practices, (4) man-induced wetlands that may lack certain wetland field indicators, and (5) hydric soil units that are too small or narrow to be delineated separately on soil survey map sheets. In March 1993, under direction of Section 307(e) of the Water Resources Development Act of 1990, the Corps of Engineers initiated a Wetland Delineator Certification Program. A 1-year demonstration program has recently ended in Maryland, Florida, and Washington, with nationwide implementation scheduled for later in 1994. This voluntary program is designed to increase the quality of wetland delineations submitted with Section 404 permit applications, and reduce processing time by reducing the need for extensive field verification of wetland boundaries.

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394. Impacts of sedimentation and nitrogen enrichment on wetland plant community development.

Mahaney, W. M.; Wardrop, D. H.; and Brooks, R. P.

Plant Ecology 175(2): 227-243. (2004)

NAL Call #: QK900 .P63; ISSN: 1385-0237

Abstract: Many factors influence which plant species are found in a particular wetland. The species pool is composed of the species present in the seed bank and species able to disperse into the wetland, and many abiotic and biotic factors interact to influence a species performance and abundance in the plant community. Anthropogenic activities produce specific stressors on wetland systems that alter these abiotic and biotic interactions, potentially altering species composition. We simulated three common wetland hydrogeomorphic (HGM) subclasses in a greenhouse to examine the effects of two stressors-sedimentation and nitrogen (N) enrichment-on the performance of 8 species grown in artificial communities. Species establishment, height, biomass, and foliar N and P concentrations were measured to explore species responses to stressors and competition, as well as the potential impacts of changes in species composition on ecosystem processes. Species were affected differently by sedimentation and N enrichment, and there were differences in overall community sensitivity to stressors between wetland subclasses. Sedimentation generally reduced seedling establishment, while N enrichment

produced variable effects on height and biomass. Interspecific competition had little effect on establishment but significantly reduced most species biomass. Sedimentation generally lowered community biomass, diversity, and richness, while enrichment increased community biomass. Establishment, biomass, and foliar nutrient concentrations significantly differed between many species, suggesting that shifts in species composition may impact ecosystem processes such as nutrient cycling and carbon storage. *Phalaris arundinacea*, an aggressive clonal graminoid, universally dominated all wetland subclasses. This dominance across a range of environmental conditions (sedimentation, fertility, and hydrology) has important implications for both restoration and predicting the impacts of human activities on species composition. Our results suggest that, in regions where *P. arundinacea* is common, restoration projects that establish communities from seeds and human activities that cause vegetation removal are likely to become dominated by *P. arundinacea*. This citation is from AGRICOLA.

395. Landscape-level processes and wetland conservation in the southern Appalachian Mountains.
Pearson, S. M.

Water, Air, and Soil Pollution 77(3-4)(1994)
NAL Call #: TD172 .W36; ISSN: 0049-6979.

Notes: Conference: Southern Appalachian Man and the Biosphere (SAMAB) Conference on Wetland Ecology, Management, and Conservation, Knoxville, TN (USA), 28-30 Sep 1993

Descriptors: wetlands/ conservation/ landscape/ ecosystem management/ nature conservation/ environmental protection/ environmental impact/ ecosystem disturbance/ ecosystems/ environmental effects/ hydrology/ USA, Appalachian Mts./ landscape/ ecosystem management/ nature conservation/ environmental impact/ ecosystem disturbance/ environmental effects

Abstract: The function of wetland ecosystems is not independent of the landscapes in which they are embedded. They have strong physical and biotic linkages to the surrounding landscape. Therefore, incorporating a broad-scale perspective in our study of wetland ecology will promote our understanding of these habitats in the southern Appalachians. Changes in the surrounding landscape will likely affect wetlands. Broad-scale changes that are likely to affect wetlands include: 1) climate change, 2) land use and land cover change, 3) water and air-borne pollution, 4) a shift in disturbance/recovery regimes, and 5) habitat loss and fragmentation. Changes in climate and land cover can affect the hydrology of the landscape and, therefore, the water balance of wetlands. Excessive nutrients and toxin transported by air and water to wetlands can disrupt natural patterns of nutrient cycling. Periodic disturbances, like flooding in riparian zones, is required to maintain some wetlands. A change in disturbance regimes, such as an increase in fire frequency, could alter species composition and nutrient cycles in certain wetlands. Many plant and animal species that found in small, isolated wetlands have populations that are dependent on complementary habitats found in the surrounding landscape. Loss or fragmentation of these complementary habitats could result in the collapse of wetland populations.

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396. Methane production and sulfate reduction in two Appalachian peatlands USA.

Wieder R. K.; Yavitt J. B.; and Lang G. E.

Biogeochemistry 10(2): 81-104. (1990)

NAL Call #: QH345 .B564; ISSN: 0168-2563

Descriptors: sphagnum/ bog/ anaerobic/ carbon/ mineralization/ carbon dioxide

Abstract: Anaerobic carbon mineralization was evaluated over a 1-year period in two Sphagnum-dominated peatlands, Big Run Bog, West Virginia, and Buckle's Bog, Maryland. In the top 35 cm of peat, mean rates of methane production, anaerobic carbon dioxide production, and sulfate reduction at Big Run Bog were 63, 406 and 146 $\mu\text{mol L}^{-1} \text{d}^{-1}$, respectively, and at Buckle's Bog were 18, 486 and 104 $\mu\text{mol L}^{-1} \text{d}^{-1}$. Annual anaerobic carbon mineralization to methane and carbon dioxide at Big Run Bog and Buckle's Bog was 52.8 and 57.2 mol m^{-2} , respectively. Rates of methane production were similar to rates reported for other freshwater peatlands, but methane production accounted for only 11.7 and 2.8%, respectively, of the total anaerobic carbon mineralization at these two sites. Carbon dioxide production, resulting substantially from sulfate reduction, dominated anaerobic carbon mineralization. Considerable sulfate reduction despite low instantaneous dissolved sulfate concentrations (typically < 300 $\mu\text{mol L}^{-1}$ of substrate) was apparently fueled by oxidation and rapid turnover of the reduced inorganic sulfur pool. The coincidence of high sulfate inputs to the Big Run Bog and Buckle's Bog watersheds through acid precipitation with the unexpected importance of sulfate reduction leads us to suggest a new hypothesis: peatlands not receiving high sulfate loading should exhibit low rates of anaerobic decomposition, and a predominance of methane production over sulfate reduction; however, if such peatlands become subjected to high rates of sulfur deposition, sulfate reduction may be enhanced as an anaerobic mineralization pathway with attendant effects on carbon balance and peat accumulation.

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397. Microhabitat selection by small mammals in a southern Appalachian fen in the USA.

Rossell, C. R. and Rossell, I. M.

Wetlands Ecology and Management 7(4): 219-224. (1999)

NAL Call #: QH541.5.M3 W472; ISSN: 0923-4861

Descriptors: wetlands/ habitat selection/ vegetation cover/ plant populations/ ecological distribution/ microhabitats/ fens/ vegetation/ mammals/ canopy/ Mammalia/ *Ochrotomys nuttalli*/ *Zapus hudsonius*/ *Peromyscus leucopus*/ *Blarina brevicauda*/ mammals/ fens/ meadow jumping mouse/ white-footed mouse/ northern short-tailed shrew/ golden mouse/ USA, Appalachian Mts.

Abstract: Little ecological information is available on small mammals inhabiting wetlands in the southern Appalachian mountains of the USA. These wetland systems are becoming rare features in southern landscapes due to human activities. We investigated the small mammal fauna and examined the microhabitat associations of the two most abundant species in a southern Appalachian fen. Four species of small mammals were captured: the meadow jumping mouse (*Zapus hudsonius*), short-tailed shrew (*Blarina brevicauda*), white-footed mouse (*Peromyscus leucopus*), and golden mouse (*Ochrotomys nuttalli*). *Peromyscus* and *Ochrotomys*, which were caught in the largest numbers, preferred sites characterized by moderate

herbaceous cover and substantial canopy closure.

Peromyscus, however, selected areas with greater canopy closure and higher tree densities, suggesting that they are greater habitat specialists than *Ochrotomys* in this wetland community.

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398. Mine-drainage treatment wetland as habitat for herptofaunal wildlife.

Lacki, M. J.; Hummer, J. W.; and Webster, H. J. *Environmental Management* 16(4): 513-520. (1992)
NAL Call #: HC79.E5E5; ISSN: 0364-152X

Abstract: Land reclamation techniques that incorporate habitat features for herptofaunal wildlife have received little attention. We assessed the suitability of a wetland, constructed for the treatment of mine-water drainage, for supporting herptofaunal wildlife from 1988 through 1990 using diurnal and nocturnal surveys. Natural wetlands within the surrounding watershed were also monitored for comparison. The treatment wetland supported the greatest abundance and species richness of herptofauna among the sites surveyed. Abundance was a function of the frog density, particularly green frogs (*Rana clamitans*) and pickerel frogs (*R. palustris*), while species richness was due to the number of snake species found. The rich mix of snake species present at the treatment wetland was believed due to a combination of an abundant frog prey base and an ample supply of den sites in rock debris left behind from earlier surface-mining activities. Nocturnal surveys of breeding male frogs demonstrated highest breeding activity at the treatment wetland, particularly for spring peepers (*Hyla crucifer*). Whole-body assays of green frog and bullfrog (*R. catesbeiana*) tissues showed no differences among sites in uptake of iron, aluminum, and zinc; manganese levels in samples from the treatment wetland were significantly lower than those from natural wetlands. These results suggest that wetlands established for water quality improvement can provide habitat for reptiles and amphibians, with the species composition dependent on the construction design, the proximity to source populations, and the degree of acidity and heavy-metal concentrations in drainage waters.

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399. Modification of acid mine drainage by Sphagnum-dominated wetlands and the effect on stream water quality.

Lang, G. E. and Wieder, R. K. In: Proceedings of the Conference: Wetlands of the Chesapeake. (Held 9 Apr 1985-11 Apr 1985 at Easton, Md.) Groman, Hazel A. (eds.) Washington D.C.: Environmental Law Institute; pp. 176-184; 1985.

NAL Call #: QH76.5.C48P76; ISBN: 0911937196
Descriptors: wetlands/ mine spoil/ water quality/ water pollution/ iron/ streams/ mosses and liverworts/ West Virginia

This citation is from AGRICOLA.

400. Nitrate removal in a riparian wetland of the Appalachian Valley and Ridge physiographic province.

Flite, O. P.; Shannon, R. D.; Schnabel, R. R.; and Parizek, R. R.

Journal of Environmental Quality 30(1): 254-261. (2001)
NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: wetlands/ path of pollutants/ fate of pollutants/ groundwater pollution/ nitrates/ riparian waters/ denitrification/ soil horizons/ soil saturation/ organic carbon/ pollution (groundwater)/ nitrate/ riparian environments/ groundwater/ enzymes/ nutrient loading/ soil/ USA, Appalachian Mts./ USA, Appalachian Mts.

Abstract: Riparian zones within the Appalachian Valley and Ridge physiographic province are often characterized by localized variability in soil moisture and organic carbon content, as well as variability in the distribution of soils formed from alluvial and colluvial processes. These sources of variability may significantly influence denitrification rates. This investigation studied the attenuation of nitrate (NO₃⁻) as wastewater effluent flowed through the shallow ground water of a forested headwater riparian zone within the Appalachian Valley and Ridge physiographic province. Ground water flow and NO₃⁻ measurements indicated that NO₃⁻ discharged to the riparian zone preferentially flowed through the A and B horizons of depressional wetlands located in relic meander scars, with NO₃⁻ decreasing from >12 to <0.5 mg L⁻¹. Denitrification enzyme activity (DEA) attributable to riparian zone location, soil horizon, and NO₃⁻ amendments was also determined. Mean DEA in saturated soils attained values as high as 210 μg N kg⁻¹ h⁻¹, and was significantly higher than in unsaturated soils, regardless of horizon (p < 0.001). Denitrification enzyme activity in the shallow A horizon of wetland soils was significantly higher (p < 0.001) than in deeper soils. Significant stimulation of DEA (p = 0.027) by NO₃⁻ amendments occurred only in the meander scar soils receiving low NO₃⁻ (<3.6 mg L⁻¹) concentrations. Significant denitrification of high NO₃⁻ ground water can occur in riparian wetland soils, but DEA is dependent upon localized differences in the degree of soil saturation and organic carbon content.

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401. Non-alluvial wetlands of the Southern Blue Ridge: Diversity in a threatened ecosystem.

Weakley, A. S. and Schafale, M. P. *Water, Air, and Soil Pollution* 77(3-4): 359-383. (1994)
NAL Call #: TD172.W36; ISSN: 0049-6979

Abstract: The generally steep landscape of the Southern Blue Ridge is not conducive to the formation of extensive wetlands, but wetlands do occur. Wetlands in this region are mostly small in size (<10 ha), and are found in locations where topography is unusually gentle or where seepage is unusually strong or constant. Despite their rarity and small size, such wetlands show great species and community diversity, and are one of the most important habitats for rare (endemic and disjunct) plants and animals in the region. Community species composition seems to vary primarily in relation to elevation, topographic position, hydrology, underlying bedrock composition, recent land use, and biogeographic history. Based on differences in vegetation structure and composition, landscape position,

and hydrology, we recognize nine groups of non-alluvial wetlands in the Southern Blue Ridge. An inventory of non-alluvial wetlands in the mountains of North Carolina revealed that the majority of these naturally rare communities are now destroyed or severely altered. Bogs and fens of the North Carolina mountains have been reduced nearly six-fold from an original extent of about 2000 ha, so that only about 300 ha remain in reasonably intact condition, and most of the remnants are compromised by hydrologic alteration and nutrient inputs. Because wetlands tend to be concentrated in valley bottoms and at low elevations where most land is privately owned. Efforts to assure their long-term viability will require innovative protection and restoration tools. Based on differences in vegetation structure and composition, landscape position, and hydrology, nine groups of non-alluvial wetlands in the Southern Blue Ridge are recognized. An inventory of non-alluvial wetlands in the mountains of South Carolina revealed that the majority of these naturally rare communities are now destroyed or severely changed. Bogs and fens of the North Carolina mountains have been reduced nearly six-fold from the original gamut of about 2000 ha, so that only about 300 ha remain in reasonably intact condition, and most of the remnants are compromised by hydrologic alteration and nutrient inputs. Because wetlands tend to be concentrated in valley bottom and low elevations where most land is privately owned, efforts to assure their long-term viability will require innovative protection and restoration tools.
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402. The occurrence and impact of sedimentation in central Pennsylvania wetlands.

Wardrop, Denise H. and Brooks, Robert P.
Environmental Monitoring and Assessment 51(1-2): 119-130. (1998)
NAL Call #: TD194; ISSN: 0167-6369
Descriptors: wetlands/ environmental impact/ headwater floodplain/ hydrogeomorphology/ impoundment/ land use management/ landscape disturbance/ mineral accretion rates/ organic accretion rates/ riparian depression/ sedimentation rate/ slope/ wetland plant communities
Abstract: Sedimentation rates and deposited sediment characteristics in twenty-five wetlands in central Pennsylvania were measured during the period Fall 1994 to Fall 1995. Wetlands were located primarily in five watersheds, and represented a variety of hydrogeomorphic (HGM) subclasses surrounding land use. Sedimentation rates were measured via the placement of 135 Plexiglas disks. Annual organic and inorganic loadings were determined. Sedimentation rates ranged from 0 to 8 cm/year, with sedimentation rates significantly correlated with surrounding land use and HGM subclass. Overall mean mineral and organic accretion rates were 778 g m² yr⁻¹ (+/- 1417) and 550 g m² yr⁻¹ (+/- 589), respectively. Mean mineral and organic accretion rates were significantly different by HGM subclass. The highest mineral accretion rates were for headwater floodplains, followed by impoundments, riparian depressions, mainstem floodplains, and slopes. The highest organic accretion rates were for riparian depressions, followed by impoundments, slopes, headwater floodplains, and mainstem floodplains. The potential effects of landscape disturbance on these sedimentation rates was also investigated, in order to develop a conceptual model to predict sedimentation rates

for a given wetland in a variety of landscape settings. Different HGM subclasses exhibited significantly different mineral and organic accumulation rates, and varied in their responses to landscape disturbance and spatial variability in sedimentation patterns. Characterization of wetland plant communities in these same wetlands showed clear associations between individual plant species and ability to tolerate sediment. Species were categorized as very tolerant, moderately tolerant, slightly tolerant, and intolerant based on their association with environments of varying sedimentation magnitude. In general, species that were categorized as very tolerant or moderately tolerant increased their percent cover (dominance) over the sedimentation gradient. These observations were supported by greenhouse germination trials of eight species of wetland plants under a variety of sediment depths, ranging from 0 to 2 cm.
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403. Patterns of wetland hydrology in the Ridge and Valley province, Pennsylvania, USA.

Cole, C. A. and Brooks, R. P.
Wetlands 20(3): 438-447. (2000)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: wetlands/ USA/ hydrology/ sampling/ hydrodynamics/ geomorphology/ surface water/ riparian land/ flood plains/ classification systems/ USA, Pennsylvania
Abstract: Developing an understanding of wetland hydrology that is free from site-specific constraints is difficult. Many hydrologic studies are focused upon a single site and the development of water-budget components. Our previous research examined the hydrology of several wetlands based upon monthly sampling during the growing season. Those data did not provide adequate information on moisture regimes and did not tell us enough about year-round hydrodynamics. Our new objective was to expand hydrologic analyses to a larger proportion of our reference wetlands and extend them over a longer period of time. We continued to organize our wetlands and our analyses around hydrogeomorphic (HGM) principles. We found ground-water-dominated wetlands (riparian depressions and slopes) to be the wettest sites. Surface-water systems (headwater and mainstem floodplain wetlands) were drier. We found little difference between slopes and the floodplain wetlands in the amount of time water was within the root zone. Riparian depressions were wetter longer, as the average duration of water within the root zone was almost a year for riparian depressions and much less for all other wetland types. Disturbance seemed to play a large role in hydrologic behavior, even more than did HGM classification. We believe that knowledge of HGM subclass might serve as a useful surrogate for actual knowledge of site-specific hydrology. The level of uncertainty increases with surface-water systems, but we have shown a large degree of predictability by HGM subclass. Our data likely have applicability within the entire Ridge and Valley province of the Appalachian Mountains in the United States, although our conclusions have not been tested over that wide latitudinal range.
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404. Plant community composition and surface water chemistry of fen peatlands in West Virginia's Appalachian Plateau.

Walbridge, M. R.

Water, Air, and Soil Pollution 77(3-4)(1994)

NAL Call #: TD172.W36; ISSN: 0049-6979.

Notes: Conference: Southern Appalachian Man and the Biosphere (SAMAB) Conference on Wetland Ecology, Management, and Conservation, Knoxville, TN (USA), 28-30 Sep 1993

Descriptors: wetlands/ peatlands/ plant communities/ water chemistry/ surface water/ chemical analysis/ plants/ fens/ geomorphology/ river basins/ peat/ community composition/ geochemistry/ peat bogs/ vegetation cover/ USA, West Virginia, Appalachian Mts., Allegheny Plateau/ geochemistry/ peat bogs/ vegetation cover/ plant communities/ water chemistry/ fens/ geomorphology/ peatlands/ community composition/ plants

Abstract: I analyzed plant community composition, surface water chemistry, soil saturation, landscape position, and disturbance history in 4 small peatlands in West Virginia's Allegheny Plateau, to determine vegetational differences among communities and identify environmental variables associated with community patterning. Thirty-four plant communities were identified, representing 5 physiognomic types: forest, tall and low shrub, herbaceous, and bryophyte. Of 138 species, only 34 were common to all sites; 56 were unique to single sites. Principal components analysis identified a major physiognomic separation between forest and tall shrub communities with less acid surface waters (pH 4.6-5.0) dominated by base cations (Ca super(++), Mg super(++), Na super(+), K super(+)), vs. low shrub and bryophyte communities with more acidic surface waters (pH 4.0-4.4). Much of the variation in community composition resulted from changes in the distributions of *Hypericum densiflorum*, *Rubus hispidus*, *Polytrichum commune*, and *Sphagnum fallax*, with changes in soil saturation. Community distribution reflected an underlying pattern of basin geomorphology modified by beaver disturbance.

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405. Plant litter decomposition in wetlands receiving acid mine drainage.

Kittle, D. L.; McGraw, J. B.; and Garbutt, K.

Journal of Environmental Quality 24(2): 301-306. (1995)

NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: wetlands/ *Acorus calamus*/ *Juncus effusus*/ *Scirpus*/ *Typha latifolia*/ stems/ leaves/ degradation/ acid mine drainage/ heavy metals/ pH/ plant litter/ West Virginia

Abstract: The impact of acid mine drainage on the decomposition of wetland plant species of northern West Virginia was studied to determine if the potential exists for nutrient cycling to be altered in systems used to treat this drainage. There were two objectives of this study. First, decomposition of aboveground plant material was measured to determine species decomposition patterns as a function of pH. Second, decomposition of litter from various pH environments was compared to assess whether litter origin affects decomposition rates. Species differences were detected throughout the study. Decomposition rates of woolgrass [*Scirpus cyperinus* (L.) Kunth] and common rush (*Juncus effusus* L.) were significantly lower than those of *calamus* (*Acorus calamus* L.) and rice cutgrass (*Leersia oryzoides* L.). Differences among species explained a large

proportion of the variation in percentage of biomass remaining. Thus, differences in litter quality among species was important in determining the rate of decomposition. In general, significantly more decomposition occurred for all species in high pH environments, indicating impeded decomposition at low pH. While decomposition of some species litter differed depending on its origin, other species showed no effect. Cattail (*Typha latifolia* L.), in particular, was found to have lower decomposition rates occurring with material grown at low pH. Lower decomposition rates could result in lower nutrient availability leading to further reduction of productivity under low pH conditions. This citation is from AGRICOLA.

406. Rare and endangered plants and animals of Southern Appalachian wetlands.

Murdock, N. A.

Water, Air, and Soil Pollution 77(3-4): 385-405. (1994)

NAL Call #: TD172.W36; ISSN: 0049-6979

Abstract: At least one-third of the threatened and endangered species of the United States live in wetlands. Southern Appalachian bogs and fens, in particular, support a wealth of rare and unique life forms, many of which are found in no other habitat type. In North Carolina alone, nonalluvial mountain wetlands provide habitat for nearly 90 species of plants and animal that are considered rare, threatened, or endangered by the North Carolina Plant Conservation Program, the North Carolina Natural Heritage Program, the North Carolina Wildlife Resources Commission, or the U.S. Fish and Wildlife Service. These species include the bog turtle, mountain sweet pitcher plant, green pitcher plant, swamp pink, bunched arrowhead, and Gray's lily, all of which are either on the federal list of endangered and threatened species or under consideration for that list. Mountain wetlands habitats for these species are being destroyed and degraded at an accelerating rate for highway construction and expansion and residential and recreational development, as well as for industrial and agricultural use. At least one-third of the threatened and endangered species of the United States live in wetlands. Southern Appalachian bogs and fens, in particular, support a wealth of rare and unique life forms, many of which are found in no other habitat type. In North Carolina alone, nonalluvial mountain wetlands provide habitat for nearly 90 species of plants and animals that are considered rare, threatened, or endangered by the North Carolina Plant Conservation Program, the North Carolina Natural Heritage Program, the North Carolina Wildlife Resources Commission, or the U.S. Fish and Wildlife Service. These species include the bog turtle, mountain sweet pitcher plant, green pitcher plant, swamp pink, bunched arrowhead, and Gray's lily, all of which are either on the federal list of endangered and threatened species or under consideration for that list. Mountain wetland habitats for these species are being destroyed and degraded at an accelerating rate for highway construction and expansion and residential and recreational development, as well as for industrial and agricultural uses.

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407. Response of amphibians to restoration of a southern Appalachian wetland: A long-term analysis of community dynamics.

Petranka, J. W.; Kennedy, C. A.; and Murray, S. S.
Wetlands 23(4): 1030-1042. (Dec. 2003)
 NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ environmental restoration/ community structure/ species diversity/ amphibians/ monitoring/ frogs/ dynamics/ salamanders/ ecosystems/ restoration/ colonization/ community composition/ environmental impact/ breeding seasons/ *Ambystoma maculatum*/ *Rana sylvatica*/ *Notophthalmus viridescens*/ *Anura*/ USA, North Carolina/ spotted salamander/ wood frog/ reclamation/ effects of pollution/ conservation, wildlife management and recreation/ water pollution: monitoring, control and remediation

Abstract: Although amphibians are increasingly being used to assess ecosystem function of compensatory wetlands, there are almost no long-term studies of responses to ecological restoration. Consequently, much uncertainty exists about the appropriate timeframes and best criteria for evaluating responses to wetland restoration. We studied aspects of pond colonization and long-term community dynamics in ponds created at a mitigation site in western North Carolina. We examined whether landscape variables influenced the initial colonization of 22 constructed ponds and conducted a long-term study of changes in species richness and community composition in ten constructed and ten reference ponds over seven breeding seasons. During the first year of pond filling, species richness and the number of egg masses of the wood frog (*Rana sylvatica*) and spotted salamander (*Ambystoma maculatum*) were positively correlated with pond size, depth, and hydroperiod but independent of distance to the nearest forest, paved road, or source pond. The ten constructed ponds in the long-term study first filled in 1996 and were larger, deeper, warmer, more oxygen-rich, and of longer seasonal hydroperiod than reference ponds. Seven species bred in the constructed ponds during the first year of filling, and species richness reached equilibrium within two years of initial pond filling. Most species colonized constructed ponds rapidly, but frequency of use by eastern newts (*Notophthalmus viridescens*) increased slowly over five years. Constructed ponds supported significantly more species than reference ponds, and the annual turnover rate of breeding populations was approximately 25% for both pond types. Our data suggest that post-restoration monitoring for 2-3 years may be sufficient to characterize species and communities that will utilize ponds for the first decade or so after pond creation.

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408. Response of amphibians to restoration of a southern Appalachian wetland: Perturbations confound post-restoration assessment.

Petranka, J. W.; Murray, S. S.; and Kennedy, C. A.
Wetlands 23(2): 278-290. (June 2003)
 NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ environmental restoration/ monitoring/ demography/ pathogens/ amphibians/ population dynamics/ eggs/ ponds/ land management/ restoration/ amphibiotic species/ larvae/ environmental monitoring/ droughts/ environmental impact/ reproduction/ mortality causes/ recruitment/ hatching/ breeding seasons/ animal physiology/ life cycle/ sexual selection/

metamorphosis/ governments/ *Rana sylvatica*/ *Ambystoma maculatum*/ *Ranavirus*/ *Anura*/ USA, North Carolina/ wood frog/ spotted salamander/ reclamation/ water quality control/ habitat community studies/ conservation, wildlife management and recreation/ water pollution: monitoring, control and remediation

Abstract: Although regulatory agencies in the USA typically require 3-5 yr of post-restoration monitoring of biotic responses to wetland mitigation, many researchers have argued that longer time frames are needed to assess population responses adequately. We conducted an 8-yr study to examine the demographic responses of the wood frog (*Rana sylvatica*) and spotted salamander (*Ambystoma maculatum*) to wetland creation at a mitigation bank in western North Carolina. Our primary goals were to compare juvenile output in ten reference and ten constructed ponds and to assess the overall change in breeding population size in response to site restoration. We used annual censuses of egg masses to assess changes in breeding population size and used estimates of larval population size at hatching and the initiation of metamorphosis to assess embryonic and larval survival. Adults of both species bred in most constructed ponds within a few months after filling in 1996. Estimated juvenile production from 1996 to 2002 did not differ significantly between pond types for either species. The percentage of both constructed and reference ponds that produced juveniles decreased markedly from 1996 to 1998 and remained low through 2002. The decrease in juvenile output was mostly associated with reduced larval survival rather than increased embryonic mortality across years. Drought and outbreaks of a pathogen (*Ranavirus*) were the primary causes of low juvenile production from 1998 to 2002. The overall breeding population of *R. sylvatica* increased markedly in 1999-2000 following a large recruitment of juveniles from constructed ponds in 1996-1997. With the onset of drought and ranaviral infections, the population declined to levels in 2002 that were at or below 1995 pre-restoration numbers. Despite site perturbations, the breeding population of *A. maculatum* remained relatively stable from 1995 to 2002, a phenomenon that may reflect selection for delayed reproduction and iteroparity in this species. Although we have monitored *R. sylvatica* and *A. maculatum* for seven breeding seasons after the creation of seasonal wetlands, we are still uncertain that site restoration will achieve the goal of increasing breeding populations above pre-restoration levels. Because amphibians have significant population lags and are sensitive to site perturbations, monitoring that exceeds five years may be required to assess demographic responses to site restoration adequately.

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409. The roles of spent mushroom substrate for the mitigation of coal mine drainage.

Stark, Lloyd R. and Williams, Frederick M.
Compost Science and Utilization 2(4): 84-94. (1994)
 NAL Call #: TD796.5.C58; ISSN: 1065-657X

Descriptors: iron/ manganese/ carbon/ nitrogen/ sulfate/ Basidiomycetes (Fungi Unspecified)/ fungi/ microorganisms/ nonvascular plants/ plants/ acidity/ iron/ limestone dissolution/ manganese/ nitrogen/ organic carbon/ pH/ sulfate reduction/ water quality

Abstract: Spent mushroom substrate (SMS) has been used widely in coal mining regions of the USA as the primary

substrate in constructed wetlands for the treatment of coal mine drainage. Such mine drainage is usually acidic and contains high concentrations of dissolved Fe and, less commonly, Mn. In laboratory and mesocosm studies, SMS has emerged as one of the substrates for mine water treatment, owing to its high organic carbon and limestone content. Processes that are responsible in waterlogged SMS for the successful treatment of acidity and Fe include limestone dissolution, sulfate reduction, and Fe oxidation. Provided the pH of the mine water does not fall below 3.0, SMS can be used in the mitigation plan. However, neither Mn nor dissolved ferric Fe appears to be treatable using reducing SMS wetlands. Care must be taken to create reducing conditions in the SMS wetlands, since if the SMS volume is too low, oxidizing conditions will obtain throughout the profile of the SMS, and eventually the SMS will fail to treat the water. Since after a few years much of the nonrefractive organic carbon in SMS will have been decomposed and metabolized, carbon supplementation can significantly extend the life of the SMS treatment wetland and improve water treatment. Several species of plants thrive in SMS under mine water conditions, but none improve water quality over the short term in excess of the treatment provided by SMS. Nitrogen leakage from SMS wetlands is not problematic after several weeks of operation.

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410. The seed banks of a southern Appalachian fen and an adjacent degraded wetland.

Rossell, I. M. and Wells, C. L.

Wetlands 19(2): 365-371. (1999)

NAL Call #: QH75.A1W47; *ISSN:* 0277-5212

Descriptors: wetlands/ seeds/ fens/ conservation/ land management/ seedlings/ soil types/ seed banks/ nature conservation/ flood plains/ biological surveys/ vegetation cover/ hydrology/ USA/ USA, Appalachian Mts./ USA, North Carolina/ fens

Abstract: Bogs and fens are rare communities in the southern Appalachians of the USA. Many have been degraded, and little ecological information beyond cursory floral inventories is available to help guide conservation and restoration efforts. The seedling emergence technique was used to examine the soil seed banks of open and closed canopy regions of a southern mountain fen in North Carolina. We also examined the seed bank of an adjoining portion of the floodplain, which had been drained and cleared for a golf fairway and is now slated for restoration. A total of 32 taxa emerged, with graminoids (particularly *Juncus* spp.) dominating all three seed banks. Seedlings were assigned to one of five plant types: woody, rush, sedge, grass, or forb. Significantly more woody seedlings emerged in soils from the closed canopy fen than in soils from the other two areas. Most rush seedlings emerged in open canopy fen soils, more sedge and forb seedlings emerged in floodplain soils, and more grass seedlings emerged in floodplain soils than in closed canopy fen soils. A discriminant function analysis separated the open canopy fen from the closed canopy fen and floodplain by seedlings of woody plants and rushes. The floodplain was separated from the open and closed regions of the fen by sedge and grass seedlings. These patterns in seed bank composition bore little similarity to the standing vegetation in the three

areas. Restoration activities planned for the floodplain are intended to restore its hydrology and microtopography, which will strongly influence recruitment from the seed bank and surrounding seed sources.

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411. Small mammal communities of high elevation central Appalachian wetlands.

Francl, K. E.; Castleberry, S. B.; and Mark Ford, W.

American Midland Naturalist 151(2): 388-398. (2004)

NAL Call #: 410 M58; *ISSN:* 0003-0031

Descriptors: wetlands/ population levels/ species richness/ disturbance/ land use/ mountains/ community composition/ species diversity/ population density/ biological surveys/ quantitative distribution/ environment management/ environmental factors/ mammals/ density/ meadows/ elevation/ roads/ deciduous forests/ distribution/ Mammalia/ *Microtus pennsylvanicus*/ *Clethrionomys gapperi*/ *Sorex cinereus*/ *Synaptomys cooperi*/ *Blarina brevicauda*/ USA, West Virginia/ USA, Maryland/ USA, West Virginia, Appalachian Mts./ USA, Maryland, Appalachian Mts.

Abstract: We surveyed small mammal assemblages at 20 high-elevation wetlands in West Virginia and Maryland and examined relationships among mammal capture rates, richness and evenness and landscape features at multiple spatial scales. In 24,693 trap nights we captured 1451 individuals of 12 species. Small mammal species richness increased with wetland size and was negatively correlated with trail density. Generalists, such as meadow voles (*Microtus pennsylvanicus*) and shrews (*Sorex cinereus*, *Blarina brevicauda*), dominated larger, more open wetlands, whereas southern red-backed voles (*Clethrionomys gapperi*) were more prevalent at smaller sites surrounded by mixed coniferous-deciduous forest stands. Furthermore, meadow voles were captured more often at sites with higher road density and lower trail density. Southern bog lemmings (*Synaptomys cooperi*) were captured at less than half the sites, all of which were surrounded by a high proportion of deciduous forest. Although significant relationships were found, landscape features explained <20% of total variation at any spatial scale. Other factors, such as land use history or competition, likely have exerted a greater influence in small mammal abundance and distribution at these sites.

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412. Soil characteristics of four southern Appalachian fens in North Carolina, USA.

Moorhead, K. K.; Moynihan, R. E.; and Simpson, S. L.

Wetlands 20(3): 560-564. (2000)

NAL Call #: QH75.A1W47; *ISSN:* 0277-5212

Descriptors: wetlands/ fens/ organic carbon/ soil properties/ hydrogen ion concentration/ flood plains/ groundwater/ seepage/ sediment properties/ sediment chemistry/ classification systems/ hydrology/ geomorphology/ USA, North Carolina/ USA, North Carolina

Abstract: Mountain fens are uncommon and unique wetlands in the southern Appalachian Highlands. We selected four mountain fens in North Carolina to compare soil particle-size distribution, organic carbon, pH, cation exchange capacity (CEC), and exchangeable Mg super(+2), Ca super(+2), and K super(+). Three of the sites are depressional areas on alluvial floodplains at elevations between 700 and 1130 m above sea level, while the fourth site is located on a slope intersecting ground-water

seepage at an elevation of 950 m. Peat accumulation amounted to a shallow surface Sphagnum layer (usually <5 cm) at three sites, and the organic carbon content of the surface soil horizon ranged from 4 to 21%. Three of the soils would be classified as Cumulic Humaquepts, and the other is a Terric Haplohemist. The pH of the surface horizon of the four soils ranged from 4.3 to 4.9. The alluvial fens had higher silt concentrations than the seepage fen, and two of the alluvial fens had a subsurface, fine-textured deposit. The seepage fen showed little textural variation with depth. Exchangeable Ca super(+2) concentrations were higher for the seepage fen. The CEC ranged from 15 to 62 cmol sub(c) kg super(-1) in the surface horizon, and base saturation (Ca super(+2), Mg super(+2) and K super(+)) was <12% for the three alluvial fens and 20% for the seepage fen. Base saturation increased to 40% in the lower horizons of the seepage fen but remained <10% for the alluvial fens. The differences in soil characteristics suggest that geomorphic location should be considered when comparing mountain fens.

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413. Treatment of domestic wastewater by three plant species in constructed wetlands.

Coleman, J.; Hench, K.; Garbutt, K.; Sexstone, A.; Bissonnette, G.; and Skousen, J
Water, Air, and Soil Pollution 128(3-4): 283-295. (2001)
 NAL Call #: TD172 .W36; ISSN: 0049-6979
 Descriptors: pollution control/ wastewater treatment/ aquatic plants/ biochemical oxygen demand/ water pollution treatment/ nitrogen/ ammonia/ gravel/ phosphates/ suspended particulate matter/ domestic wastes/ plants/ effluents/ phytoremediation/ Juncus effusus/ Scirpus validus/ Typha latifolia/ USA, West Virginia/ artificial wetlands/ experimental design/ plant growth/ species composition/ wastewater analysis/ performance evaluation/ domestic wastewater/ sewages

Abstract: Three common Appalachian plant species (*Juncus effusus* L., *Scirpus validus* L., and *Typha latifolia* L.) were planted into small-scale constructed wetlands receiving primary treated wastewater. The experimental design included two wetland gravel depths (45 and 60 cm) and five planting treatments (each species in monoculture, an equal mixture of the three species, and controls without vegetation), with two replicates per depth x planting combination. Inflow rates (19 L day super(-1)) and frequency (3 times day super(-1)) were designed to simulate full-scale constructed wetlands as currently used for domestic wastewater treatment in West Virginia. Influent wastewater and the effluent from each wetland were sampled monthly for ten physical, chemical and biological parameters, and plant demographic measurements were made. After passing through these trough wetlands, the average of all treatments showed a 70% reduction in total suspended solids (TSS) and biochemical oxygen demand (BOD), 50 to 60% reduction in nitrogen (TKN), ammonia and phosphate, and a reduction of fecal coliforms by three orders of magnitude. Depth of gravel (45 or 60 cm) had little effect on wetland treatment ability, but did influence *Typha* and *Scirpus* growth patterns. Gravel alone provided significant wastewater treatment, but vegetation further improved many treatment efficiencies. *Typha* significantly out-performed *Juncus* and *Scirpus* both in growth and in effluent quality improvement. There was also some evidence that the species mixture out-performed species

monocultures. *Typha* was the superior competitor in mixtures, but a decline in *Typha* growth with distance from the influent pipe suggested that nutrients became limiting or toxicities may have developed.

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414. Vegetation, invertebrate, and wildlife community rankings and habitat analysis of mitigation wetlands in West Virginia.

Balcombe, C. K.; Anderson, J. T.; Fortney, R. H.; and Kordek, W. S.
Wetlands Ecology and Management 13(5): 517-530. (2005)
 NAL Call #: QH541.5.M3 W472; ISSN: 0923-4861
 Descriptors: created wetland/ man-made wetland/ mitigation wetland/ reference wetland/ restored wetland/ wetland management/ wetland mitigation

Abstract: Numerous efforts have been made in West Virginia to construct and restore compensatory wetlands as mitigation for natural wetlands destroyed through highway development, timbering, mining, and other human activities. Because such little effort has been made to evaluate these wetlands, there is a need to evaluate the success of these systems. The objective of this study was to determine if mitigation wetlands in West Virginia were adequately supporting ecological communities relative to naturally occurring reference wetlands and to attribute specific characteristics in wetland habitat with trends in wildlife abundance across wetlands. Specifically, avian and anuran communities, as well as habitat quality for eight wetland-dependent wildlife species were evaluated. To supplement this evaluation, vegetation and invertebrate communities also were assessed. Wetland ranks were assigned based on several parameters including richness, abundance, diversity, density, and biomass, depending on which taxa was being analyzed. Mitigation wetlands consistently scored better ranks than reference wetlands across all communities analyzed. Canonical correspondence analysis revealed no correlations between environmental variables and community data. However, trends relating wetland habitat characteristics to community structure were observed. These data stress the need to maintain specific habitat characteristics in mitigated wetlands that are compatible with wildlife colonization and proliferation. © Springer 2005.

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415. Wetland nitrogen dynamics in an Adirondack forested watershed.

McHale, Michael R.; Cirimo, Christopher P.; Mitchell, Myron J.; and McDonnell, Jeffrey J.

Hydrological Processes 18(10): 1853-1870. (2004)
 NAL Call #: GB651.H93; ISSN: 0885-6087
 Descriptors: wetlands/ groundwater/ streams/ nitrogen/ nutrients/ surface water/ nitrogen compounds/ stream discharge/ lysimeters/ cross-sections/ forest watersheds/ nitrates/ watersheds/ stream flow/ coastal inlets/ dissolved organic nitrogen/ surface chemistry/ USA, New York, Adirondack Mts./ chemical processes/ physics and chemistry

Abstract: Wetlands often form the transition zone between upland soils and watershed streams, however, stream-wetland interactions and hydrobiogeochemical processes are poorly understood. We measured changes in stream nitrogen (N) through one riparian wetland and one beaver meadow in the Archer Creek watershed in the Adirondack

Mountains of New York State, USA from 1 March to 31 July 1996. In the riparian wetland we also measured changes in groundwater N. Groundwater N changed significantly from tension lysimeters at the edge of the peatland to piezometer nests within the peatland. Mean N concentrations at the peatland perimeter were 1.5, 0.5 and 18.6 $\mu\text{mol L}^{-1}$ for NH_4^+ , NO_3^- and DON (dissolved organic nitrogen), respectively, whereas peatland groundwater N concentration was 56.9, 1.5 and 31.6 $\mu\text{mol L}^{-1}$ for NH_4^+ , NO_3^- and DON, respectively. The mean concentrations of stream water N species at the inlet to the wetlands were 1.5, 10.1 and 16.9 $\mu\text{mol L}^{-1}$ for NH_4^+ , NO_3^- and DON, respectively and 1.6, 28.1 and 8.4 $\mu\text{mol L}^{-1}$ at the wetland outlet. Although groundwater total dissolved N (TDN) concentrations changed more than stream water TDN through the wetlands, hydrological cross-sections for the peatland showed that wetland groundwater contributed minimally to stream flow during the study period. Therefore, surface water N chemistry was affected more by in-stream N transformations than by groundwater N transformations because the in-stream changes, although small, affected a much greater volume of water. Stream water N input-output budgets indicated that the riparian peatland retained 0.16 mol N ha⁻¹ day⁻¹ of total dissolved N and the beaver meadow retained 0.26 mol N ha⁻¹ day⁻¹ during the

study period. Nitrate dominated surface water TDN flux from the wetlands during the spring whereas DON dominated during the summer. This study demonstrates that although groundwater N changed significantly in the riparian peatland, those changes were not reflected in the stream. Consequently, although in-stream changes of N concentrations were less marked than those in groundwater, they had a greater effect on stream water chemistry because wetland groundwater contributed minimally to stream flow.
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416. Wildlife and vegetation response to wetland restoration in the Montezuma Marsh Complex of central New York.

Sleggs, Sheila E. and VanDruff, Larry W.
Syracuse, New York: State University of New York, 1997.
Descriptors: wetlands/ restoration/ ecology/ wetland plants

417. Wildlife use of southern Appalachian wetlands in North Carolina.

Boynton, A. C.
Water, Air, and Soil Pollution 77(3/4): 349-358. (1994)
NAL Call #: TD172 .W36; ISSN: 0049-6979
Descriptors: wetlands/ habitats/ wildlife/ community ecology/ vegetation/ wild animals/ endangered species
This citation is from AGRICOLA.

Effects of Agricultural Conservation Practices on Wetlands

418. Best management practices for forested wetlands in the southern Appalachian region.

Aust, W. M.
Water, Air, and Soil Pollution 77(3-4)(1994)
NAL Call #: TD172 .W36; ISSN: 0049-6979.
Notes: Conference: Southern Appalachian Man and the Biosphere (SAMAB) Conference on Wetland Ecology, Management, and Conservation, Knoxville, TN (USA), 28-30 Sep 1993
Descriptors: wetlands/ forest management/ forestry/ nature conservation/ watersheds/ pollution control/ water quality/ resource management/ nonpoint pollution/ water quality control/ nonpoint pollution sources/ river basin management/ USA, Appalachian Mts./ best management practices/ nonpoint pollution/ nonpoint pollution sources/ water quality control/ river basin management/ forest management/ nature conservation/ pollution control/ resource management/ forestry
Abstract: Forestry best management practices (BMPs) have been developed for all of the states included in the Southern Appalachian Region (Alabama, Georgia, Kentucky, North Carolina, South Carolina, Tennessee, Virginia, West Virginia). All of the state forestry BMPs were developed to reduce nonpoint source pollution from forestry operations. However, the states have developed BMPs that differ substantially with regard to methodology, particularly for forested wetlands. The state BMP guidelines vary in several major areas, including wetland types, BMP manual detail, streamside management zones, harvesting operations, site preparation operations, regeneration

systems, road construction, and timber removal activities. An understanding of the similarities and differences between the state BMP guidelines will allow the forested wetland manager to comply with or improve upon existing forestry BMPs for wetlands.
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419. Effect of landscape position on N mineralization and nitrification in a forested watershed in the Adirondack Mountains of New York.

Ohrui, Kiyokazu; Mitchell, Myron J.; and Bischoff, Joseph M.
Canadian Journal of Forest Research 29(4): 497-508. (1999)
NAL Call #: SD13.C35; ISSN: 0045-5067
Descriptors: pollution assessment control and management/ forest ecosystem/ forested watershed/ landscape position effect/ wetland ecosystem
Abstract: Within a forest ecosystem in the Adirondack Mountains of New York, net N mineralization and nitrification rates were measured at different landscape positions (zones). Net N mineralization rates (0-15 cm depth) were less (39 kg Ncndtoha⁻¹ per year) within a wetland without alder and with a coniferous overstory than an upland conifer zone (82 kg Ncndtoha⁻¹ per year) and an upland hardwood zone (107 kg Ncndtoha⁻¹ per year). Net N mineralization rates (39 to 82 kg Ncndtoha⁻¹ per year) and the forest floor N concentrations (2.3 to 2.5%) were higher than values reported (1.2-29 kg Ncndtoha⁻¹ and 1.1-2.12%, respectively) for other spruce forests. The

net nitrification rates were higher at the upland hardwood zone (29 kg Ncndtotha-1 per year) than the upland conifer zone (2 kg Ncndtotha-1 per year). The wetland conifer zone without alders had an intermediate rate of net nitrification (13 kg Ncndtotha-1 per year) compared with the upland zones. The presence of white alder (*Alnus incana* (L.) Moench) in the wetland increased the NO₃- content and net nitrification rate of the soil.

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420. Effects of drainage ditches on vegetation patterns in abandoned agricultural peatlands in central New York.

Fisher, A. S.; Podniesinski, G. S.; and Leopold, D. J. *Wetlands* 16(4): 397-409. (1996)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ peat/ marshes/ environmental impact/ plant populations/ agriculture/ environmental effects/ vegetation patterns/ vegetation/ vegetation establishment/ drainage ditches/ hydrological regime/ USA, New York/ drainage ditches/ vegetation patterns/ vegetation establishment/ hydrological regime/ vegetation/ plant populations/ environmental impact/ environmental effects
Abstract: Drainage ditches and ground-water gradients in abandoned agricultural sapric peatlands (mucklands) produce distinctive vegetation patterns. Ditches in abandoned mucklands were ineffective in creating ground-water depression in adjacent soil, while ditches in a newly-cleared muckland were effective in doing so. Upon abandonment, drainage ditches are subject to bank erosion and sedimentation. Coupled with years of soil subsidence and an altered hydrologic regime, ditches lose effectiveness in draining and function merely as small-scale topographic depressions, providing linear zones of seasonally high water levels. Species are distributed on abandoned mucklands in association with soil moisture conditions induced by topographic variation at both small (i.e., ditches) and larger (i.e., site-wide) spatial scales. Vegetation that is usually restricted to moist or saturated soils had greater cover closer to or within drainage ditches or in other topographically low areas, while species with low fidelity to saturated soil dominated the remaining drier areas. Some shrub species had slightly greater stem densities either within or immediately adjacent to ditches, resulting in a "parallel" distribution (i.e., illustrating ditch fidelity). Species having higher affinity to lower soil moisture conditions, such as quaking aspen (*Populus tremuloides*), showed significantly greater stem density in areas farther away from ditches. Ground-water levels are of primary importance in affecting distribution patterns on naturally revegetating, abandoned agricultural mucklands. The accuracy of the wetland indicator status for woody and herbaceous species encountered on these abandoned mucklands is supported quantitatively by direct gradient analysis. The functioning of existing drainage ditch systems should be assessed prior to any mitigation or restoration activities.

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421. Factors influencing amphibian and small mammal assemblages in central Appalachian forests.

Mitchell, J. C.; Rinehart, S. C.; Pagels, J. F.; Buhlmann, K. A.; and Pague, C. A.

Forest Ecology and Management 96(1/2): 65-76. (1997)

NAL Call #: SD1.F73; ISSN: 0378-1127

Descriptors: wetlands/ biodiversity/ species diversity/ community ecology/ forest management/ forest ecology/ small mammals/ deciduous forests/ forest plantations/ clear felling/ plant succession/ seral stages/ climax communities/ habitats/ stand characteristics/ synecology/ age of trees/ stand density/ mixed forests/ wild animals/ Amphibia/ frogs/ insectivores/ rodents/ *Pinus strobus*/ *Quercus alba*/ *Quercus rubra*/ *Betula lenta*/ *Carya glabra*/ *Acer rubrum*/ *Soricidae*/ *Quercus montana*

Abstract: Terrestrial amphibian and small mammal assemblages were studied using drift fences and pitfall traps in five forested stands during 1987-88 on Shenandoah Mountain in the George Washington National Forest, Virginia, USA. The stands were (1) recently clear felled (2 yr old, dominant species *Pinus strobus*, *Quercus alba*), (2) white pine (*P. strobus*) managed forest, (3) mixed hardwood forest (dominant species *Q. rubra*, *Betula lenta*), (4) oak/hickory forest (dominant species *Q. prinus*, *Q. alba*, *Carya glabra*) and (5) climax hardwood forest (dominant species *Q. rubra*, *Acer rubrum*, *Q. alba*). Eleven species of salamanders, 5 species of frogs, 5 species of shrews, and 7 species of rodents were monitored. Amphibians were significantly more abundant in forest stands consisting of mature hardwoods than in the recently clear felled area and the white pine forest. Although there was considerable variation in abundance among species in the 5 stands, small mammal abundance was high in all the habitats studied. Amphibian species diversity (Shannon Index) was less than half that for small mammals because red-backed salamanders (*Plethodon cinereus*) were dominant in most assemblages. Amphibian and small mammal diversity and total species richness were not related to estimated stand age, total number of canopy trees, tree diversity, or frequency of underground rocks. Maintenance of amphibian biodiversity requires the combination of mature hardwoods and wetland habitats (e.g. wildlife ponds and seepages). Most of the small mammals encountered were habitat generalists. Management focus on mature hardwood forests would maintain populations of small mammals requiring cool, moist situations in upper-altitude habitats in the central Appalachian Mountains.

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422. Forest management and wildlife in forested wetlands of the southern Appalachians.

Wigley, T. Bently and Roberts, Thomas H.

Water, Air, and Soil Pollution 77(3-4): 445-456. (1994)

NAL Call #: TD172.W36; ISSN: 0049-6979

Descriptors: animal (Animalia unspecified)/ plant (Plantae unspecified)/ Animalia (Animalia unspecified)/ Plantae (Plantae unspecified)/ animals/ plants/ biodiversity/ ecology/ environmental protection/ forestry/ habitat/ resource management

Abstract: The southern Appalachian region contains a variety of forested wetland types. Among the more prevalent types are riparian and bottomland hardwood forests. In this paper we discuss the temporal and spatial changes in wildlife diversity and abundance often associated with forest management practices within

bottomland and riparian forests. Common silvicultural practices within the southern Appalachians are diameter-limit cutting, clearcutting, single-tree selection, and group selection. These practices alter forest composition, structure, and spatial heterogeneity, thereby changing the composition, abundance, and diversity of wildlife communities. They also can impact special habitat features such as snags, den trees, and dead and down woody material. The value of wetland forests as habitat also is affected by characteristics of adjacent habitats. More research is needed to fully understand the impacts of forest management in wetlands of the southern Appalachians.
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423. Long-term impacts of forest road crossings of wetlands in Pennsylvania.

Miller, R. L.; DeWalle, D. R.; Brooks, R. P.; and Finley, J. C. *Northern Journal of Applied Forestry* 14(3): 109-116. (1997)
NAL Call #: SD143.N6; ISSN: 0742-6348
Descriptors: wetlands/ forests/ roads/ surveys/ habitats/ waterways/ vegetation/ land ownership/ landforms/ rivers/ width/ Pennsylvania

Abstract: A survey was conducted of 70 forest road crossings of wetlands in Pennsylvania to describe the characteristics of these crossings and to evaluate the long-term impacts of the crossings on habitat quality, channel stability, vegetation, wetland width and channel sediment embeddedness above and below the crossings. Sampling was stratified into five physiographic provinces and three land ownership types. Difficulty was encountered in identifying sites for the survey especially in the glaciated northwest region and on private and industry lands. The majority of samples obtained were from unglaciated provinces and public lands. Wetlands identified were primarily linear riparian wetlands associated with first- and second-order channels. Crossings encountered were largely gravel-covered culverts used to provide access to adjacent management areas. Only 35 of 814 comparisons of mean environmental conditions above and below the wetland crossings were found to be significant. Significant differences that did occur suggested that stream bed fine sediment levels were higher, basal area lower, and herbaceous cover higher in the immediate vicinity of some crossings simply due to the presence of the road and fill banks.

This citation is from AGRICOLA.

Wetlands as Agricultural Conservation Practices

424. Evaluating the efficiency of toxicity abatement in a constructed wetland with *Ceriodaphnia dubia*.

Belin, J. I.; McCaskey, T. A.; and Black, M. C. *Journal of Toxicology and Environmental Health, Part A* 60(2): 137-151. (2000)
NAL Call #: RA565.A1J6; ISSN: 0098-4108
Descriptors: wetlands/ wastewater treatment/ nutrients/ biochemical oxygen demand/ animal wastes/ toxicity testing/ nitrate/ toxicity/ agriculture/ municipal wastewater/ monitoring/ nitrogen/ phosphorus/ oxygen demand/ nitrates/ agricultural wastes/ effluents/ *Ceriodaphnia dubia*/ toxicity abatement/ pigs/ *Ceriodaphnia dubia*/ swine/ wastewater treatment processes/ sewage & wastewater treatment/ toxicology and health

Abstract: Constructed wetlands are becoming increasingly popular as low-cost, high-efficiency means of treating agricultural and municipal wastewaters. Monitoring programs for constructed wetlands usually measure physical and chemical characteristics of wetland treatment, including hydraulic residence time and removal of nutrients (N, P), suspended solids, and biochemical oxygen demand (BOD). However, toxicity abatement is seldom measured as evidence of wetland treatment efficiency. In this study, toxicity tests combined with chemical measurements were employed to measure the efficiency of a constructed wetland in treating swine wastes during fall and winter sampling periods. Although the wetland system operated at three wastewater loading rates, only the high-loading-rate cells were tested because of their year-round flows. Wastewater samples were collected prior to, during, and following wetland treatment to track treatment progress as effluents passed through the wetland cells. Toxicity tests with *Ceriodaphnia dubia* showed significant toxicity abatement of wastewater as it progressed through the constructed wetland system; however, residual toxicity was still observed in the final wetland effluent. No seasonal

differences were observed in toxicity abatement between fall and winter wastewater samples, although nitrate and BOD were removed more efficiently during the fall. Results suggest that, while the constructed wetland system is effective in reducing toxicity in swine wastewater, further pre- or posttreatment or additional dilution is necessary before treated effluents are discharged into surface water.
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425. An evaluation of a constructed wetland to treat wastewater from a dairy farm in Maryland, USA.

Schaafsma, J. A.; Baldwin, A. H.; and Streb, C. A. *Ecological Engineering* 14(1-2): 199-206. (2000)
NAL Call #: TD1.E26; ISSN: 0925-8574

Descriptors: wastewater treatment/ agricultural pollution/ USA, Maryland, Frederick Cty./ dairy wastes/ agricultural runoff/ artificial wetlands/ phosphorus/ best management practices/ animal wastes/ technology/ dairies/ water sampling/ physicochemical properties/ nutrients/ biochemical oxygen demand/ dairy industry waste waters/ runoff (agricultural)/ animal manures/ USA, Maryland, Frederick Cty./ dairy pollution

Abstract: In the Chesapeake Bay drainage basin, wastewater from animal operations laden with nutrients, sediment, and biochemical oxygen demand (BOD) contributes to the degradation of surface water quality. A constructed wetland system was built to treat wastewater from a dairy farm in Frederick County, Maryland to evaluate the use of wetland technology as a best management practice for dairy waste. To assess treatment effects, we sampled water once a month at several sites through the system, which consists of two settling basins, two cells, and a vegetated filter strip. Samples were analyzed for total nitrogen, ammonia, nitrate/nitrite, total phosphorus, ortho-phosphate, total suspended solids, biochemical oxygen

demand, dissolved oxygen, temperature, conductivity, and pH. Flow through the wetland system resulted in significant reductions in concentrations of all analytes except nitrate/nitrite. Relative to initial concentrations, total nitrogen was reduced 98%, ammonia 56%, total phosphorus 96%, ortho-phosphate 84%, suspended solids 96%, and biochemical oxygen demand 97%. Nitrate/nitrite increase by 82%, although mean concentrations were much lower than concentrations of ammonia or total nitrogen. The increase in nitrate/nitrite is probably due to the oxidation of ammonia via nitrification in the vegetated filter strip. Our results suggest that while reductions are large, further removal is necessary to meet design requirements. This may be possible through the addition of another anaerobic wetland cell downstream of the system or recirculation of wastewater through the wetland cells to promote denitrification and uptake of nutrients by plants.

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426. Nitrogen trace gas emissions from a riparian ecosystem in southern Appalachia.

Walker, J. T.; Geron, C. D.; Vose, J. M.; and Swank, W. T. *Chemosphere* 49(10): 1389-1398. (Dec. 2002)
NAL Call #: TD172.C54; ISSN: 0045-6535

Descriptors: wetlands/ biogeochemistry/ riparian vegetation/ grazing/ rehabilitation/ air-earth interfaces/ nitrogen compounds/ mass transfer/ soil chemistry/ data collections/ nitrogen emissions/ nitrogen in ecosystems/ nitric oxide emissions from soil/ ammonia exchange, air-soil/ nitrous oxide emissions from soil/ livestock biometeorology/ renovation/ soil science/ riparian environments/ gas exchange/ atmospheric chemistry/ ammonia/ atmospheric gases/ soils/ ammonium compounds/ microorganisms/ compaction/ organic wastes/ restoration/ nitrates/ BOS/ USA, Appalachian Mts./ cattle effects/ nitrous oxide/ nitric oxide/ true cattle/ chemical processes/ air pollution/ water resources and supplies/ mechanical and natural changes/ atmospheric chemistry
Abstract: In this paper, we present two years of seasonal nitric oxide (NO), ammonia (NH sub(3)), and nitrous oxide (N sub(2)O) trace gas fluxes measured in a recovering riparian zone with cattle excluded and adjacent riparian zone grazed by cattle. In the recovering riparian zone, average NO, NH sub(3), and N sub(2)O fluxes were 5.8, 2.0, and 76.7 ng N m super(-2) s super(-1) (1.83, 0.63, and 24.19 kg N ha super(-1) y super(-1)), respectively. Fluxes in the grazed riparian zone were larger, especially for NO and NH sub(3), measuring 9.1, 4.3, and 77.6 ng N m super(-2) s super(-1) (2.87, 1.35, and 24.50 kg N ha super(-1) y super(-1)) for NO, NH sub(3), and N sub(2)O, respectively. On average, N sub(2)O accounted for greater than 85% of total trace gas flux in both the recovering and grazed riparian zones, though N sub(2)O fluxes were highly variable temporally. In the recovering riparian zone, variability in seasonal average fluxes was explained by variability in soil nitrogen (N) concentrations. Nitric oxide flux was positively correlated with soil ammonium (NH super(+)) sub(4)) concentration, while N sub(2)O flux was positively correlated with soil nitrate (NO super(-)) sub(3)) concentration. Ammonia flux was positively correlated with the ratio of NH super(+)) sub(4) to NO super(-)) sub(3). In the grazed riparian zone, average NH sub(3) and N sub(2)O fluxes were not correlated with soil temperature, N concentrations, or moisture. This was likely due to high variability in soil microsite conditions related to cattle effects

such as compaction and N input. Nitric oxide flux in the grazed riparian zone was positively correlated with soil temperature and NO super(-)) sub(3) concentration. Restoration appeared to significantly affect NO flux, which increased approximately 600% during the first year following restoration and decreased during the second year to levels encountered at the onset of restoration. By comparing the ratio of total trace gas flux to soil N concentration, we show that the restored riparian zone is likely more efficient than the grazed riparian zone at diverting upper-soil N from the receiving stream to the atmosphere. This is likely due to the recovery of microbiological communities following changes in soil physical characteristics.

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427. Periodic draining reduces mosquito emergence from free-water surface constructed wetlands.

Mayhew, C. R.; Raman, D. R.; Gerhardt, R. R.; Burns, R. T.; and Younger, M. S. *Transactions of the ASAE* 47(2): 567-573. (Mar. 2004-Apr. 2004)

NAL Call #: 290.9 Am32T; ISSN: 0001-2351
Descriptors: constructed wetlands/ waste treatment/ wastewater/ dairies/ cattle manure/ chemical oxygen demand/ nitrogen/ phosphorus/ biological treatment/ mosquito control/ drainage/ temporal variation/ Culicidae/ population density/ larvae/ pupae/ eclosion/ Tennessee
Abstract: Both subsurface flow and free-water surface constructed wetland systems have been used for partial treatment of manure-laden wastewater from animal production systems. Subsurface flow systems are considerably more expensive but do not breed mosquitoes. The less expensive free-water surface systems have significant mosquito production potential, which is a serious drawback, especially because of increasing concerns about emerging mosquito-borne disease organisms. Periodically draining constructed wetlands has been suggested as a method of mosquito control. To test this approach, eight free-water surface constructed wetland mesocosms (0.7 m² each) were operated on a one-week drain/fill cycle. Simultaneously, four subsurface flow mesocosms were operated continuously, to compare nitrogen, phosphorus, and organic matter removal between the two systems. Mosquito populations (larvae, pupae, and emerged adults) were monitored in the free-water surface cells, with results demonstrating that periodic draining prevents mosquito emergence in all but high-rainfall conditions. During high-rainfall periods, supplemental drainage or chemical controls might be required to prevent mosquito emergence. Pollutant removal rates, expressed as mass removal rate per unit area, were similar for the free-water surface cells and the subsurface flow cells.
This citation is from AGRICOLA.

428. Pesticide removal from container nursery runoff in constructed wetland cells.

Stearman, G. K.; George, D. B.; Carlson, K.; and Lansford, S. *Journal of Environmental Quality* 32(4): 1548-1556. (2003)
NAL Call #: QH540.J6; ISSN: 0047-2425
Descriptors: wetlands/ pesticide effects/ simazine/ water contamination
Abstract: The increased use of pesticides by container nurseries demands that practices for removal of these

potential contaminants from runoff water be examined. Constructed wetlands may be designed to clean runoff water from agricultural production sites, including container nurseries. This study evaluated 14 constructed wetlands cells (1.2 by 4.9 m or 2.4 by 4.9 m, and 30 or 45 cm deep) that collected pesticide runoff from a 465-m² gravel bed containerized nursery in Baxter, TN. One-half of the cells were vegetated with bulrush, *Scirpus validus*. The cells were loaded at three rates or flows of 0.240, 0.120, and 0.060 m³ d⁻¹. Herbicides - simazine (Princep) [2-chloro-4,6-bis(ethylamino)-s-triazine] and metolachlor (Pennant) [2-chloro-N-(2-ethyl-6methylphenyl)-N-2-methoxy-l-methylethyl-acetamide] - were applied to the gravel portion of the container nursery at rates of 4.78 and 2.39 kg ha⁻¹, respectively, 9 July 1998, and at rates of 2.39 and 1.19 kg ha⁻¹, respectively, 17 May 1999. Pesticides entering the wetland and wetland cell water samples were analyzed daily to determine pesticide removal. At the slower flow rate, which corresponds to lower mass loading and greater hydraulic retention times (HRTs), a greater percentage of pesticides was removed. During the 2-yr period, cells with plants removed 82.4% metolachlor and 77.1% simazine compared with cells without plants, which removed 63.2% metolachlor and 64.3% simazine. At the lowest flow rate and mass loading, wetland cells removed 90.2% metolachlor and 83% simazine. Gravel subsurface flow constructed wetlands removed most of the pesticides in runoff water with the greatest removal occurring at lower flow rates in vegetated cells.

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Central Plains Wetlands General Information

429. **Constructed wetlands for municipal wastewater treatment: Recent experience in Oklahoma.**

Wright, S. G.; Shields, R. T.; and Thung, H. J.
In: Versatility of Wetlands in the Agricultural Landscape.
(Held 17 Sep 1995-20 Sep 1995 at Hyatt Regency, Tampa,
Fla.) Campbell, K. L. (eds.)

St Joseph, Mo.: American Society of Agricultural Engineers
(ASAE); pp. 665-673; 1995.

NAL Call #: QH87.3.V47 1995

Descriptors: groundwater flow/ ponding/ design/ land
types/ artificial wetlands/ wastes/ sewage effluent/
treatment/ waste water treatment/ evaluation

Abstract: Recent design, construction and operating
experience at 3 subsurface flow constructed wetlands in
Oklahoma, USA, are discussed. Ponding, septic conditions
and poor effluent quality were attributed to a complexity of
interrelated biological, physical, chemical, hydrological and
hydraulic factors and to insufficient information concerning
best site specific design criteria.

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430. **A holistic passive integrative sampling approach for assessing the presence and potential impacts of waterborne environmental contaminants.**

Petty, J. D.; Huckins, J. N.; Alvarez, D. A.; Brumbaugh, W.
G.; Cranor, W. L.; Gale, R. W.; Rastall, A. C.; Jones-Lepp,
T. L.; Leiker, T. J.; Rostad, C. E.; and Furlong, E. T.

Chemosphere 54(6): 695-705. (Feb. 2004)

NAL Call #: TD172.C54; ISSN: 0045-6535

Descriptors: artificial wetlands/ wastewater treatment/
water sampling/ sampling methods/ environmental
monitoring/ membranes/ monitoring instruments/ pesticides/
polycyclic aromatic hydrocarbons/ chemical pollution/
environmental assessment/ mercury/ sampling/ samplers/
sewage disposal/ aromatic hydrocarbons/ chlorine

compounds/ sewage & wastewater treatment/ species
interactions: pests and control/ characteristics, behavior
and fate/ water & wastewater treatment

Abstract: As an integral part of our continuing research in
environmental quality assessment approaches, we have
developed a variety of passive integrative sampling devices
widely applicable for use in defining the presence and
potential impacts of a broad array of contaminants. The
semipermeable membrane device has gained widespread
use for sampling hydrophobic chemicals from water and air,
the polar organic chemical integrative sampler is applicable
for sequestering waterborne hydrophilic organic chemicals,
the stabilized liquid membrane device is used to
integratively sample waterborne ionic metals, and the
passive integrative mercury sampler is applicable for
sampling vapor phase or dissolved neutral mercury
species. This suite of integrative samplers forms the basis
for a new passive sampling approach for assessing the
presence and potential toxicological significance of a broad
spectrum of environmental contaminants. In a proof-of-
concept study, three of our four passive integrative
samplers were used to assess the presence of a wide
variety of contaminants in the waters of a constructed
wetland, and to determine the effectiveness of the
constructed wetland in removing contaminants. The
wetland is used for final polishing of secondary-treatment
municipal wastewater and the effluent is used as a source
of water for a state wildlife area. Numerous contaminants,
including organochlorine pesticides, polycyclic aromatic
hydrocarbons, organophosphate pesticides, and
pharmaceutical chemicals (e.g. ibuprofen, oxindole, etc.)
were detected in the wastewater. Herein we summarize the
results of the analysis of the field-deployed samplers and
demonstrate the utility of this holistic approach.

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Wetlands as Agricultural Conservation Practices

431. **A comparison of subcanopy versus overhead application of constructed wetland treated nursery runoff on short and long rotation nursery crops.**

Arnold, Michael A.; Lesikar, Bruce J.; McDonald, Garry V.;
and Wilkerson, Don C.

Journal of Environmental Horticulture 22(4):
217-224. (2004)

NAL Call #: SB1.J66; ISSN: 0738-2898

Descriptors: methods and techniques/ pollution
assessment control and management/ terrestrial ecology:
ecology, environmental sciences/ bog like free surface flow
wetland cell/ gravel filtration sub surface flow wetland cell/
field equipment/ subcanopy irrigation/ water reuse/ applied
and field techniques/ non point source pollution/ nursery
industry/ nursery runoff/ product quality/
water conservation

Abstract: The nursery/greenhouse industry is the fastest
growing segment of U.S. agriculture. Consumer demand for
excellent product quality requires luxury applications of
water and agricultural chemicals. These cultural practices

tend to yield significant volumes of runoff rich in nutrients
and pesticides. A capture and recycle system at the
Nursery/Floral Crops Research and Education Center at
Texas A&M University was fitted with 12 gravel filtration
sub-surface flow (SSF) and 12 bog-like free-surface flow
(FSF) wetland cells. Three cells of each type were planted
with *Canna x generalis* Bailey 'Cherry Red', *Iris L. x 'Clyde
Redmond'*, both species, or no wetland plants. Runoff was
continually collected from the nursery and recycled through
wetland cells prior to application via overhead impact
sprinklers or subcanopy microsprinklers. Short-term (10 wk)
differential effects between overhead and subcanopy
irrigation during production of *Fraxinus pennsylvanica*,
Pistacia chinensis von Bunge, *Quercus virginiana* P. Miller,
and *Taxodium distichum* (L.) Richard in 9.4 liter (3)
containers or *Ilex vomitoria* W. Aiton 'Nana' and
Catharanthus roseus G. Don in 5.8 liter (2) containers were
limited in magnitude. However, overhead irrigation reduced
height and caliper growth or injured the foliage compared to
plants irrigated with subcanopy microsprinklers during

longer-term (14 months) production in large 87.9 liter (27) containers. The extent of reduction was species dependent with *Pinus elliottii* Englemann being minimally impacted, *Pyrus calleryana* Descaisne 'Bradford' intermediate, and *Lagerstroemia* L. x 'Basham's Party Pink' (purportedly a *Lagerstroemia indica* L. x *Lagerstroemia fauriei* B. Koehne hybrid) and *T. distichum* exhibiting more pronounced effects. Damage appeared to be largely a result of high dissolved salt concentrations in irrigation water contacting the foliage. Recycling of runoff through the FSF cells concentrated soluble salts more so than passing the water through the SSF cells. Efficacy of nitrate nitrogen removal varied with species, season, loading rate, and wetland type. However, the constructed wetlands were generally effective under our test conditions at maintaining effluent nitrate levels at ≤ 10 mg/liter (10 ppm) when loading rates were ≤ 50 mg/liter (50 ppm). Presence of emergent wetland plants (those with roots imbedded in the substrate and shoots extending above the water surface, rather than floating or submerged plants) in the system was more important for effectively reducing nitrate levels in effluent from SSF than from FSF cells.

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Central Valley Wetlands General Information

432. Benthic invertebrates at foraging locations of nine waterbird species in managed wetlands of the northern San Joaquin Valley, California.

Safran, R. J.; Isola, C. R.; Colwell, M. A.; and Williams, O. E.

Wetlands 17(3): 407-415. (1997)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ USA, California, San Joaquin Valley/ invertebrates/ forages/ water depth/ site selection/ water birds/ benthic fauna/ midges/ aquatic habitats/ oligochaetes/ ecology/ zoobenthos/ aquatic birds/ habitat selection/ food availability/ Invertebrata

Abstract: The ecologies of waterbirds are closely tied to the distribution and abundance of food resources. For many species of waterfowl and shorebirds, benthic invertebrates (especially Chironomidae) are an important dietary component that influences habitat selection. Consequently, we sampled benthic invertebrates and measured water depth at foraging locations of nine waterbird species and paired random sites in the Grasslands of the northern San Joaquin Valley, California, USA from January to April 1994 and 1995. Our resulting habitat-selection models indicate significant differences in benthic invertebrate densities or biomasses at foraging and random locations for three of nine species and significant differences in water depths between foraging and random locations for four of nine species. Additionally, we observed significant interspecific differences in water depths at foraging locations - shorebirds used shallow habitats (<10 cm), whereas most waterfowl species foraged in deep water (>20 cm).

Waterfowl foraged over a wider range of water depths than shorebirds, indicating greater behavioral flexibility in habitat use. Our results indicate that selection of foraging habitat by smaller bodied waterbirds, including dowitchers, dunlin, western sandpiper, and least sandpiper is strongly influenced by water depth, which mediates the availability of benthic invertebrates. Additionally, foraging site selection of more mobile taxa that are able to forage in a wide range of water depths, including northern shoveler and American green-winged teal, is influenced by invertebrate biomass. The broad range of water depths used by waterfowl and the relatively restricted depths used by shorebirds indicate that water depth can be manipulated to benefit a multitude of waterbird species.

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433. Bird community patterns of spring-seasonal and semi-permanent wetlands in the Sacramento Valley, California.

Harris, P. Dawn

Corvallis, Oregon: Oregon State University, 2001.

Descriptors: wetlands/ restoration/ ecology/ birds/ California

434. A decision support system for adaptive real-time management of seasonal wetlands in California.

Quinn, N. W. T. and Hanna, W. M.

Environmental Modelling and Software 18(6): 503-511.

(2003); ISSN: 1364-8152

Descriptors: wetlands/ environment management/ environmental protection/ water flow/ rivers/ surface water/

models/ saline environments/ wildlife/ decision support systems/ salinity/ water management/ environmental management/ environmental legislation/ environmental monitoring/ ecosystem management/ salts/ saline water/ habitat/ nature conservation/ USA, California, San Joaquin Valley/ management tools/ aquatic birds

Abstract: This paper describes the development of a comprehensive flow and salinity monitoring system and application of a decision support system (DSS) to improve management of seasonal wetlands in the San Joaquin Valley of California. The Environmental Protection Agency regulates salinity discharges from non-point sources to the San Joaquin River using a procedure known as the total maximum daily load (TMDL) to allocate the assimilative capacity of the river for salt among watershed sources. Management of wetland sources of salt load will require the development of monitoring systems, more integrative management strategies and coordination with other entities. To obtain local cooperation, the Grassland Water District (GWD), whose primary function is to supply surface water to private duck clubs and manage wetlands, needs to communicate to local landowners the likely impacts of salinity regulation on the long-term health and function of wildfowl habitat. The project described in this paper will also provide this information. The models that form the backbone of the DSS, develop salinity balances at both a regional and local scale. The regional scale concentrates on deliveries to and exports from the GWD while the local scale focuses on an individual wetland unit where more intensive monitoring is being conducted. The design of the DSS is constrained to meet the needs of busy wetland managers and is being designed from the bottom up utilizing tools and procedures familiar to these individuals.
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435. Interspecific differences in habitat use of shorebirds and waterfowl foraging in managed wetlands of California's San Joaquin Valley.

Isola, C. R.; Colwell, M. A.; Taft, O. W.; and Safran, R. J.

Waterbirds 23(2): 196-203. (2000)

NAL Call #: QL671; ISSN: 1524-4695

Descriptors: bottom topography/ foraging/ habitat use/ interspecific differences/ managed wetlands/ water depth
Abstract: A common wetland management objective is to provide habitat for a diverse assemblage of species, which requires data on interspecific differences in habitat use. Consequently, we studied habitat use by ten water-bird taxa (four dabbling ducks and six shorebirds) foraging in managed, seasonal wetlands in the northern San Joaquin Valley, California during late winter and early spring of 1994 and 1995. A MANOVA analysis detected strong interspecific differences in habitat use, with water depth explaining 86% of differences among taxa in a discriminant function analysis. ANOVA identified four groups based on similarities in use of water depth: 1) small shore-birds (<5 cm); 2) large shorebirds (5-11 cm); 3) teal (10-15 cm); and large dabbling ducks (>20 cm). Among these groups, variation in water depth at foraging locations increased with size, suggesting that water depth constrained foraging by shorebirds and teal more than larger waterfowl. In California's Central Valley, where large numbers of

shorebirds and waterfowl winter, our findings suggest that managers can provide habitat for shorebirds and water-fowl by reducing the average depth to which habitats are flooded, especially during winter when deep-water habitat is abundant. Within a wetland complex or an individual wetland, this prescription will yield greatest diversity of water depth, and, hence, bird use in wetlands characterized by variable bottom topography.

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436. Modeling pollutant fate and transport in constructed wetlands.

Brown, Russell T.; Field, Joanne J.; Zanolli, Michael J.; and Crites, Ron W.

In: National Conference on Environmental Engineering.; pp. 532-539; 1994.

Abstract: The Constructed Wetlands Fate and Aquatic Transport Evaluation Model (CWFATE) was developed to evaluate alternative design and operations of the constructed wetlands treatment system (CWTS) at the Sacramento Regional Wastewater Treatment Plant in Elk Grove, California. The model simulates the daily fate and transport of metals and other influent pollutants in an effort to predict CWTS effluent concentrations, removal efficiency, and long-term bioaccumulation of pollutants in sediment, vegetation, organic material, and aquatic organisms. Due to the difficulty of obtaining scientific information for model verification, final calibration is postponed until further field data become available.

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437. Regional wetlands planning: A case study of coastal wetlands planning in the San Francisco Bay area & southern California.

Denisoff, C. and Movassaghi, M.

In: Taking a Look at California's Ocean Resources: An Agenda for the Future. (Held 24 Mar 1997-27 Mar 1997 at San Deigo, California.) Magoon, O. R.; Converse, H.; Baird, B.; and Miller-Henson, M. (eds.); Vol. 2.

Reston, Va.: American Society of Civil Engineers; pp. 1028-1037; 1998.

Notes: Conference: California and the World Ocean '97
Descriptors: wetlands/ marine resources/ resource management/ coastal zone management/ environment management/ regional planning/ salt marshes/ USA, California, San Francisco Bay/ USA, California, Southern/ case studies/ land reclamation/ land management/ agriculture/ estimating/ coasts/ coastal zone/ USA, California, San Francisco Cty./ conservation, wildlife management and recreation/ coastal zone management/ conservation and environmental protection/ techniques of planning/ environmental action/ legal/ governmental
Abstract: Historically, wetland habitats were often seen only as a breeding ground for disease-carrying mosquitoes. From approximately the mid-18th century through the middle of the 20th century, the vast majority of wetlands in the United States were drained and converted into agricultural land through policies of the federal and state governments for what were the considered more "productive" uses. For example, the Federal Swamp Land Acts - National Swamp and Overflowed Land Act- of the 1800's gave 65 million acres of wetlands to 15 states, including California, for reclamation. In 1866, the California Legislature Commissioned the Board of Swamp and Overflowed Land to manage these properties. In turn, by

1870, the majority of wetlands had been transferred to private ownership. Between 1850 and 1920, about 70 percent of California's wetlands were destroyed, largely by levee and drainage projects. These projects where in some cases subsidized to aid private developers in reclaiming swamplands for agricultural purposes, helping to make California the leading agricultural state in the Nation by 1887 (CA Department of Water Resources 1993).

Estimates of wetlands that historically existed in California range from 3 to 5 million acres. The current estimate of wetland acreage in California is approximately 454,000 acres; this represents an 85 to 90 percent reduction, the greatest percentage loss in the nation.

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438. Seasonal and semipermanent wetlands of California: Invertebrate community ecology and responses to management methods.

de Szalay, Ferenc A.; Euliss, Ned H.; and Batzer, Darold P. In: Invertebrates in freshwater wetlands of North America: Ecology and management/ Batzer, Darold P.; Rader, Russell B.; and Wissinger, Scott A.

New York: John Wiley & Sons, 1999; pp. 829-855.

Notes: ISBN: 0471292583

NAL Call #: QL365.4.A1158

Descriptors: Invertebrata/ disturbance by man/ habitat management/ seasonal and semipermanent wetlands management effect on fauna/ ecology/ semiaquatic habitat/ seasonal and semipermanent wetlands/ community ecology and management/ California/ seasonal and semipermanent wetlands community ecology and management

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439. Simulating vernal pool hydrologic regimes for two locations in California, USA.

Pyke, C. R.

Ecological Modelling 173(2-3): 109-127. (2004)

NAL Call #: QH541.15.M3E25; *ISSN:* 0304-3800

Descriptors: wetlands/ models/ community composition/ hydrology/ USA, California

Abstract: Ecological processes and community composition in vernal pools are dominated by a suite of interrelated hydrologic factors collectively described as a hydrologic regime. This study reports on the development of a hydrologic regime simulation model called PHYDO and its application to two locations in California. PHYDO calculates daily water balance using meteorological data and parameters describing basin morphology, soil characteristics, and vegetation cover. The model provides daily estimates of water depth, volume, and temperature, as well as statistics on seasonal and inter-annual variability. Model predictions are compared to field observations for coastal vernal pools in southern Santa Barbara County, CA, USA (2000-2001), and interior vernal pools near Oroville in the Central Valley of CA, USA (1994-1998). The model was also run for the period 1990-2000 to investigate patterns of inter-annual variation in hydrologic conditions at both sites. Results indicate that vernal pool hydrologic regimes can be modeled primarily based on the direct interception of precipitation and the loss of water to evapotranspiration. Results also suggest differences in hydrologic limiting factors between the sites. Storm frequency appears to be the primary control of hydrologic conditions for Santa Barbara pools, while basin morphology dominates conditions in Oroville. These findings suggest ecologically

important differences in hydrologic regimes between the two vernal pool localities, and PHYDO provides a new set of tools for quantifying these differences for a range of hydrologic variables.

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440. Using tidal salt marsh mesocosms to aid wetland restoration.

Callaway, J. C.; Zedler, J. B.; and Ross, D. L.

Restoration Ecology 5(2): 135-146. (June 1997)

NAL Call #: QH541.15.R45R515; ISSN: 1061-2971

Descriptors: wetlands/ environmental restoration/ salt marshes/ tides/ mesocosms/ USA, California/ environment management/ ecosystem management/ estuaries/ land reclamation/ hydrology/ *Salicornia virginica*/ USA, California, Tijuana Estuary/ reclamation/ protective measures and control

Abstract: Tidal wetland mesocosms at Tijuana River National Estuarine Research Reserve failed to elucidate effects of hydrologic treatments (excluded, impounded, and fully tidal systems) for most parameters measuring *Salicornia virginica* (pickleweed). Although soil salinity increased tidal flushing was excluded for 10 months (salinities rose similar to 20 to 50%), pickleweed cover and algal chlorophyll did not differ among treatments. Effects were seen only in pickleweed growth rates (similar to 30% decrease where tides were excluded) and normalized difference vegetation index (NDVI) measurements. We failed to show any differences between impounded and fully tidal conditions, because the mesocosms had coarse sediments, and impounded water drained easily via subsurface flow. However, the problems that we encountered with the mesocosms led to the following advice for future wetland restoration projects: (1) Mesocosms are useful for testing restoration techniques before an actual restoration project takes place. (2) Mesocosms should be used to test factors that may lead to more successful restoration in the future, including planting techniques, substrate conditions, and hydrology. (3) Mesocosms should be used to develop new assessment methods for monitoring wetland ecosystems. Because of the ability to control some environmental parameters while maintaining seminatural conditions, mesocosms offer great potential for the future evaluation of experimental restoration techniques.

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441. Vernal pool creation in the Sacramento Valley: A review of the issues surrounding its role as a conservation tool.

Sutter, Greg and Francisco, Robert.

In: *Ecology, Conservation, and Management of Vernal Pool Ecosystems*. (Held 19 Jun 1996-21 Jun 1996 at Sacramento, CA.) Witham, Carol W. (eds.): California Native Plant Society; pp. 190-194; 1998.

ISBN: 0-943460-37-9

<http://www.vernalpools.org/proceedings/sutter.pdf>

442. Waterbird communities in managed wetlands of varying water depth.

Colwell, M. A. and Taft, O. W.

Waterbirds 23(1): 45-55. (2000)

NAL Call #: QL671; ISSN: 0738-6028

Descriptors: wetlands/ habitat selection/ community composition/ species diversity/ aquatic birds/ water depth/ environment management/ ecosystem management/ ecological distribution/ habitat utilization/ winter/ USA, California/ Aves/ USA, California, San Joaquin Valley/ birds/ behaviour/ management/ birds

Abstract: Published accounts of interspecific differences in habitat use by waterbirds predict that shallow wetlands should accommodate more species and greater numbers of waterbirds than deep wetlands. We evaluated this hypothesis by examining relationships between winter (January/February) waterbird use (presence/absence, density and number of species) and average depth, variation in depth and size of 25 wetlands in the northern San Joaquin Valley, California. Bird densities correlated consistently with depth. Likelihood of use increased in shallow wetlands for all nine wading birds (shorebirds and ibis); densities of three dabbling duck species and Black-necked Stilt (*Himantopus mexicanus*) also increased in shallow wetlands, whereas use and densities of two diving birds increased in deep wetlands. We observed no statistically significant relationship between depth and densities of two other waterbird species. The number of species of waterbird, dabbling duck, and wading bird increased in shallow wetlands, whereas the number of species of diving bird increased in deep wetlands. Wetland size and topographic variation inconsistently predicted waterbird densities, but both characteristics correlated positively with number of species. Our results provide general support for shallow flooding of wetlands to provide habitat for more species. We conclude that managers seeking to provide foraging habitat for a diverse community of wintering waterbirds should flood wetlands to average depths of 10-20 cm, where topography can provide a range of depths attractive to a large number of species. However, this prescription is region-specific and influenced by the great diversity and abundance of waterfowl and shorebirds wintering in California's Central Valley.

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Effects of Agricultural Conservation Practices on Wetlands

443. Cattle grazing mediates climate change impacts on ephemeral wetlands.

Pyke, Christopher R. and Marty, Jaymee
Conservation Biology 19(5): 1619-1625. (Oct. 2005)
NAL Call #: QH75.A1C5; ISSN: 0888-8892.

Notes: Original Title: El Apacentamiento de Ganado Inluye en los Impactos del Cambio Climatico sobre Humedales Efimeros

<http://www.vernalpools.org/documents/Pyke%20and%20Marty%20Cons%20bio.pdf>

Descriptors: wetlands/ climatic changes/ grazing/ feeding behaviour/ amphibiotic species/ environmental impact/ resource management/ vulnerability/ rare species/ hydrology/ environmental effects/ precipitation/ reproduction/ conservation/ temperature effects/ *Ambystoma californiense*/ Caudata/ USA, California/ California tiger salamander/ salamanders/ habitat community studies/ conservation

Abstract: Climate change impacts depend in large part on land-management decisions; interactions between global changes and local resource management, however, rarely have been quantified. We used a combination of experimental manipulations and simulation modeling to investigate the effects of interactions between cattle grazing and regional climate change on vernal pool communities. Data from a grazing enclosure study indicated that 3 years after the removal of grazing, ungrazed vernal pools dried an average of 50 days per year earlier than grazed control pools. Modeling showed that regional climate change could also alter vernal pool hydrology. Increased temperatures and winter precipitation were predicted to increase periods of inundation. We evaluated the ecological implications of interactions between grazing and climate change for branchiopods and the California tiger salamander (*Ambystoma californiense*) at four sites spanning a latitudinal climate gradient. Grazing played an important role in maintaining the suitability of vernal pool hydrological conditions for fairy shrimp and salamander reproduction. The ecological importance of the interaction varied nonlinearly across the region. Our results show that grazing can confound hydrologic changes driven by climate change and play a critical role in maintaining the hydrologic suitability of vernal pools for endangered aquatic invertebrates and amphibians. These observations suggest an important limitation of impact assessments of climate change based on experiments in unmanaged ecosystems. The biophysical impacts of land management may be critical for understanding the vulnerability of ecological systems to climate change.

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444. Changes of soil and plant tissue selenium status in an upland grassland contaminated by selenium-rich agricultural drainage sediment after ten years transformed from a wetland habitat.

Wu, L.; Banuelos, G.; and Guo, X.

Ecotoxicology and Environmental Safety 47(2): 201-209. (Oct. 2000)

NAL Call #: QH545.A1E29; ISSN: 0147-6513

Descriptors: wetlands/ soil pollution/ plants/ selenium/ grasslands/ sediment pollution/ drainage water/ agriculture/ bioaccumulation/ trees/ soil contamination/ leaching/ environmental impact/ sources and fate of pollution

Abstract: A field survey was conducted in 1989, 1994, and 1999 in order to monitor the soil and vegetation Se concentrations at the Kesterson upland grassland contaminated by Se-rich drainage sediment. The rate of Se dissipation estimated by the change of soil Se concentration, via volatilization, found to be about 1.1% per year. Soil water-extractable Se increased in 1994, but greatly reduced in 1999. The increase of soil Se concentration in the top 15 cm of soil at the fresh-soil fill sites indicates that the plants were able to effectively take up the soluble soil Se from the lower soil profile and to deposit it on the top of the field. This process may reduce the rate of leaching of soil Se. Overall, the concentration of soil water-soluble Se was relatively low and it is unlikely that problems of transport of Se from the Kesterson soil to the adjacent uncontaminated environment by leaching can occur. Plant tissue Se concentration was found to coincide with the soil water-extractable Se concentration. The average plant tissue Se concentration and soil water-extractable Se detected in 1999 was about 10 $\mu\text{g Se g super}(-1)$ and 110 $\mu\text{g Se kg super}(-1)$ dry weight, respectively, and the estimated bioaccumulation value of this upland grassland is less than 10% of the previous wetland habitat. Therefore, the existing Kesterson grassland should not be at high risk to the environment.

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445. Effects of an agricultural drainwater bypass on fishes inhabiting the grassland water district and the lower San Joaquin River, California.

Saiki, M. K.; Martin, V. A.; Schwarzbach, S. E.; and May, T. W.

North American Journal of Fisheries Management 21(3): 624-635. (2001); ISSN: 1548-8675

Descriptors: grassland water district/ Lower San Joaquin River map/ California/ United States of America/ USA/ North America/ agricultural drainwater bypass/ freshwater fish/ community structure/ checklist/ abundance/ selenium concentration/ Se/ environmental factors/ abiotic factors/ water quality/ freshwater fish/ checklist/ impact of forestry or agriculture/ physiology, biology, biochemistry/ ecology and conservation

Abstract: The Grassland Bypass Project, which began operation in September 1996, was conceived as a means of diverting brackish selenium-contaminated agricultural drainwater away from canals and sloughs needed for transporting irrigation water to wetlands within the Grassland Water District (the Grasslands), Merced County, California. The seleniferous drainwater is now routed into the San Luis Drain for conveyance to North Mud Slough and eventual disposal in the San Joaquin River. The purpose of this study was to determine the extent to which the Grassland Bypass Project has affected fishes in sloughs and other surface waters within and downstream from the Grasslands. During September-October 1997, 9,795 fish representing 25 species were captured at 13 sampling sites. Although several species exhibited restricted spatial distributions, association analysis and cluster analysis failed to identify more than one fish species assemblage inhabiting the various sites. However, seleniferous drainwater from the San Luis Drain has influenced selenium concentrations in whole fish within North Mud Slough and the San Joaquin River. The highest

concentrations of selenium (12-23 $\mu\text{g/g}$, dry weight basis) were measured in green sunfish *Lepomis cyanellus* from the San Luis Drain where seleniferous drainwater is most concentrated, whereas the second highest concentrations occurred in green sunfish (7.6-17 $\mu\text{g/g}$) and bluegills *Lepomis macrochirus* (14-18 $\mu\text{g/g}$) from North Mud Slough immediately downstream from the drain. Although there was some variation, fish in the San Joaquin River generally contained higher body burdens of selenium when captured immediately below the mouth of North Mud Slough (3.1-4.9 $\mu\text{g/g}$ for green sunfish, 3.7-5.0 $\mu\text{g/g}$ for bluegills) than when captured upstream from the mouth (0.67-3.3 $\mu\text{g/g}$ for green sunfish, 0.59-3.7 $\mu\text{g/g}$ for bluegills). Waterborne selenium was the single most important predictor of selenium concentrations in green sunfish and bluegills, as judged by results from multiple-regression analyses. Among bluegills, water temperature also contributed to the prediction of selenium body burdens.
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446. Effects of cattle grazing on diversity in ephemeral wetlands.

Marty, Jaymee T.

Conservation Biology 19(5): 1626-1632. (Oct. 2005)
NAL Call #: QH75.A1C5; ISSN: 0888-8892.

Notes: Original Title: Efectos del Apacentamiento de Ganado sobre la Diversidad en Humedales Efimeros
<http://www.vernalpools.org/documents/Marty%20Cons%20Bio.pdf>

Descriptors: wetlands/ species diversity/ grazing/ feeding behaviour/ introduced species/ ranching/ endemic species/ life cycle/ nature conservation/ biodiversity/ rare species/ environmental impact/ aquatic plants/ species richness/ conservation/ USA, California, Central Valley/ habitat community studies/ conservation

Abstract: Cattle are usually thought of as a threat to biodiversity. In regions threatened by exotic species invasion and lacking native wild grazers, however, cattle may produce the type of disturbance that helps maintain diverse communities. Across 72 vernal pools, I examined the effect of different grazing treatments (ungrazed, continuously grazed, wet-season grazed and dry-season grazed) on vernal-pool plant and aquatic faunal diversity in the Central Valley of California. After 3 years of treatment, ungrazed pools had 88% higher cover of exotic annual grasses and 47% lower relative cover of native species than pools grazed at historical levels (continuously grazed). Species richness of native plants declined by 25% and aquatic invertebrate richness was 28% lower in the ungrazed compared with the continuously grazed treatments. Release from grazing reduced pool inundation period by 50 to 80%, making it difficult for some vernal-pool endemic species to complete their life cycle. My results show that one should not assume livestock and ranching operations are necessarily damaging to native communities. In my central California study site, grazing helped maintain native plant and aquatic diversity in vernal pools.

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447. Evaluation of the macroalga, muskgrass, for the phytoremediation of selenium-contaminated agricultural drainage water by microcosms.

Lin, Z. Q.; De Souza, M.; Pickering, I. J.; and Terry, N.

Journal of Environmental Quality 31(6): 2104-2110. (2002)
NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: wetlands/ selenium/ phytoremediation/ agriculture/ drainage/ macrophytes/ water pollution control/ aquatic macrophytes (Characeae)/ remediation/ volatile materials/ *Chara canescens*

Abstract: Previous field studies suggested that the macroalga, muskgrass (*Chara canescens* Desv. & Lois), plays an important role in the removal of selenium (Se) from agricultural drainage water. This study evaluated the efficiency of Se removal from drainage water by muskgrass-vegetated wetland microcosms, and determined the extent to which muskgrass removed Se through phytoextraction and biovolatilization. Six flow-through wetland microcosms were continuously supplied with drainage water containing an average Se concentration of 22 $\mu\text{g L}^{-1}$ over a 24-d experimental period. The Se mass input and outflow and the rate of Se volatilization were monitored daily for each microcosm. Three microcosms containing muskgrass reduced the daily mass Se input in the inflow drainage water by 72.1%; this compared with a reduction of 50.6% of the mass Se input for three unvegetated control microcosms. Selenium accumulated in muskgrass tissues accounted for 1.9% of the total mass Se input in the microcosm, followed by 0.5% via biological volatilization. The low rates of Se volatilization from selenate-supplied muskgrass, which were 10-fold less than from selenite, were probably due to a major rate limitation in the reduction of selenate to organic forms of Se in muskgrass. This conclusion was derived from X-ray absorption spectroscopy speciation analysis, which showed that muskgrass treated with selenite contained 91% of the total Se in organic forms (selenoethers and diselenides), compared with 47% in muskgrass treated with selenate.
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448. Grazing maintains diversity in seasonal wetlands.

Marty, Jaymee T.

In: 89th Annual Meeting Ecological Society of America - Lessons of Lewis and Clark: Ecological Exploration of Inhabited Landscapes. (Held 1 Aug 2004-6 Aug 2004 at Portland, Oregon.); Vol. 89.; pp. 326; 2004.

Descriptors: compatible management practice/ effect of cattle grazing/ species diversity/ vernal pool

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449. The impact of waterfowl foraging on the decomposition of rice straw: Mutual benefits for rice growers and waterfowl.

Bird, J. A.; Pettygrove, G. S.; and Eadie, J. M.

Journal of Applied Ecology 37(5): 728-741. (2000)
NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: agriculture/ ducks/ nitrogen/ straw disposal/ wetland management/ winter habitat

Abstract: 1. Recent legislation in California, USA, has restricted traditional open-field burning of rice straw residues, leading farmers to adopt alternative methods of straw disposal such as post-harvest flooding of rice fields. These changes may benefit wildlife because winter-flooded fallow rice fields provide foraging habitat to migratory waterfowl. In turn, the foraging activity of waterfowl may

help to increase rice straw decomposition, providing a reciprocal benefit to farmers. We examined the effects of waterfowl foraging activity on straw decomposition and nitrogen mineralization following rice harvest in a fallow flooded soil. 2. Experimental plots (25m²) were established on a silty clay soil and were subjected to two post-harvest treatments: wet-rolled or untilled. Mallard ducks *Arias platyrhynchos* were placed in one-half of the experimental plots, following a splitplot design, for a 3-week period, at a density equivalent to 33 birds ha⁻¹ over a season of 180 days to approximate regional abundance data. 3. Waterfowl foraging activity increased residual surface straw decomposition by 78% in untilled plots and 18% in wet-rolled plots compared with the respective unforaged plots. Average straw diameter in foraged plots was reduced to one-third that of unforaged plots. 4. Waterfowl foraging and field tillage reduced nitrogen (N) concentrations in the surface straw residue remaining at the end of the winter fallow period. Below-ground organic residue was not affected by waterfowl foraging, indicating that ducks did not incorporate the straw. There were no apparent additions of carbon (C) or N to the soil as a result of waterfowl activity. 5. We conclude that waterfowl foraging can substantially increase straw decomposition in flooded, fallow, rice fields. Accordingly, rice producers should consider agronomic practices that attract waterfowl, such as winter flooding, to maximize the decomposition of rice straw residue. At the upper end of regionally observed waterfowl densities (at or near 33 birds ha⁻¹ season⁻¹) waterfowl foraging activity may alleviate the need for autumn tillage. Shallow flooded rice fields will also provide important winter habitat to migratory waterfowl, aiding wetland management and conservation efforts in the Central Valley of California. 6. These results provide an example of how a mutually beneficial solution can be achieved that provides needed waterbird habitat while concomitantly alleviating an agricultural problem.
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450. Impacts of changing irrigation practices on waterfowl habitat use in the southern San Joaquin Valley, California.

Barnum, D. A. and Euliss, N. H.
California Fish and Game 77(1): 10-21. (1991)
NAL Call #: 410 C12; ISSN: 0008-1078
Descriptors: agricultural runoff/ California/ diurnal variation/ ducks/ irrigation/ Kern National Wildlife Refuge/ population dynamics/ seasonal variation/ ecological effects/ environmental impact/ irrigation effects/ irrigation practices/ San Joaquin Valley/ waterfowl/ habitat use/ hydrology/ water management/ mallards/ northern pintails/ cinnamon teal/ green-winged teal/ northern shovelers/ ruddy ducks
Abstract: Diurnal aerial census data were used to examine habitat use patterns of ducks wintering in the southern San Joaquin Valley, California from 1980-87. Densities (birds/ha) for the northern pintail (*Anas acuta*), mallard (*A. platyrhynchos*), green-winged teal (*A. crecca*), cinnamon teal (*A. cyanoptera*), shoveler (*A. clypeata*), ruddy duck (*Oxyura jamaicensis*), and total ducks, in each of five habitats, were determined--nocturnal habitat use by ducks may be very different than diurnal use and would therefore yield different densities. Low densities were observed for most species on evaporation ponds, hunting clubs and miscellaneous wetlands. Most hunting clubs were small, isolated parcels of wetland with food production limited by

cost and availability of irrigation water. The low densities observed on these wetlands suggests that they were not heavily used by wintering ducks. However, hunting clubs provided habitat important for attracting ducks away from contaminated evaporation ponds in September and again in late winter (January-February). Evaporation ponds were not heavily used by ducks, but the large area provided by evaporation ponds may affect use of these habitats in the future. Density for all species, except the ruddy duck, was highest on preirrigated croplands or Kern National Wildlife Refuge (Kern NWR). Ducks such as mallard and teal that use densely vegetated wetlands were probably attracted to the diversity of vegetative cover on Kern NWR. Other species, such as pintail, make use of Kern NWR's managed areas for diurnal feeding and resting. Preirrigated croplands had the highest density of pintail. The value of these shallow-flooded wetlands with their available waste grains may be similar to that of rice fields in the Sacramento Valley. Moreover, preirrigated fields provided large expanses of open water for diurnal resting locations important to pintail for predator detection.
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451. Long-term grazing study in spring-fed wetlands reveals management tradeoffs.

Allen-Diaz, B.; Jackson, R. D.; Bartolome, J. W.; Tate, K. W.; and Oates, L. G.
California Agriculture 58(3): 144-148. (2004)
NAL Call #: 100 C12Cag; ISSN: 0008-0845
Descriptors: wetlands/ grazing/ cattle/ springs (water)/ ecosystems/ California
This citation is from AGRICOLA.

452. Organic matter sources and rehabilitation of the Sacramento-San Joaquin Delta (California, USA).

Jassby, A. D. and Cloern, J. E.
Aquatic Conservation: Marine and Freshwater Ecosystems 10(5): 323-352. (2000)
NAL Call #: QH541.5.W3A67; ISSN: 1052-7613
Descriptors: environmental restoration/ rivers/ organic matter/ productivity/ restoration/ tributaries/ organic carbon/ recruitment/ fishery resources/ food availability/ fish larvae/ phytoplankton/ volume transport/ resource conservation/ ecosystem management/ environment management/ particulate organic matter/ conservation/ tidal rivers/ agricultural runoff/ ecosystems/ fisheries/ trophic level/ Pisces/ USA, California, Sacramento-San Joaquin Delta
Abstract: The Sacramento-San Joaquin River Delta, a complex mosaic of tidal freshwater habitats in California, is the focus of a major ecosystem rehabilitation effort because of significant long-term changes in critical ecosystem functions. One of these functions is the production, transport and transformation of organic matter that constitutes the primary food supply, which may be sub-optimal at trophic levels supporting fish recruitment. A long historical data set is used to define the most important organic matter sources, the factors underlying their variability, and the implications of ecosystem rehabilitation actions for these sources. Tributary-borne loading is the largest organic carbon source on an average annual Delta-wide basis; phytoplankton production and agricultural drainage are secondary; wastewater treatment plant discharge, tidal marsh drainage and possibly aquatic macrophyte production are tertiary; and benthic microalgal production, urban run-off and other sources are negligible.

Allochthonous dissolved organic carbon must be converted to particulate form - with losses due to hydraulic flushing and to heterotroph growth inefficiency - before it becomes available to the metazoan food web. When these losses are accounted for, phytoplankton production plays a much larger role than is evident from a simple accounting of bulk organic carbon sources, especially in seasons critical for larval development and recruitment success.

Phytoplankton-derived organic matter is also an important component of particulate loading to the Delta. The Delta is a net producer of organic matter in critically dry years but, because of water diversion from the Delta, transport of organic matter from the Delta to important, downstream nursery areas in San Francisco Bay is always less than transport into the Delta from upstream sources. Of proposed rehabilitation measures, increased use of floodplains probably offers the biggest increase in organic matter sources. An isolated diversion facility - channelling water from the Sacramento River around the Delta to the water projects - would result in substantial loading increases during winter and autumn, but little change in spring and summer when food availability probably matters most to developing organisms. Flow and fish barriers in the channel could have significant effects, especially on phytoplankton sources and in dry years, by eliminating 'short-circuits' in the transport of organic matter to diversion points. Finally, productivity of intentionally flooded islands probably would exceed that of adjacent channels because of lower turbidity and shallower mean depth, although vascular plants rather than phytoplankton could dominate if depths were too shallow.

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453. Review of 15 years of research on ecotoxicology and remediation of land contaminated by agricultural drainage sediment rich in selenium.

Wu, L.

Ecotoxicology and Environmental Safety 57(3): 257-269. (Mar. 2004)

NAL Call #: QH545.A1E29; ISSN: 0147-6513

Descriptors: wetlands/ selenium/ land reclamation/ bioaccumulation/ wildlife/ food chains/ drainage/ grasslands/ vegetation/ soil remediation/ water reservoirs/ sediment pollution/ leaching/ ecotoxicology/ pollution effects/ pollution control/ microorganisms/ salinity effects/ agricultural pollution/ habitats/ reservoirs/ water birds/ methylation/ drainage water/ sediment contamination/ remediation/ contamination/ nesting/ rooted aquatic plants/ safety/ *Gambusia affinis*/ USA, California, Kesterson/ USA, California, Kesterson Reservoir/ USA, California, Central Valley/ mosquitofish/ western mosquitofish/ land pollution/ ecosystems and energetics/ prevention and control/ effects of pollution/ water quality/ soil pollution: monitoring, control & remediation/ effects on organisms

Abstract: The consequences of elevated Se accumulation at the Kesterson Reservoir National Wildlife Refuge in the Central Valley of California created adverse effects on wildlife and led to extensive research on the behavior of Se in both the wetland and upland ecosystems. Selenium concentrations in water entering the Kesterson Reservoir averaged 300 $\mu\text{g/L}$ super(-1). In pond waters 20-30% of the Se was selenate, while only 2% was selenite in the drainage water entering the reservoir. Submerged rooted aquatic plants fed on by water birds were found to contain 18-390mg Sekg super(-1) dry weight. Mosquitofish

collected from the San Luis Drain contained 332mg Sekg super(-1), and those collected from the ponds ranged from 339 to 380mgkg super(-1). Livers of water birds had Se concentrations ranging from 19.9 to 127mgkg super(-1). The high concentrations of Se accumulation in the food chain of the wetland strongly suggest that Se bioaccumulation was the cause of death and deformity of embryos of the waterfowl nesting at the wetland habitat. In June 1986, the Kesterson Reservoir was closed to drain-water inputs, and the wetland was transformed to an upland grassland. New remedial plans were proposed. These new plans involved soil, water, and vegetation management to dissipate Se by bioaccumulation and volatilization through soil microorganisms and plants. The investigations of the potential transfer of Se from farm land into the crop and vegetables in the Central Valley indicated that plant tissue Se concentrations generally fall in a nonseleniferous category, except that the highest Se concentration of cotton was at a threshold where toxicity in animals could occur at a relatively low frequency. At the Kesterson upland grassland habitat, average total Se concentrations ranged from 500 to 8000 $\mu\text{g/kg}$ super(-1) and water-extractable Se ranged from 10 to 700 $\mu\text{g/kg}$ super(-1) in the top 15cm of soil and varied greatly, by a factor greater than 100, among soil samples. Uptake of Se by the plants was profoundly affected by the soil available Se concentration, soil moisture, pH, soil salinity, soil sulfate concentration, soil reoxidation condition, kind of plant species, and soil-management practices. The rate of soil Se dissipation at the Kesterson grassland system was from 1% (low methylation rate) to 5% (high methylation rate) Se inventory per year and it will take from 46 to 230 years to bring the soil Se down to a normal level, 4mg Sekg super(-1) soil. However, the Kesterson upland grassland habitat had Se bioaccumulation values less than 10% of those of the previous wetland. The potential food-chain contamination at the existing Kesterson grassland is much less problematic. No negative impact on wildlife has been reported for the upland habitat. Plants may contribute to the Se reoxidation process and be able to reduce the movement of Se in the soil. At the Kesterson grassland, the distribution of soil Se is extremely uneven; high levels of soil Se concentrated only in isolated spots. Therefore, leaching of soil Se is not at an area level. It is unlikely that problems of transport of Se from the Kesterson soil to the adjacent uncontaminated environment by leaching can occur.

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454. Salt toxicosis in ruddy ducks that winter on an agricultural evaporation basin in California.

Gordus, A. G.; Shivaprasad, H. L.; and Swift, P. K. *Journal of Wildlife Diseases* 38(1): 124-131. (2002)

NAL Call #: 41.9 W64B; ISSN: 0090-3558

Descriptors: brain sodium/ evaporation ponds/ hypersaline water/ *Oxyura jamaicensis*/ ruddy duck/ salt encrustation/ salt toxicosis

Abstract: Agricultural evaporation basins are used as a means to dispose of highly saline underground-tile-drainage water in the San Joaquin Valley (California, USA). The hypersaline water conditions encourage high aquatic invertebrate production, primarily brine shrimp (*Artemia franciscana*), which attract birds to those sites. Cool winter temperatures (<4 C) and hypersaline water conditions (>70,000 $\mu\text{hos/cm}$) resulted in feather salt encrustation and salt toxicosis in ruddy ducks (*Oxyura jamaicensis*).

During December 1998 and January 1999, approximately 200 dead and sick ruddy ducks were collected from an evaporation basin and five healthy control ruddy ducks were collected from a freshwater wetland. Brains contained $1,890$ ppm sodium (wet tissue mass) in seven dead birds and contained $1,150$ ppm sodium in the control birds. Liver arsenic, lead, and mercury concentrations were <1 ppm in all birds examined. Manganese, molybdenum, and copper liver concentrations did not differ significantly ($P > 0.05$) between the two groups of ducks. The dead ducks had significantly higher liver selenium, cadmium, iron, and zinc than the controls, but the concentrations were not sufficient to cause toxicity. Significant gross and microscopic lesions in most of the dead birds included conjunctivitis, lens opacity and cataract formation, vascular congestion in various organs most notably in the meninges of the brain, and myocardial and skeletal muscle degeneration.

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455. Selection of flooded agricultural fields and other landscapes by female northern pintails wintering in Tulare Basin, California.

Fleskes, J. P.; Jarvis, R. L.; and Gilmer, D. S. *Wildlife Society Bulletin* 31(3): 793-803. (2003)
 NAL Call #: SK357.A1W5; ISSN: 0091-7648
 Descriptors: wetlands/ radio-tagging/ agricultural land/ habitat selection/ habitat utilization/ water levels/ hunting/ marshes/ overwintering/ evaporation tanks/ drainage water/ habitat improvement (physical)/ ponds/ nature conservation/ females/ population dynamics/ aquatic birds/ agriculture/ *Anas acuta*/ USA, California, Tulare Basin/ USA, California, San Joaquin Valley/ northern pintail
 Abstract: Habitat selection and use are measures of relative importance of habitats to wildlife and necessary information for effective wildlife conservation. To measure the relative importance of flooded agricultural fields and other landscapes to northern pintails (*Anas acuta*) wintering in Tulare Basin (TB), California, we radiotagged female pintails during late August-early October, 1991-1993 in TB and other San Joaquin Valley areas and determined use and selection of these TB landscapes through March each year. Availability of landscape and field types in TB changed within and among years. Pintail use and selection (based upon use-to-availability log ratios) of landscape and field types differed among seasons, years, and diel periods. Fields flooded after harvest and before planting (i.e., pre-irrigated) were the most available, used, and selected landscape type before the hunting season (Prehunt). Safflower was the most available, used, and--except in 1993, when pre-irrigated fallow was available--selected pre-irrigated field type during Prehunt. Pre-irrigated barley-wheat received 19-22% of use before hunting season, but selection varied greatly among years and diel periods. During and after hunting season, managed marsh was the most available, used, and, along with floodwater areas, selected landscape type; pre-irrigated cotton and alfalfa were the least selected field types and accounted for less than or equal to 13% of pintail use. Agricultural drainwater evaporation ponds, sewage treatment ponds, and reservoirs accounted for 42-48% of flooded landscape available but were little used and least selected. Exodus of pintails from TB coincided with drying of pre-irrigated fallow, safflower, and barley-wheat fields early in winter, indicating that preferred habitats were lacking in TB during late winter.

Agriculture conservation programs could improve TB for pintails by increasing flooding of fallow and harvested safflower and grain fields. Conservation of remaining wetlands should concentrate on increasing the amount and productivity of marsh that is shallow-flooded as pre-irrigated grain fields dry. If pintails were provided with adequate preferred field and marsh habitats, including hunt-day sanctuaries, contaminant risks associated with exposure to drainwater evaporation ponds probably should remain low for these waterfowl even if their abundance in TB increased.

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456. Selenium in agricultural drainage: Essential nutrient or toxic threat?

Moore, S. B. *Journal of Irrigation and Drainage Engineering* 115(1): 21-28. (1989)
 NAL Call #: 290.9 AM3Ps (IR); ISSN: 0733-9437
 Abstract: The essential nutrient selenium is believed responsible for numerous deformities, reproductive failures, and deaths of migratory birds at Kesterson Reservoir in California's San Joaquin Valley. Wildlife problems at the reservoir appeared only a few years after the area began receiving selenium-laden subsurface drainage water from less than 42,000 acre (17,000 ha) or irrigated agricultural land on the west side of the valley. Although substantially reduced in acreage from their historic extent, the valley's wetland habitats continue to satisfy the wintering and migratory needs of substantial populations of Pacific Flyway migratory birds. Remnant anadromous fish populations struggle to survive the inadequate flows and low water quality of the valley's riverine habitats. It is estimated that in order to sustain intensively managed, irrigated agriculture and associated high levels of crop production, more than 1,000,000 acre (405,000 ha) of land on the west side of the valley must eventually be drained. Unless extraordinary measures are taken, the potential is great for contaminated agricultural drainage to further harm fish and wildlife resources of the San Joaquin Valley.
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457. Selenium in wetlands and waterfowl foods at Kesterson Reservoir California USA 1984.

Schuler C. A.; Anthony R. G.; and Ohlendorf H. M. *Archives of Environmental Contamination and Toxicology* 19(6): 845-853. (1990)
 NAL Call #: TD172.A7; ISSN: 0090-4341
 Descriptors: plants/ aquatic insects/ agrichemical/ water pollution/ environmental surveillance/ bioaccumulation/ health hazard/ toxicity
 Abstract: Kesterson Reservoir (Kesterson) received subsurface agricultural drainwater containing high levels of salts and selenium from farmland in the San Joaquin Valley of California. The accumulation of selenium in wetlands and waterfowl foods at Kesterson was investigated during May, August, and December of 1984. High concentrations of selenium were found in water, sediments, terrestrial and aquatic vegetation, and aquatic insects. Mean selenium concentrations in aquatic plants and insects ranged from 1.5 to 170 $\mu\text{g/g}$ dry weight and were about 11 to 290 times those found at a nearby reference site. Concentrations in some waterfowl food plants and insects at Kesterson were up to 64 times those reported to be a health hazard to birds. Selenium concentrations were more

seasonally variable in aquatic plants than in aquatic insects. Few differences in selenium accumulation were found among ponds. Deposition of selenium in plant parts was not uniform; rhizomes contained higher concentrations than seeds and leaves were intermediate. Most biota bioaccumulated maximum selenium concentrations that were 1,000 to nearly 5,000 times the concentration in the water.

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458. Water quality impacts from agricultural drainage of peat soils in the Sacramento-San Joaquin Delta.

Brown, Russ T.

In: International Water Resources Engineering Conference. (Held 3-7 Aug 1998 at Memphis, Tennessee.); Vol. 2. Reston, Va.: American Society of Civil Engineers; pp. 1165-1170; 1998.

NAL Call #: TC5 .J696 1998; ISBN: 0784403597

Abstract: Agricultural drainage from peat soils in the Sacramento-San Joaquin Delta impacts the water supply exported by the State Water Project (SWP) and Central Valley Project (CVP) pumping plants. A monthly planning model (DeltaDWQ) was developed that links the agricultural diversion and drainage for the Delta peat soils with the river inflows and transport in the Delta channels. This model accounts for the water budget, salinity budget, and dissolved organic carbon budget for the agricultural soils and the Delta channels to provide an integrated evaluation of the effects of agricultural drainage on export water quality. This model was used for impact assessment of the proposed Delta Wetlands project (JSA 1995) that would convert two Delta agricultural islands to reservoirs.

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459. Waterbird communities in rice fields subjected to different post-harvest treatments.

Day, John H. and Colwell, Mark A.

Colonial Waterbirds 21(2): 185-197. (1998);

ISSN: 0738-6028

Descriptors: community composition/ post harvest treatments/ rice fields/ habitat/ species richness/ wetland management

Abstract: In California's Sacramento Valley, the potential value of rice fields as habitat for waterbirds may vary with harvest method, postharvest treatment of rice straw (chopped, burned, plowed), and extent of flooding. Recent changes in rice harvesting methods (i.e., use of stripper-headers) and a legislative mandate to decrease burning of rice straw after harvest may alter habitat availability and use. Thus, we investigated species richness and community composition of nonbreeding waterbirds during October-March 1993-94 and 1994-95 in rice fields of the northern Sacramento Valley. Most (85-91% of land area) rice was conventionally harvested (i.e., cutter bar), and the remainder was stripped. Rice straw was left untreated in more than half of fields (52% in 1994 and 54% in 1995), especially in stripped fields (56-70%). In fields where farmers treated straw, the most common management methods were plowing (15-21%), burning (19-24%), and chopping (3-5%). Fields became increasingly wet from October through March as seasonal precipitation accumulated and farmers flooded fields to facilitate straw decomposition and provide habitat for ducks. Species richness of waterbirds was greater ($P < 0.002$) in conventionally-harvested fields than in stripped fields; within harvest methods, species richness was consistently greater ($P < 0.01$) in flooded than non-flooded fields. By contrast, species richness did not differ among straw treatments ($P > 0.23$). Species richness in stripped fields probably was low because foraging opportunities were limited by tall dense straw, decreased grain density, and infrequent flooding. We recommend that land managers wishing to provide habitat for a diverse waterbird community harvest rice using conventional methods and flood fields shallowly.

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Wetlands as Agricultural Conservation Practices

460. Accumulation, release, and solubility of arsenic, molybdenum, and vanadium in wetland sediments.

Fox, P. M. and Doner, H. E.

Journal of Environmental Quality 32(6): 2428-2435. (Nov. 2003-Dec. 2003)

NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: artificial wetlands/ sediment pollution/ arsenic/ molybdenum/ vanadium/ agriculture/ trace elements/ drainage/ solubility/ bioaccumulation/ sediment contamination/ farm wastes/ water pollution sources/ wastewater treatment/ sediment chemistry/ drying/ redox potential/ redox reactions/ anthropogenic factors/ water pollution treatment/ agricultural runoff/ drainage water/ water quality control/ artificial wetlands/ sewage & wastewater treatment/ industrial effluents/ sources and fate of pollution/ protective measures and control/ water & wastewater treatment

Abstract: This study was undertaken to determine the fate of As, Mo, and V (trace elements, TEs) in the sediments of a constructed wetland in use for the remediation of potentially toxic trace element-contaminated agricultural

drainwater. After three years of wetland operation, sediment cores were collected to determine changes in TE concentrations as a function of depth and the effects of varying water column depth. All TE concentrations were highest in the top 2 to 4 cm and decreased with depth. Molybdenum accumulated in the wetland sediments, up to levels of 32.5 plus or minus 4.6, 30.2 plus or minus 8.9, and 59.3 plus or minus 26.1 mg kg super(-1) in the top 1 cm of sediment at water depths of 15, 30, and 60 cm, respectively. In the top 2 cm of sediment, As accumulated (28.2 plus or minus 3.0 mg kg super(-1)) only at the 60-cm water depth. Below 2 cm, as much as 10 mg kg super(-1) of As was lost from the sediment at all water depths. In most cases, V concentrations decreased in the sediment. In this wetland system, the lowest redox potentials were found near the sediment surface and increased with depth. Thus, in general As, Mo, and V concentrations in the sediment were highest under more reducing conditions and lowest under more oxidizing conditions. Most of the accumulated

Mo (73%) became water soluble on drying of samples. This has important implications for systems undergoing changes in redox status; for instance, if these wetland sediments are dried, potentially large amounts of Mo may be solubilized.
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461. Agricultural wetland management for conservation goals: Invertebrates in California ricelands.

O'Malley, Rachel Emerson

In: Invertebrates in freshwater wetlands of North America:

Ecology and management/ Batzer, Darold P.; Rader, Russell B.; and Wissinger, Scott A.

New York: John Wiley & Sons, 1999; pp. 857-885.

NAL Call #: QL365.4.A1158

Descriptors: Invertebrata/ farming and agriculture/ agricultural wetlands management for conservation/ conservation measures/ agricultural wetlands conservation goals/ habitat management/ agricultural wetlands/ cultivated land habitat/ California/ agricultural wetlands conservation value and management

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462. Dissolved organic carbon and disinfection by-product precursor release from managed peat soils.

Fleck, J. A.; Bossio, D. A.; and Fujii, R.

Journal of Environmental Quality 33(2): 465-475. (2004)

NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: wetlands/ soil pollution/ drinking water/ peat soils/ dissolved organic carbon/ soil organic matter/ land use change/ agricultural soils/ agricultural management/ biogeochemical cycles/ chlorine/ disinfectants/ carcinogens/ environmental factors/ biodegradation/ seasonal variation/ California

Abstract: A wetland restoration demonstration project examined the effects of a permanently flooded wetland on subsidence of peat soils. The project, started in 1997, was done on Twitchell Island, in the Sacramento-San Joaquin Delta of California. Conversion of agricultural land to a wetland has changed many of the biogeochemical processes controlling dissolved organic carbon (DOC) release from the peat soils, relative to the previous land use. Dissolved organic C in delta waters is a concern because it reacts with chlorine, added as a disinfectant in municipal drinking waters, to form carcinogenic disinfection byproducts (DBPs), including trihalomethanes (THMs) and haloacetic acids (HAAs). This study explores the effects of peat soil biogeochemistry on DOC and DBP release under agricultural and wetland management. Results indicate that organic matter source, extent of soil organic matter decomposition, and decomposition pathways all are factors in THM formation. The results show that historical management practices dominate the release of DOC and THM precursors. However, within-site differences indicate that recent management decisions can contribute to changes in DOC quality and THM precursor formation. Not all aromatic forms of carbon are highly reactive and certain environmental conditions produce the specific carbon structures that form THMs. Both HAA and THM precursors are elevated in the DOC released under wetland conditions. The findings of this study emphasize the need to further investigate the roles of organic matter sources, microbial decomposition pathways, and decomposition status of soil organic matter in the release of DOC and DBP precursors from delta soils under varying land-use practices.

This citation is from AGRICOLA.

463. Effects of inorganic nitrogen enrichment on mosquitoes (Diptera: Culicidae) and the associated aquatic community in constructed treatment wetlands.

Sanford, Michelle R.; Chan, Karrie; and Walton, William E.

Journal of Medical Entomology 42(5): 766-776. (2005)

NAL Call #: 421 J828; ISSN: 0022-2585

Descriptors: parasitology/ terrestrial ecology: ecology, environmental sciences/ agrichemicals/ biogeography: population studies/ wastewater/ constructed treatment wetland

Abstract: Ammonium nitrogen (NH₄-N) is a significant component of municipal and agricultural wastewaters, and nitrogen reduction is an important use of constructed treatment wetlands. The effects of ammonium nitrogen enrichment on resources of larval mosquitoes, larval mosquito abundance, adult mosquito production, and the abundance of related wetland organisms were examined in 0.1-ha replicate treatment wetlands. The hypothesis of a bottom-up effect induced by ammonium addition was not supported by bacterial abundance, mean bacterial cell size, or algal biomass in the water column. There was, however, a significant negative correlation between bacterial cell length and *Culex tarsalis* Coquillett (Diptera: Culicidae) larval abundance 1 wk later in wetlands enriched with ammonium nitrogen. Larval mosquito (*Culex* spp.) abundance in southern California wetlands enriched with NH₄-N (mean approximate to 3 mg/liter) was significantly greater than in control wetlands at ambient nitrogen levels (8.3 mg N₀(3)-N/liter, 0.1 mg NH₄-N/liter). Adult mosquito production was nine-fold greater and chironomid larvae were significantly more abundant in wetlands enriched with NH₄-N than in controls but other censused taxa exhibited no significant trends. Mosquitofish, *Gambusia affinis* (Baird & Girard), abundance was significantly reduced in enriched wetlands, but other potential mosquito predators were not significantly affected by ammonium enrichment.

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464. Evaluation of constructed wetland treatment performance for winery wastewater.

Grismer, M. E.; Carr, M. A.; and Shepherd, H. L.

Water Environment Research 75(5)(Sept. 2003-Oct. 2003)

NAL Call #: TD419.R47; ISSN: 1061-4303

Descriptors: wetlands/ suspended particulate matter/ chemical oxygen demand/ wastewater treatment/ agriculture/ water quality/ tracers/ ammonium compounds/ pH/ aeration/ industrial wastewater/ artificial wetlands/ food-processing wastes/ performance evaluation/ suspended solids/ tannins/ sampling/ retention time/ organic loading/ springs/ sulfates/ suspended load/ evaluation/ contamination/ ammonium/ USA, California/ wineries/ prevention and control/ wastewater treatment processes/ industrial effluents/ water & wastewater treatment

Abstract: Rapid expansion of wineries in rural California during the past three decades has created contamination problems related to winery wastewater treatment and disposal; however, little information is available about performance of on-site treatment systems. Here, the project objective was to determine full-scale, subsurface-flow constructed wetland retention times and treatment performance through assessment of water quality by daily sampling of total dissolved solids, pH, total suspended solids, chemical oxygen demand (COD), tannins, nitrate, ammonium, total Kjeldahl nitrogen, phosphate, sulfate, and sulfide across operating systems for winery wastewater

treatment. Measurements were conducted during both the fall crush season of heavy loading and the spring following bottling and racking operations at the winery. Simple decay model coefficients for these constituents as well as COD and tannin removal efficiencies from winery wastewater in bench-scale reactors are also determined. The bench-scale study used upward-flow, inoculated attached-growth (pea-gravel substrate) reactors fed synthetic winery wastewater. Inlet and outlet tracer studies for determination of actual retention times were essential to analyses of treatment performance from an operational subsurface-flow constructed wetland that had been overloaded due to failure to install a pretreatment system for suspended solids removal. Less intensive sampling conducted at a smaller operational winery wastewater constructed wetland that had used pretreatment suspended solids removal and aeration indicated that the constructed wetlands were capable of complete organic load removal from the winery wastewater.

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465. Functional equivalency between rice fields and seminatural wetland habitats.

Elphick, Chris S.

Conservation Biology 14(1): 181-191. (2000)

Descriptors: multivariate analysis: analytical method/ anthropogenic habitat/ behavior/ feeding efficiency/ food abundance/ foraging performance/ functional equivalency/ predation threat/ rice fields/ seminatural wetland habitat/ time allocation

Abstract: Evaluating the potential for anthropogenic habitats to act as surrogates for the natural habitats they replace is a key issue in conservation biology. In California, flooded rice fields are used by numerous aquatic birds during winter. If this habitat functions similarly to more natural wetlands, increased flooding may help replace the extensive wetlands that occurred in the region prior to agricultural development. I tested whether food abundance, perceived predation threat, foraging performance, and the way in which birds allocate their time to different behaviors differed between flooded rice fields and seminatural wetlands for several species of aquatic bird. When appropriate, I also compared flooded and unflooded fields. Invertebrate densities did not differ among habitats. Seminatural wetlands had less rice grain but more seeds from other plants than the two rice habitats. The frequency with which predators passed over a feeding area was lower in flooded fields than in unflooded fields or seminatural wetlands. Most differences in feeding performance and time allocation among habitats were small and statistically insignificant. For some species, feeding efficiency was greater in seminatural wetlands than in flooded fields. Increasing attack rates and the amount of time spent feeding when in flooded fields, however, may allow birds to compensate for reduced efficiency. Multivariate analyses showed that group size, predation threat, time of day, date, and water depth often were associated with behaviors, but that these variables rarely accounted for habitat differences. Flooded fields apparently provide equivalent foraging habitat to seminatural wetlands and, because of reduced predation threat, may be a safer habitat for waterbirds. Thus, if managed appropriately, one of the world's dominant forms of agriculture can provide valuable waterbird habitat.

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466. Heat as a tracer to estimate dissolved organic carbon flux from a restored wetland.

Burow, K. R.; Constantz, J.; and Fujii, R.

Ground Water 43(4): 545-556. (2005)

NAL Call #: TD403.G7; *ISSN:* 0017-467X

Descriptors: wetlands/ discharge/ ditches/ drainage/ geology/ groundwater flow/ heat/ heat transfer/ hydraulic conductivity/ hydrology/ mathematical models/ peat soils/ seepage/ soil types/ surface water/ water temperature

Abstract: Heat was used as a natural tracer to characterize shallow ground water flow beneath a complex wetland system. Hydrogeologic data were combined with measured vertical temperature profiles to constrain a series of two-dimensional, transient simulations of ground water flow and heat transport using the model code SUTRA (Voss 1990). The measured seasonal temperature signal reached depths of 2.7 m beneath the pond. Hydraulic conductivity was varied in each of the layers in the model in a systematic manual calibration of the two-dimensional model to obtain the best fit to the measured temperature and hydraulic head. Results of a series of representative best-fit simulations represent a range in hydraulic conductivity values that had the best agreement between simulated and observed temperatures and that resulted in simulated pond seepage values within 1 order of magnitude of pond seepage estimated from the water budget. Resulting estimates of ground water discharge to an adjacent agricultural drainage ditch were used to estimate potential dissolved organic carbon (DOC) loads resulting from the restored wetland. Estimated DOC loads ranged from 45 to 1340 g C/(m² year), which is higher than estimated DOC loads from surface water. In spite of the complexity in characterizing ground water flow in peat soils, using heat as a tracer provided a constrained estimate of subsurface flow from the pond to the agricultural drainage ditch.

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467. Isotopic evidence for changes in residue decomposition and N-cycling in winter flooded rice fields by foraging waterfowl.

Diepen, L. T. A. van; Groenigen, J. W. van; and Kessel, C. van

Agriculture, Ecosystems and Environment 102(1): 41-47. (2004)

NAL Call #: S601.A34; *ISSN:* 0167-8809

Descriptors: wetlands/ animal behaviour/ crop residues/ cycling/ decomposition/ flooding/ foraging/ isotope fractionation/ nitrogen/ rice/ rice straw/ straw/ waterfowl/ wild birds

Abstract: Winter flooded rice fields can serve as substitute habitat for migratory waterfowl. Not much is known about the effects of the foraging waterfowl on nutrient cycling in rice production systems. This study quantifies the effect of foraging waterfowl on decomposition of rice residue and N-cycling in a winter flooded rice field in the Sacramento Valley, California. Along two transects in a field, pairs of control plots and enclosure plots, which excluded waterfowl, were set up. The original straw residue within the inner 2 m² of the 3 m x 3 m plots was replaced by 15N labelled straw residue. The labelled residue was subsequently followed into the light fraction and mineral fraction of the soil through the winter flooding period. Foraging waterfowl increased the loss of 15N from the residue from 83 to 89%, but did not affect the mass decomposition and loss of total N of the residue. No significant effect of the waterfowl was

seen in the recovery of the residue N in the total soil N pool and in the light fraction, although there was a low recovery of residue N within these pools in the control treatments. The recovery of residue N in the NH₄⁺-N pool after winter flooding was significantly lower in the presence of waterfowl. The increased loss of residue N and lower recovery of residue N in the presence of waterfowl may indicate that the rate of N-cycling was increased. A better understanding of the N-cycle in winter flooded rice fields in the presence of waterfowl is needed to assess the potential benefits of winter flooding for the rice farmers.
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468. Management of rice fields for wetlands, water, and rice production.

Andrews, Elizabeth S. and Williams, Philip B.
In: National Conference on Hydraulic Engineering. (San Francisco, Calif.)
New York: American Society of Civil Engineers; pp. 1161-1166; 1993.
NAL Call #: TC5 .H824 1993; ISBN: 0872629201
Abstract: The feasibility of managing a portion of the Sacramento Valley's rice fields as wetlands for waterfowl use, storage, and aid in rice straw decomposition was evaluated. Approximately 95% of the area's original wetlands have been lost, and populations of resident and migratory waterfowl have declined as a result of this and other pressures on the ecosystem. The analysis showed that there was significant potential to manage rice acreages in the Sacramento Valley for winter wetlands for the benefit of farmers, waterfowl, and downstream water uses, though constraints to such operation are numerous.
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469. Microbial selenium volatilization in rhizosphere and bulk soils from a constructed wetland.

Azaizeh, H. A.; Gowthaman, S.; and Terry, N.
Journal of Environmental Quality 26(3): 666-672. (May 1997-June 1997)
NAL Call #: QH540.J6; ISSN: 0047-2425
Descriptors: selenium/ rhizosphere/ *Scirpus robustus*/ plants/ microbial activity/ bacteria/ aeration/ bioremediation/ artificial wetlands/ soil bacteria/ irrigation/ drainage/ water pollution/ *scirpus robustus*/ rhizosphere/ selenium/ plants/ bacteria/ aeration/ bioremediation/ irrigation/ volatilization/ water pollution/ land pollution/ sources and fate of pollution/ mineral microbiology
Abstract: The potential of rhizosphere and bulk soil microbes to volatilize selenate, selenite, and selenomethionine was studied in liquid cultures under controlled conditions. Microbes cultured from the rhizosphere of bulrush (*Scirpus robustus*) plants showed higher Se volatilization than those from bulk soil of a flow-through, constructed wetland area contaminated with selenite. The data show that bacteria are the dominant microbes involved in Se volatilization; fungi contribute relatively little to this process. Bactericides significantly decreased both Se volatilization and the number of culturable bacteria in rhizosphere cultures compared to an untreated control. In the absence of added C, Se volatilization was greatest from selenomethionine, then selenite, then selenate. Aeration substantially increased the percentages of Se volatilized from rhizosphere soil cultures to which no C was added. Up to 95, 21, and 3% of the Se was volatilized from selenomethionine, selenite, and

selenate, respectively. When both C and aeration treatments were applied to the rhizosphere cultures, the corresponding percentages changed to 20, 57, and 4%, that is, selenomethionine volatilization by rhizosphere microbes decreased when C was added while selenite volatilization substantially increased. Since selenite volatilization was the greatest when rhizosphere microbes were supplied with C and aeration, we suggest that microbes in this selenite-contaminated wetland are adapted to volatilize Se by using C released from roots, and that Se volatilization may be enhanced by oxygen and environmental conditions provided by the plants.
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470. A palaeoenvironmental reconstruction to aid in the restoration of floodplain and wetland habitat on an upper deltaic plain, California, USA.

Brown, K. J. and Pasternack, G. B.
Environmental Conservation 32(2): 103-116. (June 2005)
NAL Call #: QH540.E55; ISSN: 0376-8929
Descriptors: wetlands/ environmental restoration/ sediments/ disturbance/ flood plains/ meadows/ habitat/ deltas/ historical account/ agriculture/ environment management/ forests/ conservation/ USA, California, Sacramento-San Joaquin Delta/ paleoecology/ environmental action/ general environmental engineering
Abstract: While tens of millions of dollars have been spent on land acquisition and planning for current and future floodplain and wetland restoration in the Sacramento-San Joaquin Delta, knowledge of the historical processes and landscape heterogeneity that are helpful in guiding the environmental restoration are often scarce. This study used palaeoenvironmental reconstruction to increase the historical perspective, with the aim of improving environmental management. Twelve sediment cores collected from the McCormack-Williamson Tract (MWT) leveed farmland and the juxtaposed Delta Meadows (DM) tidal wetland were sampled for a suite of environmental proxies. MWT was a non-tidal flood plain during much of the late-Holocene, with a mosaic of other habitats including dry uplands, riparian forests, and freshwater wetlands persisting nearby. Comparison with the regional sea-level history suggests that the upper delta gradually came under tidal influence 3000-800 calendar years before present (cal BP). Despite this, floodplain landforms and habitats prevailed at DM from 3650-330 cal BP, after which wetlands expanded, suggesting that a flood-based disturbance regime typified the upper delta for most of the late-Holocene. Recently, the upper deltaic plain has been profoundly disturbed by agriculture and other activities, rendering significant loss of habitat. It is believed that a flood-based disturbance regime will recur at MWT if the levees surrounding the tract are intentionally breached as planned for restoration, culminating in a variety of habitats similar to pre-agricultural conditions. Concentrations of Hg, Pb, As, and P pollutants elevated several-fold in surficial sediments are of particular concern, potentially becoming problematic after restoration.
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471. Patterns and dynamics of shorebird use of California's Central Valley.

David Shuford, W.; Page, G. W.; and Kjelson, J. E.
Condor 100(2): 227-244. (1998)

NAL Call #: QL671.C6; ISSN: 0021-8901

Descriptors: wetlands/ conservation/ distribution/ habitat use/ Pacific Flyway/ ricelands/ seasonal abundance
Abstract: Surveys of California's Central Valley between 1992-1995 document it as one of the most important regions in western North America to migratory and wintering shorebirds. Populations averaged 134,000 individuals in August, 211,000 in November, 303,000 in January, and 335,000 in April. Of 33 species, the 10 or 11 that averaged over 1,000 individuals each season accounted for 99% of total numbers. Managed wetlands, agricultural fields (especially rice), and agricultural evaporation ponds held the most shorebirds. Species varied their seasonal, geographic, and habitat use of the Central Valley, primarily in response to changes in water availability from rainfall or management practices and latitudinal variation in habitat availability mediated, in part, by climate. In the record rainfall year of 1994-1995, shorebird numbers increased 74% between November and January, primarily from coast-to-interior movements of the Dunlin (*Calidris alpina*) and Long-billed Dowitcher (*Limnodromus scolopaceus*) and local habitat shifts of Killdeer (*Charadrius vociferus*). Although the Valley's shorebirds face threats from poor or toxic water quality, changing agricultural practices, and habitat loss to urbanization, they should benefit from current efforts to increase flooding of rice fields and to secure a stable high quality water supply for wetlands. Development of a sound conservation strategy is crucial for the preservation of shorebird populations in the Central Valley, as this agriculturally-dominated landscape is among the most altered in North America and remains vulnerable to strong economic and population growth pressures that may impact shorebird habitats in the future.
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472. Screening and field evaluation of wetland algae species with superior capacities for the removal of selenium from agricultural drainage water.

Terry, N.

In: 1998-1999 Salinity/Drainage Program Annual Report; Series: Technical Progress Reports.

Riverside, CA: UC Center for Water Resources, 1999; pp. 289-312.

Notes: Other number: Project 98-4

Descriptors: water pollution treatment/ agricultural runoff/ irrigation water/ selenium/ bioremediation/ freshwater organisms/ bioaccumulation/ volatile compounds/ drainage water/ sediment pollution/ pollution control/ plant physiology/ water quality control/ artificial wetlands/ water pollution control/ accumulation/ aquatic plants/ trace elements/ evaluation/ laboratories/ algae/ Chara/ USA, California, San Joaquin Valley/ USA, California, Tulare L./ freshwater macrophytes/ protective measures and control/ physiology, biochemistry, biophysics/ wastewater treatment processes/ water pollution: monitoring, control & remediation

Abstract: In this report we present data which demonstrates that Chara, a macroalga known to accumulate very high concentrations of trace elements, is able to remove significant amounts of Se from solution, by

accumulation in tissue and by volatilization. In only 8 days Chara removed 50% of the Se supplied in solution as 32 ppb selenate. In an experiment comparing the rates of Se accumulation and volatilization by Chara compared to twenty aquatic plant species, Chara exhibited the highest rates of Se accumulation and volatilization under laboratory conditions. We constructed wetland microcosms, and used them to treat Se-contaminated solution. These microcosms removed 70% of the Se from solution. Most of the Se was in the sediments, with some Se being accumulated and volatilized by the plants in the microcosm. These experiments showed that the microcosms can effectively simulate an actual constructed wetland. Now that we know that Chara is a superior candidate for the phytoremediation of Se and we know that microcosms can be used to effectively simulate actual constructed wetlands, we will plant Chara in microcosms supplied with selenate-contaminated agricultural drainage water (similar to the water flowing into the TLDD wetland). This experiment will determine the efficiency with which Chara will remove Se from agricultural drainage water flowing into a constructed wetland.

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473. Selenium accumulation in submerged aquatic macrophytes *Potamogeton pectinatus* L. and *Ruppia maritima* L. from water with elevated chloride and sulfate salinity.

Wu, L. and Guo, X.

Ecotoxicology and Environmental Safety 51(1): 22-27. (Jan. 2002)

NAL Call #: QH545.A1E29; ISSN: 0147-6513

Descriptors: wetlands/ selenium/ bioaccumulation/ macrophytes/ aquatic organisms/ sulfate/ agricultural pollution/ drainage/ aquatic plants/ agricultural runoff/ pollution effects/ brackishwater pollution/ aquatic macrophytes (*Potamogetonaceae*)/ aquatic macrophytes (*Ruppiaceae*)/ runoff (agricultural)/ heavy metals/ USA, California/ water pollution effects/ *Potamogeton pectinatus*/ *Ruppia maritima*/ wideongrass/ macrophytes/ metabolism/ freshwater pollution/ pollution - organisms/ ecology/ toxicology/ effects of pollution/ effects of pollution/ effects on organisms

Abstract: Submerged aquatic macrophyte species *Potamogeton crispus* L. (curlyleaf pondweed) and *Ruppia maritima* L. (wideongrass) were examined for selenium accumulation from agricultural drainage water in the field and under laboratory conditions. High concentrations of chloride and sulfate salts were found in the drainage water of the constructed wetland at Tulare Lake Drainage District, Corcoran, California. Samples of *P. crispus* and *R. maritima* collected from the field, had similar plant-tissue Se concentrations, but the rhizomes accumulated significantly greater amounts of Se than the shoot tissues. When the plants were grown in culture solution supplemented with either chloride or sulfate salt, *R. maritima* was found to be more salt tolerant than *P. crispus*, and *P. crispus* accumulated more Se than *R. maritima*. Free seleno-amino acids were detected in the plant tissue, and organic Se was detected in the culture solution after 10 days of growth. The release of organic Se into the water by the plants may have a negative impact on the wetland environment. Copyright 2002 Elsevier Science.

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474. Selenium removal and mass balance in a constructed flow-through wetland system.

Gao, S.; Tanji, K. K.; Peters, D. W.; Lin, Z. Q.; and Terry, N. *Journal of Environmental Quality* 32(4): 1557-1570. (2003)
NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: drainage/ plants (botany)/ selenium/ vaporization/ vegetation/ standing plants/ water contamination/ wetland/ models/ theoretical/ *Distichlis spicata*/ *Juncus balticus*/ *Ruppia maritima*/ *Schoenoplectus acutus*/ *Spartina alterniflora*/ *Typha latifolia*
Abstract: A field study on the removal of Se from agricultural subsurface drainage was conducted from May 1997 to February 2001 in the Tulare Lake Drainage District (TLDD) of San Joaquin Valley, California. A flow-through wetland system was constructed consisting of ten 15- x 76-m unlined cells that were continuously flooded and planted with either a monotype or combination of plants, including sturdy bulrush [*Schoenoplectus robustus* (Pursh) M.T. Strong], baltic rush (*Juncus balticus* Willd.), smooth cordgrass (*Spartina alterniflora* Loisel.), rabbitsfoot grass [*Polypogon monspeliensis* (L.) Desf.], saltgrass [*Distichlis spicata* (L.) Greene], cattail (*Typha latifolia* L.), tule [*Schoenoplectus acutus* (Muhl. ex Bigelow) A. Löve & D. Löve], and widgeon grass (*Ruppia maritima* L.). One cell had no vegetation planted. The objectives of this research were to evaluate Se removal efficiency of each wetland cell and to carry out a mass balance on Se. The inflow drainage water to the cells had average annual Se concentrations of 19 to 22 $\mu\text{g L}^{-1}$ dominated by selenate [Se(VI), 95%]. Average weekly water residence time varied from about 3 to 15 d for Cells 1 through 7 (target 7 d), 19 to 33 d for Cells 8 and 9 (target 21 d), and 13 to 18 d for Cell 10 (target 14 d). Average weekly Se concentration ratios of outflow to inflow ranged from 0.45 to 0.79 and mass ratio (concentration \times water volume) from 0.24 to 0.52 for year 2000, that is, 21 to 55% reduction in Se concentration and 48 to 76% Se removal in mass by the wetland, respectively. The nonvegetated cell showed the least Se removal both in concentration and in mass. The global mass balance showed that on the average about 59% of the total inflow Se was retained within the cells and Se outputs were outflow (35%), seepage (4%), and volatilization (2%). Independent measurements of the Se retained in the cells totaled 53% of the total Se inflow: 33% in the surface (0-20 cm) sediment, 18% in the organic detrital layer above the sediment, 2% in the fallen litter, <1% in the standing plants, and <1% in the surface water. Thus, about 6% of the total Se inflow was unaccounted for in the internal compartments.

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475. Selenium removal by constructed wetlands: Quantitative importance of biological volatilization in the treatment of selenium-laden agricultural drainage water.

Lin, Zhi Qing. and Terry, Norman.
Environmental Science and Technology 37(3): 606-615. (2003)
NAL Call #: TD420.A1E5; ISSN: 0013-936X

Descriptors: freshwater ecology: ecology, environmental sciences/ pollution assessment control and management/ bioremediation/ applied and field techniques/ agricultural drainage water/ constructed wetlands/ selenium contaminated drainage water management
Abstract: Management of selenium (Se)-contaminated

agricultural drainage water is one of the most important environmental issues in California. To evaluate the feasibility of utilizing constructed wetlands to remediate Se-laden drainage water and the role of biological volatilization in Se removal, 10 flow-through wetland cells were constructed in 1996 in Corcoran, California. The monthly monitoring study from May 1997 to December 1999 showed that the vegetated wetlands were capable of significantly reducing Se from the inflow drainage water; an average of 69.2% of the total Se mass in the inflow was removed. Most of the Se was retained in sediment, and <5% of the Se was accumulated in plant tissues. Selenium volatilization was highest in the rabbitfoot grass wetland cell, where 9.4% of the Se input was volatilized over a 2-year period. Volatilization was greater in spring and summer than in fall and winter. For example, in May and June of 1998, 35 and 48%, respectively, of the Se entering the rabbitfoot grass cell was volatilized, whereas in the winter months, <5% was volatilized. The feasibility of using constructed wetlands for Se remediation, methods for the enhancement of Se volatilization, and the importance of considering potential Se ecotoxicity are discussed.
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476. Selenium removal from irrigation drainage water flowing through constructed wetland cells with special attention to accumulation in sediments.

Gao, S.; Tanji, K. K.; Peters, D. W.; Lin, Z.; and Terry, N. *Water, Air, and Soil Pollution* 144(1): 263-284. (2003)
NAL Call #: TD172.W36; ISSN: 0049-6979

Descriptors: sediment contamination/ fluvial sediments/ drainage water/ agricultural runoff/ selenium/ sinks/ artificial wetlands/ irrigation water/ drainage districts/ irrigation/ drainage/ sediments/ pollutant removal/ USA, California/ USA, California, Corcoran/ artificial wetlands
Abstract: A flow-through experimental wetland system has been under investigation since 1996 to remove selenium (Se) from agricultural drainage water in the Tulare Lake Drainage District at Corcoran, California, U.S.A. The system consists of ten cells which have dimensions of 15 x 76 m continuously flooded and various substrates planted. The objectives of this article are to present the overall performance in Se removal after establishing the wetland for three years, and to examine factors affecting Se removal with special attention to accumulation in the sediments. In 1999, The wetland cells reduced Se from inflow water by 32 to 65% in concentration and 43 to 89% in mass. Vegetation plays an important role in Se removal as non-vegetated cell showed the least removal of Se. The inflow drainage water was dominated by selenate (Se(VI), 91%) with smaller percentages of selenite (Se(IV), 7%) and organic Se (org-Se(II-), 2%). The outflow water from the cells contained an average of 47% Se(VI), 32% Se(IV) and 21% org-Se indicating reduction processes occurring in the wetland cells. The surface sediment appears as a large sink of Se removal. The highest Se concentration was found in fallen litter, followed by the fine organic detrital layer on the sediment surface. The sediment Se concentration dramatically decreased with increasing sediment depth. The mass distribution of Se, however, was sediment (0-20 cm) > fine detrital matter > fallen litter. Fractionation of surface sediment (0-5 cm) reveals that elemental Se was the largest fraction (ave. 47%) followed by organic matter-associated Se (34%). Soluble, adsorbed, and carbonate-associated Se accounted for 1.2, 3.1 and

2.5% of the total sediment Se, respectively. The major Se sink mechanism in the cells is the reduction of selenate to elemental Se and immobilization into the organic phase of the sediments.

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477. Selenium stable isotope ratios in California agricultural drainage water management systems.

Herbel, M. J.; Johnson, T. M.; Tanji, K. K.; Gao, S.; and Bullen, T. D.

Journal of Environmental Quality 31(4): 1146-1156. (2002)
NAL Call #: QH540.J6; ISSN: 0047-2425

Abstract: Selenium stable isotope ratios are known to shift in predictable ways during various microbial, chemical, and biological processes, and can be used to better understand Se cycling in contaminated environments. In this study we used Se stable isotopes to discern the mechanisms controlling the transformation of oxidized, aqueous forms of Se to reduced, insoluble forms in sediments of Se-affected environments. We measured $^{80}\text{Se}/^{76}\text{Se}$ in surface waters, shallow ground waters, evaporites, digested plants and sediments, and sequential extracts from several sites where agricultural drainage water is processed in the San Joaquin Valley of California. Selenium isotope analyses of samples obtained from the Tulare Lake Drainage District flow-through wetland reveal small isotopic contrasts (mean difference 0.7‰) between surface water and reduced Se species in the underlying sediments. Selenium in aquatic macrophytes was very similar isotopically to the NaOH and Na_2SO_3 sediment extracts designed to recover soluble organic Se and Se(O), respectively. For the integrated on-farm drainage management sites, evaporite salts were slightly (approximately 0.6‰) enriched in the heavier isotope relative to the inferred parent waters, whereas surface soils were slightly (approximately 1.4‰) depleted. Bacterial or chemical reduction of Se(VI) or Se(IV) may be occurring at these sites, but the small isotopic contrasts suggest that other, less isotopically fractionating mechanisms are responsible for accumulation of reduced forms in the sediments. These findings provide evidence that Se assimilation by plants and algae followed by deposition and mineralization is the dominant transformation pathway responsible for accumulation of reduced forms of Se in the wetland sediments.

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478. Trace element retention and release on minerals and soil in a constructed wetland.

Fox, Patricia M. and Doner, Harvey E.

Journal of Environmental Quality 31(1): 331-338. (2002)
NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: bioprocess engineering/ freshwater ecology: ecology, environmental sciences/ pollution assessment control and management/ soil science/ waste management: sanitation/ permeable bags/ field equipment/ agricultural drainwater: remediation, trace element contaminated/ air drying/ bulk soil: trace element retention/ field conditions/ flow through constructed wetland/ goethite coated quartz sand: trace element accumulation/ redox status changes/ sediment surface/ soil/ soil constituents: trace element retention/ water depth/ wetland cell

Abstract: Constructed wetlands are one method under investigation for the remediation of trace element-contaminated agricultural drainwater. A greater understanding of the retention of trace elements by the bulk

soil and soil constituents is necessary for their safe and effective use. To determine the capacity of soil, calcite, and goethite-coated quartz sand for retention of As, Mo, and V under field conditions, an in situ method was used whereby permeable bags containing those minerals were placed near the sediment surface of a flow-through constructed wetland for 3 or 12 mo. Accumulations of As, Mo, and V occurred on goethite-coated sand. Concentrations of Mo on goethite-coated sand were much higher in samples from a wetland cell with a water depth of 15 cm (38.23±7.27 mg kg⁻¹) compared with those from a cell with a water depth of 3 cm (8.30±1.45 mg kg⁻¹). Calcite sorbed no As and low amounts of Mo and V, indicating that it is not an important sink for those elements under these conditions. In soil bags, total As and V concentrations showed little change over 12 mo. Molybdenum accumulated in the soil bags, resulting in total concentrations (12 mo) of 27.22±2.69 mg kg⁻¹ and 11.42±1.35 mg kg⁻¹ at water depths of 15 and 3 cm, respectively. Nearly half of the Mo accumulation on soil became water soluble after air-drying. This has important implications for systems that may undergo changes in redox status, possibly resulting in large fluxes of water-soluble Mo.

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479. Water selenium speciation and sediment fractionation in a California flow-through wetland system.

Gao, S.; Tanji, K. K.; Peters, D. W.; and Herbel, M. J.

Journal of Environmental Quality 29(4): 1275-1283. (2000)
NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: wetlands/ selenium/ chemical speciation/ California

Abstract: A flow-through wetland system was established in the Tulare Lake Drainage District (TLDD) in California to determine if selenium (Se) from saline irrigation drainage can be removed prior to impoundment in evaporation basins to reduce potential toxicity to waterbirds. The objective of this research was to evaluate Se speciation, accumulation, and fractionation in the waters and sediments of the newly developed wetland system. The inlet water was dominated by selenate [Se(VI), 92%], with smaller percentages of selenite [Se(IV), 5%] and organic Se [org-Se(-II), 3%]. For the outflow water, the average percentage of Se(VI) was 72% in November 1997 and 59% in February 1999. This change may be due to an increase in either residence time and/or accumulation of organic detrital matter, which may enhance Se(VI) reduction processes. Selenium accumulation, transformation, and incorporation with the solid phase were all intensified in the surface sediment (<20 cm). The highest total Se concentrations in the sediments were found in the top 5 cm and concentrations dramatically decreased with depth. Elemental Se [Se(0)], as extracted by Na_2SO_3 , was the largest fraction (average of 46%) of the total sediment Se, followed by organic matter-associated Se (OM-Se) extracted by NaOH (average of 34%). Soluble, adsorbed, and carbonate-associated Se, as extracted by KCl, K_2HPO_4 (pH 8.0), and NaOAc (pH 5.0), were about 3, 10, and 3% of the total sediment Se, respectively. After establishing the wetland for 2 yr, significant Se removal from the flowing water was observed. The major sink mechanisms in the sediment are reduction to Se(0) and immobilization into the organic phase.

This citation is from AGRICOLA.

480. Winter management of Californian rice fields for waterbirds.

Elphick, C. S. and Oring, L. W.

Journal of Applied Ecology 35(1): 95-108. (1998)

NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: wetlands/ water management/ rice/ crop residues/ legislation/ burning/ waste management/ stubble/ wild birds/ nature conservation/ flooding/ submergence/ incorporation/ water/ depth/ land use/ decomposition

Abstract: Recent legislation designed to reduce air pollution has restricted Californian rice-farmers from burning rice stubble after harvest. Intentional flooding of fields during winter to speed straw decomposition is becoming increasingly common as growers seek alternatives to burning residual straw. The potential for flooded fields to act as a surrogate for destroyed wetland habitat may be an additional benefit in a region that hosts a large proportion of North America's wintering water birds. The degree to which water birds use flooded fields and whether the method of flooding affects their use was investigated. Intentionally flooded rice fields received significantly greater use by 24 of 31 species studied. Only great blue herons *Ardea herodias* and sandhill cranes *Grus canadensis* were significantly more common in unflooded fields. Geese densities did not differ between flooded and unflooded fields. There were no differences in the densities of most bird species in flooded fields that received different straw manipulations to improve decomposition rates. Exceptions included several small shore birds which occurred at highest densities in fields where straw was incorporated into the soil. For 14 species, it was tested whether preferred depths, suggested in the literature, received disproportionately higher use. Most of these species were more likely to be encountered within the suggested depth ranges. Depth, however, was a poor predictor of bird density. Depths of 15-20 cm resulted in frequent use by the greatest number of species. It is concluded that flooding rice fields increased suitable habitat for most, but not all, species studied. Different straw manipulation methods had little effect on most species. Water depth, however, was important in determining species occurrence. During the first half of the winter, water depths were greater than the median depths used by most species.

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Glaciated Interior Plains Wetlands General Information

481. Avian communities in forested riparian wetlands of southern Michigan, USA.

Inman, Rainy L.; Prince, Harold H.; and Hayes, Daniel B. *Wetlands* 22(4): 647-660. (2002)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: biodiversity/ biogeography: population studies/ modeling/ mathematical and computer techniques/ avian community/ breeding status/ floodplain/ forested riparian wetlands/ plant species dominance/ plant species richness/ plant species structure/ species composition/ vegetation composition/ vegetation structure/ wetlands ecology
Abstract: Descriptive studies are an important first step in developing assessment models for regional wetland subclasses. Objectives of this study were to gather benchmark information on the composition and structure of vegetation from minimally impacted riparian forested wetland sites in Michigan, USA, and to determine if species composition of the breeding bird community and relative densities of individual species varied among riparian and adjacent upland forest zones. Plant species richness, dominance, and structure differed greatly between floodplain wetlands and uplands and were similar among zones within floodplain forests. Of 54 breeding bird species recorded through point count surveys (1998-99), 39 were observed in both floodplain and upland forests, while 11 were found only in floodplains and 4 solely in the uplands. Detectable patterns of avian density across riparian and upland forest zones were evident for 31 breeding species. Most species preferred areas closest to the river over other zones, although a few species were more prevalent within interior floodplains or uplands as compared to riverside forests. Forested riparian wetlands in this region act as essential breeding habitats for many avian species not often found in upland areas and are especially important for obligate riparian species and rare or declining breeding birds observed within our sites. These results are consistent with many studies across North America, where riparian forests have been found to support disproportionately large numbers of breeding bird species as compared to more xeric forests and other upland habitats.

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482. Characterization of woody species distribution in riparian forests of lower Michigan, USA using map-based models.

Baker, M. E. and Wiley, M. J. *Wetlands* 24(3): 550-561. (Sept. 2004)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: wetlands/ forests/ ordination/ climate/ hydrology/ riparian environments/ floods/ geology/ climatic changes/ catchment area/ spatial variations/ ecological distribution/ community composition/ autecology/ modelling/ hydrologic models/ riparian vegetation/ structure/ ecosystems/ catchment areas/ trees/ USA, Michigan/ temperate forests/ habitat community studies/ water and plants
Abstract: The goal of this study was to identify and characterize the range of variation in riparian forests across Lower Michigan, USA as a basis for assessing the utility of map-based information in the characterization of riparian

environments. We obtained a regional sample of riparian forests and valley-bottom physiography from 94 locations throughout Lower Michigan and distinguished seven major riparian forest types using hierarchical clustering and NMDS ordination. NMDS ordination distances accounted for more than 70% of the distances in species space and achieved excellent discrimination among riparian types. We then evaluated a set of map-based variables indicative of regional climate, catchment hydrology, and valley character relative to ordination axes and interpretations of the autecology of principal tree species from each forest group. Map-based predictors accounted for 83% of the variation in sample scores along NMDS Axis 1 and explained 42% of the variation in Axis 2. Species and riparian types varied along two principal gradients, one associated with climate and geology along a north-south gradient, the second associated with flood duration and power. Map-based interpretations of regional climate and hydroperiod dynamics agreed closely with species-based interpretations of riparian character, although in certain cases, a similar biotic response arose from apparently distinct hydrogeomorphic contexts. Such dynamic patterns underscore the need for better and more explicit linkages between the controls of riparian hydrology and more proximal physical cues on biotic communities in order to understand the drivers of spatial variation in riparian ecosystem structure and composition.

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483. Coastal wetlands of the Upper Great Lakes: Distribution of invertebrate communities in response to environmental variation.

Gathman, Joseph P.; Burton, Thomas M.; and Armitage, Brian J.
In: *Invertebrates in freshwater wetlands of North America: Ecology and management*/ Batzer, Darold P.; Rader, Russell B.; and Wissinger, Scott A.
New York: John Wiley & Sons, 1999; pp. 949-994.
Notes: ISBN: 0471292583
NAL Call #: QL365.4.A1158

Descriptors: Invertebrata/ community structure/ population density/ coastal wetland fauna/ response to environmental variables/ distribution within habitat/ influence of environmental variables/ semiaquatic habitat/ wetland communities response to environmental variables/ abiotic factors/ coastal wetland environmental variables influence on community/ water movements/ coastal wetlands/ influence on communities/ Great Lakes/ coastal wetland communities response to environmental variables
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484. Do created wetlands replace the wetlands that are destroyed?

Hunt, Randall J. and Geological Survey (U.S.).
Madison, Wis.: USGS; Series: Fact sheet (Geological Survey (U.S.)) FS-246-96. (1998)
Notes: Title from caption. Includes bibliographical references.
NAL Call #: QH76.H86-1998
http://wi.water.usgs.gov/pubs/FS-246-96/FS_246-96.pdf
Descriptors: wetlands---United States/ wetlands---

Wisconsin/ wetland conservation---United States/ wetland conservation---Wisconsin/ wetland ecology---United States/ wetland ecology---Wisconsin
This citation is from AGRICOLA.

485. The ecology of invertebrates in Great Lakes coastal wetlands: Current knowledge and research needs.

Krieger, K. A.

Journal of Great Lakes Research 18(4): 634-650. (1992)

NAL Call #: GB1627.G8J6; ISSN: 0380-1330

Descriptors: wetlands/ benthic fauna/ Great Lakes/ invertebrates/ limnology/ path of pollutants/ water pollution sources/ zooplankton/ aquatic populations/ ecosystems/ energy transfer/ food chains/ lakes/ literature review/ nutrients/ population dynamics/ suspended sediments

Abstract: The composition of the invertebrate communities in the Great Lakes coastal wetlands is the result of natural factors and the effects of pollution. Information in the literature, summarized here, is comparatively sparse on the community structure, population dynamics, secondary productivity, and trophic relationships. Zooplankton species composition appears to be, in part, a function of the distance of the community from the connection with the Great Lake. The dominant species present appear to be variable, and are dependent on a complex of interacting biotic and abiotic factors. The zooplankton appear to provide a strong link in the transfer of carbon and energy between the phytoplankton and higher trophic levels. Benthic invertebrates in the Great Lakes proper are important agents of bioturbation, releasing regenerated nutrients in interstitial water back into the water column; they may have a similar function in the wetlands. In the coastal wetlands, they are a major nutritional source for numerous species of fish and waterfowl, and thus are an important link between the primary producers and decomposers to the higher trophic levels. Zooplankton and zoobenthos species composition and abundance appear to be controlled by the interaction of a combination of environmental variables; not all of the factors operate on all species, all wetlands, or at the same time. The abiotic factors include concentration gradients of nutrients and suspended sediments, sustained high turbidity, flushing with storm water runoff, intermittent separation from the lake by a barrier beach, long and short term water level changes, characteristics of available substrates, and pollution. Biotic factors include selective predation; the composition, distribution, and density of hydrophyte beds; the spatial and seasonal variation in food resources; habitat disruption of bottom feeding fish; and patch dynamics.

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486. Effects of wastewater on wetland animal communities.

Brennan, K. M.

In: *Ecological Considerations in Wetlands Treatment of Municipal Wastewaters*/ Godfrey, Paul J.

New York: Van Nostrand Reinhold, 1985; pp. 199-223.

Notes: ISBN: 0442230095

NAL Call #: QH545.S49E3

Descriptors: wetlands treatment/ wastewater treatment/ water pollution effects/ ecosystems/ wildlife/ environmental effects/ literature review/ economic aspects/ artificial wetlands

Abstract: An inventory of known discharges of wastewater to wetlands in Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin was performed. The results show that the use of natural wetlands for the discharge of treated wastewater is relatively common. However, the intentional inclusion of wetlands as part of the treatment process is rare. Both types of situations may become more attractive due to economic factors. Although the short-term benefits of the use of natural wetlands for the disposal or treatment of wastewater (cost-effectiveness, treatment efficiency, and convenience) appear promising, the long-term ability of these areas to treat wastewater is questionable. The construction of artificial wetlands for the treatment of wastewater would avoid any detrimental effects that might result from the use of natural wetlands and also could provide supplementary habitats for wetland wildlife and possibly reservoirs for rare species. Few animal-related studies have been performed at the small number of artificial wetland sites presently in existence; thus, the information base is too small and too short-term for any conclusions to be drawn.

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487. Elemental dynamics in forested bogs in northern Minnesota.

Grigal, D. F.

Canadian Journal of Botany 69(3): 539-546. (Mar. 1991)

NAL Call #: 470 C16C; ISSN: 0008-4026.

Notes: NSF grant no. DEB 7922142; Minnesota Agricultural Experiment Station Project 25-54

Descriptors: bogs/ limnology/ Minnesota/ nutrients/ wetland forests/ biomass/ calcium/ cycling nutrients/ magnesium/ nitrogen/ peat bogs/ phosphorus/ potassium/ primary productivity/ vegetation/ lakes/ chemical processes

Abstract: Dynamics of nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), and magnesium (Mg) were determined for three perched bogs, formed by lake filling, and three raised bogs, formed by landscape swamping. N and K concentrations were higher in the undergrowth of perched bogs, and Ca and Mg concentrations were higher in subsurface anaerobic peat of raised bogs. Elemental pools in vegetation were in the order $N > Ca > K > Mg > P$; in surface peat, $N > Ca > Mg > P = K$. Differences in elemental mass between the bog types were closely related to biomass differences. The atmosphere potentially supplied from 3% of annual plant uptake of K to 20% of Mg; this fraction was inversely related to uptake as a proportion of the surface peat. Vegetation on raised bogs had a greater proportion of uptake from the atmosphere (15 vs. 12%), a faster rate of elemental turnover (3.8 vs. 4.8 yrs), and lower net primary productivity (NPP) than on perched bogs, all indicative of a lower nutrient status. The annual mineralization rate of the surface peat for both bog types was estimated 15 1.5%/yr; NPP predicted from N mineralized at this rate agrees well with observations. The better nutritional status of perched bogs may be related to landscape position, with potential inputs via runoff from adjacent uplands. The nutrient capital in both bog vegetation and substrate was similar to that in upland northern conifer forests. (Author's abstract)

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488. Estimating the ground-water contribution in wetlands using modeling and digital terrain analysis.

Gerla, P. J.

Wetlands 19(2): 394-402. (1999)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ analysis/ classification/ drainage/ groundwater flow/ water budget/ mathematical models/ equations/ groundwater recharge/ water table

Abstract: Wetland classification and management often requires information on the contribution of groundwater to a wetland's water budget. Direct estimation of this parameter, however, is time-consuming, expensive, and can typically only be accomplished for small areas. Thus, a method to characterize groundwater flow in wetland areas and regions may be useful in many applications. The estimation technique described combines the use of a digital elevation model (DEM) with transient numerical modelling and assumes that the water table reflects the general pattern of surface topography. The DEM grid elevations were used as initial heads in the model. Stepwise groundwater drainage from the flow domain was simulated until a reasonable match was obtained between the observed and model water tables. By knowing or assuming hydraulic conductivity and using the model water table configuration, an estimate for groundwater flow to and from each discretized grid node can be estimated from Darcy's Law and the Dupuit approximation. The net result, when mapped, shows the simulated distribution of recharge and discharge within and surrounding the wetland. Two examples from the Shingobee River headwaters in central Minnesota, USA show how the method may be used. Geologically recent development of glacial landforms has led to numerous lakes, ponds, and wetlands in the region. Using a 30-m, 1:24 000 scale DEM grid in combination with data from the U.S. Fish and Wildlife National Wetlands Inventory, the model predicts the most likely areas of groundwater interaction in and near wetlands and lakes. More quantitative results can be obtained by applying observed water budget and soil/aquifer parameter data.

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489. Evaluation of national wetland inventory maps in a heavily forested region in the upper Great Lakes.

Kudray, Gregory M. and Gale, Margaret R.

Wetlands 20(4): 581-587. (2000)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: terrestrial ecology: ecology, environmental sciences/ national wetland inventory maps/ equipment/ cover type/ forested areas/ forested wetlands/ hydric nonhydric soil complexes/ topography/ wetland upland complexes

Abstract: National Wetland Inventory (NWI) maps are widely used in the United States but have not been independently evaluated in the Great Lakes region nor in forested areas with level topography. Field data from 148 plots in the Hiawatha National Forest ecological classification and inventory program were combined with an additional review to evaluate NWI mapping accuracy. NWI maps were over 90% accurate in identifying uplands and jurisdictional wetlands. All nonforested wetlands were identified correctly. Uplands were correctly identified 96.9% of the time. The lowest level of accuracy, 90.7%, was achieved in identifying forested wetlands. The most common error was the NWI classification of wetlands on the AuGres soil series, a somewhat poorly drained upland

soil that often occurs in complexes with wetland soils in the region. Forested wetlands with a cover type similar to adjacent uplands were also a source of error on NWI maps. The already high accuracy of NWI maps could be improved by the mapping of wetland-upland complexes, a development corresponding to the increased mapping of hydric-nonhydric soil complexes in area soil surveys. The continued refinement of regional lists of hydrophytic vegetation is supported by indicator status discrepancies between an extensive Hiawatha National Forest database and the current NWI list for the region.

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490. Factors affecting the evolution of coastal wetlands of the Laurentian Great Lakes: An overview.

Mayer, T.; Edsall, T.; and Munawar, M.

Aquatic Ecosystem Health and Management 7(2): 171-178. (2004)

NAL Call #: QH541.5.W3A682; ISSN: 1463-4988

Descriptors: freshwater wetlands/ wetland ecosystems/ wetland issues

Abstract: Coastal wetlands play a pivotal role in the Great Lakes ecosystem. As buffer zones between the land and open waters of the Great Lakes, they perform a variety of essential functions providing both direct and indirect anthropogenic benefits. Geology, morphology and climate are the dominant variables that influence Laurentian Great Lakes wetland development. However, anthropogenic factors are the major contributors to alteration of natural wetland processes. This paper provides an overview of natural and anthropogenic factors important in Great Lakes coastal wetland development and provides statistical information describing the Great Lakes Basin. A brief description of wetlands classification and research issues is also presented.

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491. The future of waterfowl habitats in the Canadian lower Great Lakes wetlands.

Crowder, A. A. and Bristow, J. M.

Journal of Great Lakes Research 14(1): 115-127. (1988)

NAL Call #: GB1627.G8J6; ISSN: 0380-1330

Abstract: Waterfowl utilization of wetlands along the Canadian shore of the lower Great Lakes, and the impact of eutrophication, metal pollution, organic pollution, and sedimentation on both the wetlands and the birds are reviewed. -from Authors

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492. Great Lakes wetlands as amphibian habitats: A review.

Hecnar, S.

Aquatic Ecosystem Health and Management 7(2): 289-303. (2004)

NAL Call #: QH541.5.W3A682; ISSN: 1463-4988

Descriptors: amphibians/ conservation/ endangered status/ conservation status/ literature review/ species diversity/ semiaquatic habitat/ importance as habitat and conservation/ Great Lakes/ wetlands importance as habitat and conservation/ review

Abstract: Amphibians are highly adapted for life in wetland habitats. They form a major component of wetland faunas, and being both prey and predator, they are important in ecosystem functioning. Wetlands provide aquatic habitats that amphibians require for breeding, development,

foraging, hibernation and refuge, and they form an interface with essential adjacent upland habitat. The size and type of wetlands as well as their spatial configuration and local structural characteristics are important features of these habitats for amphibian use. Because of their dependence on water, use of both aquatic and terrestrial habitat, permeable skin, and other biological characteristics, amphibians are considered to be excellent indicators of ecosystem health. Amphibians have a tremendous diversity of natural history characteristics and species differ in their patterns of habitat and microhabitat selection. Over 30 species of amphibians occur in wetlands within the Great Lakes Basin and an increasing trend in species richness exists from north to south across the region. Since European settlement, this region has lost over 50% of its wetlands. Loss rates of coastal and inland wetlands exceed 90% in some areas. Many restoration efforts are underway across the region but losses still exceed gains. No species have been extirpated from the entire basin but numerous local extirpations have occurred. However, nearly half of the species are officially designated as being of conservation concern somewhere in the basin. A more realistic estimate suggests that at least 2/3 of species are of concern. Habitat loss is reported as the primary cause of decline for 60% of species and habitat degradation by pollution is cited for 43% of the fauna. Considering the extent of wetland loss across the basin it seems reasonable to assume a similar magnitude of amphibian population loss. The current conservation status of amphibians indicates that Great Lakes wetlands are unhealthy ecosystems.

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493. Groundwater inflow measurements in wetland systems.

Hunt, R. J.; Krabbenhoft, D. P.; and Anderson, M. P. *Water Resources Research* 32(3): 495-507. (1996)
NAL Call #: 292.8 W295; *ISSN:* 0043-1397.

Notes: Affiliation: Water Resour. Div., U.S. Geological Surv., Madison, WI, USA

Descriptors: wetlands/ groundwater/ hydrology/ Darcy's law/ land management/ water use/ USA/ Wisconsin

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494. Human interference with natural water level regimes in the context of other cultural stresses on Great Lakes wetlands.

Patterson, N. J. and Whillans, T. H.
 In: Coastal Wetlands/ Prince, Harold H. and D'Itri, Frank M. Chelsea, Mich.: Lewis Publishers, 1985; pp. 209-251.

Notes: ISBN: 0873710525

NAL Call #: QH104.5.G7C63

Descriptors: wetlands/ water levels/ limnology/ Great Lakes/ stress analysis/ cultural control/ dikes/ channels/ ecosystems/ reviews

Abstract: Water level regime is but one of many manageable factors which could influence the condition or extent of a Great Lakes wetland. Some factors which could affect water levels such as river discharge into a wetland, diversion of lake water around a wetland, isolation from natural hydrologic influence (diking) or channelization through a wetland could also have independent influence and are subjects of considerable human tampering. It is therefore advisable to consider water level regime and human interference with it in the context of other human-

engendered problems in Great Lakes wetlands. There are at least three major aspects which merit examination: (1) comparison of causal factors in order to isolate similarities among causes (and implied solutions); (2) contrast of stresses (biological, chemical or physical perturbation) and of long-term responses in order to clarify the ecosystemic significance of water level regime (and implied priority for action); and (3) investigation of interaction among causes, among stresses and among long-term responses in order to specify synergisms and antagonisms (and implied interpretation of (1) and (2)). The aspects (1) and (2) have been examined to a degree for the Great Lakes in general, for certain wetland-rich ecosystems within the Great Lakes, and for wetlands in general. This review is based in large part upon those studies.

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495. Irreversible investment in wetlands preservation: Optimal ecosystem restoration under uncertainty.

Bloczynski, J. A.; Bogart, W. T.; Hobbs, B. F.; and Koonce, J. F.

Environmental Management 26(2): 175-193. (Aug. 2000)
NAL Call #: HC79.E5E5; *ISSN:* 0364-152X

Descriptors: wetlands/ environmental restoration/ environment management/ global warming/ climatic changes/ hydrology/ lakes/ nature conservation/ environmental economics/ USA, Ohio, Metzger Marsh/ water management/ ecosystem recovery/ models/ USA, Ohio/ environmental protection/ ecosystem management/ ecosystem disturbance/ environmental impact/ land management/ environmental effects/ model studies/ USA, Ohio, Toledo/ environmental action/ reclamation/ conservation, wildlife management and recreation/ evaluation process

Abstract: The question of how to manage a lacustrine wetland is analyzed given the uncertain potential for long-term lake level changes resulting from global warming and the uncertain biological processes involved in creating wetlands. Three management options are considered: do nothing; construct a dike that removes hydrological connections with the lake ("closed dike"); and build a dike that maintains a hydrological connection with the lake, but can be converted to a closed dike under adverse conditions ("open dike"). For all practical purposes, dike construction represents an irreversible choice. The model, a stochastic dynamic program, is used to optimize the timing and type of protective structure under a range of management goals. A wetland can either be optimal for fish or optimal for mammals and waterfowl, but not both. Because credible estimates of the economic values of wetland services do not exist, we treat those values as parameters in a multiobjective analysis and show the decisions implied by alternative valuations. The model is applied to the case of Metzger Marsh, a Lake Erie coastal wetland near Toledo, Ohio, where the decision was made in 1993 to construct an open dike. We find that the optimal decision is robust with respect to varying assumptions about the formation of barrier beaches and the probability of climate change, but that the decision is not robust to assumptions concerning the health of an unprotected Metzger Marsh. The most important source of uncertainty is the biological health of an unprotected wetland.

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496. Lake Erie coastal wetlands: A review and case study of Presque Isle invertebrates.

Botts, Pamela Silver

In: *Invertebrates in freshwater wetlands of North America: Ecology and management*/ Batzer, Darold P.; Rader, Russell B.; and Wissinger, Scott A.

New York: John Wiley & Sons, 1999; pp. 995-1012.

Notes: ISBN: 0471292583

NAL Call #: QL365.4.A1158

Descriptors: Invertebrata/ literature review/ semiaquatic habitat/ Lake Erie/ coastal wetlands fauna/ literature review and case study/ Chironomidae/ community structure/ distribution within habitat/ Pennsylvania/ Presque Isle/ coastal wetland community spatial and temporal patterns overview

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497. Lake Erie coastal wetlands: An overview.

Herdendorf, C. E.

Journal of Great Lakes Research 18(4): 533-551. (1992)

NAL Call #: GB1627.G8J6; ISSN: 0380-1330

Descriptors: wetlands/ aquatic plants/ Great Lakes/ Lake Erie/ limnology/ marshes/ coastal lagoons/ dikes/ lagoons/ river mouth/ shore protection

Abstract: Coastal wetlands of Lake Erie fall into three categories, depending on the type of protection available to the wetland vegetation: (1) coastal lagoons behind barrier beaches; (2) managed marshes protected by earthen and rip-rap dikes; and (3) estuarine tributary mouths. At one time, the most important protection was that afforded by barrier bars or other natural shoreline features which formed quiet lagoons and embayments. Very few natural wetlands of this type still exist on Lake Erie. Most of the lagoon-type coastal marshes, if they have not been drained or filled or engulfed by the lake, have been replaced by the second type: managed waterfowl marshes which are now protected by earthen rip-rap dikes. The third type of protection is the natural isolation from lake storms provided by the estuaries of virtually all of the tributaries entering Lake Erie, particularly at the western end. Large wetlands have developed along most of the estuaries where disturbance has been minimal. Estuarine coastal marshes currently form the majority of the naturally protected wetlands bordering western Lake Erie. (Author's abstract) 35 005518163

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498. Land-use correlates of anuran community richness and composition in southeastern Ontario wetlands.

Findlay, C. S.; Lenton, J.; and Zheng, L.

Ecoscience 8(3): 336-343. (2001)

NAL Call #: QH540.E366; ISSN: 1195-6860

Descriptors: wetlands/ forests/ environmental impact/ man-induced effects/ *Rana septentrionalis*/ *Rana palustris*/ Canada, Ontario/ mechanical and natural changes

Abstract: In light of increasing evidence of declining anuran populations worldwide, an important conservation issue is the extent to which declines are consequences of smaller-scale stresses such as local habitat loss or degradation, or larger-scale stresses such as climate change. That anuran richness in 77 southeastern Ontario wetlands is negatively correlated with the density of roads on lands within 1 km of the wetland, and positively correlated with the percentage of forest cover is shown here. Logistic regression analysis

shows that the presence of at least two species, the mink frog (*Rana septentrionalis*) and the wood frog (*Rana sylvatica*) is negatively related to road density, while the pickerel frog (*Rana palustris*) shows significant positive association with adjacent forest cover. These results suggest that in southeastern Ontario, significant conservation gains can be achieved through local land-use planning and management decisions that mitigate the effects of existing roads, minimize the construction of new roads, and discourage further forest conversion on lands adjacent to wetlands.

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499. Large-scale coastal wetland restoration on the Laurentian Great Lakes: Determining the potential for water quality improvement.

Mitsch, W. J. and Wang, Naiming

Ecological Engineering 15(3-4): 267-282. (July 2000)

NAL Call #: TD1.E26; ISSN: 0925-8574

Descriptors: wetlands/ coastal environments/ environmental restoration/ lakes/ water quality/ nutrient concentrations/ coastal zone/ simulation/ phosphorus/ hydrology/ coastal waters/ environmental protection/ water pollution control/ water quality control/ restoration/ marshes/ nutrients (mineral)/ watersheds/ ecosystem management/ environment management/ pollutants/ agricultural land/ nutrient retention/ USA, Michigan, Saginaw Bay/ USA, Ohio, Sandusky Bay/ North America, Great Lakes/ USA, Michigan L., Saginaw Bay/ USA, Ohio/ USA, Ohio, Erie L., Sandusky Bay/ USA, Illinois/ USA, Great Lakes/ USA, Michigan/ nutrient sequestration/ reclamation/ environmental action/ estuaries/ prevention and control/ land/ general environmental engineering

Abstract: Coastal wetlands around the Laurentian Great Lakes, estimated to cover 1290 km² in the USA after extensive losses in the past 200 years, are rarely restored for water quality enhancement of the Great Lakes, despite the need for minimizing phosphorus and other pollutant inputs to the lakes. A simulation model, developed and validated for a series of created experimental marshes in northeastern Illinois, was aggregated and simplified to estimate the nutrient retention capacity of hypothetical large-scale coastal wetland restoration in Michigan and Ohio. Restoration of 31.2 km² of wetlands on agricultural land along Saginaw Bay, Michigan, would retain 25 metric tons-P year⁻¹ (53% of the phosphorus flow from the upstream watershed). Hydrologic restoration of 17.3 km² of mostly diked wetlands in Sandusky Bay, Ohio, would retain 38 metric tons year⁻¹ (12% of the phosphorus flow from the upstream watershed). A wetland distribution model developed for the Saginaw Bay site illustrated a technique for identifying sites that have high potential for being transition zones between open water and upland and thus logical locations for wetland restoration.

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500. Linkages between groundwater and coastal wetlands of the Laurentian Great Lakes.

Crowe, A. S. and Shikaze, S. G.

Aquatic Ecosystem Health and Management 7(2): 199-213. (2004)

NAL Call #: QH541.5.W3A682; ISSN: 1463-4988

Descriptors: wetlands/ Great Lakes/ groundwater/ groundwater-surface water interaction

Abstract: Groundwater flow regimes adjacent to coastal wetlands of the Great Lakes are highly transient and vary among different types of coastal wetlands. Groundwater flow is controlled by (1) the physiography of the land adjacent to the wetland, (2) the relative elevations of the wetland and the lake, as they fluctuate over time, and (3) the amount of infiltration and evapotranspiration that occurs at the land and wetland. Groundwater from the mainland adjacent to a wetland will flow towards and discharge into the wetland throughout the year. In a spit that partially protects a wetland from a lake, the source of groundwater is precipitation and snowmelt; not water from the lake or wetland. Here, groundwater continually flows from either side of a central groundwater divide towards the lake or wetland, with the elevation of the lake only affecting the rate of groundwater drainage. Because barrier bars completely separate a lake from a wetland, the elevation of the lake and wetland are different. When the barrier bar is narrow, the resultant hydraulic gradient across the barrier bar causes groundwater flow to oscillate between flowing towards the lake during the fall and winter and towards the wetland during the spring and summer. But as the width of the barrier bar increases, the impact of the lake and wetland diminish relative to the amount of precipitation and snowmelt infiltrating into the barrier bar. Thus, the groundwater flow regime is characterized by a central groundwater divide with groundwater on either side continuously flowing towards the lake and wetland throughout the year. Intradunal wetlands are actually several small wetlands within a series of relic beach ridges and parabolic dunes. Groundwater flow regimes here are highly variable and transient with flow adjacent to different wetlands, and at different times of the year, exhibiting continuous flow to a wetland, oscillating direction of flow, and lateral migration of the groundwater divide. However, these groundwater flow patterns are caused by precipitation and evapotranspiration within the wetland complex and not by fluctuating lake levels.

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501. Literature review: Wetlands as a nonpoint source pollution control measure.

Denison, Doug and Tilson, Don
Wayne County, Michigan: Rouge River National Wet Weather Demonstration Program, 1993. 31 p.
<http://www.rougeriver.com/pdfs/wetlands/tm12.pdf>

502. Mass and nutrient content of dead wood in a central Illinois floodplain forest.

Polit, J. I. and Brown, S.
Wetlands 16(4): 488-494. (Dec. 1996)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: wetlands/ wood/ biomass/ nutrient cycles/ flood plains/ plant populations/ forests/ detritus/ organic matter/ cycling nutrients/ USA, Illinois/ cycling nutrients/ plant populations/ organic compounds/ ecosystems and energetics/ temperate forests/ chemical processes
Abstract: The quantity and quality of dead wood in a central Illinois floodplain forest was measured to determine its role in organic matter and nutrient budgets. Dead wood (downed wood and standing dead trees) was inventoried using plots and the line intersect method for mass, and samples were analyzed for density and concentration of ash, N, and P. Total dead wood was estimated at 15.9 Mg ha super(-1) and was comprised of 9.3 Mg ha super(-1) as

standing dead (59%) and 6.6 Mg ha super(-1) as downed wood (41%). Most of the downed wood (82% of the total) was in the intermediate decomposition class. Density of downed wood (0.19-0.47 g cm super(-3)) decreased and concentrations of N (0.18-1.29%), P (0.12-0.56 mg g super(-1)), and ash (1-23%) increased with increasing state of decomposition. Mean N, P, and ash pools in dead wood were 47 kg ha super(-1), 3.1 kg ha super(-1), and 481 kg ha super(-1), respectively. Downed wood contained 56%, 54%, and 69% of the total N, P, and ash pools, respectively. During periods of rapid decomposition of leaves and reproductive parts, downed dead wood is the dominant and often sole component of the floor litter mass.
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503. Modelling self-design of the aquatic community in a newly created freshwater wetland.

Metzker, K. D. and Mitsch, W. J.
Ecological Modelling 100(1-3): 61-86. (1997)
NAL Call #: QH541.15.M3E25; ISSN: 0304-3800
Descriptors: wetlands/ marshes/ freshwater fish/ community composition/ ecological succession/ climax community/ fish/ evolution/ fish populations/ community development/ USA, Ohio/ Pisces/ models/ community structure

Abstract: A dynamic simulation model was constructed to predict the natural development of a fish community in a recently constructed, freshwater marsh in the midwestern USA, and to determine which forces are significant in shaping the self-design trajectory of the fish community. The model allowed immigration of five species of fishes from a nearby river into the constructed wetland system and allowed them to interact with each other as well as with the other biotic components of the wetland. Imported fishes included *Micropterus salmoides*, *Lepomis macrochirus*, *Lepomis cyanellus*, *Cyprinus carpio* and *Ameiurus natalis*. These species were chosen because each is common in the nearby river and because each possesses physiological characteristics allowing survival in typical marsh conditions. Each species population was divided into three distinct ontogenetic stages and were graduated into the next ontogenetic stage as the normal consequence of growth. Modelled interactions included intra and interspecific competition; predation; feeding; reproduction; fish effects on system abiotic components (e.g., bioturbation) and mortality. The fish community underwent several major changes in structure during the first 4 years of its simulated existence, before establishing a stable structure. Under environmental conditions prevailing in the system, the fish community always evolved toward a stable state with a high-biomass population dominated by *Cyprinus carpio* and a smaller population of *Ameiurus natalis*. If the effects of suboptimal environmental conditions were removed, then the system always evolved toward a low-biomass state consisting entirely of *Micropterus salmoides*. The role of chance was also tested and resulted in significant short term modifications to the community structure; however, these changes decreased in magnitude and were insufficient to prevent attainment of either of the two alternate steady states. These results indicate that the fish community in wetlands has a strong self-design trajectory, tending toward almost complete dominance by *Cyprinus carpio* unless typical wetland environmental conditions were significantly ameliorated.

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504. Non-native plant commonness and dominance in the forests, wetlands, and grasslands of Illinois, USA.

Spyreas, Greg; Ellis, James; Carroll, Connie; and Molano Flores, Brenda

Natural Areas Journal 24(4): 290-299. (2004)

NAL Call #: QH76.N37; ISSN: 0885-8608

Descriptors: biodiversity/ terrestrial ecology: ecology, environmental sciences/ alien plant domination/ forest habitat/ grasslands habitat/ vegetation survey/ wetlands habitat

Abstract: Non-native species constitute one of the greatest threats to our indigenous biota. We used data from vegetation surveys of ground, shrub, and canopy strata from 1997-2001 at 399 randomly selected forests, wetlands, and grasslands to elucidate non-native plant pervasiveness throughout Illinois. The dominant non-native species in the ground layer of forests was *Lonicera japonica* Thunb., in wetlands it was *Phalaris arundinacea* L., in prairie grasslands it was *Poa pratensis* L., and across all grasslands it was *Festuca arundinacea* Schreb. Though rarely recognized as exotic, several of the most prevalent non-natives were introduced ecotypes or cultivars of cosmopolitan species. Conversely, some well-known exotics were surprisingly uncommon. Non-native species were more dominant in the ground cover (9% forests, 33% wetlands, 36% prairie grasslands, 76% secondary grasslands) than in the shrub and canopy strata across the state. Non-native ground cover varied regionally in forests and wetlands while, overall, the southern third of the state had significantly lower non-native cover. These regional patterns may be related to isolation from metropolitan areas, historical disturbances, current land use, unique edaphic features, as well as species-specific distributions for the most successful invaders. Our results show the extent to which non-native species have permeated Illinois habitats and replaced native plant communities.

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505. Nongame bird use of restored wetlands in Manitowoc County, Wisconsin.

Guggisberg, A. C. Wisconsin Department of Natural Resources, 1996. 60 p.

Descriptors: land ownership/ questionnaire/ statistics/ surveys/ vegetation

Abstract: Nongame wildlife use and vegetation were monitored on 143 restored wetlands in Manitowoc County. Included is a supplement, entitled "Wisconsin's Coastal Lake Michigan Wetland Restoration Research Program: Getting Started & Data Sheets and Instructions."

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506. Pathways of nutrient loading and impacts on plant diversity in a New York peatland.

Drexler, Judy Z. and Bedford, Barbara L.

Wetlands 22(2): 263-281. (2002)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: shannon wiener diversity/ fen/ groundwater/ hydrochemistry/ hydrogeology/ nutrient flux/ nutrient impact/ nutrient loading/ peat chemistry/ peatland/ peatland characteristics/ plant diversity/ potential pathway identification/ soil characteristics/ species richness

Abstract: Nutrient loading is a subtle, yet serious threat to the preservation of high diversity wetlands such as peatlands. Pathways of nutrient loading and impacts on plant diversity in a small peatland in New York State, USA

were determined by collecting and analyzing a suite of hydrogeological, hydro-chemical, soil, and vegetation data. Piezometer clusters within an intensive network constituted hydro-chemical sampling points and focal points for randomly selected vegetation quadrats and soil-coring locations. Hydrogeological data and nutrient analyses showed that P and K loading occurred chiefly by means of overland flow from an adjacent farm field, whereas N loading occurred predominantly through ground-water flow from the farm field. Redundancy analysis and polynomial regression showed that nutrients, particularly total P in peat, total K in peat, extractable NH₄-N, and NO₃-N flux in ground water, were strongly negatively correlated with plant diversity measures at the site. No other environmental variables except vegetation measures associated with eutrophication demonstrated such a strong relationship with plant diversity. Nitrate loading over 4 mg m⁻² day⁻¹ was associated with low plant diversity, and Ca fluxes between 80 and 130 mg m⁻² day⁻¹ were associated with high plant diversity. Areas in the site with particularly low vascular plant and bryophyte species richness and Shannon-Wiener diversity (H') occurred adjacent to the farm field and near a hillside spring. High H' and species richness of vascular plants and bryophytes occurred in areas that were further removed from agriculture, contained no highly dominant vegetation, and were situated directly along the ground-water flow paths of springs. These areas were characterized by relatively constant water levels and consistent, yet moderate fluxes of base cations and nutrients. Overall, this study demonstrates that knowledge of site hydrogeology is crucial for determining potential pathways of nutrient loading and for developing relationships between nutrient inflows and wetland plant diversity.

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507. The physical effects of the Great Lakes on tributaries and wetlands: A summary.

Bedford, K. W.

Journal of Great Lakes Research 18(4): 571-589. (1992)

NAL Call #: GB1627.G8J6; ISSN: 0380-1330

Descriptors: wetlands/ Great Lakes/ Lake Erie/ lake effects/ limnology/ seasonal variation/ tributaries/ water level fluctuations/ wind-driven currents/ hydrologic cycle/ lakes/ physical analysis/ storm surges/ water temperature

Abstract: Wetland and tributary confluences are susceptible to physical influences imposed by the Great Lakes, particularly through the effects of short and long-term water level fluctuations and accompanying transport disruptions including flow and transport reversals. With there being few, if any, direct observations of these disruptions based on velocity measurements, reviewing the possible physical effects can only be done by reviewing the current contributing physics known about the Great Lakes, and contrasting possible marine estuary transport mechanisms with what little is published about the Great Lakes. Lake Erie was chosen because that lake exhibits the strongest response to storms and the clearest measurable signals resulting from them. The important feature of Lake Erie physics is its seasonal variability. Lake Erie is shallow and responds robustly to the annual thermal heating and cooling cycle. Although ice covers 90% of the lake in the winter, the ice does not suppress wind driven circulation. The spring-summer-fall heating and cooling cycle is marked by both vertical and horizontal temperature variation. Due

primarily to prevailing storm tracks and shallowness, the lake responds to wind stress of storms with a combination of free and forced mode oscillatory responses in water level. An analogy with marine estuaries is correct in suggesting that the flood and ebb conditions are asymmetric in that the concentration of fluxes during flood are quite different than those during the subsequent ebb. The analogy is not correct in that the differential heating enhances springtime interfacial development which potentially reverses during the fall cooling season.
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508. Regional analysis of fringe wetlands in the Midwest: Creation and restoration.

Willard, D. E. and Levine, D. A.

In: Wetland Creation and Restoration: The Status of the Science.

Covelo, Calif.: Island Press, 1990; pp. 299-325.

Notes: ISBN: 1559630450

NAL Call #: QH541.5.M3W462

Descriptors: artificial wetlands/ lake shores/ reservoirs/ water resources management/ wetland restoration/ monitoring/ plant populations/ planting management/ shoreline cover/ vegetation establishment/ water level fluctuations/ water resources development

Abstract: 'Fringe' wetlands are those found along lakes and reservoirs, abundant in the midwest United States. Very few documented cases of fringe wetland mitigation are found. Their prevalence in this region suggests that Midwestern administrators of the regulatory program will be confronted with permits which impact fringe wetlands. Specific goals must be clearly outlined in the mitigation permit and include the following: detailed construction plans; a list of target species consistent with project goals; a long-term management plan; and a complete monitoring plan. To further ensure the success of mitigation, the following is recommended: the establishment of a fringe wetland should not be attempted where the fetch is greater than 13 km unless a dike is constructed to reduce wave action; and revegetation should utilize a combination of both natural (i. e., seed bank) and artificial (i.e., transplants) methods. Further research is needed (1) to determine how fringe wetland plant species and plant communities as a whole influence water quality, (2) to determine how water level fluctuations affect species composition and nutrient cycling in these wetlands, (3) to quantify shoreline stabilization needs and functions, and (4) to develop ecotypically-adapted planting stocks.

(Author 's abstract)

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509. Regional-scale measurements of CH sub(4) exchange from a tall tower over a mixed temperate/boreal lowland and wetland forest.

Werner, C.; Davis, K.; Bakwin, P.; Yi, C.; Hurst, D.; and Lock, L.

Global Change Biology 9(9): 1251-1261. (Sept. 2003)

NAL Call #: QC981.8.C5G6323; ISSN: 1354-1013

Descriptors: wetlands/ forests/ atmospheric conditions/ methanogenesis/ soils/ water table/ annual variations/ methane/ gas exchange/ atmospheric gases/ carbon dioxide/ precipitation/ Bowen's ratio/ soil temperatures/ ecosystems/ forest ecosystems/ ground temperatures/ oxidation of methane/ methane exchange, air-marsh/ biosphere-atmosphere interaction/ carbon dioxide flux/

snow melting/ USA, Wisconsin, Chequamegon-Nicolet Natl. Forest/ atmosphere/ ecosystems and energetics/ atmospheric chemistry/ composition of the atmosphere/ biometeorology and bioclimatology/ microclimates of forests and forest clearings/ swamps, marshes

Abstract: The biosphere-atmosphere exchange of methane (CH sub(4)) was estimated for a temperate/boreal lowland and wetland forest ecosystem in northern Wisconsin for 1997-1999 using the modified Bowen ratio (MBR) method. Gradients of CH sub(4) and CO sub(2) and CO sub(2) flux were measured on the 447-m WLEF-TV tower as part of the Chequamegon Ecosystem-Atmosphere Study (ChEAS). No systematic diurnal variability was observed in regional CH sub(4) fluxes measured using the MBR method. In all 3 years, regional CH sub(4) emissions reached maximum values during June-August (24 plus or minus 14.4 mg m super(-2) day super(-1)), coinciding with periods of maximum soil temperatures. In 1997 and 1998, the onset in CH sub(4) emission was coincident with increases in ground temperatures following the melting of the snow cover. The onset of emission in 1999 lagged 100 days behind the 1997 and 1998 onsets, and was likely related to postdrought recovery of the regional water table to typical levels. The net regional emissions were 3.0, 3.1, and 2.1 g CH sub(4) m super(-2) for 1997, 1998, and 1999, respectively. Annual emissions for wetland regions within the source area (28% of the land area) were 13.2, 13.8, and 10.3 g CH sub(4) m super(-2) assuming moderate rates of oxidation of CH sub(4) in upland regions in 1997, 1998, and 1999, respectively. Scaling these measurements to the Chequamegon Ecosystem (CNNF) and comparing with average wetland emissions between 40 degree N and 50 degree N suggests that wetlands in the CNNF emit approximately 40% less than average wetlands at this latitude. Differences in mean monthly air temperatures did not affect the magnitude of CH sub(4) emissions; however, reduced precipitation and water table levels suppressed CH sub(4) emission during 1999, suggesting that long-term climatic changes that reduce the water table will likely transform this landscape to a reduced source or possibly a sink for atmospheric CH sub(4).
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510. Snowmelt ponds in Wisconsin: Influence of hydroperiod on invertebrate community structure.

Schneider, Daniel W.

In: Invertebrates in freshwater wetlands of North America:

Ecology and management/ Batzer, Darold P.; Rader, Russell B.; and Wissinger, Scott A.

New York: John Wiley & Sons, 1999; pp. 299-318.

Notes: ISBN: 0471292583

NAL Call #: QL365.4.A1158

Descriptors: Invertebrata/ community structure/ snowmelt ponds/ pond/ temporary water/ physical factors/ hydroperiod influence on community structure in snowmelt ponds/ Wisconsin/ North America/ snowmelt ponds community structure/ influence of hydroperiod
© The Thomson Corporation

511. Techniques for restoration of disturbed coastal wetlands of the Great Lakes.

Wilcox, D. A. and Whillans, T. H.

Wetlands 19(4): 835-857. (1999)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ degradation/ environmental quality/ land reclamation/ land management/ hydrology/ water control/ environmental restoration/ methodology/ coastal environments/ restoration/ sedimentation/ community composition/ water levels/ pollution control/ sediment pollution/ decomposition/ environmental quality standards/ land restoration/ North America, Great Lakes/ North America/ land restoration

Abstract: A long history of human-induced degradation of Great Lakes wetlands has made restoration a necessity, but the practice of wetland restoration is relatively new, especially in large lake systems. Therefore, we compiled tested methods and developed additional potential methods based on scientific understanding of Great Lakes wetland ecosystems to provide an overview of approaches for restoration. We addressed this challenge by focusing on four general fields of science: hydrology, sedimentology, chemistry, and biology. Hydrologic remediation methods include restoring hydrologic connections between diked and hydrologically altered wetlands and the lakes, restoring water tables lowered by ditching, and restoring natural variation in lake levels of regulated lakes Superior and Ontario. Sedimentological remediation methods include management of sediment input from uplands, removal or proper management of dams on tributary rivers, and restoration of protective barrier beaches and sand spits. Chemical remediation methods include reducing or eliminating inputs of contaminants from point and non-point sources, natural sediment remediation by biodegradation and chemical degradation, and active sediment remediation by removal or by in situ treatment. Biological remediation methods include control of non-target organisms, enhancing populations of target organisms, and enhancing habitat for target organisms. Some of these methods were used in three major restoration projects (Metzger Marsh on Lake Erie and Cootes Paradise and Oshawa Second Marsh on Lake Ontario), which are described as case studies to show practical applications of wetland restoration in the Great Lakes. Successful restoration techniques that do not require continued manipulation must be founded in the basic tenets of ecology and should mimic natural processes. Success is demonstrated by the sustain-ability, productivity, nutrient-retention ability, invasibility, and biotic interactions within a restored wetland.

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512. Temperate zone fens of the glaciated midwestern USA.

Amon, J. P.; Thompson, C. A.; Carpenter, Q. J.; and Miner, J.

Wetlands 22(2): 301-317. (June 2002)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ USA/ glaciers/ temperate zone/ boreal forests/ literature review/ species diversity/ groundwater/ hydrogen ion concentration/ root zone/ organic matter/ conductivity/ fens/ inland water environment/ classification systems/ hydrology/ physicochemical properties/ community composition/ species diversity/ habitat community studies

Abstract: A study of more than 70 fens in the Midwestern

United States and a review of the literature indicates that these temperate zone wetlands may differ from fens of the boreal zone and are not adequately differentiated from them by present classification systems. Fens of the Midwestern temperate zone 1) are wetlands with high botanical diversity, 2) are supported in part by ground water with conductivity > 100mS/cm and circumneutral pH, 3) contain water in the root zone during most of the growing season yet are not usually inundated, and 4) accumulate organic and/or carbonate substrates. Individually, none of these descriptors is adequate to distinguish fens from other wetland communities of the Midwest such as marshes, sedge meadows, and wet prairies; yet, when they are taken together, such discrimination is possible. While fens of this zone share many species, our study does not support using indicator species because too few are both faithfully represented and geographically widespread. Midwestern temperate fens are sustained by forces of climate, landscape, and geology, which permit ground water to seep continuously into the root zone in a focused location. Since water availability in the temperate Midwest is less than in the boreal zone, continuous discharge is needed to maintain the saturation conducive to peat formation.

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513. Temporary woodland ponds in Michigan: Invertebrate seasonal patterns and trophic relationships.

Higgins, Michael J. and Merritt, Richard W.

In: *Invertebrates in freshwater wetlands of North America: Ecology and management*/ Batzer, Darold P.; Rader, Russell B.; and Wissinger, Scott A.

New York: John Wiley & Sons, 1999; pp. 279-297.

Notes: ISBN: 0471292583

NAL Call #: QL365.4.A1158

Descriptors: Invertebrata/ trophic structure/ community structure/ temporary woodland pond community seasonal dynamics/ pond/ community seasonal dynamics and trophic relationships/ temporary water/ woodland ponds/ Michigan/ temporary woodland ponds/ community seasonal dynamics and trophic relations

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514. Use of historical and geospatial data to guide the restoration of a Lake Erie coastal marsh.

Kowalski, K. P. and Wilcox, D. A.

Wetlands 19(4): 858-868. (Dec. 1999)

NAL Call #: QH75.A1W47; ISSN: 0277-5212.

Notes: Conference: Temperate Wetlands Restoration Workshop, Barrie, ON (Canada), 27 Nov-1 Dec 1995

Descriptors: wetlands/ North America, Erie L./ water level/ vegetation/ land reclamation/ aerial photography/ geomorphology/ hydrology/ marshes/ environmental restoration/ historical ecology/ coastal environments/ management/ USA, Ohio/ vegetation cover/ plant populations/ geographical reference systems/ water levels/ aerial photographs/ historical account/ ecosystem management/ barrier beaches/ shore protection/ restoration/ photography/ North America, Erie L./ USA, Ohio, Erie L., Metzger Marsh/ watershed protection/ reclamation/ protective measures and control/ coastal zone management/ water resources and supplies

Abstract: Historical and geospatial data were used to identify the relationships between water levels, wetland vegetation, littoral drift of sediments, and the condition of a

protective barrier beach at Metzger Marsh, a coastal wetland in western Lake Erie, to enhance and guide a joint federal and state wetland restoration project. Eleven sets of large-scale aerial photographs dating from 1940 through 1994 were interpreted to delineate major vegetation types and boundaries of the barrier beach. A geographic information system (GIS) was then used to digitize the data and calculate the vegetated area and length of barrier beach. Supplemented by paleoecological and sedimentological analyses, aerial photographic interpretation revealed that Metzger Marsh was once a drowned-river-mouth wetland dominated by sedges and protected by a sand barrier beach. Extremely high water levels, storm events, and reduction of sediments in the littoral drift contributed to the complete destruction of the barrier beach in 1973 and prevented its recovery. The

extent of wetland vegetation, correlated to water levels and condition of the barrier beach, decreased from a high of 108 ha in 1940 to a low of 33 ha in 1994. The lack of an adequate sediment supply and low probability of a period of extremely low lake levels in the near future made natural reestablishment of the barrier beach and wetland vegetation unlikely. Therefore, the federal and state managers chose to construct a dike to replace the protective barrier beach. Recommendations stemming from this historical analysis, however, resulted in the incorporation of a water-control structure in the dike that will retain a hydrologic connection between wetland and lake. Management of the wetland will seek to mimic processes natural to the wetland type identified by this analysis.
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Effects of Agricultural Conservation Practices on Wetlands

515. Analysis and conservation implications of landscape change in the Wisconsin River floodplain, USA.

Freeman, Ross E.; Stanley, Emily H.; and Turner, Monica G.

Ecological Applications 13(2): 416-431. (2003)

NAL Call #: QH540.E23; ISSN: 1051-0761

Descriptors: wetlands/ aerial photography: applied and field techniques/ orthophotography: applied and field techniques/ agriculture/ conservation implications/ deciduous forest/ floodplain forest ecosystem/ forest connectivity/ grassland/ land cover change/ landscape change/ resource management/ riparian buffer

Abstract: River floodplain landscapes are diverse and dynamic, yet little is known about long-term changes in land-cover patterns in these systems. We quantified floodplain land-cover change between the 1930s and the 1990s along nine 12-21-km reaches of the Wisconsin River by analyzing and digitally classifying 200 historic aerial photos corrected against modern orthophotographs. Several metrics of landscape structure were used to determine changes in amount and connectivity of deciduous forest, wetlands, grassland, and agriculture within the 100-yr floodplain. Deciduous forest increased by up to 51% between the 1930s and the 1990s. However, number of patches declined, and edge density increased in almost every reach, indicating that amount and connectivity of forest cover increased but that forest patches became more complex in shape. Grasslands declined, and the number, edge density, and mean size of grassland patches illustrated a progression to fewer, smaller, isolated remnants. Wetland patch dynamics demonstrated complex and divergent patterns, as wetland cover decreased in northern reaches, increased in patch density but not mean patch size in the central region, and increased in both patch density and patch size in the south. Agricultural areas declined in eight of nine reaches, and tended to fragment into fewer, smaller patches. These trends underscore a complicated and dynamic pattern of landscape change over a relatively short time scale. We explored realistic conservation scenarios to determine how disparate strategies would affect floodplain forest connectivity in four of the study reaches. One approach filled gaps in the buffer zone immediately adjacent to the river channel; the other reverted small or large agricultural patches to forest cover.

Filling buffer zone gaps resulted in dramatic changes in forest connectivity in one half of the reaches, whereas greatest forest connectivity was gained by reverting agricultural patches to forest in the other half of the reaches. These scenarios emphasize that the way that forest conservation occurs (e.g., filling gaps vs. patch conversion) is just as significant as how much land is actually protected, and the ideal management option must be tailored to the specific land-cover arrangements of a given river reach. In addition to evaluating changes in forest connectivity, the number of land-owners that would be affected by conservation strategies was determined. Greatest increases in forest connectivity under the buffer scenarios involved from 15 to 21 different land-owners, whereas the greatest increases under the reversion scenarios affected from 14 (using several large agricultural parcels) to 67 (using many small parcels) landowners. Thus the number of landowners affected by different management scenarios represents a critical constraint on idealized conservation plans. Such scenarios may prove useful in floodplain management and facilitate synthesis of ecological research and land management.

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516. Analyzing cumulative environmental effects of agricultural land drainage in southern Ontario, Canada.

Spaling, H.

Agriculture, Ecosystems & Environment 53(3): 279-292. (1995)

NAL Call #: S601.A34; ISSN: 0167-8809

Descriptors: wetlands/ agricultural land/ drainage/ environmental impact/ area/ geographical distribution/ spatial distribution/ water flow/ volume/ water quality/ nitrate nitrogen/ nitrogen content/ atrazine/ models/ geographic information systems/ Ontario

This citation is from AGRICOLA.

517. Anthropogenic correlates of species richness in southeastern Ontario wetlands.

Findlay, C. S. and Houlahan, J.

Conservation Biology 11(4): 1000-1009. (Aug. 1997)

NAL Call #: QH75.A1C5; ISSN: 0888-8892

Descriptors: wetlands/ plant populations/ community composition/ man-induced effects/ anthropogenic factors/

species diversity/ plants/ roads/ forestry/ vertebrata/
Canada, Ontario/ species richness/ forest practices/
vertebrates/ conservation/ mechanical and natural changes/
water and plants

Abstract: We examined the relationship between the richness of four different wetland taxa (birds, mammals, herptiles, and plants) in 30 southeastern Ontario, Canada wetlands and two anthropogenic factors: road construction and forest removal/conversion on adjacent lands. Data were obtained from two sources: road densities and forest cover from 1:50,000 Government of Canada topographic maps and species lists and wetland areas from Ontario Ministry of Natural Resources wetland evaluation reports. Multiple regression analysis was used to model the relationships between species richness and wetland area, road density, and forest cover. Our results show a strong positive relationship between wetland area and species richness for all taxa. The species richness of all taxa except mammals was negatively correlated with the density of paved roads on lands up to 2 km from the wetland. Furthermore, both herptile and mammal species richness showed a strong positive correlation with the proportion of forest cover on lands within 2 km. These results provide evidence that at the landscape level, road construction and forest removal on adjacent lands pose significant risks to wetland biodiversity. Furthermore, they suggest that most existing wetland policies, which focus almost exclusively on activities within the wetland itself and/or a narrow buffer zone around the wetland perimeter, are unlikely to provide adequate protection for wetland biodiversity.

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518. Assessing the potential impacts of alternative landscape designs on amphibian population dynamics.

Rustigian, H. L.; Santelmann, M. V.; and Schumaker, N. H. *Landscape Ecology* 18(1): 65-81. (2003)

NAL Call #: QH541.15.L35 L36; *ISSN:* 0921-2973

Descriptors: landscape/ population dynamics/ models/ land use/ geographic information systems/ conservation/ environmental impact/ agriculture/ watersheds/ breeding sites/ habitat selection/ climatic changes/ life history/ dispersion/ vegetation cover/ prediction/ Amphibia/ USA, Iowa/ amphibians

Abstract: An individual-based, spatially explicit population model was used to predict the consequences of future land-use alternatives for populations of four amphibian species in two central Iowa (midwest USA) agricultural watersheds. The model included both breeding and upland habitat and incorporated effects of climatic variation and demographic stochasticity. Data requirements of the model include life history characteristics, dispersal behavior, habitat affinities, as well as land use and landcover in geographic information systems databases. Future scenarios were ranked according to change in breeder abundance, saturation, and distribution, compared to baseline conditions. Sensitivity of simulation results to changes in model parameters was also examined. Simulated results suggest that while all four species modeled are likely to persist under present and future scenario conditions, two may be more at risk from future landscape change. Although the study species are all widespread generalists regarded as having a low conservation priority, they depend on wetlands and ponds, increasingly endangered habitats

in agricultural landscapes. Broader conservation strategies in the region would ensure that these currently common organisms do not become the endangered species of the future.

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519. Atrazine fate and transport in the Des Plaines wetlands.

Alvord, H. H. and Kadlec, R. H.

Ecological Modelling 90(1): 97-107. (1996)

NAL Call #: QH541.15.M3E25; *ISSN:* 0304-3800

Descriptors: wetlands/ models/ pesticides/ herbicides/ pollution dispersion/ residence time/ atrazine/ fate of pollutants/ solute transport/ USA, Illinois/ atrazine/ residence time/ pollution dispersion/ fate of pollutants/ solute transport/ models

Abstract: Atrazine fate and transport in three constructed pond and island wetlands in north east Illinois, USA, were studied in the field (1991) and modeled. The wetlands received pumped inflow from the Des Plaines River. The nominal residence time was about eight days for two, but was longer for the third. The river atrazine chemograph had two peaks that rose quickly after heavy spring rains and then subsided slowly. Maximum concentrations exceeded the United States federal drinking water standard (3 µg/l). The wetlands delayed, reduced, and spread out the peaks, removing 26 to 64% of their inflows depending on residence time. Flow and mixing models idealized the wetlands as single flow reactors or as networks of them. Atrazine reactions on biofilms with mass transfer rate limitation and when sorbed to sediments and litter were postulated. Simulation results were consistent with almost all atrazine reactions on biofilms. Mass transfer coefficients were 10-15 m/year with the wetland bottom taken as the biofilm area. The corresponding wetland half-lives were about 10 days. Best calibration resulted when most of the reaction took place near the pumping inlet. Model coefficients were similar to values for BOD and nutrients in other surface flow wetlands or to those derived from tracer data. The results suggest that observed removal rates of many pollutants in wetlands may reflect similar underlying mass transfer rate limitations.

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520. Buffer zone and windbreak effects on spray drift deposition in a simulated wetland.

Brown, R. B.; Carter, M. H.; and Stephenson, G. R.

Pest Management Science 60(11): 1085-1090. (2004)

NAL Call #: SB951.P47; *ISSN:* 1526-498X

Descriptors: agricultural land/ weed control/ herbicides/ spray drift/ wetland plants/ phytotoxicity/ plant damage/ windbreaks/ spray deposition/ Ontario

Abstract: The amount of agricultural spray that drifts into a wetland from an adjacent crop field is influenced by vegetation along the field boundary or any intentional setback distance (buffer zone) between the sprayer and the edge of the arable field. In this study, spray tracer drift deposits were measured in a simulated wetland area under different conditions of wind speed and buffer zone width. The effect of an artificial windbreak at the upwind edge of the simulated wetland was also evaluated. A level of tolerance of 0.1% of the in-swath spray deposition was established as a no-effect level for the response of aquatic plants to common herbicides. Our results indicate that a

vegetated 10-m field margin (eg a fencerow) alone provides adequate protection from herbicide drift into a wetland area under wind conditions normally considered acceptable for spraying. For high winds (>4 m s⁻¹) when field spraying would not normally be advised, adequate protection was afforded by the same 10-m margin plus a dense windbreak (25% porosity) or by the margin plus a 20-m buffer zone. This citation is from AGRICOLA.

521. Carbon storage response to harvesting and site preparation in a forested mire in northern Michigan, USA.

Trettin, Carl C.; Gale, Margaret R.; Jurgensen, Martin F.; and McLaughlin, James W.

Suo (Helsinki) 43(4-5): 281-284. (1992)

NAL Call #: 54.8 SU7; ISSN: 0039-5471

Descriptors: wetlands/ biochemistry and molecular biophysics/ climatology: environmental sciences/ development/ ecology: environmental sciences/ forestry/ freshwater ecology: ecology, environmental sciences/ soil science/ decomposition/ ecosystem/ organic matter/ plant community regeneration/ productivity/ whole tree harvest
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522. Comparisons of P-yield, riparian buffer strips, and land cover in six agricultural watersheds.

Reed, Tara and Carpenter, Stephen R.

Ecosystems 5(6): 568-577. (2002)

NAL Call #: QH540 .E3645; ISSN: 1432-9840

Descriptors: agricultural watersheds/ eutrophication/ land cover/ non point source pollution/ percent wetland land cover/ phosphorus yield variability/ riparian buffer strips/ riparian continuity/ riparian patch size/ stream sinuosity
Abstract: Riparian buffer strips may protect streams from phosphorus (P) pollution. We compared 2 years of daily P-yield (mug m⁻² day⁻¹) from six southeast Wisconsin watersheds with contrasting riparian buffer attributes. Of the variables measured, mean daily P-yield was most closely correlated with the variability in riparian patch size. Variability in P-yield was most closely correlated with characteristics of the riparian buffer, such as percent wetland land cover, riparian continuity, and stream sinuosity. During the most extreme events, mean P-yield was negatively correlated with the percentage of wetland land cover in the upland watershed. Correlations suggest that riparian continuity may influence P-loading in these watersheds. Our results corroborate the importance of continuity and uniformity of riparian buffers as moderators of P flow from upland agricultural lands into streams.
© The Thomson Corporation

523. A conceptual model of cumulative environmental effects of agricultural land drainage.

Spaling, H. and Smit, B.

Agriculture, Ecosystems & Environment 53(2): 99-108. (1995)

NAL Call #: S601.A34; ISSN: 0167-8809

Descriptors: wetlands/ environmental effects/ drainage/ model studies/ ecosystems/ pollutants/ spatial distribution/ temporal distribution/ agriculture/ land use/ environmental impact/ ecosystem disturbance/ models/ Canada, Ontario/ cumulative effects/ environmental impact/ ecosystem disturbance/ models/ environmental effects/ model studies/ pollutants/ spatial distribution/ temporal distribution/ drainage

Abstract: Cumulative environmental effects are characterized by the temporal and spatial accumulation of change in environmental systems in an additive or interactive manner. Theoretical frameworks of cumulative environmental change generally follow a causal model consisting of the source of cumulative change, pathways of accumulation, and a typology of cumulative effects. These components, and the notion of temporal and spatial accumulation, are used to develop a conceptual model of the cumulative effects of agricultural land drainage in southern Ontario, Canada. Drainage is a source of cumulative effects because of its temporally repetitive and spatially expansive nature. Drainage modifies flow regimes and contributes a mechanism for the spatial movement of water and contaminants from one location to another. Potential cumulative effects of drainage include the repeated addition of drain water to receiving streams (time crowding), the systematic gathering of contaminants at higher concentrations relative to the source (spatial crowding) and their transport from agroecosystems to aquatic ecosystems downstream (cross-boundary movement), and the severing of natural areas resulting in altered landscape structure and functioning (spatial fragmentation). The model hypothesizes that, as drainage density increases, changes in environmental components or processes manifest themselves as cumulative effects, and that these effects accumulate at broader temporal and spatial scales.
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524. Consequences of prairie wetland drainage for crustacean biodiversity and metapopulations.

Jenkins, D. G.; Grissom, S.; and Miller, K.

Conservation Biology 17(1): 158-167. (Feb. 2003)

NAL Call #: QH75.A1C5; ISSN: 0888-8892

Descriptors: wetlands/ prairies/ drainage/ biological diversity/ metapopulations/ historical ecology/ temporary ponds/ community composition/ freshwater crustaceans/ species diversity/ historical account/ long-term records/ genetics/ population genetics/ species extinction/ man-induced effects/ land use/ agriculture/ Crustacea/ USA, Illinois/ conservation/ mechanical and natural changes
Abstract: Much of Illinois was once wet prairie, dotted with ancient (ca. 10,000-year-old) ephemeral wetlands. Most wetland habitat (85%) was converted to agriculture over a span of about 100 years (ca. 1850-1950). The consequences of this severe habitat fragmentation on wetland communities and metapopulations are unknown. We studied crustacean communities (weekly stovepipe samples throughout hydroperiods) for 3 years in a set of extant ephemeral wetlands in Illinois. We generated species-sites curves by rarefaction and extrapolated those curves to conservatively estimate that 83-85 crustacean species may have inhabited approximately 4 million ephemeral wetlands that once existed in Illinois; 8-9 crustacean species were driven to extinction in Illinois during drainage; and 75-76 crustacean species are extant in the few remaining ephemeral wetlands of Illinois. We also conducted cellular automata simulations to examine the potential effects of habitat fragmentation on the genetic structure of extant crustacean metapopulation. Simulations indicated that conversion of the former wet prairie to agriculture may have reduced crustacean metapopulations to isolated populations that are more vulnerable to future habitat loss. Despite severe habitat fragmentation,

curvilinear species-sites relationships suggest that the greatest extinction rates have yet to occur for ephemeral wetland crustaceans. However, selection for limited dispersal during habitat fragmentation may contribute to extinction debt for extant species. Conservation programs can preserve much of the historical biodiversity of ephemeral wetlands, but future wetland biodiversity will depend heavily on the success of those efforts. The consequences of historical wetland loss and the importance of wetland conservation efforts to agriculture in the United States should be instructive for other regions.
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525. The effect of forestry drainage practices on the emission of methane from northern peatlands.

Roulet, N. T. and Moore, T. R.

Canadian Journal of Forest Research 25(3): 491-499. (1995)

NAL Call #: SD13.C35; ISSN: 0045-5067

Descriptors: wetlands/ forest hydrology/ methane/ peat bogs/ drainage/ air-earth interfaces

Abstract: Methane (CH sub(4)) flux was measured from undrained, drained, and ditched portions of treed fen, forested bog, and treed bog sites in the Wally Creek experimental drainage site (near Cochrane, Ontario), from May to October 1991. Drainage for 7 years lowered the water table from between -21 and -49 cm to -41 and -93 cm at the three respective sites. Drainage resulted in a conversion of the peatlands from a CH sub(4) source (0 to 15 mg CH sub(4)/m super(2)/d) to a small CH sub(4) sink (0 to -0.4 mg CH sub(4)/m super(2)/d). In contrast, CH sub(4) efflux from the ditches ranged from <5 to >400 mg CH sub(4)/m super(2)/d. The flux data were used to estimate the impact of forest drainage practices on net CH sub(4) emissions from a forest drainage complex. For the treed and forested bogs, there was a net increase in CH sub(4) emissions where ditch spacing was closer than 38 m. Even with very close ditch spacing (>12 m), there was a net decrease in CH sub(4) flux from the treed fen. The results of this study indicate that the combination of low antecedent CH sub(4) fluxes from an undrained peatland, and moderate fluxes from the drainage ditches, will produce a net increase in CH sub(4) emissions from forest drainage.
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526. Estimating the 'critical' distance at which adjacent land-use degrades wetland water and sediment quality.

Houlahan, Jeff E. and Findlay, C. Scott

Landscape Ecology 19(6): 677-690. (2004)

NAL Call #: QH541.15.L35 L36; ISSN: 0921-2973

Descriptors: adjacent land use/ buffer zone/ natural forest/ sediment/ water quality/ wetland management

Abstract: Conversion of forested lands to agriculture or urban/residential areas has been associated with declines in stream and lake water quality. Less attention has been paid to the effects of adjacent land-uses on wetland sediment and water quality and, perhaps more importantly, the spatial scales at which these effects occur. Here we address these issues by examining variation in water and sediment nutrient levels in 73 southeastern Ontario, Canada, wetlands. We modeled the relationship between water and sediment nutrient concentrations and various measures of adjacent land-use such as forest cover and road density, measured over increasing distances from the wetland edge. We found that water nitrogen and

phosphorous levels were negatively correlated with forest cover at 2250 meters from the wetland edge, while sediment phosphorous levels were negatively correlated with wetland size and forest cover at 4000 meters and positively correlated with the proportion of land within 4000 meters that is itself wetland. These results suggest that the effects of adjacent land-use on wetland sediment and water quality can extend over comparatively large distances. As such, effective wetland conservation will not be achieved merely through the creation of narrow buffer zones between wetlands and more intensive land-uses. Rather, sustaining high wetland water quality will require maintaining a heterogeneous regional landscape containing relatively large areas of natural forest and wetlands.
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527. Fate and effects of the herbicide atrazine in flow-through wetland mesocosms.

Detenbeck, N. E.; Hermanutz, R.; Allen, K.; and Swift, M. C. *Environmental Toxicology and Chemistry* 15(6): 937-946. (1996)

NAL Call #: QH545.A1E58; ISSN: 0730-7268

Descriptors: wetlands/ herbicides/ atrazine/ periphyton/ runoff/ water pollution/ USA, Midwest/ atrazine/ fate of pollutants/ periphyton/ pollutant persistence/ *Daphnia magna*/ *Rana pipiens*/ *Pimephales promelas*/ *Ceratophyllum demersum*/ *Zizania aquatica*/ pollution effects/ nutrients

Abstract: Wetland mesocosms were exposed to increasing concentrations of atrazine over time at levels typical of Midwestern surface waters following spring runoff (15 to 75 mg g/L). Atrazine had a half-life of 8 to 14 d in the 230-m-long wetlands. End points measured included nutrient levels; periphyton biomass; periphyton productivity and respiration; growth of selected macrophytes; and survival and growth of *Daphnia magna* (15, 25 µg/L atrazine), *Rana pipiens* (15, 25 µg/L), and *Pimephales promelas* larvae (25 to 75 µg/L) and adults (50, 75 µg/L). Interaction between nutrient status or grazing intensity and atrazine effects were measured using periphyton enrichment and grazing enclosure experiments. Only periphyton, *Ceratophyllum demersum*, *Zizania aquatica*, and *Daphnia* were significantly affected by atrazine at any of the concentrations tested. Periphyton net productivity was significantly depressed by incubation in treated water as compared to control water at greater than or equal to 25 µg/L atrazine (9 to 27-d exposures). In response, dissolved nutrient concentrations increased in treated mesocosms after 14 d. *Ceratophyllum* length/weight ratios increased after 6-d exposures to 50 µg/L atrazine, while *Zizania* senesced prematurely during treatments of 50 or 75 µg/L atrazine (97 d of cumulative exposure). Periphyton developed resistance to atrazine only at concentrations greater than or equal to 50 µg/L. Atrazine effects on periphyton composition varied with the N:P supply ratio. *Daphnia* survival was significantly depressed at 15 µg/L atrazine (48-h exposures).
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528. Habitat fragmentation and the distribution of amphibians: Patch and landscape correlates in farmland.

Kolozsvary, Mary B. and Swihart, Robert K.
Canadian Journal of Zoology 77(8): 1288-1299. (1999)
 NAL Call #: 470 C16D; ISSN: 0008-4301
Descriptors: Amphibia/ farming and agriculture/ agricultural fragmentation of forest and wetland/ ecological effects/ community structure/ distribution within habitat/ agriculturally fragmented forest and wetland habitats/ semiaquatic habitat/ agriculturally fragmented wetland ecology/ forest and woodland/ agriculturally fragmented forest ecology/ cultivated land habitat/ agriculturally fragmented forest and wetland/ ecology/ Indiana/ Tippecanoe and Warren Counties/ Indian Pine Natural Resources Area/ agriculturally fragmented forest and wetland habitat ecology
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529. Organic carbon characteristics in a spruce swamp five years after harvesting.

McLaughlin, J. W.; Liu, G.; Jurgensen, M. F.; and Gale, M. R.
Soil Science Society of America Journal 60(4): 1228-1236. (1996)
 NAL Call #: 56.9 So3; ISSN: 0361-5995
Descriptors: Picea mariana/ forest litter/ mineral soils/ swamp soils/ whole tree harvesting/ site preparation/ regeneration/ environmental impact/ soil chemistry/ soil organic matter/ degradation/ carbon/ soil solution/ groundwater/ chemical composition/ biogeochemical cycles/ organic acids and salts/ dissolved organic carbon/ Michigan
Abstract: Forest harvesting and regeneration may cause changes in soil and solution chemistry that adversely affect environmental quality. Organic C content in the forest floor and mineral soil, and dissolved organic carbon (DOC) fractions in the soil solution and groundwater were investigated in a black spruce [*Picea mariana* (Miller) BSP] swamp 5 yr after the application of two silvicultural prescriptions: whole-tree harvest only and whole-tree harvest followed by site preparation bedding. Soil organic carbon (SOC) content in the forest floor of both treatments were significantly lower than that of an uncut control stand. However, SOC in the upper 50 cm of mineral soil of the bedded treatment was similar to that of the control, while both were about 20% higher than SOC in the harvest-only treatment. Total DOC concentrations ranged from 12 to 87 mg/L in the soil solution and 6 to 46 mg/L in the groundwater and did not differ among treatments. Hydrophobic acids were the dominant DOC fraction across all treatments, but the proportion of hydrophobic strong acids increased at the expense of hydrophilic acids in the harvest-only treatment. Carboxyl content of hydrophilic acids in the soil water was 7.0 mmol/g hydrophilic compound in the control stand and 4.4 mmol/g in the treatments. Hydrophobic acid carboxyl content across treatments was 4.6 mmol/g hydrophobic substance. Relative to C loss and changes in water chemistry, these results indicate that 5 yr after whole-tree harvesting, this forest site has not yet fully equilibrated.
 This citation is from AGRICOLA.

530. Organic matter decomposition following harvesting and site preparation of a forested wetland.

Trettin, C. C.; Davidian, M.; Jurgensen, M. F.; and Lea, R.
Soil Science Society of America Journal 60(6): 1994-2003. (1996)
 NAL Call #: 56.9 So3; ISSN: 0361-5995
<http://www.srs.fs.usda.gov/pubs/679>
Descriptors: wetland soils/ forest soils/ soil organic matter/ cellulose/ degradation/ soil depth/ soil temperature/ oxidation/ logging/ site preparation/ silviculture/ Michigan
Abstract: Organic matter accumulation is an important process that affects ecosystem function in many northern wetlands. The cotton strip assay (CSA) was used to measure the effect of harvesting and two different site preparation treatments, bedding and trenching, on organic matter decomposition in a forested wetland. A Latin square experimental design was used to determine the effect of harvesting, site preparation, and relative position within the wetland on organic matter decomposition at soil depths of 5, 10, and 20 cm. Repeated measures analysis of variance was used to test for treatment effects on organic matter decomposition, soil temperature, and soil oxidation depth. Cellulose decomposition increased at each soil depth as site disturbance increased, with bedding > trenching > whole-tree harvest > reference. The cellulose decomposition response was correlated with changes in soil temperature; the temperature coefficient Q10 equaled 6.0, which is greater than previously reported values. Position within the wetland relative to an adjoining river affected the decomposition and soil oxidation depth. Because the rate of decomposition is strongly controlled by temperature, higher rates of organic matter decay are expected to continue on harvested and regenerated sites until canopy closure reduces soil temperature.
 This citation is from AGRICOLA.

531. Patch and landscape characteristics associated with the distribution of woodland amphibians in an agricultural fragmented landscape: An information-theoretic approach.

Weyrauch, S. L. and Grubb, T. C.
Biological Conservation 115(3): 443-450. (2004)
 NAL Call #: S900.B5; ISSN: 0006-3207
Descriptors: wetlands/ landscape/ patches/ habitat fragmentation/ agricultural ecosystems/ ecological distribution/ conservation/ man-induced effects/ land use/ agriculture/ patchiness/ forests/ habitat/ nature conservation/ amphibia/ USA, Ohio/ amphibians
Abstract: In the Midwestern United States, agricultural landscapes with scattered patches of fragmented forest are common. To investigate the relationship between amphibian distributions and wetland, woodlot, and landscape characteristics, we studied the pond-breeding amphibians within a 15, 450-ha plot in rural north-central Ohio. We surveyed 25 woodlots and one area of continuous riparian forest for amphibians, and each surveyed woodland contained at least one temporary wetland. We used Akaike's Information Criterion (AIC) to evaluate the effectiveness of 13 a priori models in predicting total amphibian species richness, anuran richness, caudate richness, and the presence of individual species in woodlots. We identified 13 species of amphibians within the study plot, and every woodlot contained at least one amphibian species. The most important variable in predicting total amphibian and anuran

species richness was hydroperiod. For caudates, woodlot edge-to-area ratio, hydroperiod, pH, and ammonia were important characteristics in predicting species richness. Woodlots within agricultural landscapes are important refuges for amphibians.

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532. Percentage land use in the watershed determines the water and sediment quality of 22 marshes in the Great Lakes Basin.

Crosbie, B. and Chow-Fraser, P.

Canadian Journal of Fisheries and Aquatic Sciences 56(10): 1781-1791. (1999)

NAL Call #: 442.9 C16J; ISSN: 0706-652X

Descriptors: wetlands/ land use/ watersheds/ water quality/ sediment pollution/ marshes/ Canada, Ontario, Great Lakes/ watershed management/ sediment contamination/ land management

Abstract: Data from 22 Ontario marshes were used to test the hypothesis that distribution of forested, agricultural, and urban land in the watershed determines the water and sediment quality of Great Lakes wetlands. The first three components of the principal components analysis explained 82% of the overall variation. PC1 ordinated wetlands along a trophic gradient; species richness of submergent vegetation decreased with PC1 scores. PC2 reflected the content of inorganic solids and phosphorus in sediment and the ionic strength of the water. Both PC1 and PC2 scores were positively correlated with percent agricultural land, whereas PC1 scores were negatively correlated with forested land. Correlation between PC1 and agricultural land improved when best-management practices were considered. Accounting for common carp (*Cyprinus carpio*) disturbance did not confound the relationship between land use and water quality. PC3, driven by soluble reactive phosphorus and nitrate nitrogen concentration in the water, was not correlated with land use. Concentrations of polycyclic aromatic hydrocarbons and Metolachlor were correlated with urban and agricultural land, respectively, and may be useful as land use surrogates. Watershed management favouring the retention of forested land, or creation of buffer strips to trap agricultural runoff in the drainage basin, should help maintain aquatic plant diversity in coastal wetlands.

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533. Plant community responses to harvesting and post-harvest manipulations in a Picea-Larix-Pinus wetland with a mineral substrate.

Gale, M. R.; McLaughlin, J. W.; Jurgensen, M. F.; Trettin, C. C.; Soelsepp, T.; and Lydon, P. O.

Wetlands 18(1): 150-159. (Mar. 1998)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ forest industry/ plant populations/ harvesting/ species diversity/ community composition/ fertilizers/ ecological succession/ man-induced effects/ North America, Great Lakes/ Picea/ Larix/ Pinus/ USA, Michigan/ mechanical and natural changes/ water and plants

Abstract: Forested wetlands in the Northern Great Lakes Region are becoming increasingly used as a timber resource. Yet, limited information is available on the effects of harvesting and post-harvest manipulations (site preparation and fertilization) on tree and ground vegetation in these wetland communities. The objective of this study

was to examine production changes and species diversity in the vascular plant community four years after a forested, mineral wetland in Northern Michigan was whole-tree harvested, site prepared (bedded or trenched), and fertilized (N, P, N + P). The wetland had an original overstory of black spruce (*Picea mariana*), tamarack (*Larix laricina*), and jack pine (*Pinus banksiana*), with a significant cover of Sphagnum and Ericaceous shrubs. Site preparation techniques were done immediately after harvesting. The site was then planted with jack pine seedlings (1-0 stock). Fertilization occurred four years after harvesting and site preparation. Results indicate that trees in bedded areas with N fertilizer applied had significantly greater total seedling height, basal diameter, and height increment when compared with those from harvest-only or trenched areas. On harvest-only areas, seedling production was greater with P and N + P fertilizers than with N fertilizer alone. Fertilizer responses were attributed to which type of site preparation (bedding versus trenching) was used and the degree of organic matter and Sphagnum incorporated into the mineral soil. Only site-preparation treatments (not fertilization treatments) had significant effects on numbers and cover of vascular plant groups (woody, herbaceous, and grass/sedge). Number of species and total cover of all vascular plants were significantly greater on the harvest-only areas than on trenched, bedded, or uncut areas. As expected, relative cover of the grass/sedge group increased with increasing site disturbance (bedded and trenched), mainly due to disturbance and lack of the thick Sphagnum mat. When compared to the adjacent uncut area, relative cover of herbaceous species was significantly reduced on treated areas. In future years, if the significant effects of manipulation treatments on tree productivity and vascular plants continue, the resulting community may be different than the successional sequence witnessed by the original forest. This will, however, depend on the rate of crown closure and the invasion of bryophyte species.

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534. Response of breeding birds to shearing and burning in wetland brush ecosystems.

Hanowski, J. M.; Christian, D. P.; and Nelson, M. C.

Wetlands 19(3): 584-593. (1999)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ wild birds/ population density/ prescribed burning/ cutting/ Minnesota

This citation is from AGRICOLA.

535. Sediment loads and accumulation in a small riparian wetland system in northern Missouri.

Heimann, D. C. and Roell, M. J.

Wetlands 20(2): 219-231. (2000)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ USA/ Missouri/ Long Branch Creek/ sediment load/ accumulation/ sediment transport/ deposition/ regression analysis/ flood plains/ monitoring/ variability/ riparian land/ clays/ forests/ hydrology/ geomorphology/ land use

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536. Soil organic matter and nitrogen cycling in response to harvesting, mechanical site preparation, and fertilization in a wetland with a mineral substrate.

Mclaughlin, J. W.; Gale, M. R.; Jurgensen, M. F.; and Trettin, C. C.

Forest Ecology and Management 129(1-3): 7-23. (2000)
NAL Call #: SD1.F73; ISSN: 0378-1127

Descriptors: wetlands/ soil organic matter/ cycling nutrients/ nitrogen/ minerals/ substrates/ fertilization/ forests/ decomposition/ soil solution/ organic carbon/ microorganisms/ agricultural practices/ North America, Great Lakes/ USA, Michigan

Abstract: Forested wetlands are becoming an important timber resource in the Upper Great Lakes Region of the US. However, there is limited information on soil nutrient cycling responses to harvesting and post-harvest manipulations (site preparation and fertilization). The objective of this study was to examine cellulose decomposition, nitrogen mineralization, and soil solution chemistry four years after a forested, mineral soil wetland in Northern Michigan was whole-tree harvested, site prepared, and fertilized (N, P, N + P). Organic matter decomposition was greatest in the site preparation bedding treatment and lowest in whole-tree harvested with no mechanical site preparation treatment. Both N and P additions, alone and in combination resulted in increased cellulose decomposition regardless of site preparation treatment (15-38% for the harvest-only treatment, 20-40% for the bedded treatment, and 15-44% for the trenched treatment). However, based on dissolved organic carbon concentrations in the soil solution, organic matter decomposition was inhibited on an overall plot basis; that is, outside the area of cellulose strip placement. The site preparation bedding treatment resulted in a net mineralization of N (9.2 g-N m^{super(-2)}) over a 10 week incubation period. The disc trench and harvest-only treatments resulted in a net immobilization of N (3.1 g-N m^{super(-2)} and 1.5 g-N m^{super(-2)}, respectively). Nitrogen, P, and N + P inhibited N mineralization in the bedded treatment by 10-25% over the control. There was a fertilizer-induced increase in N immobilization of 50-60% and 25-50% in the harvest-only and trenched treatments, respectively. It appears that soil microorganisms at this site are limited by soluble C more than N or P. By adding cellulose strips to the soil, the soluble C limitation was, in

part, overcome. Once the soluble C limitation was alleviated, then the soil microorganisms responded positively to N and P additions.

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537. The vegetation of wet meadows in relation to their land-use.

Galatowitsch, Susan M.; Whited, Diane C.; Lehtinen, Richard.; Husveth, Jason; and Schik, Karen

Environmental Monitoring and Assessment 60(2): 121-144. (2000)

NAL Call #: TD194; ISSN: 0167-6369

Descriptors: conservation/ ecology: environmental sciences/ plant guild relative abundance/ assessment method: species composition/ assessment method: wetland biomonitoring/ biota shifts: land use response/ floristic composition/ landscape disturbance: agriculture, urbanization/ prairie glacial marsh: ecosystem/ site impacts: cultivation, stormwater/ vegetation: graminoid, herbaceous perennials/ wet meadow: ecosystem, land use changes, stressor response, vegetation

Abstract: Wetland biomonitoring approaches are needed to determine when changes in response to stressors are occurring and to predict the consequences of proposed land-use changes. These approaches require an understanding of shifts in biota that occur in response to land-use, data that are lacking for most kinds of wetlands. Changes in floristic composition corresponding to land-use differences at multiple scales (site to 2500 m radius) were characterized for 40 wet meadows associated with prairie glacial marshes in Minnesota (U.S.A.). In general, guild was more useful than species composition for indicating land-use impacts. Site impacts (stormwater, cultivation) and landscape disturbance (agriculture and urbanization, combined), coincide with a reduction in native graminoid and herbaceous perennial abundance (e.g., *Carex lasiocarpa*, *Calamagrostis canadensis*, *Spartina pectinata*). This vegetation is replaced with annuals (e.g. *Bidens cernua*, *Polygonum pennsylvanicum*) in recently cultivated sites or introduced perennials (e.g., *Phalaris arundinacea*, *Typha angustifolia*) and floating aquatics (lemnids) in stormwater impacted wetlands. Ditches also reduce native perennial importance and increase perennials, but only when they are in highly impacted landscapes.

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Wetlands as Agricultural Conservation Practices

538. Agricultural ponds support amphibian populations.

Knutson, Melinda G.; Richardson, William B.; Reineke, David M.; Gray, Brian R.; Parmelee, Jeffrey R.; and Weick, Shawn E.

Ecological Applications 14(3): 669-684. (2004)

NAL Call #: QH540.E23; ISSN: 1051-0761

Descriptors: wetlands/ *Ambystoma tigrinum*/ Caudata/ agricultural ponds/ agriculture/ communities/ conservation/ ecosystems/ freshwater ecology/ habitat management/ habitat use/ Houston & Winona Counties/ land zones/ management/ Minnesota/ nearctic region/ nitrogen/ North America/ phosphorus/ ponds/ productivity/ reproduction/ reproductive success/ species diversity/ USA/ wildlife/ tiger salamander

Abstract: In some agricultural regions, natural wetlands are scarce, and constructed agricultural ponds may represent important alternative breeding habitats for amphibians. Properly managed, these agricultural ponds may effectively increase the total amount of breeding habitat and help to sustain populations. We studied small, constructed agricultural ponds in southeastern Minnesota to assess their value as amphibian breeding sites. Our study examined habitat factors associated with amphibian reproduction at two spatial scales: the pond and the landscape surrounding the pond. We found that small agricultural ponds in southeastern Minnesota provided breeding habitat for at least 10 species of amphibians. Species richness and multispecies reproductive success were more closely associated with characteristics of the

pond (water quality, vegetation, and predators) compared with characteristics of the surrounding landscape, but individual species were associated with both pond and landscape variables. Ponds surrounded by row crops had similar species richness and reproductive success compared with natural wetlands and ponds surrounded by non-grazed pasture. Ponds used for watering livestock had elevated concentrations of phosphorus, higher turbidity, and a trend toward reduced amphibian reproductive success. Species richness was highest in small ponds, ponds with lower total nitrogen concentrations, tiger salamanders (*Ambystoma tigrinum*) present, and lacking fish. Multispecies reproductive success was best in ponds with lower total nitrogen concentrations, less emergent vegetation, and lacking fish. Habitat factors associated with higher reproductive success varied among individual species. We conclude that small, constructed farm ponds, properly managed, may help sustain amphibian populations in landscapes where natural wetland habitat is rare. We recommend management actions such as limiting livestock access to the pond to improve water quality, reducing nitrogen input, and avoiding the introduction of fish.
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539. Alternative uses of wetlands other than conventional farming in Iowa, Kansas, Missouri, and Nebraska.

Leventhal, E., EPA/171/R-92/006; Washington, DC: Environmental Protection Agency, 1990.

Descriptors: wetlands/ land use/ agriculture/ economic analysis/ sociological aspects/ environmental impact/ ecosystem disturbance/ USA/ conservation, wildlife management and recreation

Abstract: Conversion of wetlands in Iowa, Kansas, Missouri, and Nebraska into agricultural dry lands in the past several decades has occurred as a means to obtain profit from what landowners would otherwise consider unprofitable land. The activity has resulted in substantial losses of wetlands valued for their unique ability to mitigate flood and storm damage, control erosion, discharge and recharge groundwater, improve water quality, and support a wide diversity of fish, wildlife, and vegetation. Utilizing fish, wildlife, and vegetation from wetlands for profit is a way for wetland owners to recognize the value their wetlands add to their property. Landowners then have an incentive to preserve rather than convert their wetlands. [Sponsored by Environmental Protection Agency, Kansas City, KS. Region VII.] (DBO)
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540. Atrazine mineralization potential in two wetlands.

Anderson, K. L.; Wheeler, K. A.; Robinson, J. B.; and Tuovinen, O. H.

Water Research 36(19): 4785-4794. (Nov. 2002)

NAL Call #: TD420.W3; *ISSN:* 0043-1354

Descriptors: wetlands/ water pollution/ fate of pollutants/ atrazine/ sediments/ comparison studies/ mineralization/ microbial degradation/ bacterial physiology/ microbiological studies/ pollution (water)/ sediment/ comparative studies/ mineralization/ biodegradation/ bogs/ agricultural runoff/ microbial activity/ USA, Ohio, Olentangy R./ USA, Ohio, Cedar Bog/ genetics/ sources and fate of pollution/ water treatment/ freshwater pollution/ water pollution: monitoring, control & remediation

Abstract: The fate of atrazine in agricultural soils has been studied extensively but attenuation in wetland systems has received relatively little attention. The purpose of this study was to evaluate the mineralization of atrazine in two wetlands in central Ohio. One was a constructed wetland, which is fed by Olentangy River water from an agricultural catchment area. The other was a natural fen (Cedar Bog) in proximity to atrazine-treated cornfields. Atrazine mineralization potential was measured by super(14)CO sub(2) evolution from [U-ring- super(14)C]-atrazine in biometers. The constructed wetland showed 70-80% mineralization of atrazine within 1 month. Samples of wetland water that were pre-concentrated 200-fold by centrifugation also mineralized 60-80% of the added atrazine. A high extent of atrazine mineralization (75-81% mineralized) was also associated with concentrated water samples from the Olentangy River that were collected upstream and downstream of the wetland. The highest levels of mineralization were localized to the top 5 cm zone of the wetland sediment, and the activity close to the outflow at the Olentangy wetland was approximately equal to that near the inflow. PCR amplification of DNA extracted from the wetland sediment samples showed no positive signals for the *atzA* gene (atrazine chlorohydrolase), while Southern blots of the amplified DNA showed positive bands in five of the six Olentangy wetland sediment samples. Amplification with the *trzD* (cyanuric acid amidohydrolase) primers showed a positive PCR signal for all Olentangy wetland sediment samples. There was little mineralization of atrazine in any of the Cedar Bog samples. DNA extracted from Cedar Bog samples did not yield PCR products, and the corresponding Southern hybridization signals were absent. The data show that sediment microbial communities in the Olentangy wetland mineralize atrazine. The level of activity may be related to the seasonality of atrazine runoff entering the wetland. Comparable activity was not observed in the Cedar Bog, perhaps because it does not directly receive agricultural runoff. Qualitatively, the detection of the genes was associated with measurable mineralization activity which was consistent with the differences between the two study sites.
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541. A constructed wetland treatment system designed for accommodation of both high nutrient nursery pad effluent and agriculture stormwater runoff.

Lippmann, B. E.; Bouchard, V.; Quigley, M.; Martin, J.; Granata, T.; and Brown, L.

Ohio Journal of Science 102(1)(Mar. 2002)

NAL Call #: 410 Oh3; *ISSN:* 0030-0950.

Notes: Conference: 111th Annual Meeting of the Ohio

Academy of Science, Columbus, OH [USA], 5-7 Apr 2002

Descriptors: suspended sediments/ artificial wetlands/ wastewater treatment/ nutrients/ urban runoff/ agricultural runoff/ pollutants/ storm runoff/ drainage/ nonpoint pollution sources/ settling basins/ wastewater treatment processes/ water & wastewater treatment

Abstract: Constructed wetlands have been developed for two main reasons: to substitute function for a natural wetland that was lost or removed, or to enable watershed managers to reduce or remove toxic or harmful substances from drainages. Many agricultural constructed wetlands are designed to ameliorate impacts of stressful environmental inputs, such as high nitrogen concentrations, chemical

pollution and sediment. Urban "detention ponds" are usually designed to slow runoff and to filter petrochemical pollutants, but not sediments. This study focuses on the potential for treating multiple land-use inputs within a single wetland system. A double basin constructed wetland treatment system (CWTS) has been constructed on the OSU Waterman Farm to test the treatment of a consistently high nutrient influent--a nursery container production pad--while providing sufficient retention of periodic storm water runoff from agricultural drainages. Nutrient and suspended sediment concentrations will be quantified at several points in the CWTS. Random soil samples will be tested periodically for bulk density, percent carbon and methane, carbon dioxide and denitrification potentials. Plant community structure (LAI, biomass, species composition) and sediment dynamics will indicate water treatment performance. Initial results include bulk density range between 1.18-1.98 g/cm super(3) and LAI range between 0.04-0.44. It is hypothesized that from the inlet to the outlet of each wetland cell, plant density will decrease, species diversity will increase and sediment deposition and pollutant level will decrease. This CWTS was created to explore minimization of costs and land requirements for agricultural wetlands, and to demonstrate a method for zero-discharge farming practice.

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542. Constructed wetlands for river water quality improvement.

Kadlec, R. H. and Hey, D. L.

Water Science and Technology 29(4)(1994)

NAL Call #: TD420.A1P7; ISSN: 0273-1223.

Notes: Conference: IAWQ 3. Int. Specialist Conf. on Wetland Systems in Water Pollution Control, Sydney (Australia), 23-25 Nov 1992; Issue editors: Bavor, H. J. and Mitchell, D. S.

Descriptors: wetlands/ wastewater treatment/ urban watersheds/ agricultural runoff/ nonpoint pollution sources/ aquatic plants/ sediments/ phosphorus removal/ hydrology/ rivers/ drainage water/ water quality control/ biofilters/ pollutants/ biofiltration/ USA, Illinois, Wadsworth/ urban watersheds/ nonpoint pollution sources/ phosphorus removal/ biofiltration/ drainage water/ biofilters/ pollutants/ wastewater treatment processes/ methods and instruments/ freshwater pollution

Abstract: The Des Plaines River Wetlands Demonstration Project has reconstructed four wetlands in Wadsworth, Illinois, USA. The river drains an agricultural and urban watershed, and carries a non-point source contaminant load of sediment, nutrients and agricultural chemicals. Up to 40% of the average stream flow is pumped to the wetlands, and allowed to return from the wetlands to the river through control structures followed by vegetated channels. Native wetland plant species have been established, ranging from cattail, bulrushes, water lilies, and arrowhead to duckweed and algae. Pumping began in the summer of 1989, and has continued during the ensuing spring, summer and fall periods. The experimental design provides for different hydraulic loading rates, ranging from 5 to 60 cm/week. Intensive wetland research began in late summer 1989, and continues to present. Detailed hydrology is measured for each wetland. Sediment removal efficiencies ranged from 86-100% for the four cells during summer, and from 38-95% during winter. Phosphorus removal efficiencies ranged from 60-100% in summer and

27-100% in winter. The river contains both old, persistent and modern, degradable agricultural chemicals. The principal modern pollutant is atrazine, of which the wetlands remove approximately half. The project is successfully illustrating the potential of constructed wetlands for controlling non-point source pollution at an intermediate position in the watershed.

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543. Creation and restoration of riparian wetlands in the agricultural Midwest.

Klarquist, J. E.; Levine, D. A.; Finn, V. M.; and Willard, D. E. In: *Wetland Creation and Restoration: The Status of the Science.*

Covelo, Calif.: Island Press, 1990; pp. 327-350.

Notes: ISBN: 1559630450

NAL Call #: QH541.5.M3W462

Descriptors: artificial wetlands/ habitat restoration/ riparian land/ water resources management/ wetland restoration/ hydrologic budget/ planting management/ riparian vegetation/ riparian waters/ vegetation regrowth/ water resources development

Abstract: Effective restoration of riparian wetlands in the agricultural midwest region of the United States demands an early determination of project goals. There are no systematic records of the changes and developments that have occurred in and around several hundred large midwestern reservoirs with extensive wetland systems. Established goals will narrow the choices of potential project sites, which can then be evaluated based on hydrology, substrate, seedbank viability, and water quality. Creation and restoration plans should include a realistic timetable that accounts for construction and hydrology constraints, including specifications for revegetation species. Finally, plans should estimate long-term vegetation management requirements and establish monitoring schedules to assess project success.

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544. Denitrification in sediments of a Lake Erie coastal wetland (Old Woman Creek, Huron, Ohio, USA).

Tomaszek, J. A.; Gardner, W. S.; and Johengen, T. H.

Journal of Great Lakes Research 23(4): 403-415. (1997)

NAL Call #: GB1627.G8J6; ISSN: 0380-1330

Descriptors: wetlands/ denitrification/ sediments/ cores/ analytical methods/ chemical reactions/ nutrients/ estuaries/ USA, Ohio, Old Woman Creek/ sediment chemistry/ nitrogen/ nutrient cycles/ agricultural pollution/ agricultural runoff/ USA, Ohio, Old Woman Creek/ USA, Ohio, Erie L./ chemical processes/ characteristics, behavior and fate/ freshwater pollution

Abstract: Denitrification in Old Woman Creek estuary (Lake Erie) sediments was measured by an in vitro N sub(2)-flux method with intact cores and by an in situ chamber method. In both methods, nitrogen gas, the end product of denitrification, was measured directly by gas chromatography. The in situ approach allowed measurement of denitrification directly over short time intervals but its use was limited to shallow depths. Denitrification rates measured with in situ chambers agreed well with those from in vitro intact cores when temperatures in the estuary remained constant. However, the two methods could not be accurately compared during the spring when temperature increased rapidly, because of the

4-day pre-incubation time needed for sparging for the in vitro method. In vitro denitrification rates ranged from ca 40 to 135 $\mu\text{mole N sub}(2) \text{ m super}(-2) \text{ h super}(-1)$ in October 1993 and from 66 to 428 $\mu\text{mole N sub}(2) \text{ m super}(-2) \text{ h super}(-1)$ in May and July 1994. Oxygen consumption rates in these experiments ranged from 0.71 to 3.0 $\text{mmole O sub}(2) \text{ m super}(-2) \text{ h super}(-1)$. Denitrification rates tended to decrease along the flow axis but differences among stations were usually not significant. In situ $\text{N sub}(2) \text{ accumulation rates}$ ranged from 45 $\mu\text{mole N sub}(2) \text{ m super}(-2) \text{ h super}(-1)$ in dark chambers during October 1993 up to apparent values of 2,100 $\mu\text{mole N sub}(2) \text{ m super}(-2) \text{ h super}(-1)$ in May 1994, immediately after the water temperature had rapidly increased to 27 degree C. These calculated values included gas-solubility corrections due to the water-temperature increases. In situ measurements of denitrification rates in transparent chambers were 76-79% higher than rates measured in a similar dark chamber. The results suggest that denitrification is an important sink for nitrogen in Old Woman Creek estuary and that environmental conditions such as temperature, light, and available substrate affect denitrification rates.
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545. Development of community metrics to evaluate recovery of Minnesota wetlands.

Galatowitsch, S. M.; Whited, D. C.; and Tester, J. R. *Journal of Aquatic Ecosystem Stress and Recovery* 6(3): 217-234. (1998)
NAL Call #: QH541.5.W3 J68; ISSN: 1386-1980.
Notes: Special Issue: Recovery in Aquatic Ecosystems.
Descriptors: wetlands/ environmental monitoring/ indicator species/ methodology/ land use/ restoration/ ecosystems/ long-term changes/ community composition/ land management/ bioindicators/ surface water/ birds/ populations/ USA, Minnesota/ land restoration/ pollution monitoring and detection/ protective measures and control/ watershed protection/ environmental action
Abstract: Monitoring wetland recovery requires assessment tools that efficiently and reliably discern ecosystem changes in response to changes in land use. The biological indicator approach pioneered for rivers and streams that uses changes in species assemblages to interpret degradation levels may be a promising monitoring approach for wetlands. We explored how well metrics based on species assemblages related to land use patterns for eight kinds of wetlands in Minnesota. We evaluated land use on site and within 500 m, 1000 m, 2500 m and 5000 m of riverine, littoral, and depressional wetlands (n = 116) in three ecoregions. Proportion of agriculture, urban, grassland, forest, and water were correlated with metrics developed from plant, bird, fish, invertebrate, and amphibian community data collected from field surveys. We found 79 metrics that relate to land use, including five that may be useful for many wetlands: proportion of wetland birds, wetland bird richness, proportion of insectivorous birds, importance of Carex, importance of invasive perennials. Since very few metrics were significant for even one-half of the wetland types surveyed, our data suggest that monitoring recovery in wetlands with community indicators will likely require different metrics, depending on

type and ecoregion. In addition, wetlands within extensively degraded ecoregions may be most problematic for indicator development because biotic degradation is historic and severe.
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546. Does facilitation of faunal recruitment benefit ecosystem restoration? An experimental study of invertebrate assemblages in wetland mesocosms.

Brady, V. J.; Cardinale, B. J.; Gathman, J. P.; and Burton, T. M. *Restoration Ecology* 10(4): 617-626. (Dec. 2002)
NAL Call #: QH541.15.R45R515; ISSN: 1061-2971
Descriptors: wetlands/ community structure/ aquatic ecosystems/ conservation/ zoobenthos/ macrofauna/ environment management/ nature conservation/ restoration/ transplantation/ stocking (organisms)/ biotic factors/ recruitment/ community composition/ colonization/ aquatic insects/ freshwater molluscs/ mesocosms/ comparative studies/ Chironomidae/ Gastropoda/ Invertebrata/ midges/ poor colonizers/ vegetation/ sediment plugs/ gastropods/ slugs/ snails/ aquatic entomology/ insects/ conservation, wildlife management and recreation
Abstract: We used wetland mesocosms (1) to experimentally assess whether inoculating a restored wetland site with vegetation/sediment plugs from a natural wetland would alter the development of invertebrate communities relative to unaided controls and (2) to determine if stocking of a poor invertebrate colonizer could further modify community development beyond that due to simple inoculation. After filling mesocosms with soil from a drained and cultivated former wetland and restoring comparable hydrology, mesocosms were randomly assigned to one of three treatments: control (a reference for unaided community development), inoculated (received three vegetation/sediment cores from a natural wetland), and stocked + inoculated (received three cores and were stocked with a poorly dispersing invertebrate group-gastropods). All mesocosms were placed 100 m from a natural wetland and allowed to colonize for 82 days. Facilitation of invertebrate colonization led to communities in inoculated and stocked + inoculated treatments that contrasted strongly with those in the unaided control treatment. Control mesocosms had the highest taxa richness but the lowest diversity due to high densities and dominance of Tanytarsini (Diptera: Chironomidae). Community structure in inoculated and stocked + inoculated mesocosms was more similar to that of a nearby natural wetland, with abundance more evenly distributed among taxa, leading to diversity that was higher than in the control treatment. Inoculated and stocked + inoculated communities were dominated by non-aerial invertebrates, whereas control mesocosms were dominated by aerial invertebrates. These results suggest that facilitation of invertebrate recruitment does indeed alter invertebrate community development and that facilitation may lead to a more natural community structure in less time under conditions simulating wetland restoration.
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547. Duffy's Marsh Wetland Restoration Project in Marquette County, Wisconsin.

Nimmer, G. L.

In: ASAE Annual International Meeting. (Held 12 Jul 1998-16 Jul 1998 at Orlando, Florida, USA.)

St Joseph, Mich.: American Society of Agricultural Engineers; pp. 21; 1998.

Notes: ASAE Paper no. 982019

Descriptors: wetlands/ water management/ drainage systems

Abstract: In 1997, the 1722-acre Duffy's Marsh Wetland Restoration Project was completed through the cooperative efforts of nine landowners participating in the USDA Wetland Reserve Program (WRP). In comparison to the average WRP project size of 50-100 acres, this is the largest WRP restoration project in Wisconsin (USA). Prior to restoration, a surface drainage system comprised of ditches around nearly every 40 acre parcel drained the large muck farming area. The Natural Resources Conservation Service assisted in implementing a plan to install 3500 ft of embankments, 13 ditch plugs, and a rock spillway outlet to restore the wetlands. This study describes the characteristics of planning, design, and construction of a large wetland restoration and shares effective restoration techniques and experiences gained in this project.

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548. Early development of vascular vegetation of constructed wetlands in northwest Ohio receiving agricultural waters.

Luckeydoo, L. M.; Fausey, N. R.; Brown, L. C.; and Davis, C. B.

Agriculture, Ecosystems & Environment 88(1): 89-94. (2002)

NAL Call #: S601.A34; ISSN: 0167-8809

Descriptors: wetlands/ vegetation/ irrigation water/ pollution control/ subsurface irrigation/ water management/ reservoirs/ seed germination/ land restoration/ natural regeneration/ Ohio

Abstract: Constructed wetlands are currently being explored for use in reducing non-point source (NPS) pollution. The Wetland Reservoir Subirrigation System (WRSIS) project links water management in agricultural fields, constructed wetlands and water storage reservoirs to enhance crop production and reduce delivery of agrichemicals and sediments to local waterways. Three WRSIS demonstration sites have been developed on prior converted cropland in the Maumee River watershed located in northwest Ohio. Construction of the wetlands was completed in 1996 and they were then allowed to passively revegetate while receiving drainage water from adjacent fields. The primary goal of this study was to characterize the initial development of vegetation, and the availability of propagules within these wetlands. Preliminary vegetation inventories conducted in 1998 identified moderate species richness but low percentage of wetland species. A germination study completed on soils from one location showed additional viable wetland species available in the seed bank. Passive revegetation of these three constructed wetlands associated with WRSIS systems has resulted in good vegetation cover, but it is lacking the desired percentage of wetland species to date. Passive

revegetation may prove to be an effective and economical method of revegetating constructed wetlands within agricultural landscapes that have suitable propagule availability.

This citation is from AGRICOLA.

549. Effect of plant species on denitrification and methane emission in constructed wetlands.

Smialek, J.; Bouchard, V.; Quigley, M.; Granata, T.; Martin, J.; and Brown, L.

Ohio Journal of Science 103(1): A39. (Mar. 2003)

NAL Call #: 410 Oh3; ISSN: 0030-0950.

Notes: Conference: 112th Annual Meeting of The Ohio Academy of Science, Findlay, OH (USA), 4-6 Apr 2003

Descriptors: wetlands/ denitrification/ methane/ sediment contamination/ vegetation/ nutrients/ nonpoint pollution sources/ water pollution control/ agricultural runoff/ organic matter/ water quality control/ USA, Ohio/ chemical processes/ water pollution: monitoring, control & remediation

Abstract: Wetlands' ability to retain excess nutrients in waterways at low costs makes them an attractive method of controlling agricultural non-point source pollution. However, it is estimated that wetlands contribute more than 40% of the annual atmospheric methane (CH₄) loading. Vegetation is an important factor in controlling methane emissions by contributing organic matter to the sediments, creating oxidized sediments, and acting as conduits for gas escape into the atmosphere. The objective of this project was to examine how vegetation can be utilized to construct a treatment wetland that has a maximum rate of denitrification and a minimum rate of methane emission. This research was conducted May-November 2002 on a constructed treatment wetland at Waterman Farm on the Columbus campus of Ohio State University. Measurements of CH₄ and CO₂ production and emission, denitrification, plant biomass, and nutrient concentration were estimated in 15 unplanted plots, 15 planted with woody (*Salix*) species, and 15 herbaceous (*Juncus*) plots. Water quality improvement by denitrification was evident along the wetland. At 15 cm below the sediment, CO₂ concentration averaged 7300-9200 ppm, higher than CH₄ (1200-4800ppm). CH₄ concentrations were significantly different between *Juncus* (1200ppm) and *Salix* (4800ppm) species. During evening hours, *Juncus* emission of CO₂ and CH₄ was 3-4 times higher than *Salix*; however, during morning hours *Juncus* species decrease their emission and *Salix* species emit 3-4 times more gas. The selection of specific plants could be used as a design tool in constructed wetlands to limit greenhouse gas emissions.

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550. The effect of water table depth on white spruce (*Picea glauca*) seedling growth in association with the marsh reed grass (*Calamagrostis canadensis*) on wet mineral soil.

Rivard, P. G.; Woodward, P. M.; and Rothwell, R. L.

Canadian Journal of Forest Research 20(10):

1553-1558. (Oct. 1990)

NAL Call #: SD13.C35; ISSN: 0045-5067

Descriptors: wetlands/ bluejoint grass/ grasses/ forestry/ marsh plants/ spruce trees/ water table/ competition/ marshes/ nutrients/ plant growth/ seedlings/ water depth/ water and plants/ groundwater

Abstract: Whether or not the survival, growth, and nutrient content of white spruce seedlings were significantly affected by competition with marsh reed grass, under simulated water table conditions on wet mineral soil substrates was investigated. The effect of water table depth (10, 20, and 40 cm) in association with marsh reed grass (*Calamagrostis canadensis* (Michx.) Beauv.) on white spruce (*Picea glauca* (Moench) Voss) 2 + 0 seedling survival and growth was tested over a 5-month period. All spruce seedlings grown alone survived, whereas, 16.7% of the trees died when grown with reed grass. The root weight and total weight of spruce seedlings and marsh reed grass were significantly affected by the water table depth. The weight of both components increased as the water table decreased. Over 80% of the roots by weight for both species were found in the upper 10 cm of the soil profile regardless of water table depth. The presence of marsh reed grass significantly affected the growth of spruce seedlings. The nutrient concentration of the white spruce foliage was significantly affected by water table depths and the presence of grass. This accumulation of marsh reed grass near the surface demonstrates the semi-aquatic nature of this species and suggests why it is a successful competitor of white spruce on wetter sites. (Author's abstract)

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551. Effectiveness of a coastal wetland in reducing the movement of agricultural pollutants into Lake Erie.

Krieger, K. A. and Ohio Sea Grant(2001).

Notes: Other numbers: OHSU-T-01-003

<http://hsgl.gso.uri.edu/ohsu/ohsut01003.pdf>

Descriptors: wetlands/ lakes/ freshwater pollution/ pollution dispersion/ barriers/ pollution control/ removal/ nutrients (mineral)/ pesticides/ chemical pollutants/ environmental factors/ hydrology/ atmospheric precipitations/ evaporation/ USA, Erie L./ USA, Ohio, Old Woman Creek Wetland/ Canada, Ontario, Erie L./ North America, Great Lakes/ pollution mitigation/ prevention and control

Abstract: The primary goal of this study was to characterize the nature and efficiency of pollution mitigation over a range of hydrologic conditions and for a broad range of substances within a representative riverine-palustrine coastal wetland. Old Woman Creek Wetland near Huron, Ohio, was selected for study because it is believed to represent many other Lake Erie tributaries prior to modification by dredging, development into marinas, filling, and other destructive activities. The authorities develop annual and seasonal surface water budgets based on fluxes of total suspended solids, nutrients, and pesticides into and out of the wetland, and precipitation, pan evaporation, and upstream and downstream flows.

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552. Effectiveness of constructed wetlands in reducing nitrogen and phosphorus export from agricultural tile drainage.

Kovacic, D. A.; David, M. B.; Gentry, L. E.; Starks, K. M.; and Cooke, R. A.

Journal of Environmental Quality 29(4): 1262-1274. (2000)

NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: wetlands/ water quality/ nonpoint pollution sources/ agricultural runoff/ nitrogen/ phosphorus/ tile drainage/ surface water/ drinking water/ water quality (natural waters)/ pollution (nonpoint sources)/ runoff

(agricultural)/ drainage/ surface water/ water supplies (potable)

Abstract: Much of the nonpoint N and P entering surface waters of the Midwest is from agriculture. We determined if constructed wetlands could be used to reduce nonpoint N and P exports from agricultural tile drainage systems to surface waters. Three treatment wetlands (0.3 to 0.8 ha in surface area, 1200 to 5400 m³ in volume) that intercepted subsurface tile drainage water were constructed in 1994 on Colo soils (fine-silty, mixed, superactive, mesic Cumulic Endoaquoll) between upland maize (*Zea mays* L.) and soybean [*Glycine max* (L.) Merr.] cropland and the adjacent Embarras River. Water (tile flow, precipitation, evapotranspiration, outlet flow, and seepage) and nutrient (N and P) budgets were determined from 1 Oct. 1994 through 30 Sept. 1997 for each wetland. Wetlands received 4639 kg total N during the 3-yr period (96% as NO₃⁻-N) and removed 1697 kg N, or 37% of inputs. Wetlands decreased NO₃⁻-N concentrations in inlet water (annual outlet volume weighted average concentrations of 4.6 to 14.5 mg N L⁻¹) by 28% compared with the outlets. When the wetlands were coupled with the 15.3-m buffer strip between the wetlands and the river, an additional 9% of the tile NO₃⁻-N was apparently removed, increasing the N removal efficiency to 46%. Overall, total P removal was only 2% during the 3-yr period, with highly variable results in each wetland and year. Treatment wetlands can be an effective tool in reducing agricultural N loading to surface water and for attaining drinking water standards in the Midwest.

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553. Evaluating perturbations and developing restoration strategies for inland wetlands in the Great Lakes Basin.

Detenbeck, N. E.; Galatowitsch, S. M.; Atkinson, J.; and Ball, H.

Wetlands 19(4): 789-820. (1999)

NAL Call #: QH75.A1W47; ISSN: 0277-5212.

Notes: Conference: Temperate Wetlands Restoration Workshop, Barrie, ON (Canada), 27 Nov-1 Dec 1995

Descriptors: wetlands/ land reclamation/ land management/ hydrology/ water quality/ vegetation/ exotic species/ sedimentation/ disturbance/ environmental restoration/ nature conservation/ ecosystem disturbance/ eutrophication/ land use/ land restoration/ land/ water quality (natural waters)/ land restoration/ North America, Great Lakes

Abstract: Wetland coverage and type distributions vary systematically by ecoregion across the Great Lakes Basin. Land use and subsequent changes in wetland type distributions also vary among ecoregions. Incidence of wetland disturbance varies significantly within ecoregions but tends to increase from north to south with intensity of land use. Although the nature of disturbance activities varies by predominant land-use type, mechanisms of impact and potential response endpoints appear to be similar across agricultural and urban areas. Based on the proportion of associated disturbance activities and proportion response endpoints affected, the highest ranking mechanisms of impact are sedimentation/turbidity, retention time, eutrophication, and changes in hydrologic timing. Disturbance activities here are defined as events that cause wetland structure or function to vary outside of a normal range, while stressors represent the individual internal or

external agents (causes) that act singly or in combination to impair one or more wetland functions. Responses most likely associated with disturbance activities based on shared mechanisms of impact are 1) shifts in plant species composition, 2) reduction in wildlife production, 3) decreased local or regional biodiversity, 4) reduction in fish and/or other secondary production, 5) increased flood peaks/frequency, 6) increased aboveground production, 7) decreased water quality downstream, and 8) loss of aquatic plant species with high light compensation points. General strategies and goals for wetland restoration can be derived at the ecoregion scale using information on current and historic wetland extent and type distributions and the distribution of special-concern species dependent on specific wetland types or mosaics of habitat types.

Restoration of flood-control and water-quality improvement functions will require estimates of wetland coverage relative to total land area or specific land uses (e.g., deforestation, urbanization) at the watershed scale. The high incidence of disturbance activities in the more developed southern ecoregions of both Canada and the U.S. is reflected in the loss of species across all wetland types. The species data here suggest that an effective regional strategy must include restoration of a diversity of wetland types, including the rarer wetland types (wet meadows, fens), as well as forested swamps, which were extensive historically. The prevalence of anthropogenic stresses and openwater habitats likely contributes to the concentration of exotic species in inland wetlands of the southern Great Lakes ecoregions. Vegetation removal and site disturbance are the best-documented causes for plant invasions, and encroachment activities are common in marshes and ponds of the southern ecoregions.

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554. GIS-based estimates of former and current depressional wetlands in an agricultural landscape.

McCauley, L. A. and Jenkins, D. G.

Ecological Applications 15(4): 1199-1208. (Aug. 2005)
NAL Call #: QH540.E23; ISSN: 1051-0761

Descriptors: wetlands/ models/ landscape/ geographic information systems/ metapopulations/ man-induced effects/ land use/ ecological distribution/ hydrology/ biological settlement/ quantitative distribution/ agriculture/ USA, Illinois/ USA, Illinois, Champaign Cty./ habitat community studies/ mechanical and natural changes

Abstract: Before European settlement, 23% of Illinois (3.2 million of 14 million ha) was covered by wetlands. It is estimated that 90% of those wetlands were lost during conversion of the landscape to agriculture and urban use. Champaign County was one of the most extensively drained counties in Illinois, with 39-60% of original county area estimated to have been drained. Current and future efforts to conserve and restore wetlands would benefit from information on the number and distribution of former wetlands. We used GIS to estimate the spatial extent, density, pattern, and sizes of former and extant depressional wetlands in Champaign County. We derived several models of former wetlands; all models used hydric soils but varied by using Digital Raster Graphics (DRG), 30-m Digital Elevation Models (DEM), or Digital Orthophotography Quarter Quadrangles (DOQ). We also combined the DRG and DEM models, and we conducted visual field surveys for saturated or ponded conditions to test the models. The DRG model was conservative: it

identified fewer and larger wetlands than the DEM model (the DOQ model was judged inadequate). Depending on the model selected, we estimated that 1077-4090 depressional wetlands formerly existed in the county, and that 78.6-91.6% were drained, accounting for 1108-2777 ha of lost wetland habitat in Champaign County alone. Thus, depressional wetlands accounted for the vast majority of historical wetland loss and should be a priority for wetland restoration efforts. Spatial pattern among wetlands also changed: an organism adapted to the former landscape had >50% probability of reaching another wetland within 260 m: today that same species faces a 7.8% probability at that distance. The modern landscape of Champaign County (and others like it) poses potential risk for remaining wetland metapopulations, and GIS models of precise former wetlands locations can be a valuable initial tool for wetland conservation and restoration efforts.

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555. Groundwater impacts from an unlined constructed wetland system receiving waste from a swine operation.

Reaves, R. P.; DuBow, P. J.; Jones, D. D.; and Sutton, A. L.

In: *Proceedings: 2nd International Conference on Groundwater Ecology*. (Held 27 Mar 1994-30 Mar 1994 at Atlanta, GA.) Stanford, J. A. and Valett, H. M. (eds.) Herndon, VA: American Water Resources Association; pp. 349-358; 1994.

Descriptors: artificial wetlands/ groundwater pollution/ livestock/ experimental design/ monitoring/ lithium/ tracers/ groundwater movement/ wastewater lagoons/ agricultural runoff/ animal wastes/ environmental impact/ agricultural pollution/ pollution monitoring/ artificial wetlands/ USA, Indiana, West Lafayette/ environmental impact/ agricultural pollution/ pollution monitoring/ livestock/ experimental design/ groundwater movement/ wastewater lagoons/ animal wastes/ monitoring/ sources and fate of pollution/ characteristics, behavior and fate/ freshwater pollution

Abstract: A 16-cell experimental constructed wetland was installed at the Purdue University Animal Sciences Swine Research Complex in 1993 to examine treatment efficiency on swine lagoon wastewater. The system was placed in a mesic soil and all cells were unlined. The experimental design allows for extensive testing during operation to determine if groundwater contamination occurs. Prior to beginning system operation in the spring of 1994 a lithium tracer study was done to determine the level of initial leakage in the system. Results of this study show that groundwater contamination at system start-up was occurring in some cells. However, movement beneath cells was only along the flow gradient. There was no lateral movement across the groundwater flow. Groundwater monitoring will be continued for the two-year duration of the study to determine if there are changes in system performance.

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556. Habitat contribution and waterbird use of Wetland Reserve Program sites in the Cache River watershed, Illinois.

Hicks, Brianne M.

Carbondale, Illinois: Southern Illinois University, 2003.

Descriptors: wetlands/ birds/ wildlife habitat/ Illinois/ Wetland Reserve Program

557. Historic and comparative perspectives on rehabilitation of marshes as habitat for fish in the Lower Great Lakes Basin.

Whillans, T. H.

Canadian Journal of Fisheries and Aquatic Sciences 53(Supplement 1): 58-66. (1996)

NAL Call #: 442.9 C16J; ISSN: 0706-652X

Descriptors: marshes/ environmental restoration/ ecosystem analysis/ historical account/ sedimentation/ ecosystems/ fish/ aquatic habitats/ Canada, Ontario
Abstract: Retrospective and comparative assessments of fish habitat have been used to guide rehabilitation in Cootes Paradise, a marsh at Hamilton, Ont., on Lake Ontario. The marsh was severely altered by human and natural stresses, including high water levels, influx of fine eroded sediments, and channelization. Recovery has been limited by a different but overlapping set of stresses, including the continued influx of fine eroded sediments, resuspension of sediments, exotic fish, and increased fetch. Assessment has involved the use of "accumulator-," "residue-," and "replica"-type retrospective evidence and the comparison of Cootes Paradise with other reference marshes. The emergent narrative science (a synthesis of science in historical and environmental context that serves as a partially testable hypothesis), verified and adjusted by small scale experiments, has identified the need to re-introduce vegetation, reduce fetch, exclude common carp (*Cyprinus carpio*), anchor the marsh sediments, and reduce the influx of land use derived fine sediments. Narrative science uses the "ecological memory" of the marsh for historical information on ecological degradation and in the form of the remnant natural resilience upon which ecological rehabilitation could build. The narrative science provides the basis for adaptive management and the monitoring that it requires.

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558. Hydrology of constructed wetlands.

Zmolek, C.; Baker, J. L.; Crumpton, W. G.; and Kanwar, R. S.

In: ASAE Annual International Meeting. (Held 10 Aug 1997-14 Aug 1997 at Minneapolis, Minnesota.); pp. 17; 1997.

Notes: Paper American Society of Agricultural Engineers no. 972036; ISSN: 0149-9890

Descriptors: wetlands/ hydrology/ water flow/ water budget/ hydrodynamics/ tracer techniques/ models

Abstract: This paper covers research being conducted on a system of constructed wetland cells in Iowa, USA, receiving subsurface drainage water at three rates on inflow with each being replicated three times. The analysis of the hydrology consisted of accounting for all inflows and outflows, thereby determining and closing the systems water budget. An average seasonal water budget was developed, encompassing all nine cells' data. The budget for the entire system was closed with only 5.47% error. This error can be accounted to the inability to precisely measure flowmeter accuracy, berm seepage, pan A evaporation estimations, and pipe leakage. The budget shows seepage as the largest outflow component, being 16.1% of the total outflow. Evapotranspiration compromised only 1.69% of the recorded outflow. Direct precipitation was 1.01% of the total system's inflow. To examine flow patterns over time, a tracer study using rhodamine WT was conducted. Concentrations were determined using a fluorometer and then mapping the values into isopleths. The pattern for the

high flow cell studied showed a definite preferential flow path along with areas of little or no contact. Knowing the significance of the hydrologic components as well as the hydrodynamic flows will provide for better information on the variables required to more accurately model the site's treatment capability and efficiency potentials.

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559. Influence of hydrologic loading rate on phosphorus retention and ecosystem productivity in created wetlands.

Mitsch, William J.; Cronk, Julie K.; and United States. Army. Corps of Engineers. U.S. Army Engineer Waterways Experiment Station. Wetlands Research Program (U.S.). Vicksburg, Miss.: U.S. Army Engineer Waterways Experiment Station; Series: Wetlands Research Program technical report WRP-RE-6; 84 p. (1995)

Notes: At head of title: Wetlands Research Program. "January 1995." Final report. Includes bibliographical references (p. 73-84).

NAL Call #: QH541.5.M3M57 1995

Descriptors: wetland conservation/ constructed wetlands/ freshwater productivity/ water---phosphorus content/ restoration ecology/ Glaciated Interior Plains
 This citation is from AGRICOLA.

560. Isotope evaluation of nitrate attenuation in restored and native riparian zones in the Kankakee watershed, Indiana.

Sidle, W. C.; Roose, D. L.; and Yzerman, V. T.

Wetlands 20(2): 333-345. (June 2000)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ isotope studies/ nitrates/ riparian land/ watersheds/ oxygen/ hydrogen/ cycling nutrients/ water properties/ flow discharge/ levees/ dikes/ water budget/ land reclamation/ water reclamation/ agriculture/ nitrogen cycle/ nitrate/ catchment areas/ embankments/ USA, Indiana, Kankakee Watershed/ watershed protection/ ecosystems and energetics/ protective measures and control/ water resources and supplies

Abstract: Isotopic analyses of oxygen and hydrogen of water ($\delta^{18}\text{O}$ and $\delta^2\text{H}$) and nitrogen and oxygen of nitrate ($\delta^{15}\text{N}$ and $\delta^{18}\text{O}$) are used in conjunction with conventional water chemistry and hydrologic measurements to investigate water flow and nitrogen cycling mechanisms through two riparian zones adjacent to upland agricultural fields. Within the Kankakee watershed of northwestern Indiana, a native riverine wetland was compared to a constructed riverine wetland to assess the wetland restoration in terms of water flow and nitrate attenuation mechanisms and efficiency. Conditions in the constructed wetland are controlled by a system of individual cells separated by dikes and levees and into which water is periodically pumped, while the native wetland occupies an area of remnant river meanders or oxbows. Analyses of samples taken from well transects across both wetlands suggest that water flow across the constructed wetland has been greatly altered. Nitrate cycling characteristics show significant differences between the two wetlands and particularly, nitrate attenuation efficiency is greatly reduced in the constructed wetland.

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561. Modeling of water routing in a Wetland-Reservoir Subirrigation System using SIMULINK.

Hothem, J. A. and Brown, L. C.

In: 1998 ASAE Annual International Meeting. (Held 12 Jul 1998-16 Jul 1998 at Orlando, Florida.)

St Joseph, MI: American Society of Agricultural Engineers; pp. 11; 1998.

Notes: ASAE Paper no. 982096

Descriptors: wetlands/ subsurface irrigation/ models/ subsurface drainage/ water quality/ reservoirs/ pollutants/ nitrates/ phosphates/ herbicides/ water balance/ water conservation/ simulation models/ herbicide residues

Abstract: Wetland-Reservoir-Subirrigation Systems (WRSIS) have the potential both to improve downstream water quality by reducing discharge to streams and to provide a reliable supply of subirrigation water. To evaluate the performance of such systems, a model is being developed to simulate the routing of water between the system's components and to model the water balance within each of the components. This is being done using SIMULINK, a software package that uses block diagrams to define dynamic systems. In the model, an entire library of blocks representing each of the different components of the system (i.e., wetland, subirrigated field, pump station, etc.) is being developed. Each of these blocks actually represents a subsystem of blocks that model the dynamic behavior of that component. The system component blocks can be linked to model a wide range of system configurations for WRSIS sites. The model will be used to analyse a variety of different management strategies.

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562. Monitoring of Spunky Bottoms restored wetland in southern Illinois for biotic and abiotic pollution indicators.

Kelley, Timothy R. and Huddleston, Eric

Transactions of the Illinois State Academy of Science 94(2): 69-78. (2001)

NAL Call #: 500 I16; ISSN: 0019-2252

Descriptors: pollution assessment control and management/ culture method/ analytical method/ membrane filtration method/ analytical method/ agricultural runoff/ conductivity/ pH/ pollution indicators: abiotic, biotic/ restored wetlands/ temperature/ total coliform concentrations

Abstract: A study was conducted to determine and compare biotic (bacterial) and abiotic (physicochemical) pollution indicator levels generated from water samples collected from eleven sites within an aquatic wetland under restoration in Brown County in Southern Illinois. The approximately 700-acre "Spunky Bottoms" wetland, purchased by The Nature Conservancy, is currently being restored by The Wetlands Initiative to conditions prior to levying of the Illinois River and draining of adjacent floodplain for intensive agriculture (circa 1900). Water samples of approximately 200-ml were collected aseptically and analyzed for indicator bacteria (total coliform and *Escherichia coli*) concentrations using a membrane filtration technique and culturing methods. Predominant bacterial genera were also isolated from selected water samples and identified using standard culturing, microscopic, and biochemical techniques. Temperature, pH, dissolved oxygen and conductivity were also monitored concurrently in the field at water sampling sites. Levels of bacterial and physicochemical pollution indicators in water samples taken

from the Illinois River and wetland sites adjacent to agricultural land use were substantially higher than levels found at other sampling sites, possibly due to agricultural runoff. Predominant bacterial genera recovered from all sampling sites were *Pseudomonas* and *Bacillus*, which may contribute to biogeochemical cycles. Results suggest that restored wetlands may contribute to pollution indicator reduction, and that wetland microbial populations may contribute to biogeochemical (N, P, C) element cycling. Further research is necessary to determine more specific contributions of aquatic wetlands to indicator bacteria concentration reduction and biogeochemical cycles.
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563. Monitoring system for water quality and quantity, and ecological parameters at the Dara wetland-reservoir subirrigation system site.

Oztekin, T.; N' Jie, N. M.; Hothem, J.; Luckeydoo, L.; Brown, L. C.; Fausey, N. R.; Czartoski, B. J.; and Mills, G. In: 1998 ASAE Annual International Meeting. (Held 12 Jul 1998-16 Jul 1998 at Orlando, Florida.)

St Joseph, MI: American Society of Agricultural Engineers; pp. 7; 1998.

Notes: ASAE Paper no. 982110

Descriptors: wetlands/ monitoring/ water quality/ subsurface irrigation/ reservoirs

Abstract: An integrated wetland reservoir subirrigation system (WRSIS) was constructed at three different locations in northwest Ohio, USA. The system was set up to recycle drainage and surface water from a subirrigated cropland through a constructed wetland to be stored in an upground reservoir for subirrigation of maize and soybeans during the growing season. In the summer of 1998, the first of these three sites will be equipped with instruments to monitor the ecological, hydrologic, sediment and nutrient dynamics of the system. The data collected will be used in modelling studies to promote an understanding of the hydrological and ecological processes in the WRSIS. The monitoring programme of the WRSIS is presented and discussed in this paper.

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564. Optimizing the placement of riparian practices in a watershed using terrain analysis.

Tomer, M. D.; James, D. E.; and Isenhardt, T. M.

Journal of Soil and Water Conservation 58(4): 198-206. (2003)

NAL Call #: 56.8 J822; ISSN: 0022-4561

Descriptors: best management practices/ conservation planning/ conservation reserve enhancement program/ constructed wetlands/ riparian buffers/ watershed management

Abstract: Riparian buffers and constructed wetlands are best management practices (BMPs) that can improve water quality. However, these practices are not equally effective in all locations. Our objective was to develop maps to help plan the placement of BMPs in a watershed for water quality benefits. Tipton Creek, a 49,000-acre Iowa watershed, provided a case study. Buffer-placement maps, developed from analysis of 30 m (100 ft) elevation data, identified riparian locations with large wetness indices, where buffer vegetation could intercept sheet/rill flows from significant upslope areas. These sites were numerous, typically small (<200 m in length) and well distributed spatially. However results showed 57% of riparian grid cells

would receive runoff from less than 0.4 ha (1 ac). Candidate wetland sites were also mapped by applying interpretive and automated techniques to terrain analyses results. A team of conservation professionals evaluated the planning utility of these maps in the field through consensus-seeking discussion. Buffer maps highlighted areas where, team members agreed, perennial vegetation could effectively intercept runoff and/or manage seasonal wetness. The review team also located three feasible wetland sites, which were all identified by an automated technique showing 12 candidate sites. The methods only required public data and should be applicable to other watersheds.

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565. Passing of northern pike and common carp through experimental barriers designed for use in wetland restoration.

French, J. R. P.; Wilcox, D. A.; and Nichols, S. J. *Wetlands* 19(4): 883-888. (Dec. 1999)

NAL Call #: QH75.A1W47; ISSN: 0277-5212.

Notes: Conference: Temperate Wetlands Restoration Workshop, Barrie, ON (Canada), 27 Nov-1 Dec 1995

Descriptors: wetlands/ North America, Erie L./ fish passages/ coasts/ land reclamation/ fish management/ carp/ fish populations/ environmental restoration/ USA, Ohio/ fishways/ restoration/ ecosystem management/ population control/ body size/ freshwater fish/ *Cyprinus carpio*/ *Esox lucius*/ USA, Ohio, Erie L., Metzger Marsh/ common carp/ northern pike/ European carp/ fisheries engineering/ reclamation/ conservation, wildlife management and recreation

Abstract: Restoration plans for Metzger Marsh, a coastal wetland on the south shore of western Lake Erie, incorporated a fish-control system designed to restrict access to the wetland by large common carp (*Cyprinus carpio*). Ingress fish passageways in the structure contain slots into which experimental grates of varying size and shape can be placed to selectively allow entry and transfer of other large fish species while minimizing the number of common carp to be handled. We tested different sizes and shapes of grates in experimental tanks in the laboratory to determine the best design for testing in the field. We also tested northern pike (*Esox lucius*) because lack of access to wetland spawning habitat has greatly reduced their populations in western Lake Erie. Based on our results, vertical bar grates were chosen for installation because common carp were able to pass through circular grates smaller than body height by compressing their soft abdomens; they passed through rectangular grates on the diagonal. Vertical bar grates with 5-cm spacing that were installed across much of the control structure should limit access of common carp larger than 34 cm total length (TL) and northern pike larger than 70 cm. Vertical bar grates selected for initial field trials in the fish passageway had spacings of 5.8 and 6.6 cm, which increased access by common carp to 40 and 47 cm TL and by northern pike to 76 and 81 cm, respectively. The percentage of potential common carp biomass (fish seeking entry) that must be handled in lift baskets in the passageway increased from 0.9 to 4.8 to 15.4 with each increase in spacing between bars. Further increases in spacing would greatly increase the number of common carp that would have to be handled.

The results of field testing should be useful in designing selective fish-control systems for other wetland restoration sites adjacent to large water bodies.

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566. Phytoremediation of herbicide-contaminated surface water with aquatic plants.

Rice, P. J.; Anderson, T. A.; and Coats, J. R.

In: Phytoremediation of soil and water contaminants/ Kruger, E. L.; Anderson, T. A.; and Coats, J. R.; Series: American Chemical Society Symposium Series 664. Washington DC: American Chemical Society, 1997; pp. 133-151

NAL Call #: QD1.A45 no.664

Abstract: There is current interest in the use of artificial wetlands and macrophyte-cultured ponds for the treatment of agricultural drainage water, sewage, and industrial effluents. Aquatic plant-based water treatment systems have proved effective and economical in improving the quality of wastewaters containing excess nutrients, organic pollutants, and heavy metals. This investigation was conducted to test the hypothesis that herbicide-tolerant aquatic plants can remediate herbicide-contaminated waters. The addition of *Ceratophyllum demersum* (coontail, hornwort), *Elodea canadensis* (American elodea, Canadian pondweed), or *Lemna minor* (common duckweed) significantly (p less than or equal to <0.01) reduced the concentration of [¹⁴C]metolachlor (MET) remaining in the treated water. After a 16-day incubation period, only 1.44%, 4.06%, and 22.7% of the applied [¹⁴C]MET remained in the water of the surface water systems containing *C. demersum*, *E. canadensis*, or *L. minor* whereas 61% of the applied [¹⁴C]MET persisted in the surface water systems without plants. *C. demersum* and *E. canadensis* significantly (p less than or equal to < 0.01) reduced the concentration of [¹⁴C] atrazine (ATR) in the surface water. Only 41.3% and 63.2% of the applied [¹⁴C]ATR remained in the water of the vegetated systems containing *C. demersum* and *E. canadensis*, respectively. Eighty-five percent of the applied [¹⁴C]ATR was detected in the water of the *L. minor* and nonvegetated systems. Our results support the hypothesis and provide evidence that the presence of herbicide-tolerant aquatic vegetation can accelerate the removal and biotransformation of metolachlor and atrazine from herbicide-contaminated waters.

This citation is from AGRICOLA.

567. Plant nutrient uptake and biomass accumulation in a constructed wetland.

Hoagland, C. R.; Gentry, L. E.; David, M. B.; and Kovacic, D. A.

Journal of Freshwater Ecology 16(4): 527-540. (Dec. 2001)

NAL Call #: QH541.5.F7J68; ISSN: 0270-5060

Descriptors: nutrient uptake/ artificial wetlands/ biomass/ nitrogen/ phosphorus/ bioremediation/ uptake/ nutrients (mineral)/ plant populations/ primary production/ water pollution treatment/ pollution control/ agricultural runoff/ aquatic plants/ nutrient cycles/ plant nutrition/ agricultural pollution/ fertilizers/ biogeochemical cycle/ bioaccumulation/ plant growth/ vegetation/ nutrients/ water pollution/ macrophytes/ absorption/ tile drainage/ algae/ Plantae/ reclamation/ protective measures and control/ ecosystems and energetics/ effects of pollution/ water & wastewater treatment

Abstract: We examined the role of plants in the nutrient cycle of a 0.3 ha constructed wetland that received tile drainage water from agricultural fields. The objectives were to determine: 1) above- and below-ground production of wetland macrophytes; 2) production of algae; 3) accumulation and uptake rate of N and P by vegetation during the growing season; and, 4) role of wetland vegetation in the overall N and P budgets. Total biomass ranged seasonally from 12000 to 30000 kg ha super(-1) in the wetland, reaching a maximum in September, with roots accounting for 54 to 77% of the total. Above-ground macrophyte biomass ranged from 2000 to 5700 kg ha super(-1), and also reached a maximum in September. Algae were only present early in the growing season and had a maximum biomass of 233 kg ha super(-1) at the end of May. During the 1998 water year, tile input transported 715 kg ha super(-1) total N and 10 kg ha super(-1) total P into the wetland, whereas wetland output was 256 kg total N ha super(-1) (256 kg ha super(-1) in outlet flow and 120 kg ha super(-1) in seepage) and 7.3 kg total P ha super(-1). Therefore, the wetland removal efficiencies for N and P were 47 and 29%, respectively. Total N and P in biomass reached maxima of 367 and 57 kg ha super(-1) respectively, with below-ground biomass accounting for most of the N and P found in plants. Although the N accumulation by wetland plants was equal to the difference between the wetland input and output for N, most of the plant growth occurred after tile flow ceased. Plant removal of N and P from the water column was likely a small component of the overall effectiveness of the wetland due to the lack of synchronization between plant growth and tile flow.

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568. Seasonal variation of selenium in outdoor experimental stream-wetland systems.

Allen, K. N.

Journal of Environmental Quality 20(4): 865-868. (Oct. 1991-Dec. 1991)

NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: nonpoint pollution sources/ path of pollutants/ selenium/ solute transport/ streams/ water pollution treatment/ artificial wetlands/ bioaccumulation/ experimental basins/ irrigation ditches/ seasonal variation/ vegetation/ sources and fate of pollution/ water quality control

Abstract: Two outdoor experimental stream-wetland systems were exposed continuously to 10 microg/L Se(IV) over a 2-yr period. A seasonal variation in the water column Se concentration was found in wetlands; a comparable variation was not observed in stream segments. Water column Se was never reduced by more than 20% in the streams, but was reduced by greater than 90% in midsummer in the wetlands. Accumulation of Se in plants was much higher in the wetlands than in the streams, particularly in duckweed (*Lemna minor*). The deposition of Se in sediments was extremely variable within the wetlands. The data indicate that the ability of wetlands to remove Se from the water column is seasonally dependent. The increased removal of Se in the wetlands found in late summer may be partially due to the physical effect of increased retention time of the water flowing through dense wetland vegetation, but much of the observed Se fluctuations are likely a result of biological activity in the wetlands. In areas where Se is a problem in free-flowing water, such as agricultural drainage and irrigation ditches,

constructed wetlands and subsequent harvesting of plant material could be useful in removing Se, particularly in areas with little climatological variation. (MacKeen-PTT) 35 062954001

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569. super(226)Ra and super(228)Ra activities associated with agricultural drainage ponds and wetland ponds in the Kankakee Watershed, Illinois-Indiana, USA.

Sidle, W. C.; Shanklin, D.; Lee, P. Y.; and Roose, D. L. *Journal of Environmental Radioactivity* 55(1): 29-46. (2001) NAL Call #: QH543.5.A1; ISSN: 0265-931X

Descriptors: radium/ agriculture/ watersheds/ ponds/ radioactivity/ pollutant identification/ radium radioisotopes/ isotope studies/ agricultural watersheds/ drainage/ artificial wetlands/ spatial distribution/ water quality (natural waters)/ farmwastes/ agricultural areas/ fertilizers/ radioactive contamination/ radium isotopes/ agricultural pollution/ drainage water/ irrigation water/ USA, Illinois, Kankakee R./ USA, Illinois/ USA, Indiana/ radiation/ identification of pollutants/ water quality/ prevention and control/ water pollution: monitoring, control & remediation

Abstract: Radioactivity is elevated in many agricultural drainage ponds and also constructed wetland ponds in the Kankakee Watershed. During 1995-1999, gross- alpha and - beta activities were measured up to 455 and 1650 mBq L super(-1), respectively. super(226)Ra and super(228)Ra averaged 139 and 192 mBq L super(-1) in controlled drainage ponds compared to 53 and 58 mBq L super(-1) for super(226)Ra and super(228)Ra, respectively, in native wetland ponds. Analyses of applied ammonium phosphate fertilizers near both native and controlled ponds indicate comparable super(226)Ra/ super(228)Ra and super(228)Ra/ super(232)Th activity ratios with only the surface waters in the controlled ponds. For example, super(226)Ra/ super(228)Ra activity ratios in controlled ponds ranged from 0.791 to 0.91 and group with a local fertilizer batch containing FL phosphate compounds with super(226)Ra/ super(228)Ra activity ratios of 0.831-1.04. Local soils of the Kankakee watershed have super(226)Ra/ super(228)Ra activity ratios of 0.541-0.70. Calculated Ra fluxes of waters, in drainage ditches associated with these controlled ponds, for super(226)Ra ranged from 0.77 to 9.00 mBq cm super(-2) d super(-1) and for super(228)Ra ranged from 1.22 to 8.43 mBq cm super(-2) d super(-1). Ra activity gradients were measured beneath these controlled ponds both in agricultural landscapes and in constructed wetlands, all being associated with drainage ditches. Ra had infiltrated to the local water table but was below regulatory maximum contaminant limits. Still, measurable Ra activity was measured downgradient of even the constructed wetlands in the Kankakee watershed, suggesting that the attenuation of Ra was low. However, no Ra excess was observed in the riparian zone or the Kankakee River downgradient of the native wetland ponds.

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570. Water table management to enhance crop yields in a Wetland Reservoir Subirrigation System.

Allred, B. J.; Brown, L. C.; Fausey, N. R.; Cooper, R. L.; Clevenger, W. B.; Prill, G. L.; Barge, G. A.; Thornton, C.; Riethman, D. T.; Chester, P. W.; and Czartoski, B. J. *Applied Engineering in Agriculture* 19(4): 407-421. (2003) NAL Call #: S671.A66; ISSN: 0883-8542

Descriptors: agricultural production/ artificial wetlands/ crop production/ crop yield/ drain pipes/ irrigation systems/ maize/ reservoirs/ river water/ rivers/ soybeans/ subsurface drainage/ subsurface irrigation/ water storage/ water table

Abstract: A Wetland Reservoir Subirrigation System (WRSIS) allows for capture, treatment, storage, and reuse of runoff and subsurface drainage waters from cropland, in turn providing both environmental and agricultural production benefits. The three WRSIS sites presently in operation are all located within the northwest Ohio portion of the Maumee River Basin and have been in use for five to six complete growing seasons. WRSIS components include an underground drainage pipe network tied to both a constructed wetland and a water storage reservoir. With this type of system, the drain pipes can be used at different times to either add water (subirrigation) or remove water (subsurface drainage) from the root zone, thereby enhancing crop yields, especially in dry years. Obtaining these crop yield benefits requires a proper water table management approach that includes practicing suggested operational guidelines and initiating as needed system modification improvements. By incorporating a proper water table management approach, and in comparison to control plots, WRSIS subirrigated field crop yield increases for corn and soybeans, respectively, were 34.5 and 38.1% during drier growing seasons, 14.4 and 9.7% during near average to wetter growing seasons, and 19.6 and 17.4% overall.

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571. A wetland to improve agricultural subsurface drainage water quality.

Miller, P. S.; Mitchell, J. K.; Cooke, R. A.; and Engel, B. A. *Transactions of the ASAE* 45(5): 1305-1317. (2002)
NAL Call #: 290.9 AM32T; ISSN: 0001-2351

Descriptors: herbicides/ water quality/ artificial wetlands/ atrazine/ evapotranspiration/ drainage water/ subsurface drainage/ orthophosphates/ agricultural runoff/ alachlor/ USA, Illinois

Abstract: The effectiveness of wetlands to cleanse event-driven agricultural drainage water in east-central Illinois was studied. A wetland was constructed at the outlet of a subsurface-drained agricultural field in a corn-soybean rotation. Hydrology data from the wetland inlet and outlet, including precipitation and evapotranspiration data, were used to develop a water budget for the system. Water quality data were collected from the wetland inlet, outlet, and the pond section of the wetland and analyzed for nitrate-nitrogen (NO₃-N), orthophosphate (PO₄-P), and nine common Midwestern herbicides: trifluralin, atrazine, alachlor, metolachlor, ethalfuralin, butylate, clomazone, cyanazine, and pendimethalin. Constituent mass loads were calculated at the inlet and outlet, and both concentration and mass load data sets were statistically analyzed. Results indicated variable performance based primarily on seasonal processes and individual chemical constituent. Overall, NO₃-N mass load assimilation was approximately 174 kg (32.9%) over the course of the study, although assimilation rates were seasonally dependent. PO₄-P and herbicide concentration and mass load assimilation were not significant.

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572. Zooplankton communities of restored depressional wetlands in Wisconsin, USA.

Dodson, S. I. and Lillie, R. A. *Wetlands* 21(2): 292-300. (2001)
NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ watersheds/ zooplankton/ waterfowl/ agriculture/ sexual reproduction/ taxonomy/ daphnia/ ecosystems/ eutrophication/ turbidity/ surface water/ environment management/ community structure/ environmental restoration/ species richness/ agricultural land/ plankton/ ecosystem disturbance/ nutrient enrichment/ restoration/ evaluation/ community composition/ species diversity/ Cladocera/ Copepoda/ USA, Wisconsin/ restoration/ water fleas/ copepods

Abstract: Wisconsin has lost approximately 2 million hectares of wetland since statehood (1848). Through the combined efforts of state and federal agencies and private groups focused primarily on wetland restoration for waterfowl habitat management or compensatory mitigation, a fairly substantial gain in wetland area has been achieved. Much of the wetland restoration effort in Wisconsin has occurred on formerly agricultural lands. However, due to the nature of the past disturbance and possible residual effects not corrected by simply returning surface waters to these lands, there is some question regarding the resultant wetland quality or biological integrity. In an effort aimed at developing tools to measure wetland gains in terms of quality or ecological integrity, the Wisconsin Department of Natural Resources (WDNR) initiated a study of biological communities on restored wetlands in Wisconsin. In this paper, we report on the community of microcrustaceans and arthropods that can be collected with a plankton net in open water in wetlands. We examined zooplankton community structure in restored wetlands in terms of richness, taxonomic representation, and *Daphnia* sexual reproduction and related these metrics to attributes on wetlands representing least-disturbed conditions and agriculturally impacted wetlands. We sampled 56 palustrine wetlands distributed across Wisconsin. These wetland sites were categorized as agricultural, least-impacted, and restored (recently withdrawn from agricultural usage). The wetlands were reasonably homogeneous in many ways, so that taxon richness was not correlated with basin origin, presence of adjacent roads, presence or absence of fish, water chemistry, or the size of the open water. We identified a total of 40 taxa. Taxon richness was significantly lower in agricultural sites (average of 3.88 taxa per site) compared to that of least-impacted sites (7.29 taxa) and restored sites (7.21 taxa). Taxon richness of restored sites was significantly correlated with time since restoration. The data indicate that taxon richness changes from a value typical of agricultural sites to the average richness of least-impacted sites in about 6.4 years. The total taxon list for 8 agricultural sites (14 taxa) was significantly smaller than the average value for randomly chosen sets of 8 least-impacted sites (20.4 taxa). Agricultural and least-impacted sites tended to have the same common taxa. Many taxa of chydorid cladocerans and cyclopoid copepods that were rare in least-impacted sites did not occur in the agricultural sites, nor did fairy shrimp occur in agricultural sites. *Daphnia* populations only produced males in least-impacted and restored sites. Further research is needed to identify the mechanism(s) responsible for the reduced species richness and lack of sexual reproduction in agricultural wetland sites. Likely factors include eutrophication, turbidity, or chemical

contamination. We conclude that restoration of wetland watersheds works. Withdrawal of the watershed from agricultural usage is followed by an increase in taxon richness, and the sites resembled least-impacted sites in about 6-7 years.

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Gulf-Atlantic Coastal Flats/Rolling Plains Wetlands

General Information

573. Accuracy assessment and validation of classified satellite imagery of Texas coastal wetlands.

Hinson, J. M.; German, C. D.; and Pulich, W.
Marine Technology Society Journal 28(2): 4-9. (1994)
NAL Call #: GC1.M3; ISSN: 0025-3324.

Notes: Conference: Third Thematic Conference on Remote Sensing for Marine and Coastal Environments

Descriptors: wetlands/ coastal zone/ satellite sensing/ mapping/ classification systems/ vegetation cover/ classification/ remote sensing/ satellite technology/ Landsat/ satellite technology/ USA, Texas, Galveston Bay/ coastal zone/ satellite sensing/ classification systems/ vegetation cover

Abstract: Two methods of determining wetlands and landcover classification accuracy for Landsat thematic mapper (TM) imagery are presented and evaluated. A partial Landsat TM scene of the upper Texas coast (Galveston Bay) was classified according to the NOAA CoastWatch-Change Analysis Program landcover classification scheme. Thirteen major wetland, upland and open water landcover types were identified using a series of supervised and unsupervised classification procedures. The classification accuracy was estimated using two accuracy assessment methods: ground truthing 407 sites located with Global Positioning System (GPS) and direct overlay of wetland categories with comparable United States Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI) data. Comparisons of the accuracy assessment estimates found that the ground truthing method consistently produced higher accuracy estimates than that of the direct overlay method. It was concluded that ancillary data as a means of accuracy assessment for classified imagery as an alternative to ground truthing should be used with caution.

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574. Analysis of landscape patterns in coastal wetlands of Galveston Bay, Texas (USA).

Liu, Amy J. and Cameron, Guy N.
Landscape Ecology 16(7): 581-595. (2001)

NAL Call #: QH541.15.L35 L36; ISSN: 0921-2973

Descriptors: GIS: geographic information system, computer method/ perimeter area method: field method/ coastal wetlands: spatial pattern/ fractal dimension/ landscape ecology: historical change

Abstract: High productivity and accessibility have made coastal wetlands attractive sites for human settlements. This study analyzed the patterns of wetland landscapes in Galveston Bay, Texas, USA. The first objective of the study was to describe the relationships between the fractal dimension of wetland boundaries and those factors which affect the wetland landscapes (e.g., land use, type of vegetation, size, location, and level of human disturbance). The second objective was to construct a historical database to contrast wetland areas which had experienced different levels of disturbance between 1956 and 1989. The fractal dimension, a measure of how much of the geographical space is filled by boundaries, was measured by the perimeter-area method. The fractal dimension of wetlands was significantly affected by land use, type of vegetation, size, and level of anthropogenic disturbance. In addition,

increasing the size of buffers around roads did not significantly affect the fractal dimension of wetlands. Landscape indices, such as fractal dimension, dominance, and diversity, were used to characterize spatial heterogeneity in the historical database. Lake Stephenson, an area of low anthropogenic disturbance, experienced no changes in wetland composition and abundance over time. Anahuac, an area of medium disturbance, experienced changes in both wetland composition and abundance. Texas City, an area of high disturbance, experienced a change in wetland composition. These differences can be associated with the type and level of disturbance present; however, more evidence is needed to determine whether certain landscape patterns have stable, intrinsic properties which allow persistence in the face of disturbance. These results will be informative to resource managers determining how wetlands can be managed as natural resources and nature reserves.

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575. Analytical method of determining wetland hydrology.

Palalay, S. and Geter, F.

In: Drainage and water table control Proceedings of Sixth International Drainage Symposium. (Held 13 Dec 1992-15 Dec 1992 at Nashville, Tennessee.)

St. Joseph, Michigan, USA: American Society of Agricultural Engineers; pp. 345-352; 1992.

Descriptors: wetlands/ water management/ rain/ temperature/ hydrology/ drainage/ spacing/ meteorology/ models/ hydrogenic soils

Abstract: The water management simulation model, DRAINMOD, was used to quantify the presence of wetland hydrology on a strip of ground between two parallel drains. It was concluded that on a Fallsington (hydric) soil subjected to the 1958-1973 rainfall and temperature at Wilmington Airport, Delaware, USA, there would be wetland hydrology if 1.2 m deep drains were spaced no closer than 97.5 m. The results of the simulation was also used to identify easily measurable climatic variables that were significant in affecting the highest 7-day average water table. Regression analyses were done on several variables and some predictive equations were derived. The analyses showed that the 14-day rainfall (7-days after and 7-day before the rise of the highest 7-day average water table) had the greatest impact. Rainfall of a prior period up to three months also had some effect and the coefficient of determination was slightly improved by including the prior 3-month rainfall as a second variable.

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576. Assessment of saltwater intrusion impact on gas exchange behavior of Louisiana Gulf Coast wetland species.

Pezeshki, S. R.; DeLaune, R. D.; and Patrick, W. H.
Wetlands Ecology and Management 1(1): 21-30. (1989)

Descriptors: wetlands/ gas exchange/ plants/ reviews/ aquatic plants/ salinity effects/ salt wedges/ literature reviews/ USA, Louisiana/ saline water/ salt wedges/ literature reviews/ plants/ reviews/ environmental effects/ physiology, biochemistry, biophysics

Abstract: A review of gas exchange responses of wetland plants to salinity is presented for several species representative of different wetland habitats extending along water level and salinity gradients in the Louisiana Gulf Coast, U.S.A. The information was synthesized from earlier plant physiological response studies. Vegetation examined represent a broad range of sensitivity to salt, including brackish marsh, freshwater marsh, and bottomland tree species. Changes in stomatal conductance and carbon assimilation rates are common responses of wetland plants to short-term and long-term exposure to salinity. The combination of anaerobiosis and salinity apparently causes substantial reductions in stomatal conductance and carbon assimilation. Exposure to salt concentrations greater than 170 mol/m³ (10 ppt) caused leaf death in plants representing freshwater habitats.

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577. Benthic macroinvertebrates of small Florida pondcypress swamps and the influence of dry periods.

Leslie, A. J.; Crisman, T. L.; Prenger, J. P.; and Ewel, K. C. *Wetlands* 17(4): 447-455. (1997)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: drawdown/ forested wetland/ macroinvertebrates/ pondcypress swamps

Abstract: Benthic macroinvertebrate communities were sampled bimonthly from December 1993 to April 1995 in three small pondcypress swamps. Eighty-five taxa were collected, with Chironomidae, Dytiscidae, and Hydrophilidae contributing large numbers of genera. Annual mean density was 4,229 individuals/m², and monthly densities for individual ponds ranged from 950 to 11,623 individuals/m². Three genera, Crangonyx (Amphipoda), Polypedilum, and Chironomus (Chironomidae), accounted for 70% of the total density. High levels of temporal and inter-pond variability were documented. Taxon richness and total density of communities sampled during drawdown were similar to those of wet months. The large number of taxa unique to the dry period contributed substantially to overall taxon richness. The benthic macroinvertebrate communities of these systems seem to be adapted to unpredictable drawdown.

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578. Carbon dioxide exchange in a high marsh on the Texas Gulf Coast: Effects of freshwater availability.

Heinsch, F. A.; Heilman, J. L.; McInnes, K. J.; Cobos, D. R.; Zuberer, D. A.; and Roelke, D. L.

Agricultural and Forest Meteorology 125(1-2): 159-172. (2004)

NAL Call #: 340.8 AG8; ISSN: 0168-1923

Descriptors: relaxed eddy accumulation: applied and field techniques/ carbon dioxide exchange/ channelization/ drought/ dryland ecosystem/ ecosystem respiration/ evaporation/ flooding/ freshwater inflow/ gas exchange/ gross ecosystem production/ marsh/ net ecosystem exchange/ rainfall/ sediment salinity/ standing water/ water availability/ wetland ecosystem

Abstract: The supply of water to the Nueces River Delta near Corpus Christi, Texas is limited by dams and channelization of the river which restrict freshwater inflow. The upper end (high marsh) of the delta frequently dries up during the summer. The marsh consists of slightly elevated islands containing emergent halophytes, and shallow ponds interconnected by narrow channels. Carbon dioxide

exchange in the marsh was measured by relaxed eddy accumulation (REA) during two periods, one in 1997 that included two floods from the river followed by an extended period of drying and disappearance of standing water, and the other in 1998 that was in the midst of a drought with no standing water present. The marsh was a net CO₂ sink during periods of high water availability and low sediment salinity, and a net source when water availability was low and salinity was high. During the 1997 period, net ecosystem exchange (NEE) and gross ecosystem production (GEP) ranged from -7.3 g CO₂ m⁻² per day (net gain of CO₂) and 12.3 g CO₂ m⁻² per day, respectively, after flooding to +8.7 g CO₂ m⁻² per day (net loss of CO₂) and 0.4 g CO₂ m⁻² per day, respectively, when sediments were dry. NEE and GEP averaged 0.5 and 7.7 g CO₂ m⁻² per day, respectively, during this period. Standing water, and water in pores restricted gas exchange between sediment and the atmosphere so that ecosystem respiration (R) increased as the marsh dried, with R ranging from 1.2 to 15.6 g CO₂ m⁻² per day and averaging 8.2 g CO₂ m⁻² per day. During the 1998 drought, NEE, GEP, and R averaged 5.8, 3.3, and 9.19 CO₂ m⁻² per day, respectively. A 27 turn rain during this period produced a 14-fold increase in GEP and a 75% reduction in R that lasted for 2 days. In 1997, NEE and its components were all significantly correlated at the 0.05 level with water availability as estimated by the cumulative difference between rainfall and evaporation, while in 1998, only NEE and GEP were significantly correlated with water availability. Results of this study indicate that the marsh NEE behaved more like that of a dryland ecosystem than a wetland because of limited freshwater inflow. Copyright 2004 Elsevier B.V. All rights reserved.
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579. Carolina bay wetlands: Unique habitats of the southeastern United States.

Sharitz, R. R.

Wetlands 23(3): 550-562. (2003)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ species richness/ biological diversity/ conservation/ habitats/ groundwater/ evapotranspiration/ species diversity/ hydrology/ coastal plains/ amphibians/ rainfall/ agriculture/ aquatic environment/ drainage/ life cycles/ ecosystems/ water level/ community composition/ mapping/ nature conservation/ environmental protection/ freshwater organisms/ Amphibia/ USA North Carolina/ USA, South Carolina/ amphibians

Abstract: Carolina bays, depression wetlands of the southeastern United States Coastal Plain, are 'islands' of high species richness within the upland landscape and are the major breeding habitat for numerous amphibians. The 2001 Supreme Court decision that removes isolated wetlands from protection under the Clean Water Act has potential for great losses of these wetland ecosystems. Most Carolina bays are not naturally connected with stream drainages or other water bodies, and their hydrology is driven primarily by rainfall and evapotranspiration. Their potential interaction with shallow ground water is not well-understood. Water levels in these wetlands may vary seasonally and across years from inundated to dry, and organisms inhabiting Carolina bays must be adapted to fluctuating and often unpredictable hydrologic conditions. The ecological importance of these wetlands as habitats for species that require an aquatic environment for a part of

their life cycle has been well-documented. Many Carolina bays have been drained and converted to agriculture or other uses, and many of the smaller bays have been poorly inventoried and mapped. If these wetlands are not protected in the future, a major source of biological diversity in the southeastern United States will be lost.

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580. Changes in benthic algal attributes during salt marsh restoration.

Zheng, L.; Stevenson, R. J.; and Craft, C.

Wetlands 24(2): 309-323. (June 2004)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ marshes/ sediments/ environmental restoration/ salt marshes/ algae/ biomass/ species composition/ habitat improvement/ community composition/ chronostratigraphy/ species diversity/ primary production/ Periphyton/ age determination/ regional variations/ seasonal variations/ restoration/ organic matter/ epiphytes/ sediment chemistry/ sediment samples/ nutrients/ diatoms/ accumulation/ *Spartina*/ indicators/ phosphorus/ nitrogen/ Bacillariophyceae/ *Spartina alterniflora*/ USA, North Carolina/ reclamation/ habitat community studies/ conservation, wildlife management and recreation/ water and plants

Abstract: To assess attributes of algal assemblages as indicators of salt marsh restoration, we chose eight pairs of salt marshes in North Carolina, USA, each pair with one restored marsh (from 1 to 28 years old) and a nearby existing salt marsh. Algae on both *Spartina alterniflora* and sediments (sediment algae) were collected in each marsh during spring and summer 1998 for assaying algal biomass (dry mass (DM), ash free dry mass (AFDM), chl a content, algal biovolume), algal species composition and diversity, and gross primary production. An attribute restoration ratio was calculated by dividing attribute values from each restored marsh by values from a paired reference marsh. Controlling for regional variation in reference marshes substantially increased precision in relations between attributes and the increase in age of restored marshes. The organic matter restoration ratio of sediments increased with age of restored marshes in both spring and summer. The algal biomass restoration ratios of epiphytes, calculated with algal biovolume and chl a, increased with restored marsh age in summer but not during spring. Biomass of sediment algae was not related to marsh age. The species diversity of sediment algae in summer showed an asymptotic relationship with sediment nutrient concentration. The similarity of diatom species composition between paired restored and reference sites increased with age of restored marshes during spring and summer. Primary production by epiphytic and sediment algae in summer showed site-specific changes and did not change consistently with marsh age. Algal biomass, algal diversity, and diatom species composition during summer were positively correlated with sediment nitrogen and phosphorus concentration. We concluded that other structural and functional development of restored wetlands, especially nutrient storage in sediments, regulates algal species composition and algal biomass accumulation, which can be used to evaluate salt marsh restoration.

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581. Chesapeake wetlands: The vital link between the watershed and the bay.

Chesapeake Bay Program

Annapolis, Md.: United States Fish and Wildlife Service; EPA 903-R-97-002, 1997.

NAL Call #: QH76.5.A123C542 1997

Descriptors: wetlands---Chesapeake Bay/ watershed (Md. and Va.)/ wetland conservation---Chesapeake Bay/ watershed (Md. and Va.)

This citation is from AGRICOLA.

582. Chironomidae (Diptera) and vegetation in a created wetland and implications for sampling.

Streever, W. J.; Evans, D. L.; Keenan, C. M.; and Crisman, T. L.

Wetlands 15(3): 285-289. (1995)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ sampling/ vegetation patterns/ artificial wetlands/ ecosystems/ vegetation cover/ habitat improvement (physical)/ habitat improvement (biological)/ ecological associations/ invertebrates/ habitats/ Diptera/ Chironomidae/ USA, Florida/ artificial wetlands/ vegetation cover/ habitat improvement (physical)/ habitat improvement (biological)/ ecological associations/ invertebrates/ habitats/ vegetation patterns/ Diptera/ Chironomidae

Abstract: Although invertebrate communities are used in the evaluation of created freshwater wetlands, spatial patterns of invertebrate community structure are frequently ignored. Invertebrate distributions are generally associated with plant community distribution in natural aquatic ecosystems. In this study, 180 core samples were collected to examine associations between chironomid (Diptera) genera and emergent vegetation communities in a single created freshwater herbaceous wetland in central Florida. Three of the five common genera were significantly more abundant ($p < 0.05$, Wilcoxon Rank Sum Test) in areas with greater than 50% cover by emergent vegetation than in open water, but no differences were found between areas dominated by *Pontederia cordata* and areas dominated by mixed emergent vegetation. Samples from an area of open water and an area with over 80% cover by *P. cordata* showed significant differences in abundances of all common chironomid genera ($P < 0.05$, Wilcoxon Rank Sum Test). Results suggest that sampling designs for studies comparing benthic invertebrate communities from natural and created wetlands should consider the possible associations between vegetation and invertebrate communities.

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583. Citronelle ponds: Little-known wetlands of the central Gulf Coastal Plain, USA.

Folkerts, George W.

Natural Areas Journal 17(1): 6-16. (1997)

NAL Call #: QH76.N37; ISSN: 0885-8608

Descriptors: kaolinite/ kaolinite dissolution/ pond cypress/ swamp tupelo/ water fluctuation/ freshwater ecology/ habitat/ forested depression wetland/ dominant species/ citronelle ponds/ conservation/ crustaceans (Crustacea Unspecified)/ insects (Insecta Unspecified)/ Crustacea (Crustacea Unspecified)/ Insecta (Insecta Unspecified)/ *Nyssa biflora* (Nyssaceae)/ *Taxodium ascendens* (Coniferopsida)/ angiosperms/ animals/ arthropods/ crustaceans/ dicots/ gymnosperms/ invertebrates/ plants/ spermatophytes/ vascular plants/ Central Gulf coastal plain

Abstract: Citronelle ponds are forested depression wetlands occurring on relatively flat uneroded surfaces of the Citronelle Formation along the Gulf coast of the United States from Mississippi to the central Florida Panhandle. The depressions seem to have formed by the dissolution of kaolinite in the substrate and associated loss of volume. Most are temporarily flooded, typically from early winter to late spring. Soils are usually of the Grady series. Few depressions have connections with surface or subsurface drainage. Nearly all Citronelle ponds were forested in their primeval state, characteristically supporting pondcypress (*Taxodium ascendens* Brogn.) and swamp tupelo (*Nyssa biflora* (Walt.) Sarg.) as dominants. The fauna consists of species that can tolerate water fluctuation and frequent drying and includes a large diversity of crustaceans and insects. Fishes are seldom present. Most of the ponds are isolated amid lands used for agriculture and forestry. Few remain in anything resembling a natural state. Action to preserve representative Citronelle ponds is urgently needed.

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584. Common reed *Phragmites australis*: Control and effects upon biodiversity in freshwater nontidal wetlands.

Ailstock, M. Stephen.; Norman, C. Michael.; and Bushmann, Paul J.

Restoration Ecology 9(1): 49-59. (Mar. 2001)

NAL Call #: QH541.15.R45R515; ISSN: 1061-2971

Descriptors: Macroinvertebrata/ disturbance by man/ vegetation control/ effects on community structure/ community structure/ effects of vegetation control measures/ semiaquatic habitat/ fertilizers and pesticides/ herbicide/ fire/ burning for vegetation control/ effect on community structure/ Maryland/ Chesapeake Bay/ non tidal wetlands/ effect of vegetation control measures

Abstract: *Phragmites australis* (common reed) has expanded in many wetland habitats. Its ability to exclude other plant species has led to both control and eradication programs. This study examined two control methods-herbicide application or a herbicide-burning combination-for their efficacy and ability to restore plant biodiversity in nontidal wetlands. Two *Phragmites*-dominated sites received the herbicide glyphosate. One of these sites was burned following herbicide application. Plant and soil macroinvertebrate abundance and diversity were evaluated pre-treatment and every year for four years post-treatment using belt transects. The growth of *Phragmites* propagules-seeds, rhizomes, and rooted shoots-was examined in the greenhouse and under bare, burned, or vegetated soil conditions. Both control programs greatly reduced *Phragmites* abundance and increased plant biodiversity. Plant re-growth was quicker on the herbicide-burn site, with presumably a more rapid return to wetland function. Re-growth at both sites depended upon a pre-existing, diverse soil seed bank. There were no directed changes in soil macroinvertebrate abundance or diversity and they appeared unaffected by changes in the plant community. *Phragmites* seeds survived only on bare soils, while buried rhizomes survived under all soil conditions. This suggests natural seeding of disturbed soils and inadvertent human planting of rhizomes as likely avenues for *Phragmites* colonization. Herbicide control, with or without burning, can reduce *Phragmites* abundance and increase plant

biodiversity temporarily. These changes do not necessarily lead to a more diverse animal community. Moreover, unless *Phragmites* is eradicated and further human disturbance is prohibited, it will likely eventually re-establish dominance.
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585. A comparison of factors controlling sedimentation rates and wetland loss in fluvial-deltaic systems, Texas Gulf Coast.

White, W. A.; Morton, R. A.; and Holmes, C. W.

Geomorphology 44(1-2): 47-66. (2002)

NAL Call #: GB400; ISSN: 0169-555X

Descriptors: wetlands/ marshes/ deltas/ spatial distribution/ submergence/ water level fluctuations/ sedimentation rates/ erosion/ model studies/ comparison studies/ USA, Texas, Trinity R./ USA, Texas, Lavaca R./ USA, Texas, Navidad R./ USA, Texas, Nueces R.

Abstract: Submergence of coastal marshes in areas where rates of relative sea-level rise exceed rates of marsh sedimentation, or vertical accretion, is a global problem that requires detailed examination of the principal processes that establish, maintain, and degrade these biologically productive environments. Using a simple super(210)Pb-dating model, we measured sedimentation rates in cores from the Trinity, Lavaca-Navidad, and Nueces bayhead fluvial-deltaic systems in Texas where more than 2000 ha of wetlands have been lost since the 1950s. Long-term average rates of fluvial-deltaic aggradation decrease southwestward from 0.514 plus or minus 0.008 cm year super(-1) in the Trinity, 0.328 plus or minus 0.022 cm year super(-1) in the Lavaca-Navidad, to 0.262 plus or minus 0.034 cm year super(-1) in the Nueces. The relative magnitudes of sedimentation and wetland loss correlate with several parameters that define the differing fluvial-deltaic settings, including size of coastal drainage basin, average annual rainfall, suspended sediment load, thickness of Holocene mud in the valley fill, and rates of relative sea-level rise. There is some evidence that upstream reservoirs have reduced wetland sedimentation rates, which are now about one-half the local rates of relative sea-level rise. The extant conditions indicate that fluvial-deltaic marshes in these valleys will continue to be lost as a result of submergence and erosion.

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586. Comparison of nitrogen cycling in salt marsh zones related to sea-level rise.

Thomas, C. R. and Christian, R. R.

Marine Ecology Progress Series 221: 1-16. (2001)

NAL Call #: QH541.5.S3M32; ISSN: 0171-8630

Descriptors: nitrogen cycle/ salt marshes/ sea level/ modelling/ USA, Massachusetts, Cape Cod, Buzzard's Bay, Great Sippewissett Salt Marsh/ USA, Virginia, Phillips Creek Marsh/ USA, Georgia, Sapelo I./ literature reviews/ primary production/ nitrogen fixation/ denitrification/ mineralization/ tidal effects/ ecosystems and energetics

Abstract: Zones in salt marshes can be distinguished by different community and ecosystem properties. As marshes respond to changes in sea level, one might expect alterations in the relative proportions of these zones and, hence, alterations in overall functioning. We used ecological network analysis to assess potential changes in 1 ecosystem function, nitrogen cycling. We constructed nitrogen cycle networks of zones (creekbank, low marsh, and high marsh) for 3 salt marshes on the East Coast of the

USA; Great Sippewissett in Massachusetts, Upper Phillips Creek in Virginia, and Sapelo Island in Georgia. The same network structure was applied to all zones, largely using data derived from the literature on the 3 marshes. The factors used to analyze how nitrogen flowed through each zone included how nitrogen imported into the marsh was exported, how imports were related to primary productivity, and how much nitrogen was cycled within the system. Emphasis was placed on identifying patterns across zones that were consistent for all 3 marshes. When precipitation and tidal particulate nitrogen (PN) were the imports, export from active cycling via burial and denitrification significantly increased in importance moving across the marsh from the creekbank to the high marsh. Relative nitrogen cycling also significantly increased from creekbank to high marsh. As the area of the marsh zones decrease or increase in response to sea-level rise, nitrogen dynamics will change as a consequence. If the landscape slope is low allowing the marsh to migrate overland, the high marsh zone will increase in area. Nitrogen cycling as a percentage of total system throughput will increase per unit area averaged over the total marsh. If, however, the marsh stalls because of a steep slope at the upland margin, cycling will decrease on a per unit area basis. If the supply of sediment is great and the marsh progrades toward the sea, nitrogen cycling within the marsh may decrease. Therefore, as relative sea-level rises, the response of a salt marsh's nitrogen cycle will depend on the slope and sediment supply available to the marsh.

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587. Composition and aboveground productivity of three seasonally flooded depressional forested wetlands in coastal South Carolina.

Busbee, W. S.; Conner, W. H.; Allen, D. M.; and Lanham, J. D.

Southeastern Naturalist 2(3): 335-346. (Sept. 2003)

NAL Call #: IPSP11706; ISSN: 1528-7092

Descriptors: wetlands/ forests/ leaf litter/ community composition/ rare species/ primary production/ coastal zone/ ecosystem management/ nature conservation/ dominant species/ *Nyssa aquatica*/ *Nyssa sylvatica*/ *Taxodium distichum*/ USA, South Carolina/ depressional wetlands/ productivity/ conservation, wildlife management and recreation

Abstract: Depressional wetlands provide habitat for birds, mammals, reptiles, amphibians, invertebrates, and rare plant species. In order to protect, restore, and manage depressional wetlands, it is important to know more about the vegetative composition and productivity of these systems. The species composition and aboveground productivity of three seasonally flooded depressional forested wetlands were studied on the coastal plain of South Carolina from January 2000 to January 2001. The dominant tree species in the depressions were *Taxodium distichum* [L.] Rich., *Nyssa aquatica* L., and *Nyssa sylvatica* var. *biflora* [Walt.] Sarg. Annual diameter at breast height (dbh) growth was measured for all trees >10 cm dbh in five 20 x 25 m plots within each depression, and changes in dbh were used to estimate annual biomass and stem production. Aboveground net primary productivity (ANPP) was calculated for each wetland by summing stem and leaf litter production. There were no significant differences in

ANPP among sites, ranging from 564-774 grams/m²/yr. These ANPP values are similar to values reported for slowly flowing forested wetland systems of the southern United States.

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588. Composition and vulnerability of bottomland hardwood forests of the coastal plain province in the South Central USA.

McWilliams W. H. and Rosson J. F.

Forest Ecology and Management 33-34(1-4): 485-502. (1990)

NAL Call #: SD1.F73; ISSN: 0378-1127.

Notes: International Forested Wetlands Resource: Identification and Inventory Conference, Baton Rouge, Louisiana, USA, September 19-22, 1988.

Descriptors: species/ composition/ moist/ types/ cover/ vegetation

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589. A conceptual model of ecological interactions in the mangrove estuaries of the Florida Everglades.

Davis, Steven M.; Childers, Daniel L.; Lorenz, Jerome J.; Wanless, Harold R.; and Hopkins, Todd E.

Wetlands 25(4): 832-842. (2005)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: estuarine ecology/ environmental sciences/ models and simulations/ computational biology/ wildlife management/ conservation/ horticulture/ agriculture/ conceptual model/ mathematical and computer techniques/ salinity gradient/ precipitation pattern/ global climate change/ freshwater flow/ ecological interaction

Abstract: A brackish water ecotone of coastal bays and lakes, mangrove forests, salt marshes, tidal creeks, and upland hammocks separates Florida Bay, Biscayne Bay, and the Gulf of Mexico from the freshwater Everglades. The Everglades mangrove estuaries are characterized by salinity gradients that vary spatially with topography and vary seasonally and inter-annually with rainfall, tide, and freshwater flow from the Everglades. Because of their location at the lower end of the Everglades drainage basin, Everglades mangrove estuaries have been affected by upstream water management practices that have altered the freshwater heads and flows and that affect salinity gradients. Additionally, interannual variation in precipitation patterns, particularly those caused to El Nino events, control freshwater inputs and salinity dynamics in these estuaries. Two major external drivers on this system are water management activities and global climate change. These drivers lead to two major ecosystem stressors: reduced freshwater flow volume and duration, and sea-level rise. Major ecological attributes include mangrove forest production, soil accretion, and resilience; coastal lake submerged aquatic vegetation; resident mangrove fish populations; wood stork (*Mycteria americana*) and roseate spoonbill (*Platelea ajaja*) nesting colonies; and estuarine crocodilian populations. Causal linkages between stressors and attributes include coastal transgression, hydroperiods, salinity gradients, and the "white zone" freshwater/estuarine interface. The functional estuary and its ecological attributes, as influenced by sea level and freshwater flow, must be viewed as spatially dynamic, with a possible near-term balancing of transgression but ultimately a long-term continuation of inland movement. Regardless of the spatio-

temporal timing of this transgression, a salinity gradient supportive of ecologically functional Everglades mangrove estuaries will be required to maintain the integrity of the South Florida ecosystem.

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590. Constructing freshwater wetlands to replace impacted natural wetlands: A subtropical perspective.

Streever, W. J.; Kiefer, J. H.; and Crisman, T. L.

In: Tropical limnology/ Timotius, K. H. and Goeltenboth, F.; Vol. 3, 1995; pp. 127-135.

Notes: Special issue: Tropical rivers, wetlands and special topics; Conference: International Conference on Tropical Limnology in Commemoration of the 65th Anniversary of The Ruttner-Thienemann Limnological Sunda Expedition, Salatiga (Indonesia), 4-8 Jul 1994; ISBN: 979-8792-01-3
Descriptors: wetlands/ nature conservation/ fishery management/ agricultural runoff/ water quality control/ USA, Florida/ mining/ phosphates/ conservation, wildlife management and recreation

Abstract: Numerous tropical nations are interested in wetland conservation, but as economies and populations continue to grow wetland losses will continue to accrue. In the U.S.A. legislation encourages the construction of wetlands as mitigation for unavoidable wetland loss. Construction of over 4000 ha of freshwater wetlands in Florida's phosphate mining district (latitude 28 N, longitude 82 W) provides a subtropical perspective on the potential of wetland construction in the tropics. Extensive field data from industry reports and from government-supported research indicate that vegetation, fish, meiofauna, and benthic invertebrate communities of some constructed wetlands are similar to those of nearby natural wetlands. In this paper, six "principles of wetland construction" are presented to summarize and synthesize experience gained through the construction of wetlands in central Florida: 1. The potential benefits offered by construction of wetlands should only be considered when loss of natural wetlands is unavoidable. 2. Clear and realistic goals should be formulated for each wetland construction project. 3. Establishment of the appropriate hydrology should be a primary concern in wetland construction. 4. Establishment and maintenance of vegetation involve both active and passive strategies. 5. Because wetland construction technology is still in a developmental stage, all projects should be carefully monitored. 6. If monitoring reveals major faults with a constructed system, remedial measures should be taken Future wetland construction projects in the tropics may benefit from wetland constructor experience in Florida's subtropics.

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591. Contiguity and edge characteristics of wetlands in five coastal counties of North Carolina, USA.

Moorhead, K. K.

Wetlands 19(1): 276-282. (Mar. 1999)

NAL Call #: QH75.A1W47; *ISSN:* 0277-5212

Descriptors: wetlands/ nature conservation/ regional planning/ resource management/ classification systems/ forest industry/ vegetation cover/ plant populations/ geographical reference systems/ USA, North Carolina/ geographical information systems/ conservation/ classification/ forestry/ vegetation/ geographic information system/ habitat community studies/ conservation, wildlife management and recreation/ network design

Abstract: Wetland contiguity and edge were determined with a geographic information system (GIS) for five coastal counties in North Carolina, USA. The digital database was created from wetlands digitized from U.S. Fish and Wildlife Service National Wetlands Inventory maps. The GIS analysis was based on three classes of information: 1) all wetlands as one class; 2) wetlands separated by dominant vegetative community type (e.g., forest, shrub, or marsh); and 3) forest and shrub wetlands further separated by dominant vegetation (e.g., evergreen, deciduous, or mixed). The contiguity analysis supports the perception that the lower coastal plain counties are dominated by large contiguous wetlands. When wetlands were lumped into one class, the number of wetlands > 1,000 ha ranged from 2 to 7 and the area accounted for 77 to 96% of the total wetland area. Several of those sites were > 100,000 ha in size. When wetlands were separated into more specific classes, the number of sites < 10 ha ranged from 416 to 3,370, but the wetland area in this size class was < 5% of the total wetland area. The average size of evergreen forest and shrub wetlands was typically much greater than deciduous forest and shrub wetlands, a reflection of the configuration of large, block pocosin wetlands. Percent edge was also typically lower for the evergreen forest and shrub wetlands than for deciduous forest and shrub wetlands. The counties with the highest number of wetland sites in transition to other uses have the most land owned by private timber companies. Contiguity analysis of wetlands with GIS provides landscape-scale information for natural resource management issues such as preserve design, habitat fragmentation, rare species management, and species migration opportunities.

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592. Creation and restoration of coastal wetlands of the northeastern United States.

Shisler, J. K.

In: Wetland Creation and Restoration: The Status of the Science.

Covelo, Calif.: Island Press, 1990; pp. 143-170.

Notes: ISBN: 1559630450

NAL Call #: QH541.5.M3W462

Descriptors: artificial wetlands/ coastal zone management/ habitat restoration/ water resources management/ wetland restoration/ monitoring/ performance evaluation/ vegetation establishment/ water resources development/ watershed management

Abstract: The wetlands of the coastal zone of the northeast have been managed since the colonization of the United States. Restoration work associated with mitigation of impacts has been going on in the region for over twenty years. Despite this history, there has not been an extensive evaluation of these projects to determine their success and how they function. The mitigation process should be directed towards a management approach that is concerned with the total system instead of just the 'vegetated' wetland. Goals should be based upon a wetland system's requirements within a watershed or region. The use of adjacent wetlands as models is critical in this process. Monitoring the created or restored wetlands can provide an important database which can be used in planning future projects. Goals, clearly defined in the design process, will promote meaningful evaluations. (Author's abstract)

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593. Cypress domes in north Florida: Invertebrate ecology and response to human disturbance.

Leslie, Andrea J.; Prenger, Joseph P.; and Crisman, Thomas L.
 In: *Invertebrates in freshwater wetlands of North America: Ecology and management/* Batzer, Darold P.; Rader, Russell B.; and Wissinger, Scott A.
 New York: John Wiley & Sons, 1999; pp. 105-119.
Notes: ISBN: 0471292583
NAL Call #: QL365.4.A1158
Descriptors: Invertebrata/ disturbance by man/ human disturbance effects on pondcypress swamps communities/ community structure/ population density/ pondcypress swamps community/ swamp/ human disturbance effects/ Florida/ pondcypress swamps aquatic community/ response to human disturbance
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594. Denitrification and soil characteristics of wetlands created on two mine soils in east Texas, USA.

Johns, D.; Williams, H.; Farrish, K.; and Wagner, S.
Wetlands 24(1): 57-67. (2004)
NAL Call #: QH75.A1W47; *ISSN:* 0277-5212
Descriptors: soil properties/ denitrification/ artificial wetlands/ mine wastes/ lignite/ land reclamation/ mining/ sediment properties/ nitrogen cycle/ soil/ nitrates/ USA, Texas
Abstract: Recovery of wetland function is the primary goal of wetland creation. This study was undertaken to quantify denitrification and soil characteristics of wetlands created after lignite mine reclamation in east Texas, USA. Surface-soil denitrification rate and capacity were quantified using an acetylene (C₂H₂) inhibition/gas chromatography method in created wetlands of two age classes (4-8 years, and 10 years) on two mine soil types. Soil texture, pH, total-N, ammonium (NH₄⁺), nitrate (NO₃⁻), cation exchange capacity (CEC), total-P, and organic matter (OM) content were determined. Soil characteristics varied by soil type and by age. Denitrification rate ranged from less than 1 to 105 kg N ha⁻¹yr⁻¹, was highly variable, but did not differ among created wetlands. Denitrification rate was similar between natural and created wetlands. Denitrification capacity, denitrification rate when nitrate is in excess, ranged from 23 to 302 kg N ha⁻¹yr⁻¹ and varied by soil type. Denitrification appears to function as well in wetlands created on mine soil as in natural wetlands, but may be limited by soil characteristics.
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595. Denitrification enzyme activity of fringe salt marshes in New England (USA).

Wigand, C.; McKinney, R. A.; Chintala, M. M.; Charpentier, M. A.; and Groffman, P. M.
Journal of Environmental Quality 33(3): 1144-1151. (2004)
NAL Call #: QH540.J6; *ISSN:* 0047-2425
Descriptors: water pollution/ pollution control/ pollution load/ salt marshes/ watersheds/ wetland soils/ conservation buffers/ soil enzymes/ enzyme activity/ denitrification/ seasonal variation/ nitrogen/ phosphorus/ soil amendments/ Rhode Island
Abstract: Coastal salt marshes are a buffer between the uplands and adjacent coastal waters in New England (USA). With increasing N loads from developed watersheds, salt marshes could play an important role in the water quality maintenance of coastal waters. In this

study we examined seasonal relationships between denitrification enzyme activity (DEA) in salt marshes of Narragansett Bay, Rhode Island, and watershed N loadings, land use, and terrestrial hydric soils. In a manipulative experiment, the effect of nutrient enrichment on DEA was examined in a saltmeadow cordgrass [*Spartina patens* (Aiton) Muhl.] marsh. In the high marsh, DEA significantly ($p < 0.05$) increased with watershed N loadings and decreased with the percent of hydric soils in a 200-m terrestrial buffer. In the low marsh, we found no significant relationships between DEA and watershed N loadings, residential land development, or terrestrial hydric soils. In the manipulation experiment, we measured increased DEA in N-amended treatments, but no effect in the P-amended treatments. The positive relationships between N loading and high marsh DEA support the hypothesis that salt marshes may be important buffers between the terrestrial landscape and estuaries, preventing the movement of land-derived N into coastal waters. The negative relationships between marsh DEA and the percent of hydric soils in the adjacent watershed illustrate the importance of natural buffers within the terrestrial landscape. Denitrification enzyme activity appears to be a useful index for comparing relative N exposure and the potential denitrification activity of coastal salt marshes. This citation is from AGRICOLA.

596. Denitrification in a constructed wetland receiving agricultural runoff.

Poe, A. C.; Piehler, M. F.; Thompson, S. P.; and Paerl, H. W.
Wetlands 23(4): 817-826. (2003)
NAL Call #: QH75.A1W47; *ISSN:* 0277-5212
Descriptors: artificial wetlands/ agricultural runoff/ denitrification/ nitrogen removal/ water quality control/ nutrient loading/ runoff/ water quality/ estuaries/ brackishwater pollution/ agricultural pollution/ pollution control/ restoration/ environment management/ nitrogen/ nutrients/ pollution load/ fluvial sediments/ sediments/ water pollution control/ surface water/ USA, North Carolina, Neuse R./ artificial wetlands
Abstract: Constructed wetlands are recognized as a means to improve water quality through nitrogen (N) removal. Water-quality concerns in the N-sensitive Neuse River Estuary, North Carolina, USA, have necessitated enactment of a 30% reduction in nitrogen (N) loading accompanied by an N loading cap. Open Grounds Farm (OGF) is an 18,220-ha row-crop farm located in the lower Neuse River Estuary. In 1999, a wetland was constructed to remove nutrients (N and Phosphorus), sediment, and pathogens in surface water draining from a 971-ha area of OGF. The wetland site is 5.1 ha of alternating segments of emergent marsh and open water. Nitrogen removal from the wetland via denitrification was measured monthly by analysis of dissolved nitrogen, oxygen, and argon in laboratory incubated sediment chambers using a Membrane Inlet Mass Spectrometer (MIMS). Nitrate concentration appeared to be the primary variable controlling denitrification rates. Spatial and temporal variability in rates of denitrification were investigated, including pre- and post- N loading events. Following rainfall, there was a 400% increase in denitrification rates in response to increased inorganic N loading. Nutrient loads entering and leaving the wetland were determined from nutrient analysis (twice monthly), intensive precipitation

event sampling, and continuous flow measurements at the entrance and exit of the wetland. Results indicated that the wetland received variable N loading (1-1,720 kg N per month) and had variable N removal via denitrification (8-81 kg N per month). Denitrification was an important mechanism for N removal.

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597. The design of ecological landscape models for Everglades restoration.

Sklar, F. H.; Fitz, H. C.; Wu, Y.; Van Zee, R.; and McVoy, C.

Ecological Economics 37(3): 379-401. (June 2001)

NAL Call #: QH540.E26; ISSN: 0921-8009.

Notes: Special Section: South Florida: The Reality of Change and The Prospects for Sustainability.

Descriptors: wetlands/ models/ environmental restoration/ landscape/ human impact/ hydrology/ USA, Florida, Everglades/ model studies/ ecology/ landscaping/ restoration/ phosphorus/ plant populations/ man-induced effects/ pollution effects/ ecosystem disturbance/ ecosystem management/ ecological distribution/ environment management/ environmental policy/ water management/ plant communities/ water quality/ mathematical models/ storm water/ trophic levels/ Typha/ Cladium/ USA, Florida, Everglades/ models/ modeling, mathematics, computer applications/ evaluation process/ protective measures and control/ land/ general environmental engineering/ reclamation

Abstract: Restoration of the Everglades is a multi-objective, multi-scale, multi-agency program that requires numerous computer models to test alternatives, understand ecosystem processes, and evaluate restoration performance. Landscape models used for Everglades restoration include hydrologic models, transition probability models, gradient models, distributional mosaic models, and individual-based models. As tools for restoration feasibility and as the backbone of the policies that will drive Everglades restoration for the next 20 years, it is critical that a wide audience evaluate the strengths and weaknesses of six landscape models. Simulations of historic hydropatterns and current hydropatterns, based mostly upon sheet-flow equations and canal-flow equations, respectively, have been the realm of the Natural Systems Model (NSM) and the South Florida Water Management Model (SFWMM). Despite a lack of biology in these two models, a comparison of their spatial output became the basis for the Comprehensive Everglades Restoration Plan (CERP) approved by the US Congress in October, 2000. SAWCAT, a transitional probability model, was based upon an analysis of the patchiness of cattail (*Typha*) and sawgrass (*Cladium*) cells in association with levees, water depth, and phosphorus. This statistical approach was used to predict the amount of sawgrass that would be converted to less desirable cattail, if phosphorus runoff patterns to the Everglades remained constant. The Everglades Water Quality Model (EWQM), a mass-balance gradient approach used to track phosphorus according to a simple net phosphorus removal coefficient, was used to design Storm Water Treatment Areas (STA) and to evaluate where and when phosphorus 'thresholds' would be exceeded under various hydrologic restoration plans. The Everglades landscape Model (ELM), a complex distributional mosaic model, used site-specific biogeochemical mechanisms and mass-balance to control energy and material flows, and to

predict changes in carbon and phosphorus structure of the soil, water, and plant communities as a result of modified water deliveries to the Everglades. The Across Trophic Level Spatial Simulation (ATLSS), also a distributional mosaic modeling approach, used individual-based rules of behavior to predict animal movement and abundance in relation to hydrologic restoration plans. When these landscape models are combined, they effectively contribute to water management and policy for Everglades restoration. To insure their effectiveness, an applied science strategy provides the framework for their integration into the restoration process.

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598. Differential recovery of a deepwater swamp forest across a gradient of disturbance intensity.

De Steven, D. and Sharitz, R. R.

Wetlands 17(4): 476-484. (Dec. 1997)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ USA, South Carolina, Savannah R./ deep-water habitats/ swamps/ cooling water/ vegetation establishment/ forests/ canopy/ substrates/ population density/ environmental impact/ water pollution/ thermal pollution/ ecosystem disturbance/ vegetation cover/ flood plains/ hydrology/ disturbance/ ecosystem recovery/ USA, South Carolina/ *Taxodium distichum*/ *Nyssa aquatica*/ USA, South Carolina, Savannah R./ Savannah River Site/ baldcypress/ water tupelo/ water and plants/ habitat community studies/ effects on organisms

Abstract: On the Savannah River Site, South Carolina, USA, large areas of floodplain swamp forest of baldcypress (*Taxodium distichum*) and water tupelo (*Nyssa aquatica*) were destroyed by the cumulative impacts of cooling-water discharges over a 35-year period of nuclear reactor operations. In one floodplain area, four years after thermal discharges ended, we analyzed the pattern of forest recovery across a disturbance gradient spanning from a site of chronic thermal impact and extensive sediment deposition to sites of intermittent thermal impact and little substrate change. Across this spatial gradient, we measured density and size structure of cypress and tupelo and assessed regeneration success in relation to density of surviving canopy trees and to substrate changes. Compared with undisturbed forest, canopy tree density was lower in all disturbed sites and decreased progressively with greater site disturbance. Density of tree regeneration decreased in parallel with declining canopy tree density; however, regeneration was particularly low in the site of chronic impact, where very few canopy trees had survived and where substrates had been modified by sedimentation. Size structures suggested that tree recruitment had occurred synchronously during a 5-year period of regional drought and minimal river flooding. Thus, cypress-tupelo recovery was influenced both by availability of seed sources and by site conditions, but floodplain hydrology also affected regeneration. The pattern of differential recovery across the disturbance gradient has allowed the use of natural regeneration potential in efforts to restore the pre-disturbance forest, and it also illustrates several key factors in wetlands design.

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599. Distribution and characterization of forested wetlands in the Carolinas and Virginia.

Brown, M. J.

Southern Journal of Applied Forestry 21(2): 64-70. (1997)
NAL Call #: SD1.S63; ISSN: 0148-4419

Descriptors: wetlands/ forests/ sampling/ classification/ estimating/ spatial distribution/ USA, Virginia/ USA, North Carolina/ USA, South Carolina/ water and plants/ evaluation, processing and publication

Abstract: Recent forest inventories of North Carolina, South Carolina, and Virginia, included sampling for hydric vegetation, hydric soils, and wetland hydrology. Forest samples that met all 3 of these criteria were classified as forested wetland. This study characterizes wetland forests by extent, owner, age, forest type, physiography, volume, growth, and removals, and evaluates its contribution to the timber supply. Wetland stands comprise 8.1 million ac, or 17% of the forests in the 3 States. They are over 90% privately owned, they vary widely by type and physiography, and they contribute 21% of all removals. Classification of wetland area based simply on broad management class and physiography will result in inaccurate estimates.

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600. Distribution of adult Odonata among localized wetlands in east-central Mississippi.

Bried, Jason T. and Ervin, Gary N.

Southeastern Naturalist 4(4): 731-744. (2005)
NAL Call #: IPSP11706; ISSN: 1528-7092

Descriptors: species composition/ species richness/ habitat preference/ man made wetland site/ natural bottomland forest/ beta diversity index/ proportion coefficient

Abstract: We measured species richness and composition of adult Odonata and inferred habitat preferences among man-made wetland sites and surrounding tracts of natural bottomland forest. Cumulative species richness and composition were described by proportion coefficients and beta diversity indices. The three man-made sites provided open space resources, and more species were observed in each than in the floodplain forest. Twenty-nine of 42 species documented over a four-month period were observed in only one or two of the four wetlands studied. Large differences in species assemblages between the immediately adjacent ditch and marsh sites were the best evidence for high habitat affinity because distance and structural barriers to movement were absent. Such compositional asymmetry may reflect differential vegetative and reproductive suitability of the habitats. Results suggest that the open-canopy wetlands supported higher diversity of adult Odonata, and that distinct odonate assemblages were found among different habitat types in this floodplain wetland complex.

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601. The distribution of benthic infauna of a Texas salt marsh in relation to the marsh edge.

Whaley, Shannon D. and Minello, Thomas J.

Wetlands 22(4): 753-766. (2002)
NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: benthic infauna distribution/ coastal salt marsh/ elevation/ fishery production/ marsh edge relations/ nekton predator activity/ predation/ prey source/ sediment/ trophic link/ vegetated marsh surface shallow open water interface/ wetlands ecology

Abstract: Coastal salt marshes in the northern Gulf of Mexico are often highly fragmented, with a large amount of marsh edge, the interface between the vegetated marsh surface and shallow open water. Nekton predators, including many juvenile fishery species, aggregate near this marsh edge, and benthic infaunal populations are a primary source of prey for many of these predators. We examined the fine-scale (1-10 m) distributions of benthic infauna in relation to the edge of a Texas, USA salt marsh. Every six weeks for nearly a year, we sampled marsh sediments at five locations: on nonvegetated bottom 1 m from the marsh edge and on the vegetated marsh surface at 1, 3, 5, and 10 m from the edge. Surface-dwelling annelid worms and peracarid crustaceans were most abundant in low-elevation sediments near the marsh edge for most sampling periods. Because the marsh slope varied within the study area, we could distinguish between correlative relationships with elevation and distance from the marsh edge. Distributions of common surface-dwelling species were often unrelated to elevation but almost always negatively related to distance from the marsh edge. Abundances of near-surface direct deposit feeders and omnivores were related to both distance from edge and elevation. In contrast to surface dwellers, densities of abundant subsurface deposit feeders (mainly oligochaetes) were frequently greatest in sediments located away from the marsh edge. Surface and near-surface dwelling infauna are an important prey resource for nekton, including many juvenile fishery species that concentrate near the marsh edge. Populations of these infaunal prey fluctuated seasonally, with the greatest densities occurring during winter and early spring when predator abundances are generally low. Infaunal densities decreased dramatically near the marsh edge from the late spring through early fall, and this decrease coincides with historically high seasonal densities of nekton predators. Our data suggest that there is a strong trophic link between infauna and nekton near the marsh edge and that this relationship contributes to the high fishery productivity derived from Gulf Coast marshes.

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602. A dynamic nutrient budget of subsystem interactions in a salt marsh estuary.

Childers, D. L.; McKellar, H. N.; Dame, R. F.; Sklar, F. H.; and Blood, E. R.

Estuarine, Coastal and Shelf Science 36(2): 105-131. (1993)

NAL Call #: GB451.E72; ISSN: 0272-7714

Descriptors: wetlands/ estuarine chemistry/ salt marshes/ hydrodynamics/ nutrient cycles/ carbon/ nitrogen/ phosphorus/ estuarine dynamics/ tidal effects/ biogeochemical cycle/ estuaries/ nutrient dynamics/ USA, South Carolina, North Inlet Estuary/ USA, South Carolina/ nutrient dynamics/ estuarine chemistry/ carbon/ nitrogen/ phosphorus/ estuarine dynamics/ tidal effects/ biogeochemical cycle/ ecosystems and energetics/ ecology/ community studies/ organic compounds

Abstract: In tidal salt marsh estuaries, the different habitats of the ecosystem interact primarily through the tidal creek water column. These interactions include nutrient and materials exchanges with the salt marsh, oyster reefs, creek bottoms, and adjacent uplands. Nutrient budgets are often used to synthesize these kinds of subsystem exchange data, and are usually based on annual totals without accounting for nutrient variability at finer temporal

resolutions. In this paper, we present a dynamic budget of carbon (C), nitrogen (N), and phosphorus (P) for the North Inlet estuary, South Carolina that synthesizes subsystem flux data in a new way. We have developed a dynamic budget that uses a tidal hydrology model to generate daily areas of inundated intertidal habitat (i.e. vegetated marsh and oyster reef) from tidal heights calculated hourly and combines them with flux data to determine a net daily input to, or removal from, the water column. Daily surpluses or deficits of each nutrient were compared with daily rates of change in observed tidally-averaged nutrient concentrations. Particular emphasis was placed on evaluating budget output from the intertidal subsystems. We compared our total annual budgets to values from syntheses of two North Inlet flux studies.

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603. Ecological research for aquatic science and environmental restoration in South Florida.

Redfield, G. W.

Ecological Applications 10(4): 990-1005. (2000)

NAL Call #: QH540.E23; ISSN: 1051-0761

Descriptors: wetlands/ resource management/ aquatic sciences/ restoration/ research programs/ aquatic environment/ environmental restoration/ USA, Florida/ resources/ law, policy, economics and social sciences/ reclamation

Abstract: The theme of this feature--the land-water interface: science for a sustainable biosphere--provides a forum to highlight the relationship between science and resource management, using restoration of the Kissimmee-Okeechobee-Everglades (KOE) ecosystem of south Florida as a case study. This subtropical ecosystem encompasses 16 counties and 44,000 km², from the Kissimmee Chain of Lakes in central Florida to the shallow estuarine waters of Florida Bay, and is within the jurisdiction of the South Florida Water Management District. During the next two decades, the floodplain and channel of the Kissimmee River will be re-coupled into a meandering river system with riparian wetlands and a more natural hydrology. An evaluation program on this restoration has been designed using ecological concepts and will provide opportunities to corroborate river/floodplain theory and document the varied responses of biotic communities to hydrological restoration. The evaluation program will provide the information needed for adaptive management of the river/floodplain ecosystem. Scientists and engineers are testing an array of ecological hypotheses on Lake Okeechobee, a central feature of the KOE ecosystem, to reduce uncertainty in predicting responses to nutrient loading, lake stage variation, and exotic species invasion. Research on the lake has clarified the linkage between physical factors, nutrient levels and biotic variables, and the frequency of algal blooms. This information has been used to support decisions and plans for managing the lake and its watershed. Restoration of the Florida Everglades is grounded in a diverse suite of scientific projects that are contributing to wetland science, ecosystem modeling, and restoration ecology. Studies on the effects of nutrients on wetland ecosystem structure and function have provided information at several spatial scales which is being applied directly to management issues. Findings from research and monitoring have been crucial in supporting decisions on the completion of six large stormwater treatment areas in the Everglades Construction Project. At the southern edge of the ecosystem, Florida Bay

has been the focus of intensive research leading to changing paradigms on the relative effects of nutrients, turbidity, physical factors, and fresh water on the functions of this unique estuary. Scientific findings on the bay support the current direction of management actions to increase freshwater inputs from the southern Everglades, although much remains to be learned about this subtropical system.
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604. Ecosystem structure, nutrient dynamics, and hydrologic relationships in tree islands of the southern Everglades, Florida, USA.

Troxler Gann, T. G.; Childers, D. L.; and Rondeau, D. N. *Forest Ecology and Management* 214(1-3): 11-27. (2005)
NAL Call #: SD1.F73; ISSN: 0378-1127

Descriptors: Chrysobalanus icaco/ Everglades/ forested wetlands/ hot spots/ nutrient-use efficiency/ sheet flow/ tree islands

Abstract: Tree islands are an important structural component of many graminoid-dominated wetlands because they increase ecological complexity in the landscape. Tree island area has been drastically reduced with hydrologic modifications within the Everglades ecosystem, yet still little is known about the ecosystem ecology of Everglades tree islands. As part of an ongoing study to investigate the effects of hydrologic restoration on short hydroperiod marshes of the southern Everglades, we report an ecosystem characterization of seasonally flooded tree islands relative to locations described by variation in freshwater flow (i.e. locally enhanced freshwater flow by levee removal). We quantified: (1) forest structure, litterfall production, nutrient utilization, soil dynamics, and hydrologic properties of six tree islands and (2) soil and surface water physico-chemical properties of adjacent marshes. Tree islands efficiently utilized both phosphorus and nitrogen, but indices of nutrient-use efficiency indicated stronger P than N limitation. Tree islands were distinct in structure and biogeochemical properties from the surrounding marsh, maintaining higher organically bound P and N, but lower inorganic N. Annual variation resulting in increased hydroperiod and lower wet season water levels not only increased nitrogen use by tree species and decreased N:P values of the dominant plant species (*Chrysobalanus icaco*), but also increased soil pH and decreased soil temperature. When compared with other forested wetlands, these Everglades tree islands were among the most nutrient efficient, likely a function of nutrient immobilization in soils and the calcium carbonate bedrock. Tree islands of our study area are defined by: (1) unique biogeochemical properties when compared with adjacent short hydroperiod marshes and other forested wetlands and (2) an intricate relationship with marsh hydrology. As such, they may play an important and disproportionate role in nutrient and carbon cycling in Everglades wetlands. With the loss of tree islands that has occurred with the degradation of the Everglades system, these landscape processes may have been altered. With this baseline dataset, we have established a long-term ecosystem-scale experiment to follow the ecosystem trajectory of seasonally flooded tree islands in response to hydrologic restoration of the southern Everglades.
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605. Effects of dominant species on vegetation change in Carolina bay wetlands following a multi-year drought.

Mulhouse, John M.; De Steven, Diane; Lide, Robert F.; and Sharitz, Rebecca R.

Journal of the Torrey Botanical Society 132(3): 411-420. (2005)

NAL Call #: QK1.J687; ISSN: 1095-5674

<http://www.srs.fs.usda.gov/pubs/21578>

Descriptors: Carolina bays/ climate variation/ depression wetlands/ drought/ plant colonization/ succession/ vegetation dynamics

Abstract: Wetland vegetation is strongly dependent upon climate-influenced hydrologic conditions, and plant composition responds in generally consistent ways to droughts. However, the extent of species composition change during drought may be influenced by the pre-existing structure of wetland vegetation. We characterized the vegetation of ten herbaceous Carolina bay wetlands on the South Carolina Upper Coastal Plain during a period of average rainfall and again near the end of a four-year drought. We hypothesized that, as a group, bays dominated by less robust plant species (characteristic of open-water pond and depression meadow vegetation types) would show greater compositional change than bays dominated by dense, robust-form clonal graminoids (characteristic of grass and sedge marsh vegetation types). Aquatic species decreased during the drought in all wetlands, regardless of vegetation group. Compared to grass/sedge marshes, pond/meadow wetlands acquired more species, particularly non-wetland species, during the drought. Pond/meadow wetlands also had greater increases in the abundances of species that require unflooded conditions to establish. Prior to the drought, all wetlands were ponded almost continuously, but during drought the pond/meadow wetlands had shorter and more variable hydroperiods than the grass/sedge marshes. Thus, vegetation change may be partly confounded with hydrologic conditions that provide greater opportunities for species recruitment in pond/meadow bays. The results suggest that Carolina bay vegetation dynamics may differ as a function of dominant vegetation and climate driven variation in wetland hydrologic condition.

This citation is from Treesearch.

606. Fish assemblage structure in relation to environmental variation in a Texas Gulf Coastal wetland.

Gelwick, F. P.; Akin, S.; Arrington, D. A.; and Winemiller, K. O.

Estuaries 24(2): 285-296. (2001)

NAL Call #: GC96.E79; ISSN: 0160-8347

Descriptors: wetlands/ community structure/ marshes/ coastal environments/ seasonal variations/ species diversity/ estuaries/ habitats/ salt marshes/ estuarine environment/ fish migration/ fish populations/ water depth/ flooding/ dissolved oxygen/ habitat/ seasons/ floods and flooding/ oxygen (dissolved)/ organism aggregations/ brackishwater fish/ freshwater fish/ community composition/ ecological zonation/ indicator species/ salinity gradients/ vertical distribution/ environmental factors/ pisces/ USA, Texas, Matagorda Bay/ seasonal variations

Abstract: We described seasonal fish-assemblages in an estuarine marsh fringing Matagorda Bay, Gulf of Mexico. Habitat zones were identified by patterns of fish species

abundance and indicator species optima along gradients in salinity, dissolved oxygen (DO), and depth in our samples. Indicators of the lower brackish zone (lower lake and tidal bayou closest to the bay) were gulf menhaden (*Brevoortia patronus*), bay anchovy (*Anchoa mitchilli*), silver perch (*Bairdiella chrysoura*), and spotted seatrout (*Cynoscion nebulosus*) at salinity > 15ppt, DO 7-10 mg l super(-1), and depth < 0.5 m. Indicators of the upper brackish zone (lake and fringing salt marsh) were pinfish (*Lagodon rhomboides*) and spot (*Leiostomus xanthurus*) at salinity 10-20ppt, DO > 10 mg l super(-1), and depth < 0.5 m. In the freshwater wetland zone (diked wetland, ephemeral pool, and perennial scour pool), indicators were sheephead minnow (*Cyprinodon variegatus*), rainwater killifish (*Lucania parva*), mosquitofish (*Gambusia affinis*), and sailfin molly (*Poecilia latipinna*) at salinity < 5ppt, DO < 5 mg l super(-1), and depth greater than or equal to 1 m. In the freshwater channelized zone (slough and irrigation canal), indicators were three sunfish species (*Lepomis*), white crappie (*Pomoxis annularis*), and gizzard shad (*Dorosoma cepedianum*) at salinity < 5ppt, DO < 5 mg l super(-1), and depth > 1.5 m. In brackish zones, seasonal variation in species diversity among sites was positively correlated with temperature, but assemblage structure also was influenced by depth and DO. In the freshwater zones, seasonal variation in species diversity among sites was positively correlated with depth, DO, and salinity, but assemblage structure was weakly associated with temperature. Species diversity and assemblage structure were strongly affected by the connectivity between freshwater wetland and brackish zones. Uncommon species in diked wetlands, such as tarpon (*Megalops atlanticus*) and fat sleeper (*Dormitator maculatus*), indicated movement of fishes from the brackish zone as the water level rose during natural flooding and scheduled (July) releases from the diked wetland. From September to July, diversity in the freshwater wetland zone decreased as receding waters left small isolated pools, and fish movement became blocked by a water-control structure. Subsequently, diversity was reduced to a few species with opportunistic life histories and tolerance to anoxic conditions that developed as flooded vegetation decayed.

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607. Florida Everglades: Natural variability, invertebrate diversity, and foodweb stability.

Rader, Russell B.

In: *Invertebrates in freshwater wetlands of North America: Ecology and management*/ Batzer, Darold P.; Rader, Russell B.; and Wissinger, Scott A.

New York: John Wiley & Sons, 1999; pp. 25-54.

Notes: ISBN: 0471292583

NAL Call #: QL365.4.A1158

Descriptors: Invertebrata/ food webs/ wetland community stability/ community structure/ Piscean predators/ predation influence on wetland communities/ chemical pollution/ eutrophication threat to wetland communities/ physical factors/ hydrological variation influence on wetland communities/ Florida/ Florida Everglades/ wetland community diversity and food web stability/ overview

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608. Florida Wetland Condition Index for depressional forested wetlands.

Reiss, K. C.

Ecological Indicators 6(2): 337-352. (2006);

ISSN: 1470-160X

Descriptors: biological integrity/ Florida wetland condition index/ forested wetlands/ landscape development intensity/ urban wetlands

Abstract: Increasingly in the last decade biological monitoring and assessment have been used by federal and state agencies to assess water quality standards as required under the Clean Water Act. These efforts have led to the development of indices of biological integrity (often referred to as IBIs). Many states have created multi-metric indices, incorporating individual metrics into a quantitative value of community condition or biological integrity. The primary objective of this study was to develop the Florida Wetland Condition Index (FWCI) as a tool to evaluate the biological integrity of Florida depressional freshwater forested wetlands. Vegetative community composition and chemical and physical water and soil parameters were measured at 118 wetlands throughout Florida. An independent measure of the human disturbance gradient, the Landscape Development Intensity (LDI) index, which is based on the use of nonrenewable energy within a 100 m buffer around a wetland, was calculated. Six macrophyte community composition metrics were selected for inclusion in the FWCI based on the strength of correlation with LDI ($P < 0.01$) and differentiation between low (LDI < 2.0) and high (LDI ≥ 2.0) LDI groups ($P < 0.01$). The metrics included tolerant indicator species, sensitive indicator species, exotic species, floristic quality assessment index, native perennial species, and wetland status species. Metrics were scaled between 0 and 10, with 10 representing the reference wetland condition (correlating to wetlands in undeveloped landscapes). Scaled metrics were then added together to create the FWCI, with values ranging from 0 to 60. The FWCI was significantly correlated with LDI ($P < 0.001$), and significantly differentiated among sample wetlands categorized by low and high LDI groups ($P < 0.001$). In addition, significant correlations were found among the six metrics, FWCI, and LDI with measured chemical and physical water and soil parameters, including water column pH, turbidity, ammonia-nitrogen concentration, and total phosphorus concentration, and soil moisture, organic matter, total Kjeldahl nitrogen, and total phosphorus concentration. The primary efficacy of the FWCI was the calculation of a quantitative value of biological integrity for wetlands across a gradient of anthropogenic land use activities, which can be used objectively to assess water quality standards of Florida wetlands.

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609. Floristics of wetland pine savannas in the Big Thicket National Preserve, southeast Texas.

MacRoberts, Barbara R. and MacRoberts, Michael H.

Phytologia 85(1): 40-50. (1998)

NAL Call #: 450 P563; ISSN: 0031-9430

Descriptors: wetland pine savanna/ checklist

Abstract: We describe the floristics and edaphic conditions of wetland pine savannas in southeastern Texas.

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610. Forested limesink wetlands of southwest Georgia: Invertebrate habitat and hydrologic variation.

Golladay, Stephen W.; Entrekin, Sally; and Taylor, Brad W. In: *Invertebrates in Freshwater Wetlands of North America: Ecology and Management*/ Batzer, Darold P.; Rader, Russell B.; and Wissinger, Scott A.

New York: John Wiley, 1999; pp. 197-216.

Notes: ISBN: 0471292583

Descriptors: Invertebrata/ community structure/ population density/ forested limesink wetland communities/ semiaquatic habitat/ forest and woodland/ physical factors/ flooding/ hydrologic influences on forested limesink wetland communities/ Georgia, USA/ hydrologic influences

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611. Forms and amounts of soil nitrogen and phosphorus across a longleaf pine-depressional wetland landscape.

Craft, Christopher B. and Chiang, Connie

Soil Science Society of America Journal 66(5):

1713-1721. (2002)

NAL Call #: 56.9 So3; ISSN: 0361-5995

Descriptors: freshwater ecology: ecology, environmental sciences/ soil science/ terrestrial ecology: ecology, environmental sciences/ carbon:nitrogen:phosphorus ratios/ drainage gradients/ landscape position: degree of wetness, drainage/ longleaf pine depressional wetland landscape/ longleaf pine wiregrass forests/ nutrient retention/ periodic waterlogging/ sandy soils/ soil organic matter

Abstract: Forms and amounts of soil N and P were measured across transects from freshwater depressional wetlands into longleaf pine-wiregrass forests of southwestern Georgia to evaluate changes in labile vs. recalcitrant N and P and C:N:P ratios across drainage gradients. Plant-available $\text{NO}_3\text{-N}$ (3.7 mug cm^{-3}) and organic N (2000 mug cm^{-3}) were significantly greater in wetland than upland soils ($\text{NO}_3\text{-N}=0.03 \text{ mug cm}^{-3}$, organic N= 890 mug cm^{-3}) and C:N increased from wetlands (17:1) into uplands (43:1). Forms and amounts of P were not as strongly related to landscape position as N. Labile organic P (Po , 2.6 mug cm^{-3}) was significantly greater in wetland than upland soils (0.88 mug cm^{-3}). Recalcitrant organic compounds accounted for 95 to 97% of the N and 50 to 82% of the P stored in wetland and upland soils. Wetland soils stored a disproportionately large share of N as compared with upland soils even though soil organic matter (C) content was uniform across the landscape. Landscape position (drainage, degree of wetness) is an important determinant of nutrient retention in sandy soils of the southeastern coastal plain. Periodic waterlogging favors sequestration of biological (organic) forms of N and P with proportionally greater storage of N relative to P. Soil waterlogging by promoting accumulation of N more than P favors a shift from N limitation in upland soils towards P limitation in wetland soils of the southeastern coastal plain.

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612. Functional equivalency of natural and excavated coastal plain ponds.

Zampella, R. A. and Laidig, K. J.

Wetlands 23(4): 860-876. (2003)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ ponds/ hydrology/ water quality/ vegetation patterns/ restoration/ pH/ species diversity/ community composition/ total organic carbon/ coastal zone/

environmental effects/ slopes (topography)/ ecological zonation/ biodiversity/ land use/ plant populations/ vegetation cover/ light transmission/ hydrogen ion concentration/ coastal plains/ vegetation/ organic carbon/ species composition/ water depth/ watersheds/ substrates/ Plantae/ USA, New Jersey/ comparative studies/ New Jersey pinelands

Abstract: A major obstacle to assessing functional equivalency of restored or created wetlands is the time needed to develop the functions of natural wetlands. We compared hydrologic, water-quality, and vegetation-composition functions of nine natural coastal plain ponds in the New Jersey Pinelands with those of four small, well-established excavated basins that are at least 50 years old. Our study revealed that well-established (> 50 yr old) excavated ponds achieved a moderate degree of functional equivalency with Pinelands wetlands, representing a range of coastal plain pond characteristics. Based on water-depth-fluctuation patterns and the similarity of most hydrologic indices, including high-water pond area, mean water depth, area of exposed substrate (drawdown), and the presence of a clay lens, the excavated ponds seemed to achieve hydrologic equivalency with the natural reference wetlands. However, steeper bank slopes found at most of the excavated ponds affected nearshore water depths and resulted in the absence of plant zonation that characterizes coastal plain ponds. The water-quality function, represented by pH, specific conductance, and total organic carbon, differed between pond types. The pH and specific conductance of the excavated ponds were higher and total organic carbon concentrations were lower compared with the natural ponds. We attributed these differences to landscape setting, reflected by adjacent vegetation and contrasting plant zonation. Elevated specific conductance values in the natural ponds were likely due to the higher hydrogen ion concentrations. Reduced light transmission due to higher organic carbon concentrations in the natural ponds may have greater ecological importance. However, differences in water-quality functions between the pond types may make excavated ponds more prone to changes in pH if constructed within landscapes with extensive developed or agricultural lands. The excavated ponds met or exceeded most vegetation-composition reference criteria associated with the natural wetlands. Total and herbaceous species richness were greater in the excavated ponds. Most importantly, the excavated ponds supported a native Pinelands species composition, thus preserving regional biodiversity. Because all ponds were acidic and displayed pH values within the range associated with native Pinelands plants, differences in pH may not have been the cause of the greater species richness. Although overall species composition differed between the two pond types, the flora of the created wetlands was similar to that of coastal plain ponds found in other regions and other areas of the Pinelands. The major difference in vegetation composition between ponds was both the lack of distinct vegetation zonation due to steeper slopes and lower patch-type diversity in the excavated ponds. These structural differences can be overcome by constructing ponds with slopes that are comparable to natural ponds. Because the transitional-upland location of the excavated ponds is a more likely location for a mitigation wetland, the effect of landscape setting on water quality may not be as easily remedied as the lack of nearshore slopes.

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613. Functions and values of forested wetlands in the southern United States.

Walbridge, M. R.

Journal of Forestry 91(5): 15-19. (1993)

NAL Call #: 99.8 F768; ISSN: 0022-1201

Descriptors: wetlands/ watershed management/ forest hydrology/ ecosystems/ flood control/ water quality/ water use/ land use/ biogeochemistry/ hydrology/ resource management/ USA/ resource management/ watershed management/ forest hydrology/ water use/ watershed protection/ conservation, wildlife management and recreation/ freshwater pollution

Abstract: Forested wetlands in the southern United States include bottomland hardwood forests, cypress swamps, and pocosin and bay forest ecosystems—a comparatively unique feature of the Carolina coastal plain. Hardwood swamps also line major black-, brown-, and redwater rivers of the Atlantic and Gulf coastal plain. This heterogeneous group of wetlands exhibits an equally diverse range of functions and values, from controlling flooding to maintaining water quality, coastal fisheries, and wildlife habitat. This article will quantify the importance of southern forested wetlands. It will also identify their specific functions and values, focusing on the biogeochemical functions that lead to improved water quality, and suggest strategies for wise use and management.

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614. The Great Dismal Swamp: An illustrated case study.

Carter, V.

In: *Forested Wetlands*/ Lugo, Ariel E.; Brinson, Mark M.; and Brown, S. K.; Series: *Ecosystems of the World* 15. New York: Elsevier Science Publishing Co., 1990; pp. 201-211.

Notes: ISBN: 0444428127

NAL Call #: QH540.E27 no.15

Descriptors: Great Dismal Swamp/ North Carolina/ plant populations/ remote sensing/ swamps/ Virginia/ wetland forests/ anthropogenic disturbance/ ecosystems/ hydrology/ litter/ nutrients/ phytoplankton/ vegetation/ water quality/ wildlife habitats

Abstract: The Great Dismal Swamp is an 84,000 ha forested wetland on the Virginia-North Carolina border in the southern Atlantic Coastal Plain of the United States. The organic soils of the swamp range in depth from 4 m in ancient drainage channels to less than 0.3 m along the outer edges. Lake Drummond, approximately 4 km in diameter, is almost centrally located within the swamp. The flora includes individual species and plant assemblages otherwise scattered widely to the north and south along the Coastal Plain. Anthropogenic disturbance of the natural vegetation has resulted in a wide diversity of wildlife habitats. Present studies include the dynamics of the wetland-to-upland transition zone, wetland hydrology, litter production and nutrient studies in individual communities, water quality and phytoplankton populations in the lake and ditches, vegetation trends and regeneration strategies, organic soil development and wildlife habitat requirements. Remotely-sensed data provide an overview and level of detail needed to put small areas into perspective with the total ecosystem represented by this swamp.

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615. Habitat use by nonbreeding wood ducks in the Coastal Plain and Rice Prairie Region of Texas.

Anderson, James T. and Tacha, Thomas C.

Southwestern Naturalist 47(3): 486-489. (2002)

NAL Call #: 409.6; ISSN: 0038-4909

Descriptors: aquatic habitat/ forested wetlands/ habitat types/ habitat use

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616. Heterogeneity of hydromorphic features: Observations from a Coastal Plain hydrosequence.

Tangren, S. A.; Fanning, D. S.; Presteggaard, K. L.; and Rabenhorst, M. C.

In: Quantifying soil hydromorphology Proceedings of a symposium, Indianapolis, Indiana, 4 November 1996.

Rabenhorst, M. C.; Bell, J. C.; and McDaniel, P. A. (eds.) Madison, WI: Soil Science Society of America;

pp. 173-193; 1998.

Descriptors: soil variability/ sampling/ soil classification/ sandy loam soils/ coastal plain soils/ soil/ redox potential/ soil morphology/ hydrosequences/ forests/ internal drainage/ upland soils/ wetland soils/ catenas

Abstract: The following are discussed: (i) the variability that results from choice of a sampling site within a pedon, (ii) how that variability affects the ability to detect catenary variation, (iii) within-pedon heterogeneity as a function of catenary position, and (iv) the implications of within-pedon heterogeneity for soil classification. The study site is a valley situated on glauconitic sandy-loams of the Coastal Plain in Maryland, USA. Six of forty pre-existing well sites were selected for replicate soil sampling. The well sites represent a variety of soil drainage conditions, from moderately well to poorly drained. Within a pedon-sized (10-m²) area around each of the six wells, six replicate auger holes have been drilled and the profiles described (36 descriptions total). For each description, the depth to redox concentrations and redox depletions was recorded. Standard errors of the six replicated descriptions were calculated and provide a quantitative indication of each pedon's redoximorphic variability. Upland pedons had a greater redoximorphic variability than wetland pedons. Variability within a pedon often affected the conclusions made about the soil. Although considerable, particularly in higher positions of the transect, variability was not so great as to obscure the landscape trend in depth to redoximorphic features. The spatial heterogeneity of hydromorphic features affected the determinations of soil drainage class, hydric soil indicators, and taxonomic classification.

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617. Historic landcover and recent landscape change in the North Indian River Lagoon Watershed, Florida, USA.

Duncan, B. W.; Larson, V. L.; and Schmalzer, P. A.

Natural Areas Journal 24(3): 198-215. (July 2004)

NAL Call #: QH76.N37; ISSN: 0885-8608

Descriptors: wetlands/ historical ecology/ lagoons/ watersheds/ maps/ ecosystem management/ environment management/ land use/ coastal lagoons/ anthropogenic factors/ marshes/ resource management/ estuaries/ river basin management/ long-term changes/ urbanization/ agriculture/ photographs/ coastal zone/ canals/ time series

analysis/ man-induced effects/ USA, Florida, Indian River Lagoon/ surveying and remote sensing/ mechanical and natural changes/ management

Abstract: Terrestrial landcover features within watersheds greatly influence aquatic systems. Humans have settled primarily in coastal regions putting tremendous stress on coastal aquatic systems. The Indian River Lagoon (IRL), located along Florida's Atlantic coast, is one of North America's most diverse estuaries surrounded by a rapidly growing human population. To quantify changes that have occurred within the watershed, we produced landcover maps representing the northern portion of the Indian River Lagoon watershed for 1920, 1943, and 1990. The 1943 and 1990 maps were generated by photo interpretation and the 1920 map was produced by spatial modeling techniques. All anthropogenic landcover types increased throughout the study period, while all native landcover types decreased, with the exception of hammocks. The dominant, terrestrial landcover types in 1920 were flatwoods, scrub, and freshwater marsh. In 1943, flatwoods and scrub types were still dominant, but agriculture was the third most abundant type. In 1990 urban became the dominate landcover with flatwoods second and agriculture third. The remaining natural areas have been highly fragmented by roads, canals, and urban areas. Shoreline composition has changed, with 1% of the Indian River Lagoon study shoreline being comprised of urban in 1920 and 26% in 1990. This dataset is useful for identifying changes in functional landcover, which will help improve the management of resources within the IRL watershed and support important ecological studies investigating the relationships between nature and anthropogenic influences.

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618. History of Delaware and New Jersey salt marsh restoration sites.

Philipp, K. R.

Ecological Engineering 25(3): 214-230. (2005)

NAL Call #: TD1.E26; ISSN: 0925-8574

Descriptors: diked marshes/ restoration planning/ tidal marsh geomorphology/ tidal marshland use

Abstract: Humans have modified the tidal marsh sites of the Public Service Enterprise Group Estuary Enhancement Program over the past 400 years as well as by natural processes such as sea level change and storms. We used the data reported here - photographs and maps that showed the range of changes and the time frame in which these changes occurred - as the basis for restoration design. These data show the ephemeral nature of some salt marsh features and the persistence of others, despite centuries of diking, hurricanes and flooding. These data were used to develop the restoration time lines and the expectations as to marsh form and function. The individual history of each restoration site is reviewed through historic maps and aerial photographs and is followed by reference to site features, such as drainage ditches, channels, tidal range, vegetation change, and land use over time.

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619. Influence of restoration and succession on bottomland hardwood hydrology.

Kolka, R. K.; Singer, J. H.; Coppock, C. R.; Casey, W. P.; and Trettin, C. C.

Ecological Engineering 15(Suppl. 1): S131-S140. (Sept. 2000)

NAL Call #: TD1.E26; ISSN: 0925-8574

Descriptors: wetlands/ environmental restoration/ hydrology/ ecological succession/ vegetation cover/ ecosystem disturbance/ geomorphology/ USA, South Carolina/ reclamation/ protective measures and control
Abstract: The hydrologic pathways of four bottomland hardwood wetland sites were investigated with transects consisting of nests of shallow wells and piezometers. Sites included a disturbed but recently restored system, two disturbed systems that are recovering naturally and a relatively undisturbed reference site. Water table elevations in both uplands and bottomlands were significantly higher in the reference site than in disturbed sites. Hydrologic budgets were developed that included throughfall inputs, upland inputs, bottomland interflow, bottomland losses to the stream and evapotranspiration (ET) losses. The recently restored bottomland had significantly higher throughfall and lower ET than the naturally recovering sites. Higher throughfall and lower ET is attributed to canopy manipulations that occurred during restoration. Other hydrologic fluxes are relatively similar among the disturbed sites. Reference site flow pathways were significantly different than those of the disturbed sites. Higher ET in the reference site is attributed to differences in canopies between the reference and disturbed sites. Higher upland inputs, bottomland interflow, and bottomland losses to the stream are the result of higher water tables in the reference site. Lower water tables in disturbed sites may be caused by the geomorphic changes that occurred during elevated flow periods prior to recovery.

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620. Influences of herbivory and canopy opening size on forest regeneration in a southern bottomland hardwood forest.

Castleberry, S. B.; Ford, W. M.; Miller, K. V.; and Smith, W. P.

Forest Ecology and Management 131(1/3): 57-64. (2000)

NAL Call #: SD1.F73; ISSN: 0378-1127

Descriptors: wetlands/ canopy gaps/ size/ bottomland forests/ natural regeneration/ browsing/ browsing damage/ wild animals/ seasonal variation/ species diversity/ fences/ species richness/ woody plants/ forbs/ habitats/ animal behaviour

Abstract: The effects were examined of white-tailed deer (*Odocoileus virginianus*) browsing and canopy opening size on relative abundance and diversity of woody and herbaceous regeneration in various sized forest openings in a southern bottomland hardwood forest at the Savannah River Site in South Carolina, USA, over 3 growing seasons (1995-1997). 36 canopy openings (gaps) were created by group selection timber harvest in December 1994, ranging from 7 to 40 m in radius. Fenced exclosures of 2 types (excluding either deer alone, or deer and swamp rabbits, *Sylvilagus aquaticus*) were constructed in the centre of each gap, with unfenced adjacent controls, and vegetation was sampled monthly from April to September. Plant species richness, diversity, evenness, relative abundance, and a browsing index were calculated for each gap size

and for each exclosure type. Herbaceous richness, diversity, or evenness did not differ among exclosure types in any year of the study. Browsing index was higher in the controls in 1996 and 1997. Browsing index for woody species was highest in the controls in 1995 and 1997. Relative abundance of herbaceous species was highest in the 29 m gap size in 1997. Richness and diversity of woody species were lowest in the 29 m gap size in 1995 and 1996. Overall browsing rates on both woody and herbaceous vegetation were low throughout all 3 years of the study. Low browsing rates reflect seasonal changes in habitat use by deer. Because of the low rates of browsing, vegetative differences among exclosure treatments and gap sizes likely are not attributable to deer herbivory. Other factors, such as soil disturbance, may have influenced the initial vegetative response more than herbivory or gap size.
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621. Insecticides for insect pest control in constructed wetlands for wastewater treatment: A dilemma.

Snoddy, E. L. and Cooney, J. C.

In: Pesticides in terrestrial and aquatic environments: Proceedings of a national research conference. (Held 11 May 1989-11 May 1989 at Virginia Water Resources Research Center, Blacksburg, Va.); pp. 440-443; 1989.

NAL Call #: QH545.P4P4844

Descriptors: wetlands/ pesticides/ wastewater treatment/ acid mine drainage/ aquatic plants/ cattails/ domestic wastewater/ macrophytes/ mosquitoes/ organophosphorus pesticides/ wastewater treatment processes/ lakes

Abstract: The utilization of macrophytes for both primary and secondary wastewater treatment is a relatively new technology now being utilized for domestic sewage, certain industrial discharges, and acid mine drainage. Some of the major insect problems associated with these facilities include mosquitoes and other biting flies produced as a result of facility construction and operation, and plant feeding insects that may destroy the planted flora. The macrophytes utilized in these constructed wetlands, particularly the cattail *Typha latifolia*, are subject to severe depredation by the armyworm complex. In order to control this pest, insecticides must be applied immediately upon discovery of this insect on the plants. An operational case study, which describes this particular problem and the use of organophosphorus (OP) insecticides for the control of the cattail army worm *Simyra henrici* (Lepidoptera: Noctuidae) is presented. The treatments and observations were made in acid drainage treatment wetlands at Widow 's Creek Steam-Electric Plant, Stevenson, Alabama.

(Author 's abstract)

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622. Interactive effects of seed availability, water depth, and phosphorus enrichment on cattail colonization in an Everglades wetland.

Miao, S. L.; McCormick, P. V.; Newman, S.; and Rajagopalan, S.

Wetlands Ecology and Management 9(1): 39-47. (2001)

NAL Call #: QH541.5.M3 W472; ISSN: 0923-4861

Descriptors: wetlands/ nutrient enrichment/ seeds/ USA, Florida/ nutrients (mineral)/ phosphorus/ water depth/ environmental factors/ colonization/ recruitment/ air temperature/ germination/ growth/ *Typha domingensis*/ USA, Florida, Everglades/ grasses/ environmental effects/ reproduction and development

Abstract: The relative importance of seed availability, water depth, and soil phosphorus (P) concentrations on cattail (*Typha domingensis* pers.) early establishment in an Everglades wetland area was examined using seed bank analysis and controlled experiments. The experiment measured seed germination and seedling growth in tanks with cattail seed addition subjected to two P concentrations (un-enriched vs. enriched) and water depth (saturated vs. flooded soils). A limited seed bank (223 plus or minus 69 m super(2)) of cattail was found in the surface soil of the area studied. The germination of added seeds was inhibited under flooded conditions, and only 0.6% of the germination was found. In contrast, under-saturated soil conditions, a maximum of 6% and 15% germination was observed in P-un-enriched and P-enriched treatments, respectively. High mortality of seedlings occurred regardless of P treatments following a cold spell. However, P enrichment resulted in increased seedling growth and asexual propagation. These results suggested the importance of the concurrence of appropriate hydrologic regimes, P enrichment, and air temperature on the recruitment of plant species.

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623. Invertebrate communities of forested limesink wetlands in southwest Georgia, USA: Habitat use and influence of extended inundation.

Golladay, S. W.; Taylor, B. W.; and Palik, B. J.
Wetlands 17(3): 383-393. (1997)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ aquatic habitats/ invertebrates/ sinks/ limestone/ forests/ benthos/ population density/ flooding/ community composition/ ecosystem disturbance/ Invertebrata/ USA, Georgia, Dougherty Plain, Ichauway Ecological Reserve

Abstract: Limesink wetlands are a common aquatic habitat in southwest Georgia, USA. These wetlands are non-alluvial, occupying shallow depressions formed from dissolution of limestone bedrock and collapse of surface sands. They are seasonally inundated, with a typical hydroperiod extending from late February to early July. Little is known about factors influencing invertebrate community structure in limesink wetlands. Recently, it has been suggested that regular inundation and drying are important influences on community structure in some seasonal wetlands. We had an opportunity to examine this hypothesis in 3 forested limesink wetlands. Quantitative samples of invertebrates were taken monthly on benthic and wood surfaces from March 1994 through July 1995. This included a period of unusually heavy precipitation, summer and autumn of 1994, when the wetlands would normally be dry. Immediately following inundation, benthic samples were dominated by amphipods (*Crangonyx* sp.), isopods (*Caecidotea* sp.), cladocerans, and copepods. Maximum total densities (1000-4000 individuals per m super(2)) were observed within 3 months of inundation. During summer and autumn, densities decreased (< 500 individuals per m super(2)), and the benthos was dominated by larval chironomids. Wood surfaces were dominated by chironomids, with greatest densities (1000-3000 individuals per m super(2)) observed in summer and autumn. Although not quantified, freshwater sponge became very abundant on wood surfaces during autumn. During the following spring (1995), invertebrate densities on sediments remained low, and few amphipods, isopods, cladocerans, or copepods were collected. Chironomids

remained very abundant on wood. Our results suggest that extended inundation is a disturbance to some elements of wetland invertebrate communities. Extended inundation may cause short-term reductions in populations by eliminating summer refugia (amphipoda, isopoda) or by altering environmental cues necessary for the completion of life cycles (cladocerans, copepods).

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624. Invertebrates associated with woody debris in a southeastern U.S. forested floodplain wetland.

Braccia, Amy and Batzer, Darold P.

Wetlands 21(1): 18-31. (Mar. 2001)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: Invertebrata/ biomass/ community structure/ habitat utilization/ woody debris in forested wetland/ semiaquatic habitat/ forest and woodland/ forested wetland/ communities associated with woody debris/ South Carolina/ Coosawhatchie River floodplain/ communities associated with woody debris in forested wetland/ survey and influencing factors

Abstract: Woody debris is an ecologically important resource in upland forests and stream ecosystems. Although much is known about invertebrate-woody debris interactions in forests and streams, little information exists for forested wetlands. In this study, invertebrates associated with woody debris in a Southeastern U. S. forested floodplain are described and factors that shape community structure are examined. Woody debris samples were collected during two wet (March 1998 and 1999) and one dry period (August 1998) from a bottomland hardwood wetland along the Coosawhatchie River, South Carolina, USA. During wet period collections, both submersed and floating woody debris were collected. Invertebrate richness, density, and arthropod standing-stock biomass were compared among sampling periods (wet and dry), between floating and submersed wood, and among woody debris decay classes. Most invertebrate richness and arthropod biomass was associated with wood collected during wet periods. However, the non-aquatic rather than aquatic arthropods were the most significant component of the overall community structure. Floating woody debris was a "hot spot" for invertebrate richness and arthropod biomass. Increased invertebrate richness was also associated with well-decayed wood. Invertebrates were classified based on temporal use of woody debris and included perennial residents, seasonal colonizers, and seasonal refugees. Overall findings suggest that woody debris is an important resource for invertebrates, and wood-associated invertebrates (especially non-aquatics) need to be considered when studying the diversity and function of forested wetlands.

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625. Landscape-based spatially explicit species index models for Everglades restoration.

Curnutt, J. L.; Comiskey, J.; Nott, M. P.; and Gross, L. J.

Ecological Applications 10(6): 1849-1860. (2000)

NAL Call #: QH540.E23; ISSN: 1051-0761

Descriptors: wetlands/ models/ landscape/ environmental restoration/ USA, Florida/ ecosystem management/ nature conservation/ habitat improvement/ hydrology/ water management/ USA, Florida, Everglades/ modeling, mathematics, computer applications/ protective measures and control/ reclamation

Abstract: As part of the effort to restore the similar to 10,000-km super(2) Everglades drainage in southern Florida, USA, we developed spatially explicit species index (SESI) models of a number of species and species groups. In this paper we describe the methodology and results of three such models: those for the Cape Sable Seaside Sparrow and the Snail Kite, and the species group model of long-legged wading birds. SESI models are designed to produce relative comparisons of one management alternative to a base scenario or to another alternative. The model outputs do not provide an exact quantitative prediction of future biotic group responses, but rather, when applying the same input data and different hydrologic plans, the models provide the best available means to compare the relative response of the biotic groups. We compared four alternative hydrologic management scenarios to a base scenario (i.e., predicted conditions assuming that current water management practices continue). We ranked the results of the comparisons for each set of models. No one scenario was beneficial to all species; however, they provide a uniform assessment, based on the best available observational information, of relative species responses to alternative water-management plans. As such, these models were used extensively in the restoration planning.
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626. Landscape ecological assessment of the Chesapeake Bay Watershed.

Weber, T.

Environmental Monitoring and Assessment 94(1-3): 39-53. (June 2004)

NAL Call #: TD194; ISSN: 0167-6369

Descriptors: wetlands/ watersheds/ environmental monitoring/ ecosystem management/ conservation/ monitoring/ environmental conditions/ regional planning/ environmental policy/ land use/ resource management/ catchment areas/ ecology/ assessments/ environmental effects/ environmental protection/ catchment area/ water quality control/ environmental legislation/ agriculture/ urbanization/ rare species/ vulnerability/ policies/ runoff/ resource conservation/ nature conservation/ river basin management/ ecological evaluation/ landscape/ vegetation cover/ coniferous forests/ USA, Chesapeake Bay/ USA, Maryland/ USA, Washington, D.C./ USA, Virginia/ USA, Pennsylvania/ USA, Mid-Atlantic Region/ management/ environmental action/ water resources and supplies/ data acquisition/ conservation, wildlife management and recreation/ land/ general environmental engineering

Abstract: The Chesapeake Bay Watershed, located in the Mid-Atlantic Region of the United States, is experiencing rapid habitat loss and fragmentation from sprawling low-density development. The bay itself is heavily stressed by excess sediment and nutrient runoff. Three states, the District of Columbia, and the federal government signed an agreement in 2000 to address these problems. The commitments included an assessment of the watershed's resource lands, and targeting the most valued lands for protection. As part of this task, the Resource Lands Assessment identified an ecological network comprised of large contiguous blocks (hubs) of forests, wetlands, and streams, interconnected by corridors to allow animal and plant propagule dispersal and migration. Hubs were prioritized by ecoregion, by analyzing a variety of ecological parameters, including: rare species presence, rarity and population viability; vegetation and vertebrate richness;

habitat area, condition, and diversity; intactness and remoteness; connectivity potential; and the nature of the surrounding landscape. I found that much of the watershed was still fairly intact, although this varied dramatically by ecoregion. Current protection also varied, and an assessment of vulnerability will help focus protection efforts among the most valuable hubs and corridors.
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627. Landscape modeling for Everglades ecosystem restoration.

DeAngelis, D. L.; Gross, L. J.; Huston, M. A.; Wolff, W. F.; Fleming, D. M.; Comiskey, E. J.; and Sylvester, S. M. *Ecosystems* 1(1): 64-75. (Jan. 1998-Feb. 1998)

NAL Call #: QH540 .E3645; ISSN: 1432-9840

Descriptors: wetlands/ ecosystem management/ environmental protection/ marshes/ trophic structure/ habitat improvement/ hydrology/ food webs/ water management/ models/ landscape/ environmental restoration/ ecosystem recovery/ USA, Florida/ USA, Florida, Everglades/ ecosystems/ trophic level/ simulation/ model studies/ spatial distribution/ rehabilitation/ estimating/ habitats/ prediction/ water depth/ geographic information systems/ habitat/ USA, Florida, Everglades/ modelling/ spatial variations/ ATLSS/ landscape modeling/ conservation, wildlife management and recreation/ modeling, mathematics, computer applications/ environmental action/ reclamation

Abstract: A major environmental restoration effort is under way that will affect the Everglades and its neighboring ecosystems in southern Florida. Ecosystem and population-level modeling is being used to help in the planning and evaluation of this restoration. The specific objective of one of these modeling approaches, the Across Trophic Level System Simulation (ATLSS), is to predict the responses of a suite of higher trophic level species to several proposed alterations in Everglades hydrology. These include several species of wading birds, the snail kite, Cape Sable seaside sparrow, Florida panther, white-tailed deer, American alligator, and American crocodile. ATLSS is an ecosystem landscape-modeling approach and uses Geographic Information System (GIS) vegetation data and existing hydrology models for South Florida to provide the basic landscape for these species. A method of pseudotopography provides estimates of water depths through time at 28 x 28-m resolution across the landscape of southern Florida. Hydrologic model output drives models of habitat and prey availability for the higher trophic level species. Spatially explicit, individual-based computer models simulate these species. ATLSS simulations can compare the landscape dynamic spatial pattern of the species resulting from different proposed water management strategies. Here we compare the predicted effects of one possible change in water management in South Florida with the base case of no change. Preliminary model results predict substantial differences between these alternatives in some biotic spatial patterns.

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628. Long-term nutrient accumulation rates in the Everglades.

Reddy, K. R.; Delaune, R. D.; Debusk, W. F.; and Koch, M. S.

Soil Science Society of America Journal 57(4): 1147-1155. (1993)

NAL Call #: 56.9 So3; ISSN: 0361-5995

Abstract: The study was conducted to determine potential rates for this ecosystem along a gradient of nutrient loading. Accumulation rates were calculated using the vertical peat accretion rates, as determined by ¹³⁷Cs dating, and nutrient concentration profiles. Vertical accretion rates of peat decreased logarithmically with distance from the inflow. The C/P and N/P accumulation ratios increased with distance from the inflow, suggesting that a greater proportion of P accumulated in the system, compared with C and N. These findings suggest that P was either directly adsorbed by soil or precipitated with Ca in the water column and deposited on the soil surface. This hypothesis was further supported by a highly significant correlation between P and Ca accretion rates, suggesting that Ca-bound P controls equilibrium concentrations in this ecosystem. -from Authors

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629. Melaleuca in Florida: A literature review on the taxonomy, distribution, biology, ecology, economic importance and control measures.

Serbesoff-King, K.

Journal of Aquatic Plant Management 41: 98-112. (2003)

NAL Call #: SB614.H9; ISSN: 0146-6623

Descriptors: trees/ aquatic weeds/ aquatic plants/ exotic species/ ecological effects/ economic impact/ lakes/ literature review/ marshes/ dispersion/ rare species/ biodiversity/ geographical distribution/ literature reviews/ seed production/ environmental impact/ Melaleuca quinquenervia/ USA, Florida/ bottle brush tree/ control of water on the surface/ species interactions: pests and control

Abstract: Melaleuca (*Melaleuca quinquenervia* (Cav.) S.T. Blake) is a large tree species that occurs naturally throughout eastern Australia, New Caledonia, Irian Jaya and southern New Guinea. In North America, melaleuca has primarily infested the Florida peninsula south of Lake Okeechobee. It is classed as a Federal Noxious Weed in the United States and as a Prohibited Aquatic Plant and Noxious Weed in the state of Florida. In the continental United States, melaleuca has been recorded from Louisiana, Texas and California. Additionally, this tree has become moderately invasive in Puerto Rico and Hawaii. Melaleuca rapidly invades moist, open habitats, both disturbed and undisturbed, and forms dense, impenetrable monocultures. In general, invasion is less prominent in forested sites than marshes; however, only dense hammock-type communities seem to produce enough shade to prevent invasion. Invasive characteristics of melaleuca include its evergreen habit, prolific seed production, frequent flowering, and flood and drought tolerance. This tree threatens biodiversity of native flora and fauna by diminishing the value of their habitat. The large expanses of melaleuca on public lands have cost public agencies in Florida \$25 million in control efforts between 1989 and 1999. Estimations of economic impacts of melaleuca on recreation, tourism, fires, loss of endangered species, and more range from \$168 million

annually to \$2 billion over a period of 20 years. Various methods of control (chemical, mechanical, manual, biological and integrated) are evaluated.

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630. Metal uptake, transport and release by wetland plants: Implications for phytoremediation and restoration.

Weis, J. S. and Weis, P.

Environment International 30(5): 685-700. (2004)

NAL Call #: TD169.E54; ISSN: 0160-4120

Abstract: Marshes have been proposed as sites for phytoremediation of metals. The fate of metals within plant tissues is a critical issue for effectiveness of this process. In this paper we review studies that investigate the effects of plants on metals in wetlands. While most of these marsh plant species are similar in metal uptake patterns and in concentrating metals primarily in roots, some species retain more of their metal burden in belowground structures than other species, which redistribute a greater proportion of metals into aboveground tissues, especially leaves. Storage in roots is most beneficial for phytostabilization of the metal contaminants, which are least available when concentrated below ground. Plants may alter the speciation of metals and may also suffer toxic effects as a result of accumulating them. Metals in leaves may be excreted through salt glands and thereby returned to the marsh environment. Metal concentrations of leaf and stem litter may become enriched in metals over time, due in part to cation adsorption or to incorporation of fine particles with adsorbed metals. Several studies suggest that metals in litter are available to deposit feeders and, thus, can enter estuarine food webs. Marshes, therefore, can be sources and well as sinks for metal contaminants. *Phragmites australis*, an invasive species in the northeast U.S. sequesters more metals belowground than the native *Spartina alterniflora*, which also releases more via leaf excretion. This information is important for the siting and use of wetlands for phytoremediation as well as for marsh restoration efforts.

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631. Mid-Texas, USA coastal marsh vegetation pattern and dynamics as influenced by environmental stress and snow goose herbivory.

Miller, D. L.; Smeins, F. E.; Webb, J. W.; and Yager, L.

Wetlands 25(3): 648-658. (2005)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ snow/ vegetation patterns/ herbivory/ marshes/ precipitation/ ecotones/ vegetation/ geese/ salinity/ coastal marshes/ drought/ synergistic effects/ flooding/ history/ storms/ *Spartina*/ water level/ stress/ dynamics/ *Spartina patens*/ *Schoenoplectus americanus*/ USA, Texas

Abstract: Vegetation pattern and dynamics were characterized across a mid-Texas, USA coastal marsh ecotone subjected to snow goose herbivory, drought, and salt-water pulses. For eight years following snow goose feeding, species cover was evaluated in heavy and light goose-use patches at increasing distances from tidal influence. Just prior to and for two years after the feeding event, drought, and several salt-water pulses associated with tropical storms typified the hydrologic dynamics of the marsh. Herbivory history was more important than distance from tidal influence, salinity, or flooding in explaining spatial

and temporal vegetation pattern for three years. Precipitation variation influenced vegetation dynamics in areas heavily used by geese. Recovery to pre-herbivory composition and abundance required six years without further snow goose feeding. Extremes of annual precipitation, salinities, and water levels impacted cover of *Spartina patens* dominated patches little unless feeding snow geese uprooted vegetation. *Schoenoplectus americanus* was more impacted by extremes of environmental dynamics than *S. patens* but even more impacted by synergistic effects of uprooting and environmental extremes. During this period, the ecotone could be characterized as patchy, with a gulfward waxing and waning of *S. americanus*.

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632. A model for wetland hydrology: Description and validation.

Mansell, R. S.; Bloom, S. A.; and Sun, G. E.

Soil Science 165(5): 384-397. (2000)

NAL Call #: 56.8 So3; ISSN: 0038-075X

Descriptors: models and simulations: computational biology/ climatology: environmental sciences/ freshwater ecology: ecology, environmental sciences/ terrestrial ecology: ecology, environmental sciences/ soil science/ air temperature/ cypress pond/ evapotranspiration/ model simulation/ pine forest/ rainfall/ soil characteristics/ wetland hydrology

Abstract: WETLANDS, a multidimensional model describing water flow in variably saturated soil and evapotranspiration, was used to simulate successfully 3-years of local hydrology for a cypress pond located within a relatively flat Coastal Plain pine forest landscape. Assumptions included negligible net regional groundwater flow and radially symmetric local flow impinging on a truncated conical pond, deciduous cypress trees and shallow-rooted perennial undergrowth in the pond area, and pine trees in the upland area as well as within the outer 20% of the wetland area. A minimal observed parameter set of daily rainfall, daily air temperature, soil characteristics, and pond geometry provided model input. The model described temporal patterns of daily pond water and groundwater table elevations with relatively small average signed deviations of -2 and +11 cm, respectively. Potential exists for the model to be utilized as a predictive tool for wetland hydrology, even for conditions where available empirical data for a given site is minimal and appropriate simplifying assumptions are utilized.

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633. Modeling the hydrologic processes of a depressional forested wetland in South Carolina, USA.

Sun, Ge; Callahan, Timothy; Pyzoha, Jennifer E.; Trettin, Carl C.; and Amatya, Devendra M.

In: *Advances in Hydro-science and Engineering. Volume VI: Proceedings of Abstracts and Papers (on CD-ROM) of the 6th International Conference on Hydro-Science and Engineering.* (Held 31 May 2004-3 Jun 2004 at Rydges South Bank Hotel, Brisbane, Australia.) Altinaker, M. S. (eds.); Vol. 6.

University, MS: University of Mississippi, National Center for Computational Hydroscience and Engineering; pp. 1-10; 2004.

<http://www.srs.fs.usda.gov/pubs/7166>

Abstract: Depressional forested wetlands or geographically isolated wetlands such as cypress swamps and Carolina bays are common land features in the Atlantic Coastal Plain of the southeastern US. Those wetlands play important roles in providing wildlife habitats, water quality improvement, and carbon sequestration. Great stresses have been imposed on those important ecosystems due to rapid human population growth and climate change in the region. The objectives of this research were to (1) test a distributed forest hydrology model, FLATWOODS, for a Carolina bay wetland system using seven years of water table data and (2) apply the validated model to understand how wetland position (geomorphology) and geology affect lateral groundwater flow directions. The research site is a 6-ha depressional wetland known as a Carolina bay and is located in Eamberg County, South Carolina on the Lower Coastal Plain of the southeastern US (32.88 N, 81.12 W). Model calibration (1998) and validation (1997, 1999-2003) data span a wet and a long drought period allowing testing of the model for a wide range of weather conditions. While the major input to the wetland is atmospheric rainfall and output from the wetland is through evapotranspiration, modeling results suggest that the Carolina bay is a flow-through wetland, receiving discharged groundwater from one part of the upland area, but losing water as groundwater recharge to the other side, especially during wet periods in winter months. The simulation study also suggests that groundwater flow direction is controlled by the gradient of the underlying hydrologic restricting layer beneath the wetland-upland continuum, not by the topographic gradient of land surface. Groundwater flow appeared to change flow direction during the transition period during the wet-dry cycle. The changes depend on the geomorphology and underlying geology of the wetland-upland continuum.

This citation is from Treerearch.

634. Modeling wetland change along the United States Atlantic coast.

Koneff, Mark D. and Royle, J. Andrew

Ecological Modelling 177(1-2): 41-59. (2004)

NAL Call #: QH541.15.M3E25; ISSN: 0304-3800

Descriptors: conservation/ freshwater ecology: ecology, environmental sciences/ models and simulations: computational biology/ linear regression/ mathematical and computer techniques: logistic regression/ mathematical and computer techniques: zero inflation models/ mathematical and computer techniques/ U.S. Fish and Wildlife Service/ wetlands status and trends study sample plots/ lotic habitats/ model fit/ spatial structure/ waterfowl habitat conservation planning/ wetland area change/ wetland classes: estuarine emergent, forested, lacustrine, palustrine emergent, scrub shrub, unconsolidated bottom

Abstract: As an aid in waterfowl habitat conservation planning, we predicted change in wetland area between the 1950s and 1970s and the 1970s to 1990s along the United States Atlantic Coast. We developed zero-inflation models using logistic regression to predict occurrence and linear regression to predict area for six wetland classes: estuarine emergent, lacustrine, and palustrine emergent, forested, scrub-shrub, and unconsolidated bottom. A prediction grid of 10.36 km² cells was established for the study area. We predicted wetland class area for cells for four decades: 1950s, 1970s, 1980s, and 1990s. Wetland occurrence and area measurements from the U.S. Fish and Wildlife

Service's Wetlands Status and Trends Study (WST) sample plots served as response variables. Spatial structure in the WST data was preserved by interpolating residuals at plot locations and summing predicted residuals and predicted wetland area for each cell. Wetland changes reflect conversion both to and from upland as well as to and from other wetland classes. We predicted a 30.7 thousand ha decline in estuarine emergents in the study area from the 1950s to 1970s, but an increase of 0.9 thousand ha between the 1970s and 1990s. Predicted lacustrine area increased 161.6 thousand ha from the 1950s to 1970s, but declined 5.4 thousand ha from the 1970s to the 1990s. A loss of 731.4 thousand and 189.9 thousand ha of palustrine emergents was predicted from the 1950s to 1970s and from the 1970s to 1990s, respectively. Palustrine forested was predicted to have declined by 536.5 thousand ha between the 1950s and 1970s and 985.8 thousand ha between the 1970s and 1990s. Palustrine scrub-shrub was predicted to have declined 562.6 thousand ha between the 1950s and 1970s, but increased 119.2 thousand ha between the 1970s and 1990s. Finally, palustrine unconsolidated bottom wetlands were predicted to have increased 159.2 and 142.8 thousand ha between the 1950s and 1970s and 1970s and 1990s, respectively. Predictions were most reliable for estuarine emergent, lacustrine, and palustrine forested classes, probably due to the restricted distribution and relative constancy of the estuarine emergent and lacustrine classes. Reliable palustrine forested predictions were likely due to the association of this class with watercourses and the relationship between the predictor variables and lotic habitats. Predictor variables were likely less relevant for palustrine emergent, scrub-shrub, and unconsolidated bottom, where model fit was poorer. Human activities such as agriculture and forestry probably contributed to the poorer model fit for these classes. Published by Elsevier B.V.

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635. Natural and modified pocosins: Literature synthesis and management options.

Ash, A. N.; McDonald, C. B.; Kane, E. S.; and Pories, C. A. Washington, D.C.: U.S. Fish and Wildlife Service; FWS/OBS-83/04, 1983. 178 pp.

Notes: Publication Type: Unpublished Wildlife Report
Descriptors: wetlands/ bibliography/ ecosystems/ fish management/ forests/ geomorphology/ habitat changes/ habitat management/ history/ lakes/ land use/ mapping/ marshes, freshwater/ run-off/ soils/ vegetation/ vertebrates/ water resources management/ water, chemical properties/ water, physical properties/ watershed management/ wildlife management/ North America/ United States/ Virginia/ North Carolina/ South Carolina

Abstract: Literature is synthesized concerning pocosin origin, geographic distribution, ecological characters, historical and current human use, and value for water purification and wildlife management. Where possible, data from pocosins or related southeastern freshwater wetlands are used.

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636. Natural flatwoods marshes and created freshwater marshes of Florida: Factors influencing aquatic invertebrate distribution and comparisons between natural and created marsh communities.

Evans, David L.; Streever, William J.; and Crisman, Thomas L.

In: *Invertebrates in freshwater wetlands of North America: Ecology and management/ Batzer, Darold P.; Rader, Russell B.; and Wissinger, Scott A.*

New York: John Wiley & Sons, 1999; pp. 81-104.

Notes: ISBN: 0471292583

NAL Call #: QL365.4.A1158

Descriptors: Invertebrata/ community structure/ natural flatwoods marshes/ population density/ natural flatwoods marshes community/ influencing factors/ comparison with created freshwater marshes/ marsh/ Florida/ natural flatwoods marshes community structure/ influencing factors and comparison with created freshwater marshes

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637. Organic matter dynamics in four seasonally flooded forest communities of the Dismal Swamp USA.

Megonigal J. P. and Day F. P.

American Journal of Botany 75(9): 1334-1343. (1988)

NAL Call #: 450 Am36; *ISSN:* 0002-9122

Descriptors: bioenergetics: biochemistry and molecular biophysics/ development/ ecology: environmental sciences/ forestry/ metabolism/ physiology/ soil science/ leaf litter/ wood debris/ fine root turnover/ biomass/ allocation/ transfer/ accumulation/ net primary production/ wetland organic matter

Abstract: Budgets of organic matter dynamics for plant communities of the Great Dismal Swamp were developed to summarize an extensive data base, determine patterns of biomass allocation, transfer and accumulation, and make comparisons with other forested wetlands. Aboveground net primary production on the flooded sites (1,050-1,176 g m⁻² yr⁻¹) was significantly greater than on a rarely flooded site (831 g m⁻² yr⁻¹). Estimates of belowground net primary production were comparable to aboveground production on flooded sites (824-1,221 gm⁻² yr⁻¹). However, productivity was nearly three times greater belowground than aboveground on the rarely flooded site (2,256 g m⁻² yr⁻¹). Aboveground productivity in Dismal Swamp forests is relatively high compared to other forested wetlands. This is attributed to the timing and periodic nature of flood events. Fine root turnover is shown to be an important source of soil organic matter. Estimates indicate that roots contribute about 60% of the annual increment to soil organic matter. Leaf litter contributes 6-28% and wood debris contributes 5-15%. Comparisons with other forested wetlands suggest that detritus accounts for greater than half of the total organic matter (living + dead) in many wetland systems.

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638. Overview of ecology of mangroves and information needs for Florida Bay.

Snedaker, S. C.

Bulletin of Marine Science 44(1): 341-347. (1989);

ISSN: 0007-4977

Descriptors: ecology/ ecosystems/ estuaries/ mangrove swamps/ marine environment/ Florida Bay/ coastal marshes/ bays/ forests/ dissolved organic matter/ cycling nutrients/ aquatic habitats

Abstract: The mangrove forest areas bordering Florida Bay have provided research data and information that have formed the bases both for conservation laws and for the advances in mangrove research at other laboratories throughout the world. In this regard, the structural diversity of Florida Bay mangroves has been reasonably documented, but little research has been done on functional diversity, particularly, as it relates to the nearshore estuarine flora and fauna. What is already known about Florida Bay's coastal forest habitats is reviewed, and that which remains to be researched is outlined for mangrove-habitat diversity and the functional diversity among the mangrove habitats. It is postulated that the quantity, quality and timing of fluxes of dissolved organic matter (DOM) from different mangrove forest types may have a significant regulatory or control role in the structure and functioning of estuarine populations. At least three distinct roles for DOM are postulated: (1) as an alternate food source, (2) as the basis for heterotrophic microorganism food webs, and (3) as a source of chemical cues controlling the spatial and temporal distribution of estuarine species. This postulation focuses on a new area in chemical ecology that could lead to important new research findings on the interrelationships between mangrove forest habitats and the biological organization of estuarine communities. (Friedmann-PTT)
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639. Overview of wetlands and water resources of Maryland.

Clearwater, Denise; Turgeon, Paryse; Noble, Christi; and LaBranche, Julie Maryland Department of the Environment, 2000. 62 p.
<http://www.mde.state.md.us/assets/document/wetlandswaterways/h2Oresources.pdf>

640. Phosphorus retention in non-tidal palustrine forested wetlands of the Mid-Atlantic Region.

Walbridge, M. R. and Struthers, J. P.
Wetlands 13(2): 84-94. (1993)
NAL Call #: QH75.A1W47; ISSN: 0277-5212.
Notes: Special issue.
Descriptors: wetlands/ phosphorus/ soils/ hydrology/ sorption/ land use/ water quality/ USA, Virginia/ USA, Virginia, Caroline Cty./ phosphorus/ soils/ geochemistry of sediments
Abstract: We: 1) quantified the areal extent of wetlands by type in Caroline County, VA to estimate the relative importance of non-tidal palustrine forested wetlands as a component of the wetland resources in Virginia's mid-Atlantic coastal plain, 2) used a comparative literature review to identify factors that might be important in controlling P retention in these wetlands, and 3) evaluated three indices that have been used to compare P adsorption potentials in wetland soils. Non-tidal palustrine forested wetlands comprised 66.0% of the 11,372 ha of wetlands in Caroline Co. The majority were either seasonally (4000 ha) or temporarily (1596 ha) flooded wetlands dominated by broad-leaved deciduous species. These wetlands are both small (averaging 5.4 and 2.4 ha in area, respectively) and numerous in this region. Adsorption by Al and Fe (hydr)oxides and precipitation of Al, Fe, and Ca phosphates probably controls dissolved phosphate retention and long-term P storage in these wetlands, although P storage in the woody biomass of aggrading forests may also be important.

Phosphorus adsorption isotherms, a single-point phosphorus adsorption index, and concentrations of oxalate-extractable (noncrystalline) Al and Fe have all been used as comparative indices of P sorption potentials in wetland soils, although the latter may represent the best single index of P sorption capacity because of its direct relationship to the mechanisms controlling P adsorption in soil. When using these indices to compare wetland P sorption potentials, it is important to consider differences in soil depth, profile heterogeneity, and bulk density between sites. Actual amounts of phosphate retained by a wetland will also be influenced by the degree of phosphate loading it receives, as determined by hydrology, phosphate sources in the watershed, and the P sorption potentials of surrounding upland soils. Because of the low P sorption potentials of sandy soils in coastal plain uplands, non-tidal palustrine forested wetlands in the mid-Atlantic coastal plain may perform particularly important functions with respect to dissolved phosphate removal and retention on the landscape.
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641. Plant and water-level dynamics in an east Texas USA shrub-hardwood bottomland wetland.

Weller M. W.
Wetlands 9(1): 73-88. (1989)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: *Cephalanthus occidentalis/ Planera aquatica/ Quercus lyrata/ Quercus nigra/ Quercus phellos/ succession species diversity/ community composition/ hydrographic regime/ resource management*
Abstract: Plant distribution and layering were analyzed from four line transects across a nine-hectare shrub swamp and adjacent hardwood bottomlands, and water fluctuations and hydroperiod were assessed via six wells and staff gauges. Vegetational transition from deep to shallow water was buttonbrush *Cephalanthus occidentalis*, water elm *Planera aquatica*, overcup oak *Quercus lyrata*, water oak *Q. nigra*, willow oak *Q. phellos*, and several other hardwoods intermixed at less frequently flooded elevations. A past die-off of overcup oak and other vegetational changes suggest that a single event or a series of flooding events occurred during the growing season. Vegetative change included rapid establishment of herbaceous vegetation in shallow, open areas after overstory die-off, followed by gradual invasion of water elm. Further opening in adjacent bottomland woods is resulting from windfall of shallow-rooted oaks. Impoundments for green-tree reservoirs or other water-level modifications should be based upon an understanding of local plant succession since slight changes in water regime may modify plant species or cover-water patterns and seriously impact the wetland community. Where possible, natural water regimes should be preserved; where this is impossible due to watershed modifications, such regimes should be documented and duplicated by use of the most simple possible management system to avoid endangering natural plant communities.
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642. Predicting long-term wetland hydrology from hydric soil field indicators.

Vepraskas, Michael J. and Water Resources Research Institute of the University of North Carolina; Raleigh, NC: Water Resources Research Institute of the University of North Carolina (Series: Report 342), 2002. xv, 55 p.
Notes: "UNC-WRRI-2002-342." "August 2002." Includes bibliographical references (p. 53-55). Funded by through the Water Resources Research Institute of the University of North Carolina. WRRRI project no. 70175.
NAL Call #: TD201 .N6 no. 342
Descriptors: wetlands---hydrology---North Carolina/ soil absorption and adsorption---research---North Carolina/ sewage lagoons---North Carolina---hydrodynamics
 This citation is from AGRICOLA.

643. Proceedings of the Conference: Wetlands of the Chesapeake.

Groman, Hazel A.
 Washington D.C.: Environmental Law Institute, 1985. 389 p.
NAL Call #: QH76.5.C48P76
Descriptors: wetland conservation---Chesapeake Bay Region (Md. and Va.)---congresses/ wetlands---Chesapeake Bay Region (Md. and Va.)---congresses
Abstract: ISBN: 0911937196. Conference held: April 9-11 in Easton, Md.
 This citation is from AGRICOLA.

644. Reference simulations for evaluating wetland hydrology.

Skaggs, R. W.; Hunt, W. F.; Chescheir, G. M.; and Amatya, D. M.
 In: Versatility of Wetlands in the Agricultural Landscape. (Held 17 Sep 1995-20 Sep 1995 at Hyatt Regency, Tampa, Fla.)
 St Joseph, Mo.: American Society of Agricultural Engineers (ASAE); pp. 1-10; 1995.
NAL Call #: QH87.3.V47 1995
Descriptors: wetlands/ storage/ drainage/ depth/ rain/ water table/ soil water regimes/ groundwater level/ meteorology/ weather data/ models
Abstract: Reference Wetland Simulations (RWS) and short term groundwater levels may be used to determine wetland hydrology. Characteristic parameters and their hydrology can be identified and predicted by computer simulations (DRAINMOND). Simulations conducted for 4 soils from North Carolina using 2 depressional storages and 2 ditch depths for each soil showed that RWS were not strongly dependent on soil type, drain depth and surface depressional storage. It was concluded that RWS, computed with weather data for the monitoring period, could be used to interpret measured groundwater levels for all sites in a given area.
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645. Rehabilitation of impounded estuarine wetlands by hydrologic reconnection to the Indian River Lagoon, Florida (USA).

Brockmeyer, R. E.; Rey, J. R.; Virnstein, R. W.; Gilmore, R. G.; and Earnest, L.
Wetlands Ecology and Management 4(2): 93-109. (1997)
NAL Call #: QH541.5.M3 W472; ISSN: 0923-4861.
Notes: Special issue: Hydrologic restoration of coastal wetlands.
Descriptors: wetlands/ estuaries/ hydrology/ flooding/ salt marshes/ mosquitoes/ water quality/ water control/ culverts/ water reclamation/ impoundments/ habitat improvement/ environmental restoration/ USA, Florida, Indian River Lagoon/ impoundments/ habitat improvement/ environmental restoration/ mosquitoes/ water control/ culverts/ water reclamation/ effects on water of human nonwater activities/ protective measures and control/ coastal zone management/ reclamation/ freshwater pollution/ aquaculture: general
Abstract: Salt marshes of the Indian River Lagoon, Florida (USA) were once prolific producers of mosquitoes. Mosquitoes lay their eggs on the infrequently-flooded high marsh surface when the soil surface is exposed. The eggs hatch when the high marsh is flooded by the infrequent high tides or summer rains. To control mosquito production, most of the salt marshes (over 16,200 ha) were impounded by the early 1970s. Flooding, usually by pumping water from the Lagoon, effectively controlled mosquitoes. However, impounding had a profoundly negative impact on the wetland plant, fish, and invertebrate communities. Isolation from the Lagoon cut off aquatic access by transient estuarine species that used the wetlands for feeding or as nursery area. In one study, the number of fish species dropped from 16 to 5 after impounding. Wetland vegetation within some impoundments was totally eliminated; other impoundments developed into freshwater systems. When tidal exchange is restored through hydrologic connection, usually by culverts installed through the perimeter dike, recovery to more natural conditions is often rapid. In one impoundment where wetland vegetation was totally eliminated, recovery of salt-tolerant plants began almost immediately. In another, cover of salt-tolerant plants increased 1,056% in less than 3 years. Fisheries species that benefitted the most were snook, ladyfish, and striped mullet. Over 1,500 juvenile snook were captured in a single 3-hr flood-tide culvert trap as they attempted to migrate into an impoundment. The zooplankton community rapidly returned to the more typical marsh-Lagoon community. Water quality and sediment sulfides returned to typical marsh values. Overall, reconnection enhances natural productivity and diversity, although water quality in the perimeter ditch, an artifact of dike construction, remains problematic. Earlier experiments demonstrated that flooding only during the summer mosquito breeding season provided as effective mosquito control as year-round flooding. In standard management, the impoundment is flooded in summer, then left open to the Lagoon through culverts the rest of the year. Culverts are typically opened when the fall sea level rise first floods the high marsh. Impoundment reconnection is being implemented by a multi-agency partnership. The total reconnected area is expected to reach 9,454 ha by the end of 1998, representing 60% of the impounded wetlands in the entire IRL system. One stumbling block is private ownership of many of the remaining isolated impoundments.
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646. Research and policy issues regarding coastal wetland impoundments: Lessons learned in South Carolina.

Devoe, M. R. and Baughman, D. S.

In: Marsh Management in Coastal Louisiana: Effects and Issues. (Held 7 Jun 1988-10 Jun 1988 at Baton Rouge, LA.) Duffy, W. G. and Clark, D. (eds.): Fish and Wildlife Service, U.S. Department of the Interior; pp. 98-106; 1989. NAL Call #: QH540.U562 no.89(22)

Abstract: More than 140 000 acres along South Carolina's coastal rivers and tidal creeks were impounded for rice production during the early 1800's; 70 000 of the State's 504 000 acres of contiguous wetlands remain impounded today. Because of heightened awareness of the inherent productivity of these systems for waterfowl habitat and aquaculture, a number of property owners have submitted permit applications to State and Federal regulatory agencies to re-impound formerly impounded areas. These applications have generated a number of questions, regarding the ecology, management, and public policy of coastal impoundments, and wetlands in general. Opinions concerning the effects impoundments have on wetland processes have differed between wildlife and marine biologists. This dichotomy is especially evident within several of the 13 agencies which play a role in the decision-making process. Additionally, inconsistent decision-making has contributed to the dilemma, politics and economics play an extremely important role in the process. These and other issues have underscored the need for credible and focused research data and information on one hand and a fair, consistent, and unbiased regulatory framework on the other. -from Authors

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647. Responses of wetland tree species to hydrology and soils.

Wallace, P. M.; Kent, D. M.; and Rich, D. R.

Restoration Ecology 4(1): 33-41. (1996)

NAL Call #: QH541.15.R45R515; ISSN: 1061-2971

Descriptors: wetlands/ survival/ hydrology/ growth/ Florida/ soils/ plant populations/ trees/ soil hydrology/ soil types/ growth rate/ Taxodium/ Pinus serotina/ Fraxinus caroliniana/ Acer rubrum

Abstract: We conducted a study of the flood tolerance of nine wetland tree species on seven soil types. Seedlings were subjected to 11 months of continuous shallow inundation or moist soil conditions on three mineral soils, two organic soils, a manufactured soil designed to mimic the practice of layering muck over mineral soil, and a stockpiled topsoil. Taxodium ascendens, T. distichum, Acer rubrum, and Pinus serotina suffered no mortality; Fraxinus caroliniana (1%), Liquidambar styraciflua (8%), P. elliotii (8%), and Gordonia lasianthus (24%) suffered low to moderate mortality; and Persea palustris (46%) suffered significant mortality. In general, greatest net height and total biomass were achieved on moist organic soils, and least net height and total biomass were achieved on stockpiled topsoil and inundated soils. Responses to hydrological conditions were less pronounced for Taxodium spp. If the results of this experiment are transferable to the field, then Acer rubrum, Fraxinus caroliniana, Pinus serotina, Taxodium ascendens, and Taxodium distichum seedlings can reasonably be expected to survive at least one year under a broad range of hydrological and edaphic conditions. With the exception of Taxodium spp., first-year

growth for the species of this study can be facilitated by maintaining moist but not inundated conditions. These findings suggest that transfer of organic soils will benefit restoration and creation efforts, and that layering organic soil over mineral soil is more effective than using mineral soils or stockpiled topsoil.

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648. Restoration of coastal wetlands in southeastern Florida.

Milano, Gary R.

Wetland Journal 11(2): 15-24. (1999); ISSN: 1095-2063

http://www.miamidade.gov/derm/Ecosystems/library/Coastal_Wetlands_Restoration.pdf

649. A review of current salt marsh management issues in Florida.

Carlson, D. B.; O'Bryan, P. D.; and Rey, J. R.

Journal of the American Mosquito Control Association 7(1): 83-88. (1991)

NAL Call #: QL536.J686; ISSN: 8756-971X

Descriptors: Florida/ insect control/ mosquitoes/ salt marshes/ environmental protection/ legal aspects/ marshes/ public policy/ wetland impoundments

Abstract: For the past decade, salt marsh management in Florida has been a central issue in attempts to reconcile mosquito control and natural resource interests. Progress has been made in trying to maintain effective mosquito control while protecting and enhancing salt marsh resources primarily due to: (1) efforts by the Florida Coordinating Council on Mosquito Control and its Subcommittee on Managed Marshes, which are committees comprised of agencies responsible for wetlands resources, those mandated to provide mosquito control, and research institutions; and (2) funding of research to investigate ecosystem effects of marsh management techniques. Research and management experience have demonstrated that Rotational Impoundment Management (RIM) and rotary ditching can provide ecologically sound source reduction benefits. Salt marsh ownership, management of state lands and mariculture remain controversial salt marsh management issues. (Author's abstract)

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650. Review of historical tidal wetlands of the Delaware River estuary.

Philipp, K.

Philadelphia: U.S. Environmental Protection Agency, 1995. 33 p.

Descriptors: wetlands/ tidal flats/ dredging/ environmental impact/ impoundments/ historical account/ estuaries/ engineering/ tidal rivers/ drainage patterns/ history/ USA, Delaware R./ impoundments/ tidal rivers/ drainage patterns/ history/ environmental impact/ historical account/ tidal flats

Abstract: Historical Tidal Wetlands of the Delaware River and Bay have been characterized for the Delaware River Estuary Program. The characterization focused on the alteration mechanisms of Impoundments (waterfowl, agriculture, and stormwater), Filling (for Urban/Commercial/Residential Development and Dredge Material), Hydrological Alterations (road/rail/dredge material restrictions), Mosquito Control, Sea Level Rise (coastal inundation), Inlet Formation and Stabilization (and storm event changes), Phragmites Distribution, and Snow Goose

Grazing. The study was conducted through investigation of case study areas selected throughout the estuary that represented examples of these alteration mechanisms. The most pervasive of these impacts was the impoundment of tidal marshes and adjacent non-tidal wetland edges. Impoundments or meadows were created on nearly all freshwater, most brackish water, and some salt water marshes. The landscape of coastal marshes today clearly displays the patterns of these impoundments through changed drainage patterns, altered marsh vegetation, relic dikes, and the pattern of shoreline land use. Case study area reviews of historic tidal wetlands have shown the widespread impact of impoundments and the role of these impoundment meadows as related to large scale filling of historic wetland areas for made land.

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651. Sampling fish assemblages in forested floodplain wetlands.

Knight, J. G. and Bain, M. B.

Ecology of Freshwater Fish 5(2): 76-85. (1996);

ISSN: 0906-6691

Descriptors: wetlands/ flood plains/ freshwater fish/ community composition/ biological sampling/ sampling/ forests/ fish/ USA, Alabama/ Pisces/ habitat community studies/ methodology - general/ network design

Abstract: Four quantitative (area-standardized electrofishing, trap nets, small-mesh [1.3 and 2-cm bar mesh] gill nets, large-mesh [2.5 and 5-cm bar mesh] gill nets) and two qualitative (non-standardized electrofishing, dip netting) sampling techniques were concurrently used to capture larval to adult fish in forested wetland habitats on seasonally inundated floodplains of two Alabama (USA) streams. Standardized area electrofishing appeared to be the best sampling technique for collecting and quantifying species because of high catch rate, broad species and size coverage, and rapid sampling. Electrofishing accounted for most fish (47 and 57% of pooled catch), almost all taxa, and a broad range of fish sizes. Large-mesh gill nets captured few fish (2% and 8%), a distinct subset of the species present, and the largest fish. Light traps were the most efficient and taxa-comprehensive sampling technique for larval fish. Light traps captured the vast majority of the pooled larval fish catch, including 6 of 7 families recorded at the sites. Larval fish dip netting captured larval fish of most families known to be present but in low numbers. For surveys of species composition and rapid bioassessments, non-standardized electrofishing and larval fish dip netting appear adequate. For intensive research studies, the combination of area electrofishing, large-mesh (and in some cases small-mesh) gill nets, and light traps provide thorough and comprehensive data on wetland fish assemblages.

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652. Sediment accretion in coastal wetlands: A review and a simulation model of processes.

Callaway, J. C.; Nyman, J. A.; and Delaune, R. D.

Current Topics in Wetland Biogeochemistry 2: 2-23. (1996);

ISSN: 1076-4674

Descriptors: accretion/ simulation/ coasts/ computer models/ cores/ sensitivity analysis/ marshes/ sediments/ sea level/ elevation/ biogeochemistry/ sedimentation/ coastal landforms/ topographic features/ sea level changes/ British Isles, England, Norfolk, Stiffkey Marsh/ USA,

Mississippi, Biloxi Bay/ coastal landforms/ topographic features/ sea level changes/ computer models/ sensitivity analysis/ elevation

Abstract: Given the potential for future increases in eustatic sea-level rise, understanding accretion processes in coastal wetlands is extremely important. Coastal wetlands must maintain an elevation within the tidal range, or they will cease to function as wetlands. Many studies have evaluated accretion rates in coastal wetlands; however, there are problems comparing these studies: 1) they have been completed for a variety of reasons and with many different approaches; 2) they have used different vocabulary and methods; and 3) there is a complex relationship of sediment processes over both time and depth. Because of these problems a simple comparisons of different studies is not possible, and miscommunication has been common. Modelling offers a potential way of consolidating current thought on accretion processes, synthesizing factors that affect accretion rates, and formalizing assumptions and ideas in order to make future gains in the understanding of sediment processes. We developed a computer model which simulates accretion rates and sediment characteristics throughout a sediment profile. The use of both accretion rates and sediment characteristics for model calibration made this model more realistic than other model of sediment accretion and belowground bio-geochemical processes that have been developed. The model used a cohort approach, allowing annual "cohorts" of mineral and organic sediment to accumulate on the marsh surface, while earlier cohorts were buried and subjected to belowground processes, including organic matter production, decomposition, and compaction. The model tracked the relative elevation of the marsh and was run over a 300-year time span. Using the model, we successfully simulated accretion rates for sediment cores from a high-marsh site at Stiffkey Marsh, Norfolk, England, and from a mid-marsh site at Biloxi Bay, Mississippi. The model was calibrated using accretion rates based on super(137)Cs dating, and the predicted rates of vertical accretion for a 100-year time span matched the rates were measured by super(210)Pb for the Stiffkey core, confirming the accuracy of the model. Through sensitivity analyses, we identified the most important factors affecting model-generated accretion rates, including: pore space, mineral matter deposition, initial elevation, sea-level rise, and belowground organic matter production. In addition, the model was a useful tool for predicting changes to marsh relative elevation and long-term survival due to potential increases in eustatic sea-level rise. The predicted relative elevation and accretion rates indicated that Stiffkey Marsh could withstand rates of sea-level rise up to 0.5 cm/yr without the loss of high-marsh habitat, although high-marsh was likely to be converted to low-marsh habitat at lower rates of sea-level rise.

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653. Soil organic carbon, nitrogen, and phosphorus as indicators of recovery in restored *Spartina* marshes.

Craft, C. B.

Ecological Restoration 19(2): 87-91. (2001)

NAL Call #: QH76.R47; ISSN: 1522-4740

Descriptors: wetlands/ nutrient availability/ environmental restoration/ soil nutrients/ carbon/ nitrogen/ phosphorus/ organic carbon/ salt marshes/ soils/ biochemical cycles/ restoration/ water quality/ biogeochemistry/ nutrient

concentrations/ *Spartina*/ USA, Georgia, Sapelo I./ nutrients/ reclamation/ composition of water/ habitat community studies/ protective measures and control/ marine pollution/ organic compounds

Abstract: In this article, I discuss a study where I measured soil nutrient (organic C, N, and P) concentrations, pools and ratios (0-10 cm depth) in a 42-year-old restored saltwater cordgrass marsh and a natural saltwater cordgrass marsh on Sapelo Island, Georgia to evaluate the development of biogeochemical cycles following restoration. Soil C:N ratios may be especially useful for evaluating the availability of nitrogen to wetland biota in these N-limited ecosystems. I also compared sediment and organic C, N, and P accumulations as a way of evaluating the capacity of the restored marsh to improve the quality of the water moving through it.

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654. Spatial patterns in soil water fluxes along a forest-marsh transect in the southeastern United States.

Gardner, L. R. and Reeves, H. W.

Aquatic Sciences 64(2): 141-155. (2002); ISSN: 1015-1621

Descriptors: wetlands/ soil water/ marshes/ forest hydrology/ time series analysis/ hydrologic cycle/ water level fluctuations/ hydrology/ water levels/ water budget/ salt marshes/ forests/ evapotranspiration/ ground water/ rainfall/ tidal effects/ soils/ tides/ USA, South Carolina, North Inlet/ water in soils/ ecosystems and energetics/ regional studies, expeditions and data reports/ physical oceanography

Abstract: Time series of water levels in piezometer nests along a forest-marsh transect near North Inlet, SC, show fluctuations that are attributable to recharge by precipitation and tidal flooding and to removal by evapotranspiration (ET) and seepage out of the soil. Volumes of water associated with these water level changes were estimated by correlating rain-induced water level increases with measured rainfalls. In the forest the ratio of water table rise to rainfall is about 10. This ratio increases with decreasing elevation to about 40 in the mid marsh where the antecedent soil moisture is generally higher. The relative influence of removal by ET and seepage and recharge by rain and tides varies systematically along the transect. In the mainland forest, loss of water by ET is somewhat less than infiltration, leading to a net recharge of fresh water which eventually discharges in the adjacent mid marsh. With decreasing elevation, the relative importance of recharge by rain decreases as recharge by tidal flooding increases. In the low marsh, however, these mechanisms of loss and recharge can not be discerned in the water level time series because the water table rarely, if ever, drops below the marsh surface.

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655. Spatiotemporal distributions of bacterivorous nematodes and soil resources in a restored riparian wetland.

Ettema, Christien H.; Coleman, David C.; Vellidis, George; Lowrance, Richard; and Rathbun, Stephen L.

Ecology 79(8): 2721-2734. (1998)

NAL Call #: 410 Ec7; ISSN: 0012-9658

Descriptors: geostatistics/ microbial respiration/ restored riparian wetland/ soil resources/ spatiotemporal distributions

Abstract: Spatial and temporal variability in soil biotic

populations reflect heterogeneity in soil resources, affect patterns of soil process rates, and facilitate coexistence of diverse biota. We investigated these relationships in a 0.7-ha restored riparian wetland in the Coastal Plain of Georgia, USA, for an abundant and diverse group of soil fauna, the bacterivorous nematodes. We quantified spatial distributions in four different seasons for the eight most dominant bacterivorous taxa in the wetland and related their individual distributions to patterns of microbial respiration, inorganic nitrogen, moisture, and soil organic matter. We used geostatistics to quantify spatial aggregation and draw isopleths. For all variates except two nematode taxa, 36-99% of sample population variance was spatially dependent, over ranges of 11-84 m. Isopleths and spatial trend analysis showed that individual bacterivorous taxa exhibited divergent spatial distributions, with populations aggregating into different hotspots in the wetland. Although these large-scale trends persisted at all sampling dates, small-scale patterning showed significant temporal variation due to rise and fall of local populations. Individual nematode distributions did not correspond well to the (temporally more static) soil resource patterns, except occasionally to soil moisture and nitrate content. We attribute the general lack of correlation between nematode and soil resource patterns in part to the young age (2.5-3.5 yr) of the investigated wetland site. Although nematode patterns remain inadequately explained, we suggest that the observed spatiotemporal divergence among populations of bacterivorous taxa has important implications for our understanding of soil ecosystem and community processes, notably the spatiotemporal distribution of nematode-influenced nitrogen cycling rates and the maintenance of field-scale nematode diversity.

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656. Submergence of wetlands as a result of human-induced subsidence and faulting along the upper Texas Gulf Coast.

White, William A. and Tremblay, Thomas A.

Journal of Coastal Research 11(3): 788-807. (1995);

ISSN: 0749-0208

Descriptors: estuary/ Gulf of Mexico/ habitat degradation/ river/ vegetation

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657. Values and function of Chesapeake wetlands for waterfowl.

Stotts, V. D.

In: *Wetlands of the Chesapeake: Proceedings of the Conference.* (Held 9 Apr 1985-11 Apr 1985 at Easton, Md.) Groman, Hazel A. (eds.)

Washington, D.C.: Environmental Law Institute; pp. 129-142; 1985.

NAL Call #: QH76.5.C48P76

Descriptors: wetlands/ economic aspects/ submerged plants/ aquatic plants/ geese/ bottomland/ tidewater/ mud flats/ tidal flats/ waterfowl/ Chesapeake Bay/ Maryland/ erosion

Abstract: Numbers of migrating waterfowl in the Chesapeake have been declining since the mid-1950's as well as changing in composition. Several surveys of Maryland's emergent wetlands have been made since the early 1950s; surveys from 1968 indicated that about 308,000 acres of this habitat remained intact. Of this total, about 2% was non-tidal. An omission from these figures is

the waters of non-tidal streams. None of these surveys has taken into account the important hardwood bottomlands along streams. These lands have been estimated to total about 355,000 acres, but 119,600 of this acreage has been subject to extensive alteration. Including these important bottomlands, a liberal estimate for total emergent wetlands within Maryland's Chesapeake basin was about 540,700 acres in 1970 (excluding coastal wetlands and bottomlands in eastern Worcester County). Open tidal waters of the Chesapeake and its tributaries also constitute a vital part of Maryland's wetlands. The most important to waterfowl are: mud flats (831 acres); 0'-6' depths of water (mlw) (399,737 acres) and 6'-12' depths of water (282,047 acres). The rest of the Bay and its tidal tributaries include 902,367 acres of open tidal waters more than 12' deep. The declines seem to parallel declines in submerged aquatic vegetation (SAV) particularly for some species. Some species of geese, however, have been increasing apparently due to adaptation to new food sources, i.e., agricultural crops and weeds. Waterfowl have high economic and social value, and measures such as improved filtration of drainage waters and reduction of shoreline erosion must be utilized to preserve remaining wetlands and the waterfowl that depend upon them.

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658. Vegetation of Upper Coastal Plain depression wetlands: Environmental templates and wetland dynamics within a landscape framework.

De Steven, Diane and Toner, Maureen M.

Wetlands 24(1): 23-42. (2004)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

<http://www.srs.fs.usda.gov/pubs/6388>

Descriptors: Carolina bay/ depressional wetlands/ environmental gradients/ hydrogeologic setting/ hydroperiod/ landscape/ reference wetlands/ wetland management/ restoration/ vegetation types

Abstract: Reference wetlands play an important role in efforts to protect wetlands and assess wetland condition. Because wetland vegetation integrates the influence of many ecological factors, a useful reference system would identify natural vegetation types and include models relating vegetation to important regional geomorphic, hydrologic, and geochemical properties. Across the U.S. Atlantic Coastal Plain, depression wetlands are a major hydrogeomorphic class with diverse characteristics. For 57 functional depression wetlands in the Upper Coastal Plain of South Carolina, we characterized the principal vegetation types and used a landscape framework to assess how local (wetland-level) factors and regional landscape settings potentially influence vegetation composition and dynamics. Wetland sites were stratified across three Upper Coastal Plain landscape settings that differ in soils, surface geology, topography, and land use. We sampled plant composition, measured relevant local variables, and analyzed historical transitions in vegetative cover types. Cluster analysis identified six vegetation types, ranging from open-water ponds and emergent marshes to closed forests. Significant vegetation-environment relationships suggested environmental "templates" for plant community development. Of all local factors examined, wetland hydrologic regime was most strongly correlated with vegetation type, but depression size, soil textural type, and disturbance history were also significant. Because hydrogeologic settings influence wetland features, local

factors important to vegetation were partly predictable from landscape setting, and thus wetland types were distributed non-randomly across landscape settings. Analysis of long-term vegetation change indicated relative stability in some wetlands and succession in others. We developed a landscape-contingent model for vegetation dynamics, with hydroperiod and fire as major driving variables. The wetland classification, environmental templates, and dynamics model provide a reference framework to guide conservation priorities and suggest possible outcomes of restoration or management.

This citation is from Treeseearch.

659. Vertebrate use of nontidal wetlands on Galveston Island, Texas, USA.

Mueller A. J.

Texas Journal of Science 37(2-3): 215-226. (1985)

NAL Call #: 470 T31; ISSN: 0040-4403

Descriptors: amphibian/ reptile/ bird/ emergent aquatic vegetation/ rainfall/ evaporation/ salinity/ barrier island

Abstract: The nontidal wetlands of Galveston Island, Texas, depend on local rainfall for freshwater, and many dry out during summer. Evaporation and inundation by storm tides cause salinities to rise; they decline when heavy rains flush out the saltwater. Aquatic emergents are the dominant vegetation. Nontidal marshes provide important habitat for many kinds of wildlife, especially birds. In a comparison of two wetlands, one natural and the other man-made, the natural area received equal or greater use by all aquatic bird groups except the black-crowned night heron (*Nycticorax nycticorax*) and American coot (*Fulica americana*). Nontidal wetlands are the only available habitat on Galveston Island for many amphibians and reptiles.

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660. A water budget and hydrology model of a basin mangrove forest in Rookery Bay, Florida.

Twilley, Robert R. and Chen, Ronghua

Marine and Freshwater Research 49(4): 309-323. (1998)

NAL Call #: GC1.A85; ISSN: 1323-1650

Descriptors: estuarine ecology: ecology, environmental sciences/ models and simulations: computational biology/ basin mangrove forest/ evapotranspiration/ finite difference hydrology model: simulation model/ groundwater flow/ intertidal wetlands/ precipitation/ runoff/ seepage/ soil salinity/ soil saturation deficit/ stemflow/ throughfall/ tidal inundation/ water budget

Abstract: Water budgets of two basin mangrove forests in Rookery Bay were determined by measuring during a 2-year period the inputs of precipitation and tides, together with losses through seepage, runoff and evapotranspiration. Precipitation inputs to the forest floor were 75.1% from throughfall and 19% from stemflow for a total of 1097 mm year⁻¹, or 91% of annual rainfall. Runoff was estimated at 896 mm year⁻¹, or nearly 77% of the combined input of throughfall and stemflow. Loss from evapotranspiration was linear with saturation deficit of the atmosphere and was 967 mm year⁻¹ (0.7-4.5 mm day⁻¹). Loss from horizontal flow of groundwater in shallow mangrove soils was approx 285 mm year⁻¹. Frequency of tidal inundation was seasonal, ranging from <5 tides month⁻¹ in February to 30 tides month⁻¹ in September. Tides recharged soil saturation deficits, the cumulative tidal input being 12 276 mm year⁻¹ and efflux being 11 767 mm year⁻¹. The relative significance of tides and rainfall deficits

(rainfall - evapotranspiration) on the seasonal patterns of soil saturation (water levels) and soil salinity were simulated with a finite-difference hydrology model (HYMAN). Model simulations demonstrate that soil salinity at higher elevations in the intertidal zone, where tidal inundation frequency is reduced, is more sensitive to changes in rainfall deficit.

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661. A water chemistry assessment of wastewater remediation in a natural swamp.

Zhang, Xiaowei; Feagley, Sam E.; Day, John W.; Conner, William H.; Hesse, Irene D.; Rybczyk, John M.; and Hudnall, Wayne H.

Journal of Environmental Quality 29(6): 1960-1968. (2000)
NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: waste management/ sanitation/ advanced wastewater treatment/ tertiary wastewater treatment/ wastewater remediation/ water chemistry assessment/ applied and field techniques/ bottomland hardwood forest ridge/ cypress tupelo forests/ electrical conductivity/ five-day biological oxygen demand [BOD 5]/ hydraulic detention time/ hydraulic retention time/ natural forested wetland/ pH values/ secondarily treated municipal wastewater/ solids/ swamp water quality/ temperature

Abstract: Various aspects of water chemistry of a natural forested wetland were studied in order to determine the possibility of using the wetland for advanced wastewater treatment in Louisiana and to evaluate the wastewater effect on swamp water quality. The study was carried out by comparing treatment and control cypress-tupelo forests separated by a bottomland hardwood forest ridge. The treatment area (231 ha) received secondarily treated municipal wastewater at a rate of 6.3×10^6 L d⁻¹. The calculated hydraulic detention time of the wastewater was 120 d. Electrical conductivity (EC), pH, and concentrations of 5-d biological oxygen demand (BOD₅), dissolved oxygen (DO), solids, nutrients, and trace metals were monitored. Mean concentrations for the wastewater were 14.6 mg L⁻¹ for total N and 2.5 mg L⁻¹ for total P. The dominant form of N in the wastewater was NO₃-N. The swamp system attenuated the NO₃-N by 100%, total Kjeldahl nitrogen (TKN) by 69%, and total P by 66%. It appears that tertiary wastewater treatment was achieved due to the nutrient attenuations. Based upon our findings, we predict that the high N attenuation efficiency would enable the swamp to work well if the N loading rate were doubled. However, P removal was dependent on loading rate, hydraulic retention time, and temperature. The swamp was more efficient in treating wastewater during warm seasons than cool seasons. During the monitoring period, trace metals were not significantly increased in the swamp water because of very low concentrations in the wastewater.

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662. Water quality and macroinvertebrate assemblages in three types of seasonally inundated limesink wetlands in southwest Georgia.

Battle, J. and Golladay, S. W.

Journal of Freshwater Ecology 16(2): 189-208. (2001)
NAL Call #: QH541.5.F7J68; ISSN: 0270-5060

Descriptors: wetlands/ macrofauna/ zoobenthos/ water quality/ community composition/ species diversity/ ecology/ invertebrates/ aquatic life/ USA, Georgia

Abstract: In southwest Georgia there are three types of

shallow, seasonally inundated limesink wetlands based on soil characteristics and vegetation - grass-sedge marshes, cypress savannas, and cypress-gum swamps. We sampled wetlands of the three types from February 1997 through June 1998 during early, mid, and late hydroperiod in 1997. The wetlands had similar water chemistry soon after inundation. Over time, water in swamps generally had higher levels of dissolved organic carbon, NH sub(4)-N, NO sub(3)-N, and PO sub(4)-P, was more darkly stained, and had lower temperatures than in other wetland types. We collected 121 macroinvertebrate taxa, with 40 taxa occurring in >10% of the samples. Marshes had higher macroinvertebrate numbers and taxa richness than other wetland types. Early in the hydroperiod, macroinvertebrate assemblages were composed of taxa that overwintered in wetlands. Later, predators were abundant in the marshes, and detritivore numbers declined in swamps. Our findings suggest that water quality is influenced by interactions of vegetation, soils, and time since inundation. We believe that macroinvertebrate assemblages differed among the wetland types due mainly to vegetation. Macroinvertebrates in marshes probably have a wider variety of food sources (i.e., algae) and greater habitat structure available, whereas in swamps macroinvertebrates have more stressful conditions (i.e., low dissolved oxygen) caused by processing of large detrital inputs.

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663. Wetland losses in Maryland's coastal bays watershed since the beginning of the twentieth century and their implications for wetlands restoration.

Spaur, C. C.; Nichols, B. E.; Hughes, T. E.; and Noy, P. M. In: Proceedings of the conference: Conservation of biological diversity: A key to the restoration of the Chesapeake Bay ecosystem and beyond. (Held 10 May 1998-13 May 1998 at Therres, G. D. (eds.); pp. 291-302; 2001.

NAL Call #: QH76.5.C48 C66 2001

Descriptors: wetlands/ man-induced effects/ land use/ agriculture/ forest industry/ rural development/ degradation/ ecosystems/ salt marshes/ watersheds/ restoration/ ecosystem management/ nature conservation/ species diversity/ biodiversity/ aerial photographs/ long-term records/ water quality control/ rivers/ coastal waters/ bays/ USA, Maryland, St. Martin R./ USA, Maryland, Turville Creek/ USA, Maryland, Herring Creek/ USA, Maryland, Newport Bay/ USA, Chesapeake Bay/ lost acreage/ conservation/ wildlife management and recreation

Abstract: Losses of salt marsh and forested wetlands to agriculture, development, and silviculture in the coastal bays watershed of Maryland from the beginning of the twentieth century through the 1980s were estimated through a review of soil, wetlands, and land-use maps and aerial photographs; and interpretive field surveys. Loss of salt marsh was estimated to be approximately 730 ha (1,810 acres), or 10% of the historic total. Losses were concentrated in the northern coastal bays, where approximately 620 ha (1,540 acres), or 37%, of the historic salt marshes were lost to development. Losses of forested wetlands by complete conversion to agriculture and development were estimated to be 10,000 ha (24,800 acres), or 44% of the historic total. Most of the remaining areas of historic forested wetlands still under forest cover have been hydrologically degraded by drainage; up to an additional 10,700 ha (26,400 acres) may fall into this status.

Combining these categories, up to 20,700 ha (51,200 acres), or 91%, of the historic forested wetlands of the watershed might have been lost or substantially degraded. Complete losses of forested wetlands are concentrated in the St. Martin River, Turville/Herring Creek, and Newport Bay subwatersheds. Efforts to restore and create salt marsh in the northern coastal bays should be undertaken wherever suitable sites exist, since losses have been substantial in this region, and the natural processes that create and maintain salt marsh are impaired. Salt marsh restoration efforts in the southern bays should focus on sites where losses have occurred. Loss of forested wetlands has occurred on such a large scale that restoration should be undertaken throughout the coastal bays watershed wherever suitable sites exist. To improve water quality in the coastal bays, restoration and creation of forested wetlands could be focused in the St. Martin River, Turville/Herring Creek, and Newport Bay subwatersheds.
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664. Wetland losses related to fault movement and hydrocarbon production, southeastern Texas coast.

White, W. A. and Morton, R. A.
Journal of Coastal Research 13(4): 1305-1320. (1997);
ISSN: 0749-0208

Descriptors: wetlands/ oil and gas production/ ecosystem disturbance/ faults/ subsidence/ coastal erosion/ remote sensing/ oil industry/ ecological effects/ *Spartina*/ erosion/ time series analysis/ flooding/ *Spartina patens*/ *Spartina alterniflora*/ USA, Texas/ subsidence

Abstract: Time series analyses of surface fault activity and nearby hydrocarbon production from the southeastern Texas coast show a high correlation among volume of produced fluids, timing of fault activation, rates of subsidence, and rates of wetland loss. Greater subsidence on the downthrown sides of faults contributes to more frequent flooding and generally wetter conditions, which are commonly reflected by changes in plant communities (e.g., *Spartina patens* to *Spartina alterniflora*) or progressive transformation of emergent vegetation to open water. Since the 1930s and 1950s, approximately 5,000 hectares of marsh habitat has been lost as a result of subsidence associated with faulting. Marshes have expanded locally along faults where hydrophytic vegetation has spread into former upland areas. Fault traces are linear to curvilinear and are visible because elevation differences across faults alter soil hydrology and vegetation. Fault lengths range from 1 to 13.4 km and average 3.8 km. Seventy-five percent of the faults visible on recent aerial photographs are not visible on photographs taken in the 1930's, indicating relatively recent fault movement. At least 80% of the surface faults correlate with extrapolated subsurface faults; the correlation increases to more than 90% when certain assumptions are made to compensate for mismatches in direction of displacement. Coastal wetlands loss in Texas associated with hydrocarbon extraction will likely increase where production in mature fields is prolonged without fluid reinjection.

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Effects of Agricultural Conservation Practices on Wetlands

665. Agricultural best management practices and the decline in surface water total phosphorus concentrations in an impounded Everglades marsh.

Maceina, M. J.
Lake and Reservoir Management 16(3): 235-247. (2000)
NAL Call #: TC401.L3; ISSN: 0743-8141

Descriptors: wetlands/ pollution control/ freshwater lakes/ agricultural pollution/ phosphorus/ water levels/ water quality control/ best management practices/ water pollution control/ marshes/ agricultural runoff/ farms/ lakes/ nutrients/ filtration/ water level/ runoff (agricultural)/ farms and farming/ water management/ agriculture/ nutrient concentrations/ historical account/ USA, Florida, Everglades/ agricultural best management practices
Abstract: Agricultural Best Management Practices (BMPs) in the 290,000 ha Everglades Agricultural Area (EAA) resulted in a 55% reduction in phosphorus loading to the remnant Florida Everglades in 1996-98, exceeding the 25% load reduction mandated by law. Consonant with this, discharge total phosphorus concentrations (TP) declined from 173 ug times L super(-1) in the 1980s to 103 ug times L super(-1) during 1996-98. Although not mandatory until 1995, BMP activity started in the EAA in the mid-1980s. I analyzed 3,798 surface water TP samples collected from 1980 to 1999 in a 54,700 ha impounded Everglades marsh that received surface water inflows from the EAA to examine temporal changes in TP. A gradient of high (> 100 ug times L super(-1)) to low (about 10 ug times L super(-1)) TP existed from northern regions that received EAA discharge south to interior regions of the marsh. During the

1980s, higher TP concentrations extended further south into the marsh, but that process reversed in the 1990s. During the 1990s, wet climatic conditions occurred and TP was inversely correlated to water levels throughout the marsh. However in nearly all regions, TP declined between 1980 and 1999 after accounting for the effects of water levels. Marsh TP was correlated to inflow TP in the regions nearest to the discharge gates, and inflow TP declined from about 150 to 50 ug times L super(-1) with the implementation of BMPs. In addition, this marsh was kept essentially flooded for 18 years to increase water supply, but a more normal "wet-dry" regulation schedule went into effect in late 1980 that permitted drying of the marsh. Three droughts followed by reflooding occurred during the 1980s that caused short-term "TP spikes" in the surface water. Lower inflow TP and possible stabilization of phosphorus between the sediment and the water in the marsh after being kept artificially flooded for so long appeared related to the decline in TP. The establishment of BMPs in the EAA have been successful to help in part to achieve phosphorus reduction goals throughout the remaining Everglades.

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666. Agricultural BMPs for phosphorus reduction in south Florida.

Izuno, F. T.; Bottcher, A. B.; Coale, F. J.; Sanchez, C. A.; and Jones, D. B.
Transactions of the ASAE 38(3): 735-744. (1995)
NAL Call #: 290.9 AM32T; ISSN: 0001-2351
Descriptors: wetlands/ agricultural practices/ phosphorus/

nonpoint pollution sources/ pollution load/ water quality control/ water pollution control/ agriculture/ fertilizers/ agricultural runoff/ water management/ nonpoint pollution/ pollution control/ agricultural pollution/ USA, Florida/ best management practices

Abstract: Four sets of eight or twelve 0.7 ha plots, designed for soil and hydraulic uniformity, were used to screen potential "Best Management Practices" (BMPs) for reducing total phosphorus (TP) concentrations and loadings in the Everglades Agricultural Area (EAA) of south Florida. The four production systems and their alternatives (treatments) studied were: (1) sugarcane (interspecific hybrids of *Saccharum* sp.) versus drained fallow plots; (2) fast versus slow drainage rates for sugarcane; (3) rice (*Oryza sativa* L.) in rotation following radishes to serve as P filter crop versus traditional flooding fallow; and (4) banding phosphorus (P) fertilizer at 50% of the soil-test recommendation rate for cabbage (*Brassica oleracea* L.) versus full-rate broadcast applications. The study showed that there were no differences in P concentrations in drainage water between sugarcane and drained fallow fields. Annual P loading to the plots in rainfall and irrigation water (0.63 kg TP ha super(-1)) exceeded the P loading of drainage waters (0.52 kg TP ha super(-1) for sugarcane and 0.59 kg TP ha super(-1) for drained fallow plots). Slow drained sugarcane plots exhibited significantly higher TP concentrations than the fast drained plots. However, TP loads were significantly higher (0.97 kg ha super(-1)) for fast drained plots than for the slow drained plots (0.67 kg ha super(-1)). Rice as a P filter crop following radishes reduced TP concentrations and loadings. Finally, banding P fertilizer at a reduced rate for cabbage reduced TP concentrations compared to those for broadcasted P at the full recommended level. Total phosphorus loadings in drainage water were 1.17 kg ha super(-1) for banded and 1.38 kg ha super(-1) for broadcast treatments. A total of 1.30 of 1.30 kg TP ha super(-1) entered the plots in rainfall and irrigation water. All treatment TP loadings leaving the plots in drainage water were close in magnitude to TP loadings to the plots, even under heavy fertilization. This indicates that the EAA system is currently a net assimilator of P.

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667. Agricultural production and wetland habitat quality in a coastal prairie ecosystem: Simulated effects of alternative resource policies on land-use decisions.

Musacchio, L. R. and Grant, W. E.

Ecological Modelling 150(1-2): 23-43. (Apr. 2002)

NAL Call #: QH541.15.M3E25; ISSN: 0304-3800

Descriptors: wetlands/ agricultural ecosystems/ prairies/ economics/ biological diversity/ ecosystem models/ government policies/ decision making/ land use/ habitat/ agriculture/ water quality/ wildlife/ resource management/ aquatic birds/ habitat selection/ cost analysis/ biodiversity/ ecosystem disturbance/ policies/ *Oryza sativa*/ *Chen caerulescens caerulescens*/ USA, Texas/ rice/ lesser snow goose/ *Anser caerulescens caerulescens*/ modeling, mathematics, computer applications/ environmental action/ protective measures and control/ general environmental engineering

Abstract: We describe an integrated systems model of the coastal prairie ecosystem in Texas, USA to simulate the effect of alternative federal resource policy scenarios (crop subsidies) for rice (*Oryza sativa*) on land-use decisions of

farmers and the subsequent impact on lesser snow goose (*Anser caerulescens caerulescens*) habitat. We evaluate the ability of the model to predict shifts in land use, agricultural production, economic viability of farms, and the resulting wetland habitat quality for geese, in view of the uncertainty concerning representation of farmers' land-use decision making processes (management styles). We then simulate shifts in land use, rice and cattle production, farm profitability, and level of wetland habitat use by geese that might result from three alternative federal resource policy scenarios and three alternative farmers' management styles. We found changes in land-use allocation, rice and cattle production, and farm profitability resulting from the policy scenarios affected habitat use by geese. Policy financial incentives, market price for rice, level of rice production, and farm size were important factors that affected wetland habitat use by geese. The management styles of farmers affected the quality of wetland habitat when policy scenarios required rice to be grown with conventional production methods. In this case, farmers, particularly those who were concerned about maintaining farming as a way of life, continued rice production and maintained wetland habitat for geese even when crop subsidies decreased over time. The public benefited from the decision making of these farmers because the important indirect use value (wildlife habitat and water quality) and existence value (biodiversity and cultural history) of rice agriculture was maintained as an agroecosystem.

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668. Amphibian responses to helicopter harvesting in forested floodplains of low order, blackwater streams.

Clawson, R. G.; Lockaby, B. G.; and Jones, R. H.

Forest Ecology and Management 90(2-3): 225-235. (1997)

NAL Call #: SD1.F73; ISSN: 0378-1127

Descriptors: animals and man/ disturbance by man/ commercial activities/ ecology/ habitat/ terrestrial habitat/ land and freshwater zones/ Nearctic region/ North America/ USA/ Amphibia: forestry/ helicopter harvesting effects on communities/ community structure/ population dynamics/ responses to helicopter timber harvesting/ semiaquatic habitat/ forest and woodland/ floodplain forested wetlands/ community responses to timber harvest/ Alabama/ South/ community responses to helicopter timber harvesting/ forested wetlands/ Amphibia/ amphibians/ chordates/ vertebrates

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669. Analysis of on-farm best management practices in the Everglades Agricultural Area.

Willis, L. M.; Forest, S. B.; Nissen, J. A.; Hiscock, J. G.; and Kirby, P. V.

In: Environmentally Sound Agriculture: Proceedings of the Second Conference. (Held 20 Apr 1994-22 Apr 1994 at Orlando, Fla.) Campbell, Kenneth L.; Graham, Wendy D.; and Bottcher, A. B. (eds.)

St. Joseph, Mich.: American Society of Agricultural Engineers; pp. 93-99; 1994.

NAL Call #: S589.7.E57 1994; ISBN: 0929355474

Descriptors: book chapter/ fertilizer runoff/ meeting paper/ nonpoint source pollution/ resource management/ water quality

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670. Approach to the inventory of forested wetlands for timber-harvesting impact assessment.

Lea, R.; Mitchell, L. J.; Mader, S. F.; and Aust, W. M. *Forest Ecology and Management* 33: 215-225. (1990)
 NAL Call #: SD1.F73; ISSN: 0378-1127

Descriptors: ecological effects/ forest ecosystems/ forest management/ land use/ management planning/ wetland forests/ Alabama/ best management practices/ data interpretation/ economic aspects/ ecosystems/ forestry/ geohydrology/ nutrients/ primary productivity/ resources management/ sedimentation/ soil properties

Abstract: At present, available information describing the impact of forestry activities on forested-wetland functions is insufficient for use in planning optimal management strategies. A methodology has been developed to assess the impact of timber-harvesting in a tidal freshwater palustrine wetland in southwestern Alabama. Biophysical as well as socio-economic parameters were examined to estimate both stand timber stocks and the extent of disruption of ecosystem functions. Specifically, indices were chosen to detect changes in net primary productivity, plant nutrient assimilative capacity, soil nutrient retention and transformation, decomposition, sedimentation rate, hydrology, and wildlife habitat provision. Furthermore, methods were chosen for data collection efficiency, interpretive simplicity, and the ability to provide a relative index of both the integrity and recovery rates of a disturbed ecosystem. This assessment enables wetland managers to determine which parameters are sensitive to functional changes, as well as the relative effects of various harvesting methods for use in promoting best forest management practices. (Author 's abstract)

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671. Aquatic invertebrate responses to timber harvest in a bottomland hardwood wetland of South Carolina.

Batzer, D. P.; George, B. M.; and Braccia, A. *Forest Science* 51(4): 284-291. (2005)
 NAL Call #: 99.8 F7632; ISSN: 0015-749X

Descriptors: wetlands/ lowland forests/ hardwood forests/ logging/ clearcutting/ Aedes/ Culicidae/ community structure/ indicator species/ environmental impact/ South Carolina

This citation is from AGRICOLA.

672. Aquatic invertebrates in hardwood depressions of southwest Georgia.

Battle, J. M. and Golladay, S. W. *Southeastern Naturalist* 1(2): 149-158. (June 2002)
 NAL Call #: IPSP11706; ISSN: 1528-7092

Descriptors: wetlands/ temporary ponds/ aquatic insects/ community composition/ zooplankton/ forests/ freshwater crustaceans/ rare species/ new records/ distribution records/ habitat/ geographical distribution/ nature conservation/ environmental protection/ conservation/ *Limnadia lenticularis*/ *Invertebrata*/ *Streptocephalus seali*/ *Cladocera*/ *Calanoida*/ *Conchostraca*/ *Chironomidae*/ *Copepoda*/ *Lynceus gracilicornis*/ USA, Georgia/ rare habitat/ hardwood depressions/ water fleas/ midges/ other aquatic communities/ conservation, wildlife management and recreation/ aquatic entomology/ geographical distribution

Abstract: Hardwood depressions in the southeastern United States have been extensively altered due to agriculture and other land management practices. They are small isolated wetlands dominated by oaks that typically become flooded every couple years for a few weeks to several months. We sampled the aquatic invertebrate assemblages of six depressions in 1998 and five depressions in 2001 and found they were composed primarily of clam shrimp, cladocerans, calanoid copepods, and chironomids. The primary functional feeding group was collector-filterers, which comprised >60% of the total numbers. Eubranchiopoda were well represented by two species of clam shrimp (*Lynceus gracilicornis* and *Limnadia lenticularis*) and one species of fairy shrimp (*Streptocephalus seali*). *L. lenticularis* is the first record of this species in Georgia. Consideration should be made for the conservation of hardwood depressions because of the rare invertebrates they accommodate.

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673. Avian response to nutrient enrichment in an oligotrophic wetland, the Florida Everglades.

Crozier, Gaea E. and Gawlik, Dale E. *Condor* 104(3): 631-642. (Aug. 2002)
 NAL Call #: QL671.C6; ISSN: 0010-5422

Descriptors: Aves/ community structure/ wetland community response to nutrient enrichment/ semiaquatic habitat/ oligotrophic wetland/ fertilizer and pesticide pollution/ fertilizers and pesticides/ phosphates/ Florida/ North Everglades/ community response to nutrient enrichment

Abstract: We studied the effects of nutrient enrichment on the bird community in an oligotrophic wetland, the Florida Everglades. Among the non-wading birds surveyed in 1996 and 1997, Boat-tailed Grackles (*Quiscalus major*) and Common Moorhens (*Gallinula chloropus*) were consistently more abundant in enriched sites, whereas Common Yellowthroats (*Geothlypis trichas*) were consistently more abundant in unenriched sites. The abundance of Red-winged Blackbird (*Agelaius phoeniceus*) was not significantly different between enriched and unenriched sites. Among wading birds, Wood Storks (*Mycteria americana*) and Great Egrets (*Ardea alba*) were significantly more abundant in enriched than unenriched areas in a dry year, 1991. Great Egrets and all wading species combined were significantly more abundant in enriched than unenriched areas in the wet year, 1995. Great Blue Herons (*Ardea herodias*) and White Ibises (*Eudocimus albus*) did not differ in abundance between enriched and unenriched areas in the dry or wet year. A significant interaction between water depth and nutrient status in the wet year indicated that wading bird abundance increased with water depth only in nutrient-enriched areas presumably because the enriched areas had greater food availability than unenriched areas at the same water depth. Bird abundance appeared to increase in nutrient-enriched areas; however, this increase was accompanied by a shift in species composition typically found in the unenriched Everglades and was a fundamental change in the Everglades' distinctive structure.

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674. Beaver lodge distributions and damage assessments in a forested wetland ecosystem in the southern United States.

King, Sammy L.; Keeland, Bobby D.; and Moore, Joseph L. *Forest Ecology and Management* 108(1-2): 1-7. (1998)
NAL Call #: SD1.F73; ISSN: 0378-1127

Descriptors: *Castor canadensis* (Castoridae)/ population density/ distribution within habitat/ animal constructions/ lodge construction/ effect of tree felling on habitat/ impact on habitat/ tree felling for lodge construction effect/ semiaquatic habitat/ forest and woodland/ USA/ Louisiana/ Texas/ Caddo Lake/ distribution/ abundance and impact on habitat/ forested wetland

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675. Belowground nutrient dynamics following three harvest intensities on the Pearl River floodplain, Mississippi.

Schilling, E. B.; Lockaby, B. G.; and Rummer, R. *Soil Science Society of America Journal* 63(6): 1856-1868. (1999)

Abstract: The influence of clear and partial cut harvests on belowground nutrient cycling processes was examined on the Pearl River floodplain, Mississippi. Foci examined by this study included fine root biomass and detritus, fine root production, fine root nutrient contents, soil respiration rates, and microbial biomass C, N, and P during the first year post-harvest. Both the clearcut and partial cut initially reduced fine root biomass; however, fine root biomass levels within each treatment did not differ at this study's conclusion. Bimonthly fine root production within both the clearcut and partial cut declined initially following harvest; however, net primary production was greatest within the clearcut, followed by the partial cut, and lowest within the control. Soil respiration rates showed strong seasonal trends; however, increased soil respiration rates within the clearcut and partial cut were not found until almost 1 yr post-harvest. Decreased microbial biomass C levels were observed following both harvests. Only the clearcut treatment significantly reduced microbial biomass N. No treatment effects were found regarding microbial biomass P. Herbaceous and woody vegetation recolonization was vigorous within the clearcut and partial cut harvests, strongly influencing fine root production levels and soil respiration rates. It appears that fine roots from naturally recolonizing vegetation play a large role in belowground C storage following disturbance. The rapid increases in fine root production and biomass following both silvicultural methods indicates that, within these ecosystems, the negative influences of harvesting on belowground C and nutrient pools may be short lived. The influence of clear and partial cut harvests on belowground nutrient cycling processes was examined on the Pearl River floodplain, Mississippi. Foci examined by this study included fine root biomass and detritus, fine root production, fine root nutrient contents, soil respiration rates, and microbial biomass C, N, and P during the first year post-harvest. Both the clearcut and partial cut initially reduced fine root biomass; however, fine root biomass levels within each treatment did not differ at this study's conclusion. Bimonthly fine root production within both the clearcut and partial cut declined initially following harvest; however, net primary production was greatest within the clearcut, followed by the partial cut, and lowest within the control. Soil respiration rates showed strong seasonal trends; however, increased soil respiration

rates within the clearcut and partial cut were not found until almost 1 yr post-harvest. Decreased microbial biomass C levels were observed following both harvests. Only the clearcut treatment significantly reduced microbial biomass N. No treatment effects were found regarding microbial biomass P. Herbaceous and woody vegetation recolonization was vigorous within the clearcut and partial cut harvests, strongly influencing fine root production levels and soil respiration rates. It appears that fine roots from naturally recolonizing vegetation play a large role in belowground C storage following disturbance. The rapid increases in fine root production and biomass following both silvicultural methods indicates that, within these ecosystems, the negative influences of harvesting on belowground C and nutrient pools may be short lived.
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676. Best management practices to enable the coexistence of agriculture and the Everglades environment.

Izuno, F. T.; Rice, R. W.; and Capone, L. T. *Hortscience* 34(1): 27-33. (1999)

NAL Call #: SB1.H6; ISSN: 0018-5345

Descriptors: agriculture/ swamps/ ecosystems/ crop management/ environmental protection/ geographical variation/ drainage/ habitats/ farms/ pumps/ fertilizers/ low input agriculture/ Florida

This citation is from AGRICOLA.

677. Biodegradation of 4-nitrophenol by indigenous microbial population in Everglades soils.

Laha, S. and Petrova, K. P. *Biodegradation* 8(5): 349-356. (1997)
NAL Call #: QR97.X46 B56

Descriptors: acclimation/ biodegradation/ bioremediation/ Everglades/ mineralization/ nitrophenol/ soil
Abstract: The Everglades in South Florida are a unique ecological system. As a result of the widespread use of pesticides and herbicides in agricultural areas upstream from these wetlands, there is a serious potential for pollution problems in the Everglades. The purpose of this study was to evaluate the ability of indigenous microbial populations to degrade xenobiotic organic compounds introduced by agricultural and other activities. Such biodegradation may facilitate the remediation of contaminated soils and water in the Everglades. The model selected in this study is 4-nitrophenol, a chemical commonly used in the manufacture of pesticides. The mineralization of 4-nitrophenol at various concentration was studied in soils collected from the Everglades. At concentrations of 10 and 100 µg/g soil, considerable mineralization occurred within a week. At a higher concentration, i.e., 10 mg/g soil, however, no mineralization of 4-nitrophenol occurred over a 4-month period; such a high concentration apparently produced an inhibitory effect. The rate and extent of 4-nitrophenol mineralization was enhanced on inoculation with previously isolated nitrophenol-degrading microorganisms. The mixture mineralization extent measured, however, was less than 30% suggesting conversion to biomass and/or unidentified intermediate products. These results indicate the potential for natural mechanisms to mitigate the adverse effects of xenobiotic pollutants in a complex system such as the Everglades.

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678. Changes in surface water table depth and soil physical properties after harvest and establishment of loblolly pine (*Pinus taeda* L.) in Atlantic coastal plain wetlands of South Carolina.

Xu, Yi Jun; Burger, James A.; Aust, W. Michael; Patterson, Steven C.; Miwa, Masato; and Preston, David P.

Soil and Tillage Research 63(3-4): 109-121. (2002)

NAL Call #: S590.S48; ISSN: 0167-1987

Descriptors: forestry/ soil science/ Coniferopsida:

gymnosperms, plants, spermatophytes, vascular plants/ forest establishment/ post harvest soil characteristics/ soil physical properties/ surface water table depth change

Abstract: The surface water table is an important factor determining soil chemical, physical and biological processes, and thus affects the functions of forested wetlands. The objective of this study was to assess surface water table dynamics from timber harvesting through early forest plantation establishment in a coastal plain wetland area located in the southeastern United States. Simulated harvesting patterns included two replicates of clear-cutting when soils were dry (dry-weather harvest), three replicates of clear-cutting when soils were wet (wet-weather harvest), and one replicate of uncut control in three 20 ha wetland loblolly pine (*Pinus taeda* L.) forests of ages 20, 23 and 25 years. After harvesting, two site preparation levels (non-bed and bed; bedding is a tillage process of preparing a series of parallel ridges) were randomly assigned to both dry-weather and wet-weather harvested plots, while an additional level (mole-plow + bed) was assigned only to the wet-weather harvested plots. The harvest treatments were designed to create a broad gradient of surface soil disturbance, while the site preparation treatments were done to encompass a range of site drainage and aeration conditions. Areal changes in soil bulk density, macro- and total porosities, and saturated hydraulic conductivity following harvesting were quantified. The depths of water table were recorded at monthly intervals on a 20 m X 20 m grid across the 15 clear-cut and three uncut control plots (a total of 1409 PVC slotted wells) over 6 years (1992-1998), subdivided into five periods: pre-harvest, post-harvest, site preparation, and first year and second year after forest plantation establishment. The results showed that compared to the uncut control, the surface water table depth during a 1-year post-harvest period rose 14 cm for the dry-weather harvested site and 21 cm for the wet-weather harvested site. The difference in the water table rise between the two harvest treatments was small during the dormant season (<2 cm) but large during the growing season (> 10 cm). These results indicate the large influence of tree removal on the surface hydrology in forested wetlands and the strong impact of wet-weather harvesting on transpiring ground vegetation due to a larger surface area of soil disturbance. Bedding initially lowered water tables on both dry-weather and wet-weather harvested sites. However, this effect decreased rapidly during the first 2 years after forest plantation establishment. Among all treatments, the dry-weather harvested sites without bedding presented the fastest recovery of water table depth to that of the non-harvested references, suggesting that bedding may have been a further disturbance with respect to wetland surface hydrology.

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679. Compaction and rutting during harvesting affect better drained soils more than poorly drained soils on wet pine flats.

Aust, W. M.; Tippett, M. D.; Burger, J. A.; and McKee, W. H.

Southern Journal of Applied Forestry 19(2): 72-77. (1995)

NAL Call #: SD1.S63; ISSN: 0148-4419

Descriptors: wetlands/ soil air/ soil water regimes/ salvage felling and logging/ skidding/ soil degradation/ logging/ soil compaction

Abstract: Soil compaction and rutting (puddling, destruction of soil aggregates) are visually distinct types of wet-site harvesting disturbances; however, the way in which they affect soil physical properties and hydrology is not well documented. Three compacted and three rutted sites in wet pine flats on the Francis Marion National Forest, South Carolina, were evaluated to determine the effects of the disturbances during salvage logging after Hurricane Hugo on soil physical and hydrologic properties. Primary skid trails and nontrafficked areas were compared for each site. Both compaction and rutting increased bulk density, and reduced macropore space and saturated hydraulic conductivity. Water tables and reducing conditions were closer to the soil surface within the primary skid trails. For the compacted and rutted skid trails, changes were greatest on sites that initially had better drainage and aeration. Compacted sites may prove easier to mitigate with site preparation than rutted sites due to the shallower nature of the disturbances and drier site conditions that will facilitate mechanical mitigation.

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680. Comparison of wetland structure and function on grazed and ungrazed salt marshes.

Reader, Judy and Craft, Christopher

Journal of the Elisha Mitchell Scientific Society 115(4):

236-249. (1999)

NAL Call #: 500 EL4; ISSN: 0013-6220

Descriptors: estuarine ecology; environmental sciences/ backmarsh elevation/ benthic community/ biomass: aboveground, belowground/ carbon:nitrogen ratio/ grazing effects/ herbivory/ nitrogen:phosphorus ratio/ primary productivity/ salinity/ salt marshes/ soil development/ species composition/ species density/ streamside elevation/ tidal inundation/ wetlands: function, structure

Abstract: Macrophyte productivity, soil development, and benthic invertebrate communities were compared on grazed and ungrazed salt marshes to examine the effects of grazing by feral ponies on wetland structure and function. The marshes had similar geomorphology (embayment), elevation (streamside and backmarsh), tidal inundation (1 m), salinity (25-35 ppt), soil type (Carteret series), and plant species composition (*Spartina alterniflora* Loisel) but differed with respect to the presence or absence of ponies. Over a two year period, above and belowground (0-30 cm depth) biomass were significantly lower in the grazed marsh (aboveground = 196-400 g/m², belowground = 828-1049 g/m²) than the ungrazed marsh (aboveground = 588-671 g/m²; belowground = 4,921-6,730 g/m²). Reduction in *Spartina* biomass at the grazed marsh resulted in less soil organic carbon, nitrogen, and phosphorus than at the ungrazed marsh. There was no difference in C:N ratios at the two marshes, but N:P ratios were higher in the ungrazed marsh (9:1-19:1) than the grazed marsh (6:1-

11:1), suggesting that more N is available for marsh organisms at the ungrazed site. Total benthic infauna density did not differ between the grazed (31,265 organisms/m²) and ungrazed (45,511 organisms/m²) marshes. However, the density of subsurface deposit feeders was significantly lower in the grazed marsh (10,370 organisms/m²) than in the ungrazed marsh (16,877 organisms/m²), perhaps as a result of lower soil organic matter and reduced food availability. Our findings suggested that herbivory by feral ponies co-ops primary productivity that would otherwise enter the detritus based salt marsh food web. This hypothesis should be tested using manipulative studies (e.g. exclosures) that exclude the ponies from areas of the marsh.

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681. Composition and function of sulfate-reducing prokaryotes in eutrophic and pristine areas of the Florida Everglades.

Castro, H.; Reddy, K. R.; and Ogram, A.

Applied and Environmental Microbiology 68(12): 6129-6137. (Dec. 2002)

NAL Call #: 448.3 Ap5; ISSN: 0099-2240

Descriptors: wetlands/ soil microorganisms/ communities/ sulfate/ reduction/ most probable number/ methanogenesis/ sulfite reductase/ community composition/ bacterial/ sulphates/ soils/ nutrients (mineral)/ physicochemical properties/ agricultural runoff/ biogeochemistry/ ground water/ carbon cycle/ desulfotomaculum/ USA, Florida, Everglades/ soil and plants/ microorganisms

Abstract: As a result of agricultural activities in regions adjacent to the northern boundary of the Florida Everglades, a nutrient gradient developed that resulted in physicochemical and ecological changes from the original system. Sulfate input from agricultural runoff and groundwater is present in soils of the Northern Everglades, and sulfate-reducing prokaryotes (SRP) may play an important role in biogeochemical processes such as carbon cycling. The goal of this project was to utilize culture-based and non-culture-based approaches to study differences between the composition of assemblages of SRP in eutrophic and pristine areas of the Everglades. Sulfate reduction rates and most-probable- number enumerations revealed SRP populations and activities to be greater in eutrophic zones than in more pristine soils. In eutrophic regions, methanogenesis rates were higher, the addition of acetate stimulated methanogenesis, and SRP able to utilize acetate competed to a limited degree with acetoclastic methanogens. A surprising amount of diversity within clone libraries of PCR-amplified dissimilatory sulfite reductase (DSR) genes was observed, and the majority of DSR sequences were associated with gram-positive spore-forming Desulfotomaculum and uncultured microorganisms. Sequences associated with Desulfotomaculum fall into two categories: in the eutrophic regions, 94.7% of the sequences related to Desulfotomaculum were associated with those able to completely oxidize substrates, and in samples from pristine regions, all Desulfotomaculum-like sequences were related to incomplete oxidizers. This metabolic selection may be linked to the types of substrates that Desulfotomaculum spp. utilize; it may be that complete oxidizers are more versatile and likelier to proliferate in

nutrient-rich zones of the Everglades. Desulfotomaculum incomplete oxidizers may outcompete complete oxidizers for substrates such as hydrogen in pristine zones where diverse carbon sources are less available.

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682. Differential effects of surface and peat fire on soil constituents in a degraded wetland of the northern Florida Everglades.

Smith, S. M.; Newman, S.; Garrett, P. B.; and Leeds, J. A. *Journal of Environmental Quality* 30(6): 1998-2005. (2001) NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: fires/ burning/ peat/ surface layers/ wetland soils/ losses from soil/ carbon/ nitrogen/ organic compounds/ organophosphorus compounds/ phosphorus/ calcium/ soil chemistry/ volatilization/ burnt soils/ inorganic phosphorus/ Florida

Abstract: The effects of surface (aboveground) and peat (belowground) fire on a number of soil constituents were examined within a hydrologically altered marsh in the northern Florida Everglades. Peat fire resulted in losses of total carbon (TC), total nitrogen (TN), and organic phosphorus (Po), while inorganic phosphorus (Pi) and total calcium (TCa) concentrations increased. In addition, peat fire led to a more pronounced vertical gradient in constituent concentrations between upper and lower soil layers. Surface fire also affected soil constituents, but impacts were small relative to peat fire. The effects of physical versus chemical processes during burning were assessed using ratios of constituent to TCa concentrations. This measure indicated that increases in the levels of total phosphorus (TP) in peat-burned areas were due primarily to the physical reduction of soil, while decreases in TN and TC were the result of volatilization. Increases in concentrations of Pi fractions arose from both chemically and physically mediated processes. In an ecological context, the observed soil transformations may encourage the growth of invasive plant species, such as southern narrow-leaved cattail (*Typha domingensis* Pers.), which exhibits high growth rates in response to increased P availability.

This citation is from AGRICOLA.

683. Division S-10, Wetland soils: Turnover of detrital organic carbon in a nutrient-impacted Everglades marsh.

DeBusk, W. F. and Reddy, K. R.

Soil Science Society of America Journal 62(5): 1460-1468. (1998)

NAL Call #: 56.9 So3; ISSN: 0361-5995

Abstract: Phosphorus loading to the Everglades from nearby agricultural areas has become a major concern, and is considered to be a significant factor in the encroachment of cattail (*Typha domingensis* Pers.) and other rapidly growing vegetation into endemic sawgrass (*Cladium jamaicense* Crantz) marsh. The objectives of this research were to evaluate the variability in turnover of organic C in plant and soil detrital pools along a P enrichment gradient in an Everglades marsh and to identify substrate characteristics and environmental factors controlling C turnover. Potential rates of C mineralization in plant litter and peat were determined by measuring aerobic and anaerobic microbial respiration under controlled conditions in laboratory incubations. Potential C mineralization decreased with depth and, consequently, substrate age, in

the plant-soil profile. Within individual detrital pools [standing dead plant material, soil litter layer, surface peat (0-10 cm depth) and subsurface peat (10-30 cm depth)], potential C mineralization decreased down gradient from the source of nutrient loading, to WCA-2A. Overall, 91% of the variability in aerobic C mineralization in peat and plant litter was accounted for by substrate P concentration and lignocellulose composition. Anaerobic C mineralization rates were consistently about one-third of aerobic rates. Results indicated that organic C turnover in detrital pools in WCA-2A is significantly affected by accelerated P loading, but is also controlled by O₂ availability and substrate C quality.

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684. Ecological responses of an oligotrophic floodplain forest to harvesting.

Lockaby, B. G.; Thornton, F. C.; Jones, R. H.; and Clawson, R. G.

Journal of Environmental Quality 23(5): 901-906. (1994)

NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: wetlands/ bottomland forests/ groundwater level/ clear felling/ Histosols/ denitrification/ helicopters/ skidders/ damage/ nitrogen/ phosphorus/ skidding/ ecology/ floodplains/ logging/ water quality

Abstract: Aerial (hand felling plus helicopter extraction) and ground-based (use of a feller-buncher on mats plus skidder log removal) logging systems were compared in terms of effects on gaseous and hydrologic transfers on N and P. The study sites in southern Alabama were narrow floodplains of low order blackwater streams and were dominated by P-deficient histosols and a mixed, primarily deciduous forest. There was no significant effect of logging on either denitrification or surface and groundwater chemistry. An unexpected effect of the clear fellings was a significant lowering of groundwater tables.

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685. Effect of land development and forest management on hydrologic response in southeastern coastal wetlands: A review.

Richardson, C. J. and Mccarthy, E. J.

Wetlands 14(1): 56-71. (1994)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ forest industry/ land use/ hydrology/ United States, Southeast/ literature reviews/ United States, North Carolina/ resource management/ runoff/ evapotranspiration/ environmental impact/ land development/ forest management/ hydrologic models/ environmental effects/ forest management/ Mechanical and natural changes/ Ecosystems and energetics/ Freshwater pollution/ Effects on water of human nonwater activities/ Environmental degradation

Abstract: Land development activities such as agriculture, clear cutting, peat mining, and the planting of forest plantations on wetlands can affect the hydrologic behavior of these ecosystems by affecting their water storage and release patterns on the landscape. The effects of these development activities on hydrologic fluxes in peatlands (Typic Medisaprists) were compared to the effects of forest management practices in North Carolina using a field-tested hydrologic simulation model (DRAINMOD). Simulations revealed that natural peat-based (Histosol) pocosin systems lose 66% (80 cm) of the 123 cm of average annual rainfall by evapo-transpiration (ET) and

34% (42 cm/yr) via annual runoff. Annual runoff values were 63 cm/yr for peat mining areas, 48 cm/yr for cleared peatlands, 46 cm/yr for peatlands converted to agriculture and 34 cm/yr for pine plantations, once the forest canopy is closed. Thus, these wetlands alterations, except for forestry, significantly increased runoff and decreased ET compared to the natural ecosystem. Forest pine plantation management decreased runoff and increased ET. A case study of the effects of forest management practices was reviewed for a 15-year-old drained loblolly pine plantation growing on fine sandy loam soils (Thermic Typic umbraquills) in the coastal plains of North Carolina. Forestry activities such as thinning (i.e., reduced leaf area index by 50%) decreased ET and canopy interception and nearly doubled drainage loss (38 cm/yr to 60 cm/yr). Commonly applied forest practices, such as drainage, increased the average number of flow events with flows > 5 mm/day to 86 days per year from 26 days per year under natural conditions.

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686. Effects of chemical and mechanical site preparation on bottomland hardwood regeneration after ten years.

Greene, T. A. and Lowe, W. J.

In: Proceedings of the Seventh Biennial Southern Silvicultural Research Conference. (Held 17 Nov 1992-19 Nov 1992 at Mobile, Ala.) Brissette, John C. (eds.) New Orleans, La.: Southern Forest Experiment Station; pp. 425-429; 1993.

NAL Call #: aSD11.U57

<http://www.srs.fs.usda.gov/pubs/viewpub.jsp?index=1407>

Descriptors: Quercus/ Liquidambar styraciflua/ clearcutting/ site preparation/ burning/ herbicides/ chemical control/ natural regeneration/ Texas

This citation is from AGRICOLA.

687. Effects of clearcutting and natural regeneration on breeding bird communities of a baldcypress-tupelo wetland in South Carolina.

Mitchell, Laura J.; Lancia, Richard A.; Lea, Russ; and Gauthreaux, Sidney A.

In: Proceedings of an International Symposium: Wetlands and River Corridor Management. (Held 5 Jul 1989-9 Jul 1989 at Charleston, South Carolina.) Kusler, Jon A. and Daly, Sally (eds.)

Berne, N.Y.: Association of Wetland Managers; pp. 155-161; 520 p.; 1989.

NAL Call #: QH541.5.M3P75 1989

Descriptors: wetlands/ lowland forests/ clearcutting/ silvicultural practices/ environmental impact/ birds

688. Effects of forest management on biogeochemical functions in southern forested wetlands.

Walbridge, Mark R. and Lockaby, B. Graeme

Wetlands 14(1): 10-17. (1994)

Descriptors: denitrification/ forestry/ Georgia/ ground water/ growth/ hydraulic conductivity/ microorganism absorption/ nitrate/ nitrogen/ nutrients/ organic carbon/ phosphorus/ redox potential/ sediment deposition/ soil moisture/ soil temperature/ species composition

Abstract: Southern forested wetlands perform two important biogeochemical functions on the landscape: 1) nutrient (N and P) removal from incident surface, subsurface, and ground waters, and 2) export of organic

carbon and associated nutrients to aquatic ecosystems downstream. In addition to P sediment deposition, which can range from 1.6 to 36.0 kg ha⁻¹ yr⁻¹ P, denitrification of NO₃-N (0.5 to 350 kg ha⁻¹ yr⁻¹) and P adsorption (130 to 199 kg ha⁻¹ yr⁻¹) can be important mechanisms associated with N and P removal, respectively. Biological processes, uptake by plants (15.0 to 51.8 kg ha⁻¹ yr⁻¹ for N; 0.2 to 3.8 kg ha⁻¹ yr⁻¹ for P) and microorganism absorption (16.2 to 87.0 kg ha⁻¹ yr⁻¹ for N; 6.6 to 40.0 kg ha⁻¹ yr⁻¹ for P) are also important and are intimately associated with organic matter export. Clearcut harvests (ground-based or aerial), followed by natural regeneration, are the most common silvicultural techniques used in forested floodplains in the South. Ground-based methods have been shown to increase soil bulk density and decrease hydraulic conductivity and redox potential in wetter soils. In addition to the increases in soil temperature and soil wetness that frequently occur following forest harvesting, these added effects may be responsible for the reduced productivity and altered species composition observed following ground-based vs. aerial harvests. Changes in denitrification will be a function of the degree to which harvesting affects soil redox potential, substrate (C) availability, and nitrate production. In theory, denitrification rates should increase following harvesting, but low nitrate availability in acid soils may limit this effect. The effects of harvesting on P adsorption processes in forested wetland soils have not been studied. Reductions in plant uptake and litterfall and changes in species composition following harvesting could alter both nutrient retention/transformation and organic C export functions. On wetter sites, canopy removal may stimulate algal populations, providing a short-term mechanism for conserving geochemical exports. Clearcut harvest systems that minimize alterations in soil hydrology and promote rapid vegetation regrowth should have the least effect on biogeochemical functions in southern forested wetlands.

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689. Effects of grazing by feral horses, clipping, trampling, and burning on a Georgia salt marsh.

Turner, M. G.

Estuaries 10(1): 54-60. (1987)

NAL Call #: GC96.E79; ISSN: 0160-8347

Descriptors: *Spartina alterniflora*/ *Littorina*/ horses/ salt marshes/ grazing/ fires/ Georgia

This citation is from AGRICOLA.

690. Effects of group-selection timber harvest in bottomland hardwoods on fall migrant birds.

Kilgo, John C.; Miller, Karl V.; and Smith, Winston P.

Journal of Field Ornithology 70(3): 404-413. (1999)

NAL Call #: 413.8 B534; ISSN: 0273-8570

Descriptors: animals and man/ disturbance by man/ commercial activities/ behaviour/ ecology/ habitat/ terrestrial habitat/ land and freshwater zones/ Nearctic region/ North America/ USA/ Aves: forestry/ bottomland hardwood group selected timber harvest/ impacts on migrant communities/ migration/ community structure/ migrant communities/ impacts of forestry practices/ distribution within habitat/ habitat utilization/ forest and woodland/ South Carolina/ Aiken/ Barnwell and Allendale counties/ bottomland hardwood forest migrant communities/ forestry practices impacts/ Aves/ birds/ chordates/ vertebrates

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691. Effects of increased phosphorus loading on dissolved oxygen in a subtropical wetland, the Florida Everglades.

McCormick, P. V. and Laing, J. A.

Wetlands Ecology and Management 11(3): 199-215. (2003)

NAL Call #: QH541.5.M3 W472; ISSN: 0923-4861

Descriptors: wetlands/ phosphorus/ nutrient loading/ dissolved oxygen/ eutrophication/ agricultural runoff/ nutrients (mineral)/ pollution effects/ periphyton/ aquatic plants/ biota/ short-term changes/ primary production/ USA, Florida, Everglades/ USA, Florida, Everglades Natl. Park/ freshwater pollution/ effects on organisms/ habitat community studies/ environmental degradation/ water pollution: monitoring, control & remediation

Abstract: The Florida Everglades is an oligotrophic, phosphorus (P)-limited wetland that is experiencing eutrophication as a result of P-enriched agricultural runoff. Effects of P enrichment on diel water-column dissolved oxygen concentration (DO) profiles were measured along nutrient gradients downstream of agricultural discharges in two northern Everglades marshes and in field enclosures (mesocosms) exposed to different P loading rates. Reference (i.e., water-column TP < 10 µg/L) areas in the marsh interior were characterized by strong diel fluctuations in DO, and aerobic conditions generally were maintained throughout the diel cycle. Enriched stations (water-column TP elevated to between 12 and 131 µg/L) were characterized by dampened diel fluctuations and reduced DO, and the extent of these changes was correlated strongly with marsh P concentrations. Mean DO declined from between 1.81 and 7.52 mg/L at reference stations to between 0.04 and 3.18 mg/L in highly enriched areas. Similarly, minimum DO declined from between 0.33 and 5.86 mg/L to between 0 and 0.84 mg/L with increasing enrichment, and the frequency of extremely low DO (< 1 mg/L) increased from between 0 and 20% to as high as 100% in the most enriched areas. Diel oxygen profiles in P-enriched mesocosms declined progressively with time; all loading treatments exhibited similar DO during the 1st year of P loading, but concentrations declined significantly at higher loads by year 3. Reductions in water-column DO with increased P enrichment were associated with reduced oxygen production by submersed periphyton and macrophytes and increased sediment oxygen demand. Increased emergent macrophyte cover in enriched areas likely contributed to these changes by shading the water-column, which inhibited submerged productivity, and by providing inputs of nutrient-rich detritus, which increased oxygen demand. Declines in marsh DO are associated with other ecological changes such as increased anaerobic metabolism and an increase in invertebrate taxa that tolerate low DO. While background oxygen concentrations in wetlands can be lower than those in lakes and rivers, declines in water-column DO caused by eutrophication can result in biological impacts similar to those in other aquatic ecosystems.

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692. Effects of the herbicide imazapyr on benthic macroinvertebrates in a logged pond cypress dome.

Fowlkes, Mark D.; Michael, Jerry L.; Crisman, Thomas L.; and Prenger, Joseph P.

Environmental Toxicology and Chemistry 22(4): 900-907. (2003)

NAL Call #: QH545.A1E58; ISSN: 0730-7268

<http://www.srs.fs.usda.gov/pubs/5485>

Descriptors: imazapyr/ herbicide/ macroinvertebrates/ chironomid deformity/ wetland

Abstract: Increased herbicide use in silviculture over the last several decades has led to concern over potential water contamination, which may affect biotic health. In the southeastern United States, pine Ratwoods are important for timber production and are often interspersed with cypress wetlands. Cypress domes are isolated, shallow basins that collect surficial waters from adjacent forested areas and therefore might be expected to contain pesticide from storm runoff. This study utilizes in situ microcosm experiments to assess the effects of a concentration gradient of the herbicide imazapyr (0.184, 1.84, and 18.4 mg/L, equivalent to 1, 10, and 100 times the expected environmental concentration from a normal application rate) on the macroinvertebrate community of a logged pond cypress dome using changes in macroinvertebrate composition, chironomid biomass, and chironomid head-capsule deformities. The control core was not significantly different from the surrounding cypress dome for any parameter, suggesting that enclosure effects were likely of minimal importance in the final experimental results. The lack of statistical difference ($p < 0.05$) in macroinvertebrate community composition, chironomid deformity rate, and chironomid biomass between treatments suggests that imazapyr did not affect the macroinvertebrate community at the concentrations tested. Chironomid deformity rate ranged from 0.97% for imazapyr control to 4.96% for the 100X treatment, with chironomid biomass being 1.79 and 1.87 mg/L, respectively.

This citation is from Treesearch.

693. The effects of timber harvest in a South Carolina blackwater bottomland.

Perison, Donna; Phelps, Joseph; Pavel, Christina; and Kellison, Robert

Forest Ecology and Management 90(2-3): 171-185. (1997)

NAL Call #: SD1.F73; ISSN: 0378-1127

Descriptors: animals and man/ disturbance by man/ commercial activities/ ecology/ habitat/ terrestrial habitat/ land and freshwater zones/ Nearctic region/ North America/ USA/ Amphibia/ Reptilia: forestry/ comparison of harvest methods/ community structure/ timber harvest effects/ forest and woodland/ timber harvest effects on communities/ USA/ South Carolina/ South Fork Edisto River/ timber harvest effects on community structure/ blackwater forested wetland/ amphibians/ chordates/ reptiles/ vertebrates

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694. Environmental contaminants in Texas, USA, wetland reptiles: Evaluation using blood samples.

Clark, D. R.; Bickham, J. W.; Baker, D. L.; and Cowman, D. F.

Environmental Toxicology and Chemistry 19(9): 2259-2265. (2000)

NAL Call #: QH545.A1E58; ISSN: 0730-7268

Descriptors: wetlands/ pesticides (organochlorine)/ DDE/ contaminants/ water pollution sources/ fate of pollutants/ water pollution effects/ arsenic/ animal populations/ bioaccumulation/ blood/ data collections/ ecological effects/ animal physiology/ water pollution/ ecology/ pesticides/ aquatic reptiles/ *Nerodia*/ *Agkistrodon piscivorus*/ *Trachemys scripta*/ *Nerodia erythrogaster*/ *Nerodia rhombifer*/ water snakes/ cottonmouth/ common slider/ USA, Texas/ organochlorine pesticides/ reptiles/ plain-bellied water snake/ diamondback water snake/ Old River Slough/ Municipal L.

Abstract: Four species of reptiles (diamondback water snake [*Nerodia rhombifer*], blotched water snake [*N. erythrogaster*], cottonmouth [*Agkistrodon piscivorus*], and red-eared slider [*Trachemys scripta*]) were collected at two contaminated and three reference sites in Texas, USA. Old River Slough has received intensive applications of agricultural chemicals since the 1950s. Municipal Lake received industrial arsenic wastes continuously from 1940 to 1993. Blood samples were analyzed for organochlorines, potentially toxic elements, genetic damage, and plasma cholinesterase (ChE). Dichlorodiphenyldichloroethylene (DDE) concentrations reached as high as 3.0 ppm (wet weight) in whole blood of a diamondback water snake at Old River Slough, a level probably roughly equivalent to the maximum concentration found in plasma of peregrine falcons (*Falco peregrinus*) in 1978 to 1979 when DDE peaked in this sensitive species. Possible impacts on diamondback water snakes are unknown, but at least one diamondback water snake was gravid when captured, indicating active reproduction. Arsenic was not found in red-eared sliders (only species sampled) from Municipal Lake. Red-eared sliders of both sexes at Old River Slough showed declining levels of ChE with increasing mass, suggesting a life-long decrease of ChE levels. Possible negative population consequences are unknown, but no evidence was found in body condition (mass relative to carapace length) that red-eared sliders at either contaminated site were harmed.

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695. Fate and effect of (14c)fenvaterate in a tidal marsh sediment ecosystem model.

Caplan, J. A.; Isensee, A. R.; and Nelson, J. O.

Journal of Agricultural and Food Chemistry 32(1): 166-171. (1984)

NAL Call #: 381 J8223; ISSN: 0021-8561

Descriptors: pesticides/ fenvaterate/ tidal marshes/ fate of pollutants/ sediments/ leaching/ microorganisms/ water pollution effects/ salt marshes

Abstract: A model salt marsh ecosystem was developed and used to evaluate the fate and effect of a pesticide under simulated salt marsh conditions. Fenvaterate was used as a reference pesticide. Fenvaterate is a pyrethroid insecticide that has great potential for control of a wide range of insect pests in agriculture. Two dosages (0.2 and 1.0 ppm) of C-14 labeled fenvaterate were uniformly applied to the sediment. Additionally, a third treatment (1.0

ppm) was applied to the top centimeter of a 3-cm column to monitor the vertical movement of the compound (plus metabolites). No adverse effects of C-14 fenvalerate on heterotrophic microorganisms were observed after 7 days at any treatment level, as measured by plate counts and substrate degradation assays (starch, cellulose, and protein). The half-lives of C-14 fenvalerate in the 0.2- and 1.0 ppm noncolumn treatments were 6.3 and 8.9 days, respectively. The lower half-life (3.2 days) observed in the 1.0 ppm column treatment was attributed to a higher leaching rate in that treatment. TLC analysis of sediment extracts revealed the presence of three identifiable metabolites in all treatments after 4 days of incubation.

(Baker-IVI)

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696. Female American black bear use of managed forest and agricultural lands in coastal North Carolina.

Jones, Mark D. and Pelton, Michael R.

Ursus 14(2): 188-197. (2003); ISSN: 1537-6176

Descriptors: *Ursus americanus*/ abundance/ agriculture/ American black bear/ dispersion/ ecological requirements/ habitat/ home-range/ silviculture/ *Glucine max*/ *Pinus spp.*/ *Pinus taeda*/ *Triticum spp.*/ biotop/ home-range/ USA, North Carolina

Abstract: [unedited] American black bear use of intensively managed forestry and agricultural environments in the southeastern United States is poorly understood. During 1992-94, we radiomonitored female black bears (*Ursus americanus*) to determine home range and habitat use characteristics in two managed agroforestry environments in the North Carolina coastal plain. These areas represented opposite ends of the land-management spectrum. The Big Pocosin (BP) area was dominated by loblolly pine (*Pinus taeda*) plantations and human activity and development. The Gum Swamp (GS) area contained larger and more numerous remnants of unmanaged forests including bottomlands, mixed hardwoods, upland hardwoods, and pocosins. These unmanaged forests were interspersed with pine plantations and relatively low human activity. Home range and habitat analyses were conducted seasonally and annually using land use-land cover data in a geographic information system (GIS). Spring, summer, and fall home ranges of black bears were larger in the BP than the GS, and GS home ranges were among the smallest reported in the United States. Pocosins, clearcuts, and marshes were frequently preferred over managed pine plantations. Collared bears did not spend large amounts of time in agricultural areas, but evidence from a companion study suggests that bears depended heavily on crops for food obtained during short feeding forays. Changes in crop rotation patterns from corn, soybeans, and wheat to cotton may reduce agricultural food resources for bears. The continued loss of pocosins and marshes to human development may exacerbate the effects of reduced food crops. Black bears appear to benefit from early-succession habitats created by logging operations. We recommend the development of a coalition of state and federal wildlife agencies, the forest industry, and the agricultural community to discuss landscape effects on black bears in the Atlantic Coastal Plain and implement strategies to address future black bear habitat management in the region.

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697. First year analysis of the effects of phosphorus enrichment on slough communities of the Everglades: An experimental approach using a solar powered dosing system.

Richardson, C. J.; Qualls, R. G.; and Vaithianathan, P.

Lake and Reservoir Management 9(2): 108. (1994)

NAL Call #: TC401.L3; ISSN: 0743-8141

Descriptors: wetlands/ water pollution effects/ agricultural runoff/ phosphorus/ nutrients/ ecosystems/ environmental effects/ macrophytes/ algae/ eutrophication/ nutrients (mineral)/ environmental impact/ environmental monitoring/ monitoring systems/ periphyton/ USA, Florida, Everglades/ nutrients (mineral)/ environmental impact/ environmental monitoring/ monitoring systems/ periphyton/ water pollution effects/ nutrients/ macrophytes

Abstract: The Everglades is a phosphorus limited system that historically received most inputs of nutrients via rainfall but has more recently been impacted by over 200 metric tons of P per year from agricultural drainage. To determine a threshold level of phosphorus responsible for changes in community structure and ecosystem processes, a replicated solar-driven, in situ mesocosm experiment was conducted during 1992-1993. Twelve channels, each 10 meters long, were dosed with 0, 30, 50, 75, and 150 $\mu\text{g/L}$ of PO sub(4)-P (Na sub(2) HPO sub(4)). Control SRP concentrations averaged 5.8 $\mu\text{g/L}$ (plus or minus 3.9) while channels receiving highest inputs (150 $\mu\text{g/L}$ of P) displayed varying P levels that averaged between 58 and 61 $\mu\text{g/L}$ of P 1 meter from the source but varied with water depth, season and distance down the channel. Density or percent cover of all dominant macrophytes was lower in the channel segments with highest average SRP concentrations (58 to 61 $\mu\text{g/L}$ PO sub(4)-P). Chara appeared to reach its maximum percent cover at an average concentration of about 20 $\mu\text{g/L}$ PO sub(4)-P. Two hundred and twenty-nine algal species, dominated by diatoms and blue-green algae, were observed. Increased SRP levels enhanced periphyton standing crop in certain microhabitats.

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698. Floristic quality indices for biotic assessment of depressional marsh condition in Florida.

Cohen, M. J.; Carstenn, S.; and Lane, C. R.

Ecological Applications 14(3): 784-794. (2004)

NAL Call #: QH540.E23; ISSN: 1051-0761

Descriptors: agricultural disturbance/ biological assessment/ coefficient of conservatism/ Florida (USA)/ floristic quality assessment index (FQAI)/ isolated depressional marshes/ landscape development intensity index (LDI)/ wetland condition

Abstract: Evaluation of wetland ecological condition requires quantitative biological indices for measuring anthropogenic impairment. We implemented a modified floristic quality assessment index (FQAI) protocol for 75 isolated, depressional herbaceous wetland systems, exploring refinements of FQAI standard methods. Species encountered during sampling ($n = 397$) were assigned coefficients of conservatism (CC) by ten expert botanists working independently. A quantitative summary metric of adjacent site buffer (up to 100 m) land use intensity, called the landscape development intensity (LDI) index, was calculated for each wetland system to quantify expected anthropogenic impairment. The association between LDI and wetland community mean CC scores was strong and

conditionally independent of ecoregion. Weaker associations with LDI were observed for other community summary metrics, including richness-weighted FQAI. We inverted LDI to compute an intensity coefficient (IC), which quantifies observed buffer development intensity tolerated by each species. IC scores were significantly associated with CC scores on a species basis and strongly associated on a site mean basis. Growing interest in floristic quality assessment for regulatory purposes provides opportunities for formally linking expert opinion and ground observations of species-specific disturbance tolerance.
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699. Forest harvesting effects on soil temperature, moisture and respiration in a bottomland hardwood forest.

Londo, A. J.; Messina, M. G.; and Schoenholtz, S. H.

Soil Science Society of America Journal 63(3): 637-644. (1999)

NAL Call #: 56.9 So3; ISSN: 0361-5995

Descriptors: lowland forests/ bottomland soils/ soil temperature/ soil water content/ carbon dioxide/ losses from soil/ clearcutting/ felling/ biogeochemical cycles/ emissions/ soil respiration/ Texas

Abstract: The effect of forest disturbance on C cycling has become an issue, given concerns about escalating atmospheric C content. We examined the effects of harvest intensity on in situ and laboratory mineral soil respiration in an East Texas bottomland hardwood forest between 6 and 22 mo after harvesting. Treatments included a clearcut, a partial cut wherein approximately 58% of the basal area was removed, and an unharvested control. The soda-lime absorption technique was used for in situ respiration (CO₂) efflux and the wet alkali method (NaOH) was used for laboratory mineral soil respiration. Soil temperature and moisture content were also measured. Harvesting significantly (P = 0.05) increased in situ respiration during most sampling periods. This effect was attributed to an increase in live root and microflora activity associated with postharvesting revegetation. In situ respiration increased exponentially (Q(10) relationship) as treatment soil temperatures increased (mean range 8.3-29.1 degree C), but followed a parabolic-type pattern through the range of soil moisture measured (mean range 10.4-31.5%). Mean rates of laboratory mineral soil respiration measured during the study were unaffected by cutting treatment for most sampling sessions. Overall, the mean rate of CO₂ efflux in the clearcuts (7.15 g CO₂ m⁻² d⁻¹) was significantly higher than that in the partial cuts (5.95 g CO₂ m⁻² d⁻¹), which in turn was significantly higher than that in the controls (4.95 g CO₂ m⁻² d⁻¹). Mass balance estimates indicate that these treatment differences will have little or no long-term effect on C sequestration of these managed forests.

This citation is from AGRICOLA.

700. Forest harvesting influence on water table dynamics in a Florida flatwoods landscape.

Bliss, C. M. and Comerford, N. B.

Soil Science Society of America Journal 66(4): 1344-1349. (2002)

NAL Call #: 56.9 So3; ISSN: 0361-5995

Descriptors: logging/ Pinus elliottii/ Taxodium distichum/ water table/ forest plantations/ swamps/ swamp soils/ wetland soils/ Florida

Abstract: Flatwoods are an important ecological plant community in the southeastern Coastal Plain with approximately one-third of Florida's flatwoods in timberland. This study was conducted to investigate hydroperiod changes in the water table of both hydric and nonhydric soils following harvest in a Florida cypress [Taxodium distichum (L.)]-pine (Pinus elliottii var. elliottii Engelm.) flatwoods landscape. Shallow water-table wells were established on a 42-ha area and divided into three harvesting treatments containing mature slash pine plantations and pine-cypress swamps: control, clearcut (both hydric and nonhydric soils harvested), and cypress swamps only harvested (hydric soils only harvested). Water-table measurements were obtained at 2-wk intervals for 6 yr. Harvesting treatments occurred 2 yr into the study. Regression equations created from preharvest water-table data between the control block and harvested blocks allowed us to predict uncut water-table responses in the cut areas. These predicted values were compared with the actual postharvest observations. The water-table level increased 48 and 49 cm and 19 and 21 cm in the hydric and nonhydric soils in the clearcut and cypress swamps only cut, respectively, during the first 126 d after harvesting. Significant differences (P < 0.10) in water-table depth because of harvesting occurred throughout the four postharvest years, but the differences were less than seen initially, and the pattern was seasonal. Compared with the predicted uncut condition, water tables tended to be lower (drier) during the growing season and higher (wetter) during the nongrowing season. These seasonal fluctuations were presumably driven by changes in evapotranspiration rates resulting from differences in leaf area of the pine canopy and understory.
This citation is from AGRICOLA.

701. Forestry and forest management impacts on wetlands.

McKee, W. H.

In: Proceedings of the Conference: Wetlands of the Chesapeake. (Held 9 Apr 1985-11 Apr 1985 at Easton, Md.) Groman, Hazel A. (eds.)

Washington D.C.: Environmental Law Institute; pp. 216-224; 1985.

NAL Call #: QH76.5.C48P76; ISBN: 0911937196

Descriptors: wetlands/ water quality/ drainage/ forest management/ hydrology/ logging/ South Carolina
This citation is from AGRICOLA.

702. Ground-water-table rise after forest harvesting on cypress-pine flatwoods in Florida.

Sun Ge; Riekerk, H.; and Kornhak, L. V.

Wetlands 20(1): 101-112. (2000)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ forests/ harvesting/ ecosystems/ forest management/ upland areas/ water quality/ synecology/ wildlife/ habitats/ botanical composition/ logging/ hydrology/ forest influences/ groundwater level/ spatial variation/ temporal variation/ logging effects

Abstract: Forest removal represents one of the large-scale ecosystem disturbances that concern water quality degradation, species composition change, and wildlife habitat alteration along the Florida coast. A 5-year study was conducted with the objective of addressing the effects of 2 forest management scenarios on the water regimes of cypress/pine (Taxodium ascendens/Pinus elliottii, with

swamp tupelo *Nyssa sylvatica* var. *biflora* [*N. biflora*]) flatwoods ecosystems (cypress wetlands and pine uplands) in the lower coastal plain. Three experimental blocks (16-21 ha) were used in this study, with one representing control (C), one wetlands-harvest-only (W), and one wetlands + uplands harvest (ALL). Within the centre of each block, a representative cypress wetland and its surrounding pine upland were extensively instrumented to quantify the changes of each hydrological variable induced by tree removal. Water levels in cypress wetlands in both treatment areas were significantly elevated about 32-41 cm on average, and outflow doubled in the 5-month dry period immediately following the tree harvesting. The ground-water table in the upland was also raised by about 29 cm on average in the ALL treatment, but it was not affected significantly during the entire post-treatment period by treatment W. During wet periods, the treatment effects for both wetlands and uplands were not significant. Causes for spatial and temporal variability of hydrological responses to forest harvesting are speculated to be: (1) total evapotranspiration does not change significantly in flatwoods after tree removal during wet seasons; (2) specific yield of the flatwoods soils is variable in time and space; and (3) lateral water movement from uplands to wetlands. From this study, it is concluded that harvesting both uplands and wetlands causes greater response than harvesting wetlands only. The impacts lasted for more than 2 years but were most pronounced only in the dry periods. Temporal and spatial variations of each hydrological component should be considered in evaluating the hydrological impact of forest management on the flatwoods landscape.

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703. Harvest influences on floodwater properties in a forested floodplain.

Clawson, R. G.; Lockaby, B. G.; and Rummer, R. B. *Journal of the American Water Resources Association* 35(5): 1081-1088. (1999)

NAL Call #: GB651.W315; ISSN: 1093-474X

Descriptors: USA, Georgia/ forests/ water quality/ nutrients/ forestry/ biogeochemistry/ runoff/ flood plains/ water quality (natural waters)/ floodplains

Abstract: Floodplain forests directly influence water quality by serving as sinks, sources, or transformers of nutrients. Increases in the demand for timber raise the question of how silvicultural disturbance may affect this function. The objective of this research was to compare biogeochemical relationships between undisturbed vs. disturbed conditions in a floodplain forest. A randomized complete block design consisting of three blocks and two treatments (partial harvest and undisturbed) was installed on the Flint River floodplain, Georgia. The partial cut was conducted during September-October 1993. Automated water samplers were situated to sample during flood events as sheetflow entered and exited treatment plots during the 1994, 1995 and 1996 flood seasons. Pre- vs. post-contact comparisons indicated that the undisturbed floodplain has minimal influence on water chemistry at this scale of measurement. Although the partial harvest on an 8-ha scale had minimal effect upon sheetflow water chemistry for three years following harvest, the data suggest that harvests may stimulate a minor increase in Ca and K sink activity.

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704. Herbivorous insect response to group selection cutting in a southeastern bottomland hardwood forest.

Ulyshen, Michael D.; Hanula, James L.; Horn, Scott; Kilgo, John C.; and Moorman, Christopher E.

Environmental Entomology 34(2): 395-402. (2005)

NAL Call #: QL461.E532; ISSN: 0046-225X

<http://www.srs.fs.usda.gov/pubs/21698>

Descriptors: selection cutting/ uneven-aged silviculture/ forest openings/ forest management

Abstract: We compared the response of ground beetles (Coleoptera: Carabidae) to the creation of canopy gaps of different size (0.13, 0.26, and 0.50 ha) and age (1 and 7 years) in a bottomland hardwood forest (South Carolina, USA). Samples were collected four times in 2001 by malaise and pitfall traps placed at the center and edge of each gap, and 50 m into the surrounding forest. Species richness was higher at the center of young gaps than in old gaps or in the forest, but there was no statistical difference in species richness between old gaps and the forests surrounding them. Carabid abundance followed the same trend, but only with the exclusion of *Semiardistomis viridis* (Say), a very abundant species that differed in its response to gap age compared to most other species. The carabid assemblage at the gap edge was very similar to that of the forest, and there appeared to be no distinct edge community. Species known to occur in open or disturbed habitats were more abundant at the center of young gaps than at any other location. Generalist species were relatively unaffected by the disturbance, but one species (*Dicaelus dilatatus* Say) was significantly less abundant at the centers of young gaps. Forest inhabiting species were less abundant at the centers of old gaps than in the forest, but not in the centers of young gaps. Comparison of community similarity at various trapping locations showed that communities at the centers of old and young gaps had the lowest similarity (46.5%). The community similarity between young gap centers and nearby forest (49.1%) and old gap centers and nearby forest (50.0%) was similarly low. These results show that while the abundance and richness of carabids in old gaps was similar to that of the surrounding forest, the species composition between the two sites differed greatly.

This citation is from Treesearch.

705. Hydrological aspects of cypress wetlands in coastal-region pine forests and impacts of management practices.

Fares, Ali; Mansell, R. S.; and Comerford, N. B.

Soil and Crop Science Society of Florida Proceedings 55: 52-58. (1996)

NAL Call #: 56.9 So32; ISSN: 0096-4522

Descriptors: coastal region pine forest/ cypress wetlands/ evapotranspiration/ ground water/ habitat/ hydrology/ land development/ management practices/ mathematical model/ precipitation/ silviculture/ surface water/ terrestrial ecology

Abstract: Hydrology for cypress pond/flatwood pine (CPFP) systems located in coastal regions of the southeastern USA is a primary driving force influencing ecology, land development, and persistence of CPFP systems. Water budget analysis provides a means to quantify water entering, undergoing storage in, and leaving such systems. Precipitation, evapotranspiration, ground water, surface water and water storage in the vadose zone represent the main components of CPFP water budgets. Precipitation is considered the main water inflow component, and ET is the

major pathway of water consumption, with ground and surface waters being dynamically connected. Alternative silviculture management practices such as establishing unharvested buffer zones, and partial harvesting, should be tested in flatwood pine forests. However, field experiments involving these alternative scenarios are costly and time-consuming. Mathematical models can be used to lessen the number of required field experiments and to investigate important parameters and variables that most influence this system. A need exists for multi-dimensional mathematical models to describe water flow and solute transport for transient flow in a variably saturated media, such as the model WETLANDS. These models can be used to simulate the dynamic connection between free water in ponds and subsurface water in surrounding flatwood forests. The models should include temporal and spatial plant uptake of both water and solutes. This paper gives an overview of the hydrology of CFP systems, along with current and alternative management practices utilized for these environments. This type of information is helpful for field hydrologists, mathematical modelers working on such systems, and regulatory agencies dealing with these environments.

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706. Hydrological/environmental impacts of tree harvesting within flatwood pine forests upon local wetlands.

Fares, A.; Mansell, R. S.; and Bloom, S. A.

In: *Subsurface hydrological responses to land cover and land use changes*/ Taniguchi, Makoto.

Boston: Kluwer Academic, 1997; pp. 167-186

NAL Call #: GB1001.2.S83 1997

Descriptors: wetlands/ swamps/ land management/ water quality/ flow/ groundwater/ hydrology/ environmental impact/ forests/ harvesting/ models/ pollution/ clear felling/ contamination

Abstract: The impact of different management practices on the hydrology of cypress (*Taxodium distichum*) pond/flatwood (*Pinus elliotti* and *Pinus palustris*) systems was simulated using a multi-dimensional water flow and solute transport model (WETLANDS). Three hypothetical weather years were used. Results of these simulations revealed that during periods of positive net water input (NWI) flatwood areas undergo slow surface drainage by inter-connected strands of cypress ponds. It is during such times of the year that a high potential exists for contamination of the pond surface water. However, there is no concern about contaminant movement into the pond during a H&W year where NWI is negative throughout the year. Total tree harvest resulted in suppressed water consumption by ET such that water levels in the cypress pond were higher and water table depths were shallower. Total clear cut of the forest resulted in higher potential of contaminant movement into the pond as a result of the high NWI and a high water table through the simulated year. Unharvested buffer zones adjacent to ponds provided significant hydrological/environmental benefits to total harvesting.

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707. The hydrology of cypress wetlands in Florida pine flatwoods.

Riekerk, H. and Korhnak, L. V.

Wetlands 20(3): 448-460. (2000)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ hydrology/ logging/ runoff/ best management practices/ lumber/ environmental impact/ ecosystem disturbance/ forest industry/ evapotranspiration/ *taxodium ascendens*/ USA, Florida/ USA, Florida/ habitat community studies

Abstract: The poorly drained pine flatwoods of the Lower Coastal Plain of the Southern United States, including Florida, contain many pond cypress (*Taxodium ascendens*) wetlands, which cover about one-third of the area. Management of the resource includes pine silviculture and cypress harvesting for lumber, plywood, paper, and mulch. Concern about the ecological impacts and hydrologic effects prompted a cooperative study of cypress wetlands integrating several disciplines. This paper reports results of clear-cut harvesting on the wetland hydrology. Three wetlands of about 0.5 ha were selected and instrumented to measure the climatic and hydrologic variables before and after treatments from January 1993 to January 1997. Silvicultural treatments were wetland-only clear-cut harvesting, wetland plus surrounding upland clear-cut harvesting, and an undisturbed control. The absence of observable soil surface runoff (high infiltration rate) and slow ground-water movement in the upland pine flatwoods suggested that normally the precipitation and evapotranspiration balanced each other and that the wetlands generated most of the runoff from the landscape mosaic as a whole. However, the results showed that open-water evaporation after wetland harvesting exceeded evapotranspiration of the control, explaining in part a decrease in outflow after wetland-only harvesting. Increased runoff from the pine upland, generated by reduced evapotranspiration and expanded saturated areas after clear-cut harvesting, apparently was buffered to some extent by increased evaporation from the embedded clear-cut cypress wetland. The average open-water area was about fifty percent larger than the wetland area as defined by the vegetation. However, excess wetland water balance data suggested the presence of a rain-catchment area that was 2-3 times larger than the vegetative wetland area because of semi-saturated soil in the low slopes. Therefore, the actual catchment area of a cypress wetland in the pine flatwoods may be variable in time, space, and silviculture depending on the topography, the extent of open water, and saturated soil. The application of this information in water management is for better control of first-year runoff from the pine-cypress landscape as a whole. Furthermore, silvicultural Best Management Practices for cypress wetland water management need to consider a variable source area for surface-water pollution that is larger than the wetland area as defined by the vegetation.

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708. Impact of agricultural drainage activities in the coastal flats region of the Chesapeake Bay.

Hall, T. N.

In: *Proceedings of the Conference: Wetlands of the Chesapeake*. (Held 9 Apr 1985-11 Apr 1985 at Easton, Md.) Groman, Hazel A. (eds.)

Washington D.C.: Environmental Law Institute; pp. 199-207; 1985.

NAL Call #: QH76.5.C48P76; ISBN: 0911937196

Descriptors: wetlands/ drainage/ water quality/ water conservation/ coasts/ Maryland

This citation is from AGRICOLA.

709. Impact of harvesting activities on oak seedling establishment in a bottomland hardwood forest.

Barry, J. E. and Nix, L. E.

In: Proceedings of the Seventh Biennial Southern Silvicultural Research Conference. (Held 17 Nov 1992-19 Nov 1992 at Mobile, Ala.) Brissette, John C. (eds.) New Orleans, La.: Southern Forest Experiment Station; pp. 155-159; 1993.

NAL Call #: aSD11.U57

<http://www.srs.fs.usda.gov/pubs/viewpub.jsp?index=1407>

Descriptors: Quercus/ lowland forests/ natural regeneration/ harvesting

This citation is from AGRICOLA.

710. Impact of tracked and rubber-tired skidders traffic on a wetland site in Mississippi.

Murosky, D. L. and Hassan, A. E.

Transactions of the ASAE 34(1): 322-327. (1991)

NAL Call #: 290.9 AM32T; ISSN: 0001-2351

Descriptors: skidders/ tires/ environmental impact/ soil compaction/ soil physical properties/ trafficability/ lowland forests/ forest soils/ hardwood/ Mississippi

Abstract: One tracked and two rubber-tired skidders operating on a bottomland hardwood site in Mississippi were evaluated to determine the effect of machine traffic on soil compaction, soil physical properties, and site damage. Each system operated during a wet and a dry season. The machine treatments were compared with a control plot where no machine traffic was allowed. The tracked skidder and the skidder with wide tires (68X50X32) created less compaction and less site damage. Less site disturbance resulted from the wet than dry season harvest.

This citation is from AGRICOLA.

711. Influence of cattle grazing and pasture land use on macroinvertebrate communities in freshwater wetlands.

Steinman, A. D.; Conklin, J.; Bohlen, P. J.; and Uzarski, D. G.

Wetlands 23(4): 877-889. (2003)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ community structure/ species richness/ nutrient concentrations/ water column/ freshwater environments/ grazing/ stocking rates/ land use/ pasture/ pastures/ invertebrates/ nutrients/ cattle/ livestock/ environmental effects/ ostracods/ macroinvertebrates/ midges/ bioindicators/ eutrophication/ aquatic insects/ freshwater crustaceans/ zoobenthos/ population structure/ community composition/ species diversity/ biotic factors/ dominant species/ aquatic plants/ stocking density/ stocks/ agriculture/ indicator species/ pollution indicators/ Invertebrata/ Culicidae/ Juncus effusus/ Polygonum/ Panicum hemitomon/ USA, Florida/ cattle/ cattle stocking/ mosquitoes

Abstract: Responses of wetland abiotic variables and aquatic invertebrate community structure to cattle stocking density, pasture type, and dominant vegetation were evaluated in subtropical pastures. Cattle were stocked at four treatment levels on improved (fertilized) and semi-native (unfertilized) pastures in south-central Florida, USA. Improved pasture wetlands were dominated either by Panicum hemitomon (maidencane) or by a mixture of Polygonum spp. (smartweed) and Juncus effusus; semi-native pasture wetlands were dominated mainly by maidencane. Cattle stocking density had few significant

effects on water-column nutrient concentration or invertebrate community structure. However, water-column nutrient concentrations were significantly greater in the wetlands on improved pastures compared to semi-native pastures. Invertebrate richness and diversity were greater in wetlands on semi-native pastures than on improved pastures, despite lower nutrient concentrations in the former. Overall, the cattle stocking treatment had little impact on invertebrate community structure in these systems relative to prior pasture land use. However, vegetation type influenced invertebrate communities and explained some of the differences between pasture types. Semi-native (lower nutrient) wetland pastures dominated by maidencane had significantly greater invertebrate richness and diversity than improved (higher nutrient) wetland pastures dominated by mixed vegetation but showed no difference when compared to improved wetland pastures dominated by maidencane. Chironomids were the dominant invertebrate in wetlands of both pasture types. Correspondence analysis revealed that ostracods and Culicidae larvae might be useful as bioindicators of subtropical wetlands that are experiencing cultural eutrophication.

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712. Influence of harvesting on biogeochemical exchange in sheetflow and soil processes in a eutrophic floodplain forest.

Lockaby, B. G.; Clawson, R. G.; Flynn, K.; Rummer, R.; Meadows, S.; Stokes, B.; and Stanturf, J.

Forest Ecology and Management 90(2-3): 187-194. (1997)

NAL Call #: SD1.F73; ISSN: 0378-1127

Descriptors: wetlands/ water quality/ biogeochemistry/ runoff/ nutrients/ land management/ forest management/ laminar flow/ watershed management/ USA, Georgia/ silviculture

Abstract: Floodplain forests contribute to the maintenance of water quality as a result of various biogeochemical transformations which occur within them. In particular, they can serve as sinks for nutrient run-off from adjacent uplands or as nutrient transformers as water moves downstream. However, little is known about the potential that land management activities may have for alteration of these biogeochemical functions. This paper examines the effects of three harvesting regimes (unharvested control, clearcut, and partial cut) on the physical and chemical parameters within the Flint River floodplain located in southwestern Georgia, USA. Data presented in this paper were collected during the year following initiation of the harvesting treatments which occurred in September of 1993. Sheetflow water chemistry (total suspended solids (TSS), total dissolved solids (TDS), nitrate (NO₃⁻), phosphate (PO₄³⁻), sulfate (SO₄²⁻), calcium (Ca²⁺), potassium (K⁺), magnesium (Mg²⁺), ammonium (NH₄⁺), total phosphorous (P), total nitrogen (N), total carbon (C), dissolved organic carbon (DOC)), sedimentation rates, depth of soil oxidation after flooding, saturated hydraulic conductivity, and bulk density were measured. During the year immediately after treatment installation, alterations in some of the physical and chemical properties (TDS, NO₃⁻, total P, and K⁺) of floodwaters crossing harvest plots were detected. Soil oxidation depths, saturated hydraulic conductivity and bulk density also changed with treatment. The meaning of the changes detected is uncertain but they suggest the nature of potential changes in nutrient spiralling

and non-point source cumulative effects that may occur within a managed watershed. Second-year data may offer an interesting comparison of sheetflow chemistry and sedimentation changes between vegetated and non-vegetated conditions.

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713. Influence of nitrate and phosphorus loading on denitrifying enzyme activity in Everglades wetland soils.

White, J. R. and Reddy, K. R.

Soil Science Society of America Journal 63(6):

1945-1954. (1999)

NAL Call #: 56.9 So3; ISSN: 0361-5995

Descriptors: wetland soils/ denitrification/ soil enzymes/ enzyme activity/ soil heterogeneity/ seasonal variation/ correlation/ soil properties/ nitrates/ phosphorus/ pollution/ pollution load/ Florida

Abstract: There has been recent concern about the impact of increased nutrient loading on the northern Everglades ecosystem. We investigated the spatial and temporal distribution of denitrifying enzyme activity (DEA) along a P-enrichment gradient in the Water Conservation Area 2A (WCA-2A) and determined the effects of added P and NO₃⁻ on DEA. The DEA in soil and detritus layers was measured under anaerobic conditions four times during 2 yr, using the acetylene blockage technique. The DEA ranged from 0.004 to 7.75 mg N(2)O-N kg⁻¹ h⁻¹. Highest rates of DEA were found in the detritus and surface (0-10 cm) soils, and rates decreased exponentially with increasing distance from the surface-water inflow point, where nutrients are loaded to the wetland. Nitrate was found to be limiting, while the addition of P had no effect on the distribution of DEA in these soils. There was a seasonal effect on DEA, with higher activity observed during the summer when temperatures and hydraulic and nutrient loading were highest. Soils from outside the impacted zone demonstrated denitrifying potentials, within 10 h when spiked with inflow concentrations of NO₃⁻, similar to DEA of soils from within the impacted zone. This suggests that soils from outside the impacted zone can increase denitrification rates when exposed to higher NO₃⁻ concentrations in a relatively short time. Agricultural drainage water discharge, and consequent NO₃⁻ loading, has created a zone of elevated DEA proximal to the S-10C surface-water inflow point in WCA-2A. This citation is from AGRICOLA.

714. Influence of nitrogen on atrazine and 2,4 dichlorophenoxyacetic acid mineralization in blackwater and redwater forested wetland soils.

Entry, J. A.

Biology and Fertility of Soils 29(4): 348-353. (1999)

NAL Call #: QH84.8.B46; ISSN: 0178-2762

Descriptors: wetland soils/ forest soils/ soil types/ atrazine/ 2,4-D/ degradation/ mineralization/ soil fungi/ soil bacteria/ biomass/ biological activity in soil/ nitrogen fertilizers/ application rate/ Florida

Abstract: Microcosms were used to determine the influence of N additions on active bacterial and fungal biomass, atrazine and dichlorophenoxyacetic acid (2,4-D) mineralization at 5, 10 and 15 weeks in soils from blackwater and redwater wetland forest ecosystems in the northern Florida Panhandle. Active bacterial and fungal biomass was determined by staining techniques combined

with direct microscopy. Atrazine and 2,4-D mineralization were measured radiometrically. Treatments were: soil type, (blackwater or redwater forested wetland soils) and N additions (soils amended with the equivalent of 0, 200 or 400 kg N ha⁻¹) as NH₄NO₃). Redwater soils contained higher concentrations of C, total N, P, K, Ca, Mn, Fe, B and Zn than blackwater soils. After N addition and 15 weeks of incubation, active bacterial biomass in redwater soils was lower when N was added. Active bacterial biomass in blackwater soils was lower when 400 kg N ha⁻¹, but not when 200 kg N ha⁻¹, was added. Active fungal biomass in blackwater soils was higher when 400 kg N ha⁻¹, but not when 200 kg N ha⁻¹, was added. Active fungal biomass in redwater soils was lower when 200 kg N ha⁻¹, but not when 400 kg N ha⁻¹, was added. After 15 weeks of incubation 2,4-D degradation was higher in redwater wetland soils than in blackwater soils. After 10 and 15 weeks of incubation the addition of 200 or 400 kg N ha⁻¹ decreased both atrazine and 2,4-D degradation in redwater soils. The addition of 400 kg N ha⁻¹ decreased 2,4-D degradation but not atrazine degradation in blackwater soils after 10 and 15 weeks of incubation. High concentrations of N surface runoff and groundwater resulting from agricultural operations may have resulted in the accumulation of N in many wetland soils. Large amounts of N accumulating in wetlands may decrease mineralization of toxic agricultural pesticides.

This citation is from AGRICOLA.

715. Influence of selected inorganic electron acceptors on organic nitrogen mineralization in Everglades soils.

White, J. R. and Reddy, K. R.

Soil Science Society of America Journal 65(3):

941-948. (2001)

NAL Call #: 56.9 So3; ISSN: 0361-5995

Abstract: Organic N mineralization can regulate the bioavailability of N in wetland soils and be controlled by the availability of inorganic electron acceptors. During the past 40 yr, the northern Everglades has been affected by nutrient loading as a consequence of the diversion of surface water runoff from agricultural lands. The greatest hydraulic loading occurs in the summer season when precipitation is highest. Fluctuations in water levels and loading of alternate electron acceptors (NO₃⁻ and SO₄²⁻) could result in variable N turnover rates. The effect of aerobic, NO₃⁻ reducing, SO₄²⁻ reducing, and methanogenic conditions on potential organic N mineralization rate was investigated. Soil at 0- to 10- and 10- to 30-cm depths and overlying plant detritus were collected from eight stations along a 10-km eutrophic gradient in the northern Everglades, Florida. Selected soil characteristics including microbial biomass C and N (MBC and MBN), total P, and extractable NH₄⁺ were measured. Significantly (P < 0.05) higher rates of N mineralization were observed in the detritus, lower rates in the 0- to 10-cm depth, and lowest rates in the 10- to 30-cm depth under each of aerobic, NO₃⁻ reducing, SO₄²⁻ reducing, and methanogenic conditions. Organic N mineralization rates decreased sequentially from aerobic to NO₃⁻ and SO₄²⁻ reducing conditions to methanogenic conditions. Total P, MBC, and MBN were all significantly correlated (P < 0.05) to the N mineralization rates under dominance of each electron acceptor. Of all the measured soil characteristics, extractable NH₄⁺ was the most strongly correlated (P < 0.01; r = 0.62-0.92) indicator of potential N mineralization

rates. Results of this research have important implications for the biogeochemical cycling of N and ecosystem productivity in wetland systems.

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716. Influences of riparian logging on plants and invertebrates in small, depressional wetlands of Georgia, USA.

Batzer, D. P.; Jackson, C. R.; and Mosner, M.

Hydrobiologia 441(1-3): 123-132. (2000)

NAL Call #: 410 H992; ISSN: 0018-8158

Descriptors: wetlands/ logging/ plants/ USA, Georgia/ pine trees/ invertebrates/ ecological effects/ water temperature/ biomass/ vegetation/ hydrogen ion concentration/ ecosystem disturbance/ man-induced effects/ forest industry/ aquatic plants/ long-term changes/ environmental conditions/ biota/ ecosystem management/ riparian environments/ population-environment relations/ human impact/ forestry/ aquatic organisms/ environmental impact/ environmental changes/ ecology/ daphnia/ Oligochaeta/ Invertebrata/ pinus/ plantae/ pine/ oligochaetes/ angleworms/ earthworms/ pines

Abstract: We studied 12 small, seasonally flooded, depressional wetlands on the Atlantic Coastal Plain of Georgia, U.S.A. Each wetland was embedded in stands of managed plantation pine. The pine trees surrounding each wetland had been harvested and replanted beginning in 1997 (2 sites), 1995 (2 sites), 1993 (1 site), 1988 (2 sites), 1984 (2 sites) or 1975 (3 sites). Regressions of various environmental variables with harvest histories indicated that those wetlands surrounded by smaller trees had greater light levels, water temperatures, pH, herbaceous plant cover and biomass, terrestrial invertebrate diversities and numbers, and water flea numbers, and lower water electrical conductivities and aquatic oligochaete numbers than those wetlands surrounded by more mature trees. Detected variations in hydroperiod, water depth, dissolved oxygen levels, sediment inputs, macrophyte diversity, periphyton biomass and densities of most aquatic invertebrates were not clearly correlated with past histories of peripheral tree harvest. This study suggests that harvesting trees around small wetlands initiates physical and ecological changes within the embedded habitats and that changes can persist for up to 15 years.

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717. Initial responses of woody vegetation, water quality, and soils to harvesting intensity in a Texas bottomland hardwood ecosystem.

Messina, M. G.; Schoenholtz, S. H.; Lowe, M. W.; Wang, Ziyin; Gunter, D. K.; and Londo, A. J.

Forest Ecology and Management 90(2-3): 201-215. (1997)

NAL Call #: SD1.F73; ISSN: 0378-1127

Descriptors: wetlands/ species diversity/ soil erosion/ clear-cutting/ forestry/ water quality/ soil physical properties/ surface water/ groundwater/ clear cutting/ environmental impact/ USA, Texas/ clear cutting/ environmental impact/ clear-cutting/ soil physical properties/ groundwater

Abstract: Sustainable management of bottomland hardwood forest ecosystems requires a knowledge of responses to management impacts, including timber harvesting. The effects of clearcutting and partial cutting on woody vegetation regeneration dynamics, surface and groundwater quality, soil physical properties, and soil respiration were tested in a bottomland hardwood

ecosystem in southeastern Texas, USA, through comparison with non-cut control areas. Overstory removal only slightly affected composition of woody vegetation regeneration 1 year after harvesting compared with pre-harvest composition. Initial composition in both cutting treatments appeared to be the strongest determinant of post-harvest composition, at least for the first year after harvesting. There were few significant differences in groundwater properties when harvesting treatments were compared with control areas during a 17-month period following harvest. Turbidity, temperature, electrical conductivity, dissolved O₂, NH₄-N, NO₃-N, and PO₄-P of streamwater did not vary significantly among treatments. Slight decreases in total and macroporosity were observed in association with higher bulk densities at 0-5 cm depth in the clearcut and partial cut treatments. Saturated hydraulic conductivity values did not decline significantly with treatment intensity. No significant differences among treatments in measured soil physical properties were observed at 5-10 cm depth. Although in situ soil respiration increased with harvest intensity, treatment had no significant effect on mineral soil respiration. In summary, most variables showed only slight response to harvesting, thereby indicating that harvesting practices can be conducted with minimal initial impacts on measured response variables.

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718. Long-term relationship between phosphorus inputs and wetland phosphorus concentrations in a northern Everglades marsh.

Smith, E. P. and McCormick, P. V.

Environmental Monitoring and Assessment 68(2): 153-176. (May 2001)

NAL Call #: TD194; ISSN: 0167-6369

Descriptors: wetlands/ human impact/ nutrients/ water management/ nutrient loading/ marshes/ agricultural practices/ runoff/ nutrient enrichment/ environmental factors/ soil/ land/ phosphorus/ nutrient concentrations/ statistical analysis/ historical account/ agricultural runoff/ canals/ hydrology/ freshwater pollution/ water budget/ agricultural pollution/ monitoring/ assessments/ water depth/ marsh management/ USA, Florida/ USA, Florida, Everglades/ human population-hydrosphere interactions/ water resources and supplies/ freshwater pollution/ prevention and control/ water pollution: monitoring, control and remediation/ sources and fate of pollution

Abstract: Assessments of long-term relationships between changes in nutrient inputs and wetland nutrient concentrations can be complicated by fluctuations in other environmental factors as well as by problems typical of long-term monitoring data. Consequently, statistical analysis of these types of data sets requires careful consideration of environmental covariates, potential biases in the monitoring design, and irregularities caused by changes in field sampling protocols. We evaluated the relationship between anthropogenic phosphorus (P) inputs and water-column total P (TP) concentrations in a northern Everglades marsh by statistically analyzing available data collected from several sampling programs over the past 20 years (1978-1997). Canal inputs of agricultural runoff contribute most of the P to the marsh and have produced a zone of enrichment within the marsh during the past few decades. Regression analyses showed that both canal and marsh TP concentrations increased during the 1980s and

then decreased in the 1990s. However, the statistical relationship between canal P inputs and marsh TP, while significant, generally was weak except for marsh locations adjacent to the canal. Stronger relationships existed between marsh TP and hydrologic parameters such as marsh water depth, which is controlled by changes in weather patterns and marsh management. In particular, dry conditions during the 1980s may have contributed to observed increases in marsh P concentrations and the movement of a P 'front' further into the marsh. Higher rainfall and water depths and agricultural best management programs initiated during the 1990s have been associated with reduced P concentrations in canal waters entering the marsh. While it is anticipated that this reduction eventually will result in lower marsh TP concentrations, this effect is not yet evident, possibly due to internal loading of P from enriched marsh soils. Our findings illustrate some of the environmental factors that can complicate attempts to develop empirical relationships between P inputs and wetland P concentrations and to use such relationships to forecast changes in marsh concentrations based on past monitoring data alone.

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719. Methods to determine lateral effect of a drainage ditch on wetland hydrology.

Skaggs, R. W.; Chesheir, G. M.; and Phillips, B. D.

Transactions of the ASAE 48(2): 577-584. (2005)

NAL Call #: 290.9 Am32T; ISSN: 0001-2351

Descriptors: wetlands/ drainage channels/ drainage/ hydrology/ hydrologic models/ simulation models/ mathematical models/ water table/ North Carolina

Abstract: A method was developed to estimate the lateral effect of a single drainage ditch on wetland hydrology. The method can be used to calculate the distance of influence of a single ditch constructed through a wetland, where the distance of influence is defined as the width of a strip adjacent to the ditch that is drained such that it will no longer satisfy the wetland hydrologic criterion. Simulation analyses were conducted with DRAINMOD to define the minimum, or threshold, drainage intensity that would result in failure of a site to satisfy the wetland hydrologic criterion. Analyses were conducted for five hydric soils spanning a wide range of profile hydraulic transmissivities. DRAINMOD was used to predict water table fluctuations between parallel ditches for a 50-year period of climatological record. For each soil, simulations were conducted for a range of ditch spacings and depths to determine the combinations that would result in the land midway between the ditches just barely satisfying the wetland hydrologic criterion. Analyses were conducted for climatological conditions for three locations in eastern North Carolina. Results for Wilmington, North Carolina, showed that the threshold drainage intensities would result in water table drawdown from an initially ponded surface to a depth of 25 cm in approximately 6 days. That is, ditch depths and spacings sufficient to lower the water table from the surface to a depth of 25 cm in a threshold time of about 6 days would result in hydrologic conditions that would just barely satisfy the wetland hydrologic criterion for that location. The threshold time is denoted T25 and is used as a surrogate for quantifying the water table drawdown rate of sites that barely satisfy the wetland hydrologic criterion. T25 was found to depend somewhat on drain depth, but it was essentially constant for all five of the soils examined.

Similar results were obtained for the other two locations, but because of differences in weather and in the growing season, the threshold time (T25) was found to be dependent on location. The T25 value is also dependent on surface depressional storage, decreasing with increasing storage. The discovery that water table conditions barely satisfying the wetland hydrologic criterion are well correlated to the time required for water table drawdown of 25 cm (T25 values) makes it possible to predict the effects of subsurface drains on wetland hydrology. The lateral effect of a single ditch on wetland hydrology can be computed by using T25 values in solutions to the Boussinesq equation for water table drawdown due to drainage to a single drain. While the method was developed for drainage ditches, it may also be used for subsurface drains.

This citation is from AGRICOLA.

720. Metolachlor fate and mobility in a tidal wetland soil.

Seybold, C. A. and Mersie, W.

Wetlands 19(1): 228-235. (1999)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ fate of pollutants/ tidal marshes/ herbicides/ mineralization/ soil columns/ agricultural runoff/ intertidal environment/ soils/ pollution dispersion/ marshes/ mineralization/ soil

Abstract: A study was conducted to determine the fate of the herbicide metolachlor in a tidal wetland soil located along the James River in Virginia, USA. Soil adsorption/desorption and mineralization characteristics and mobility of metolachlor were determined on the Levy tidal wetland soil. The metolachlor K sub(d) value was 65.8 L kg super(-1) and K sub(oc) value was 810 L kg super(-1) C super(-1), which are much greater than would be found on typical agricultural soils. After four 24-h desorption periods, the total amount of metolachlor that desorbed ranged from 16 to 22% of the amount initially adsorbed. Metolachlor mineralization was about 0.46% of the amount applied after 84 days, which indicates that it does not mineralize very readily in the Levy soil. The amount of metolachlor that leached from the soil columns averaged 1.64% of the amount applied after 84 days, showing a low degree of mobility. These results suggest that the Levy tidal wetland soil can function as an effective filter of metolachlor and other similar herbicides that enter via agricultural runoff, protecting surface and ground waters.

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721. Minimizing adverse impacts on wetlands of water quality associated with forest and agricultural practices.

Lee, C. R.

In: Proceedings of the Conference: Wetlands of the Chesapeake. (Held 9 Apr 1985-11 Apr 1985 at Easton, Md.) Groman, Hazel A. (eds.)

Washington D.C.: Environmental Law Institute; pp. 225-230; 1985.

NAL Call #: QH76.5.C48P76; ISBN: 0911937196

Descriptors: wetlands/ water quality/ fertilizers/ pollution/ runoff/ Maryland/ Virginia

This citation is from AGRICOLA.

722. Model prediction of the effects of changing phosphorus loads on the Everglades Protection Area.

Munson, R. K.; Roy, S. B.; Gherini, S. A.; MacNeill, A. L.; Hudson, R. J. M.; and Blette, V. L.
Water, Air, and Soil Pollution 134(1-4): 255-273. (2002)
 NAL Call #: TD172.W36; ISSN: 0049-6979
Descriptors: wetlands/ wilderness areas/ nonpoint pollution sources/ phosphorus/ fate of pollutants/ water pollution control/ water quality/ prediction/ model studies/ calibrations/ simulation/ hydrology/ runoff/ water management/ national parks/ mathematical models/ pollution dispersion/ USA, Florida, Everglades
Abstract: The Everglades Phosphorus and Hydrology (EPH) model was developed to simulate water movement and phosphorus transport in the Everglades Protection Area which is comprised of the Everglades National Park (ENP) and surrounding wetlands known as the Water Conservation Areas (WCAs). Water flows from the Everglades Agricultural Area (EAA) through the WCAs into Everglades National Park (ENP). The model is designed to represent the system as a series of cells in which water flows from one cell to the next. The code allows for pumped inputs and pumped outputs of water as well as sorption and removal of phosphorus through peat accretion. Model application involved dividing the system into twenty cells representing different segments of the WCAs. Inputs to each cell consisted of water pumped from the EAA (where appropriate), flow from upgradient cells, and precipitation. Outputs included pumped outputs and flow out of each cell. Using data collected by the South Florida Water Management District, the model was calibrated by matching simulated and observed flows, water elevations, and phosphorus (P) concentrations for the period 1980-1988. The model was then validated for the 1988-1992 period using the same model parameters derived from the calibration process and comparing simulated and observed values. Reasonable agreement between simulated and observed values was attained for both the calibration and validation periods. The calibrated and validated model was used to simulate the impacts on annual average total P concentrations in each cell resulting from the implementation of the management plan mandated by the Everglades Forever Act. This plan calls for the construction of six Stormwater Treatment Areas (STAs) to treat discharges from the EAA, hydrologic modifications of the system to promote sheet flow, and the implementation of Best Management Practices to reduce P runoff from individual farms. In addition, the model was used to evaluate the impact of not building one of the STAs (STA 3/4), and sensitivity analyses were conducted to determine the effects of changing STA outlet P concentrations throughout the system. Model results indicate that phosphorus concentration reductions will occur in areas near EAA discharges in response to reductions in input P concentrations. However these measures will have little impact on phosphorus concentrations for 85% of the area of the WCAs and on the water entering Everglades National Park. The scenario analyses also indicate that phosphorus concentrations throughout most of the WCAs are similar with or without the construction of STA-3/4.
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723. Modeling the hydrologic impacts of forest harvesting on Florida flatwoods.

Sun, G.; Riekerk, H.; and Comerford, N. B.
Journal of the American Water Resources Association 34(4): 843-854. (1998)
 NAL Call #: GB651.W315; ISSN: 1093-474X
<http://www.srs.fs.usda.gov/pubs/22238>
Descriptors: wetlands/ logging/ clearcutting/ forest management/ crop rotation/ Pinus/ national forests/ coastal plains/ watersheds/ precipitation/ hydrology/ runoff/ evapotranspiration/ temporal variation/ spatial variation/ mathematical models/ highlands/ forest hydrology/ Florida
Abstract: The great temporal and spatial variability of pine flatwoods hydrology suggests traditional short-term field methods may not be effective in evaluating the hydrologic effects of forest management. The FLATWOODS model was developed, calibrated and validated specifically for the cypress wetland-pine upland landscape. The model was applied to two typical flatwoods sites in north central Florida. Three harvesting treatments (Wetland Harvesting, Wetland + Upland Harvesting, and Control) under three typical climatic conditions (dry, wet, and normal precipitation years) were simulated to study the potential first-year effects of common forest harvesting activities on flatwoods. Long-term (15 years) simulation was conducted to evaluate the hydrologic impacts at different stages of stand rotation. This simulation study concludes that forest harvesting has substantial effects on hydrology during dry periods and clear cutting of both wetlands and uplands has greater influence on the water regimes than partial harvesting. Compared to hilly regions, forest harvesting in the Florida coastal plains has less impact on water yield. This citation is from AGRICOLA.

724. Morphological changes in soils produced when hydrology is altered by ditching.

Hayes, W. A. and Vepraskas, M. J.
Soil Science Society of America Journal 64(5): 1893-1904. (2000)
 NAL Call #: 56.9 So3; ISSN: 0361-5995
Descriptors: wetland soils/ coastal plain soils/ soil morphology/ iron/ soil morphological features/ hydrology/ water table/ drainage/ oxidation/ reduction/ genetic soil types/ North Carolina
Abstract: A soil's hydrology (seasonal saturation occurrence) must be estimated in the field to delineate jurisdictional wetlands and to evaluate soil suitability for on-site waste disposal. It is difficult to predict soil hydrology on lands that contain ditches, because the areal extent of hydrologic alteration by an individual ditch is generally unknown. This study evaluated whether morphological changes occurred in soils after a drainage ditch had been installed. Four transects of plots were established parallel to a ditch with plots at distances of 7, 30, 60, and 80 m from the ditch. Each transect contained plots in the following soils: Aquic Paleudults, Aeris Paleaquults, and Typic Paleaquults. Soils within 30 m of the ditch had a significantly (0.10 level) greater volume of Fe masses at depths of 40 to 100 cm than soils further from the ditch. Duration of saturation did not vary significantly with distance from the ditch, but within 30 m of the ditch water tables fluctuated more frequently than those in soils further away. Concentrations of Fe(II) in groundwater at a depth of 60 cm were higher at 7 m from the ditch than at 60 m, but redox potentials at a depth of 60 cm were <500 mv for

shorter periods of time at 7 m than at greater distances from the ditch. We hypothesized that groundwater flowing into the soils within 30 m of the ditch introduced Fe(II) into the Bt horizons. The Fe(II) oxidized and formed Fe masses as the water table fell. Our results indicate that soil colors can change within 30 yr as a result of ditching. We suggest that the major area of soil influenced by the ditch can be identified by where the Fe masses in the argillic horizons increase as one approaches the ditch.

This citation is from AGRICOLA.

725. Nest-site selection and success of mottled ducks on agricultural lands in southwest Louisiana.

Durham, R. S. and Afton, A. D.

Wildlife Society Bulletin 31(2): 433-442. (2003)

NAL Call #: SK357.A1W5; ISSN: 0091-7648

Descriptors: wetlands/ nesting behavior/ breeding success/ survival/ agricultural land/ habitat selection/ nesting/ breeding sites/ plant populations/ reproductive behaviour/ population density/ grazing/ microhabitats/ environment management/ rice fields/ ecological distribution/ agriculture/ aquatic birds/ *Anas fulvigula maculosa*/ *Oryza sativa*/ *Rubus trivialis*/ USA, Louisiana

Abstract: Listing of the mottled duck (*Anas fulvigula maculosa*) as a priority species in the Gulf Coast Joint Venture of the North American Waterfowl Management Plan, coupled with recent declines of rice (*Oryza sativa*) acreage, led us to investigate the nesting ecology of this species on agricultural lands in southwest Louisiana. We examined nest-site selection at macro- and microhabitat levels, nest success, causes of nest failures, and habitat features influencing nest success. We found that female mottled ducks preferred to nest in permanent pastures with knolls (53% of nests) and idle fields (22% of nests). Vegetation height was greater at nests than at random points within the same macrohabitat patch. Successful nests were associated with greater numbers of plant species, located farther from water, and associated with higher vegetation density values than were unsuccessful nests. We determined that mammalian predators caused most nest failures (77% of 52 unsuccessful nests). Our results suggest that nest success of mottled ducks on agricultural lands in southwest Louisiana could be improved by 1) locating large permanent pastures and idle fields near rice fields and other available wetlands, 2) managing plant communities in these upland areas to favor dense stands of perennial bunch grasses, tall composites, dewberry (*Rubus trivialis*), and other native grasses and forbs, and 3) managing cattle-stocking rates and the duration and timing of grazing to promote tall, dense stands of these plant taxa during the nesting season (March-June).

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726. Nutrient enrichment of wetland vegetation and sediments in subtropical pastures.

Gathumbi, S. M.; Bohlen, P. J.; and Graetz, D. A.

Soil Science Society of America Journal 69(2):

539-548. (2005)

NAL Call #: 56.9 So3; ISSN: 0361-5995

Descriptors: seasonal wetlands/ pastures/ wetland plants/ wetland soils/ sediments/ nutrient enrichment/ soil depth/ land use/ subtropics/ Florida

Abstract: Land use practices exert a major influence on plant productivity, soil and plant nutrient content, and within-stand nutrient cycling in wetlands in agricultural

landscapes. We examined differences between improved and seminative pastures in plant and soil nutrient characteristics in seasonally flooded wetlands in subtropical grazing land of south central Florida. The wetlands were embedded within either grazed improved pastures with a long-term history of fertilizer application or seminative pastures with no history of previous fertilizer application. Soil nutrient concentrations decreased with soil depth for both land use types. Total C, N, and P were significantly greater ($P < 0.05$) in the 0- to 15-cm mineral layer compared with the deeper layers (15-30, 30-45 cm) for both improved and seminative pasture wetland soils. Improved pasture wetlands had greater amounts of total P (22.3 kg P ha⁻¹) in the upper 0- to 15-cm soil layer than did the seminative pasture wetlands (15.7 kg P ha⁻¹). Plant and soil (0-15 cm) N/P and C/P ratios were lower in improved pasture wetlands compared with seminative pasture wetlands, suggesting greater P enrichment in improved pasture wetlands. Microbial biomass C and N decreased with soil depth in both pasture types. Soil microbial biomass C/total C ratios decreased with soil depth and were similar for both improved and seminative pasture wetlands. Our results suggest that plant and soil nutrient enrichment and storage in temporary wetlands may be impacted by adjacent land use practices, which potentially leads to the alteration of the structure and functions of these wetland ecosystems.

This citation is from AGRICOLA.

727. Phosphorus in drainage water from sugarcane in the Everglades agricultural area as affected by drainage rate.

Coale, F. J.; Izuno, F. T.; and Bottcher, A. B.

Journal of Environmental Quality 23(1): 121-126. (1994)

NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: wetlands/ agricultural pollution/ drainage/ phosphorus/ crops/ freshwater pollution/ flow rates/ agricultural runoff/ water pollution/ organic soils/ drainage water/ water pollution sources/ saccharum/ USA, Florida, Everglades/ organic soils/ drainage water/ water pollution sources/ agricultural pollution/ saccharum/ freshwater pollution

Abstract: Sugarcane (interspecific hybrids of *Saccharum* spp.) is grown on 78% (156,000 ha) of the cultivated organic soils of the Everglades Agricultural Areas (EAA) of southern Florida. Recently, the EAA has come under scrutiny because of concerns with the impact of nutrient-rich drainage water from organic soils on the ecology of adjoining bodies of water and wetlands. The objectives of our research were to determine the effects of field drainage rate on P concentration and off-field P loads in drainage water from sugarcane grown on organic soils of the EAA and to determine the effect of field drainage rate on sugarcane productivity and sugar yield. The research site was on a Terra Ceia muck soil (euic, hyperthermic Typic Medisaprist) on a commercial sugarcane farm located in the EAA. The treatments were commercial sugarcane farm located in the EAA. The treatments were fast and slow field drainage rates. Nine drainage events were monitored between Nov. 1988 and Aug. 1990.

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728. Phosphorus load reductions under best management practices for sugarcane cropping systems in the Everglades Agricultural Area.

Rice, R. W.; Izuno, F. T.; and Garcia, R. M.
Agricultural Water Management 56(1): 17-39. (2002)
 NAL Call #: S494.5.W3A3; ISSN: 0378-3774

Descriptors: phosphorus/ nutrients/ crops/ agricultural runoff/ farming/ water quality control/ USA, Florida, Everglades

Abstract: Stormwater run-off from the 290,000 ha Everglades Agricultural Area (EAA) is directed into South Florida's Everglades wetland ecosystem. Concerns regarding run-off water quality and environmental impact led to a 1992 regulatory program which requires P levels in basin run-off be reduced by at least 25% relative to historic trends. Farmers must collectively achieve this annual basin-level target by implementing best management practices (BMPs) to reduce P levels in farm drainage waters. At the time, proposed BMP strategies were largely untested, and to what extent they might reduce farm-level P discharge trends (also poorly documented) was unknown. Given these uncertainties, objectives of this study were to: (1) document long-term drainage P trends for EAA sugarcane systems and (2) quantify BMP effects on-farm drainage P loading. In late-1992, discharge pumps at five farm sites (cropped to sugarcane, sugarcane-vegetables, and/or sugarcane-rice) were instrumented to collect water samples for P analysis during all drainage events throughout baseline (BL; pre-BMP) and BMP operations. Highly variable rainfall distributions in the region strongly influence farm drainage requirements, thus, meaningful interpretations of water quality trends require hydrologic adjustment to P load data. Five rainfall-adjustment analyses were applied to the 6-year farm-level databases. Two analysis methods compared P load trends for the entire BL and BMP monitoring periods. In Method 1, unit area P load (UAL) to rainfall ratios (UAL:R) during BMP operations were 20.4-47.3% smaller across all five sites than those recorded during BL. In Method 2, slope coefficients describing cumulative UAL versus cumulative rainfall trends during BMPs were 14.9-25.0% smaller than BL slopes. The remaining three methods assessed data trends across five consecutive "water years" (WY). In Method 3, slope coefficients describing WY96-98 cumulative UAL versus rainfall distributions were 32.8% lower in magnitude relative to WY94. In Method 4, average UAL:R for the WY96-98 period were 31.0% smaller than for WY94. Basin-level P loads are calculated every WY by state water management regulators, using a hydrologic adjustment model calibrated to a historic load and rainfall database. During the first 3 years (WY96-98) of required BMP implementation, the basin recorded a 55% P load reduction. When this model was applied to the farm data (Method 5), farm P load reductions for WY96-98 averaged 59.7%. All five analytical methods confirm favorable P-reduction trends under recommended BMP strategies for EAA sugarcane-based cropping systems.

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729. Phosphorus sorption capacities of wetland soils and stream sediments impacted by dairy effluent.

Reddy, K. R.; O'Connor, G. A.; and Gale, P. M.
Journal of Environmental Quality 27(2): 438-447. (1998)

Descriptors: phosphorus/ streams/ wetland soils/ sediments

Abstract: The ability of stream sediments and adjacent wetlands to retain added P depends on the P sorption capacity and physico-chemical properties of sediments or wetland soils. The objectives of this study were to: (i) determine the potential P sorption capacities of wetland soils and stream sediments in systems with distinctly different P loadings, and (ii) establish the relationship between P sorption capacity and selected physico-chemical properties. Batch sorption isotherms were measured under aerobic and anaerobic conditions for sediments and wetland soils along a stream-wetland-upland continuum at two sites in the Lower Kissimmee River Basin and Taylor Creek/Nubbin slough of the Okeechobee Basin, Florida. Soluble P and equilibrium P concentration (EPC) of stream sediments generally decreased along the wetland-upland continuum. The EPC values were about twofold greater under anaerobic conditions than aerobic conditions; however, P sorption capacities decreased by about 35% under anaerobic conditions compared with aerobic conditions. The P sorption maxima, estimated by a single point isotherm measured at an added P level of 1000 mg P kg⁻¹, correlated well with Langmuir adsorptive maxima. Phosphorus retention by stream sediments and wetland soils was strongly correlated with contents of amorphous and poorly crystal-line forms of Fe and Al, which explained 87% of the variability in P retention maximum. Addition of total organic C to predictive equations improved the predictability by only 5%.
 This citation is from AGRICOLA.

730. Prescribed fire's impact on water quality of depressional wetlands in southwestern Georgia.

Battle, Juliann and Golladay, Stephen W
American Midland Naturalist 150(1): 15-25. (2003)
 NAL Call #: 410 M58; ISSN: 0003-0031

Descriptors: conservation/ pollution assessment control and management/ ANOVA/ analysis of variance, mathematical and computer techniques/ prescribed burning/ applied and field techniques/ alkalinity/ annual differences/ coastal plains/ depressional wetlands/ environmental impact/ longleaf pine forests/ longleaf pine wiregrass ecosystems/ pH/ prescribed fire/ soils/ vegetation/ water quality

Abstract: Depressional wetlands are a natural feature of the longleaf pine-wiregrass ecosystem on the southeastern Coastal Plain. Fire is an essential part of the longleaf pine forest with prescribed burns occurring at 1-3 y intervals. In 2000 and 2001 we sampled wetlands whose surrounding uplands had been burned and reference wetlands (i.e., no fire) to determine the short-term changes (<1 mo) in surface water quality. In 2000 pH, alkalinity and dissolved inorganic carbon (DIC) were higher in burned wetlands than reference sites based on ranked ANOVA. In 2001 dissolved organic carbon (DOC) and NH₄-N were higher in burned wetlands than reference ones. Differences between years suggest that field conditions are very important in determining fire's affect on water quality. To clarify our findings we conducted a laboratory experiment where we looked at changes in water quality when exposed to material (wiregrass, dead pine needles and soil) that had undergone simulated fire (muffle furnace at 340 C for 1 h). Results indicated that water exposed to burned soil had elevated pH, alkalinity, DOC, NH₄-N and soluble reactive phosphorus (SRP) compared to unburned soil. Burned wiregrass and pine needles had lower DOC and DIC levels

compared to unburned material, but burned wiregrass had higher NH₄-N and SRP concentrations than the unburned treatment. Overall our results suggest that the linkage of fire and water quality of wetlands is through fire's effect on soils rather than vegetation.

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731. Recovery of ecosystem functions and plant community structure by a tupelo-cypress wetland following timber harvesting.

Mader, S. F.

Raleigh, NC: North Carolina State University, 1990.

Notes: Diss. Ph.D.: Order No.: DA9025641.

Descriptors: ecosystem disturbance/ ecosystem resilience/ aquatic plants/ community composition/ swamps/ biodegradation/ nutrient cycles/ vegetation cover/ environmental effects/ forest industry/ USA, Alabama/ timber harvesting/ mechanical and natural changes

Abstract: First- and second-year responses of aboveground net primary productivity, plant nutrient assimilation (N, P, K, Ca, and Mg), soil cellulose decomposition rates, and plant community structure following clearcutting were determined for a tidal water tupelo - bald cypress swamp in southwestern Alabama. Responses to helicopter and rubber-tired skidder timbering harvest systems were compared to each other and an adjacent, undisturbed reference forest. Additionally, cellulose decomposition was measured on plots treated with glyphosate herbicide as a means for assessing the effect of revegetation on decay rates. The greatest impact of timber harvesting was the change in plant community structure, particularly total standing biomass, habitat suitability, and the two-fold increase in plant species richness. Aggressively invading herbaceous vegetation and fast-growing stump sprouts propelled a rapid recovery of important ecosystem functions and indicated high system resilience following ecological disturbance. Plant productivity was 45-65 percent and 70-71 percent of the reference forest in the first and second years, respectively. Much of the nutrient retention function had recovered by the first year and over 80 percent of this function was achieved for all 5 nutrients by the second year. In fact, rates of P and K accumulation surpassed the reference forest rates in both years. Additionally, revegetation fueled the rapid return of soil cellulose decay rates toward preharvest levels. A historical investigation revealed that the wetland ecosystem responded similarly to more severe forestry impacts near the turn of this century. Helicopter logging is without a clear biological advantage over skidder logging with respect to minimizing impacts on certain ecosystem- and community-level attributes of tidal forests. This holds true despite the alteration of hydrologic and soil physical and chemical characteristics induced by the skidder. Both harvesting methods appear to be acceptable forestry management practices. (DBO)

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732. Recovery status of a tupelo-cypress wetland seven years after disturbance: Silvicultural implications.

Aust, W. M.; Zaebst, T. W.; Schoenholtz, S. H.; and Szabo, B. A.

Forest Ecology and Management 90(2-3): 161-169. (1997)

NAL Call #: SD1.F73; ISSN: 0378-1127

Descriptors: forested wetlands/ timber harvesting

Abstract: Three disturbance treatments were imposed on a palustrine forested wetland (*Nyssa aquatica*-*Taxodium distichum*) located in southwestern Alabama in 1986: (i) clearcutting with helicopter log removal (HELI), (ii) HELI followed by rubber-tired skidder traffic simulation (SKID) and (iii) HELI followed by removal of all vegetation during the first two growing seasons via glyphosate herbicide application (GLYPH). After two growing seasons, it was hypothesized that eventual woody plant growth would be best in the HELI-treated areas, because SKID plots had reduced rates of water movement and soil aeration. However, measurements at stand age seven years indicate that SKID actually has greater total above-ground biomass (65 979 kg/ha) than HELI (46 748 kg/ha) and SKID plots have a higher proportion of the most desirable timber species (*Nyssa aquatica*). GLYPH areas resemble freshwater marshes, although the areas are being invaded by *Salix nigra* seedlings. All disturbance treatments have significant groundflora components that have increased sediment accumulation 70-175% relative to an undisturbed reference area. By age seven years, regrowth of vegetation has lowered the water table during the growing season but has had little effect on soil redox potential and pH. Our observations suggest that this wetland system is rapidly recovering from logging disturbance seven years ago.

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733. Reducing diffuse pollution through implementation of agricultural best management practices: A case study.

Cook, M. G.; Hunt, P. G.; Stone, K. C.; and Canterberry, J. H.

Water Science and Technology 33(4-5)(1996)

NAL Call #: TD420.A1P7; ISSN: 0273-1223.

Notes: Conference: 2. IAWQ Int. Specialized Conference and Symposia on Diffuse Pollution, (Czech Rep.), 13-18 Aug 1995

Descriptors: water quality/ monitoring/ agricultural practices/ nutrients/ animal wastes/ waste management/ nonpoint pollution sources/ case studies/ pesticides/ pollution monitoring/ agricultural pollution/ USA, North Carolina, Duplin Cty./ pollution monitoring/ agricultural pollution/ monitoring/ agricultural practices/ nonpoint pollution sources/ case studies

Abstract: A system of agricultural best management practices (BMPs) was implemented on a 2,100 ha watershed in Duplin County, North Carolina, USA, for the purpose of improving water quality. The BMPs included: Nutrient, pest, and animal waste management; and soil conservation practices. Both surface and ground water were continually analyzed to assess the water quality impacts. Nutrient management plans have been developed for over 80% of the cropland. Pest management plans have been developed for over 60% of the cropland. Over one-half of all plans have been implemented. Poultry mortality composting and improved swine waste management have decreased the potential adverse effects of animal operations. A constructed wetland shows promise as a pre-treatment of swine waste prior to land application. Stream monitoring shows decreasing amounts of nitrate- and ammonium-nitrogen in the surface waters of the watershed. Ground water monitoring shows relatively high concentrations of nitrate in areas of intensive swine and poultry operations. Ground water monitoring of pesticides reveals low levels of alachlor, atrazine, and metolachlor

even though large amounts of these chemicals are used on crops. The successful implementation of agricultural BMPs appears to be having a positive effect on water quality. Both stream and ground water monitoring will be continued for several years to assess more definitively the changes in water quality.

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734. Removal of floodwater sediments by a clearcut tupelo-cypress wetland.

Aust, W. M.; Lea, R.; and Gregory, J. D.

Water Resources Bulletin 27(1): 111-116. (1991)

NAL Call #: 292.9 AM34; ISSN: 0043-1370

Descriptors: wetlands/ deltas/ water quality/ Nyssa aquatica/ Taxodium distichum/ clearcutting/ logging/ glyphosate/ sediments/ Alabama

Abstract: A palustrine water tupelo (*Nyssa aquatica* L.)- baldcypress (*Taxodium distichum* (L.) Rich.) swamp in southwestern Alabama was subjected to three types of disturbance, including helicopter logging, rubber-tired skidder logging simulation, and helicopter logging followed by an herbicide application. An adjacent undisturbed stand served as a control area. Post-harvest collection of sedimentation data revealed that the herbaceous and woody vegetation regrowth within the helicopter and skidded clearcut areas trapped more sediments than did the control or herbicide treatment areas. Clearcutting, followed by plant regrowth, improved the wetland's capacity to remove sediments from overbank flow flood waters. This citation is from AGRICOLA.

735. Residual organochlorine pesticides in soils and fish from wetland restoration areas in central Florida, USA.

Marburger, J. E.; Johnson, W. E.; Gross, T. S.; Douglas, D. R.; and Di, J.

Wetlands 22(4): 705-711. (Dec. 2002)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ soil contamination/ organochlorine compounds/ pesticides/ aquatic organisms/ Chlordane/ DDT/ Dieldrin/ tissues/ soil/ contamination/ pesticides (organochlorine)/ USA, Florida/ rehabilitation/ water pollution/ fate of pollutants/ sediment contamination/ spatial distribution/ bioaccumulation/ fish populations/ animal tissues/ data collections/ sediment pollution/ DDE/ geographical distribution/ restoration/ pollution dispersion/ Pisces/ *Ameiurus nebulosus*/ *Micropterus salmoides*/ *Pomoxis nigromaculatus*/ fish/ black crappie/ largemouth bass/ brown bullhead/ freshwater pollution/ environmental impact/ sources and fate of pollution/ effects on organisms/ water pollution: monitoring, control and remediation

Abstract: Four wetland restoration sites in the Emerald Marsh Conservation Area located in central Florida, USA were flooded between 1992 and 1994. Florida Fish and Wildlife Conservation Commission stocked largemouth bass in the flooded areas from 1992 to 1996. In 1996, organochlorine pesticides (OCPs) were measured in flooded soils and in black crappie, brown bullhead catfish, and largemouth bass from the four sites. Areas 5 and 7 had the highest concentrations of total residual OCPs in the flooded soils, including dieldrin (385 plus or minus 241 mu g/kg), sum of DDT, DDD, and DDE (7,173 plus or minus 1,710 mu g/kg), and toxaphene (39,444 plus or minus 11,284 mu g/kg). Sum of chlordane residuals was highest in area 5 (1,766 plus or minus 1,037 mu g/kg). ANOVA

indicated significant differences in location and fish muscle tissue concentrations for chlordane residuals, DDT residuals, and dieldrin. Fish from areas 5 and 7 had the greatest concentrations of chlordane residuals, DDT residuals, and dieldrin, which corresponded to the higher soil concentrations in these two areas. OCPs in muscle tissue were below the U.S. Food and Drug Administration action limits for human consumption. For three-year-old bass collected from Area 5, mean concentrations of chlordane residuals, DDT residuals, and dieldrin were 15-17 times higher in ovary tissue and 76-80 times higher in fat tissue compared with muscle tissue. Mean toxaphene levels in bass ovary and fat tissues were 9 and 39 times higher, respectively, than in muscle tissues. Tissue OCP concentrations were consistent with site OCPs, regardless of fish species.

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736. Response of macroinvertebrates and small fish to nutrient enrichment in the northern Everglades.

Rader, Russell B. and Richardson, Curtis J.

Wetlands 14(2): 134-146. (June 1994)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: Invertebrata/ pisces/ farming and agriculture/ agricultural runoff effects on wetland community/ trophic structure/ community structure/ population density/ effects of nutrient enrichment/ semiaquatic habitat/ wetland/ chemical factors/ nutrient enrichment effects on wetland community/ Florida/ Everglades, North/ nutrient enrichments effects on community

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737. Responses of isolated wetland herpetofauna to upland forest management.

Russell, Kevin R.; Hanlin, Hugh G.; Wigley, T. Bently; and Guynn, David C.

Journal of Wildlife Management 66(3): 603-617. (July 2002)

NAL Call #: 410 J827; ISSN: 0022-541X

Descriptors: Amphibia/ Reptilia/ forestry/ upland forest management/ isolated wetland taxa responses and conservation implications/ habitat management/ implications/ community structure/ population dynamics/ wetland taxa/ responses to upland forest management and conservation implications/ semiaquatic habitat/ isolated wetland/ taxa responses to upland forest management/ South Carolina/ Marion County/ Woodbury tract/ wetland taxa community/ ecology related to upland forest management/ conservation implications

Abstract: Because many amphibians and reptiles associated with wetlands also use adjacent terrestrial habitats to complete their life cycles, it has been suggested that undisturbed upland areas are required to maintain populations of these species. To date, however, measured responses of wetland herpetofauna to upland silviculture include only retrospective comparisons or anecdotes without true spatial and temporal references. We used an experimental approach to measure responses of herpetofauna at isolated wetlands in the Coastal Plain of South Carolina, USA, to disturbance of adjacent loblolly pine (*Pinus taeda*) forests. We used drift fences with pitfall traps to sample herpetofauna at 5 wetland sites for 1 year before (1997) and 2 years after (1998-1999) the following treatments were applied to the upland stands surrounding each site: (1) reference (unharvested), (2) clearcutting, and (3) clearcutting followed by mechanical site preparation.

Although silvicultural treatments significantly altered overstory and ground-cover characteristics of upland stands, we did not observe any treatment-related changes in the overall richness, abundance, or community similarity of amphibian and reptile communities at the wetlands. Turtles and snakes were less abundant adjacent to clearcut and site-prepared stands 6 months after treatment but not after 1.5 years, possibly in response to physical disturbance of nest sites and changes in ground cover. Fifteen of the 17 species of herpetofauna with [gtoreq]30 individual captures showed no effects of treatments. Bronze frogs (*Rana clamitans*) entered the wetlands in proportionally higher numbers from clearcuts and site-prepared stands 1.5 years after treatment, possibly in relation to increased standing water in treated stands. In contrast, site preparation appeared to reduce the abundance of black racers (*Coluber constrictor*) 6 months after treatment. In the short term at least, many species of isolated wetland herpetofauna in the southeastern Coastal Plain may tolerate some disturbance in adjacent upland stands. Responses of isolated wetland herpetofauna to upland silviculture and the need for adjacent forested buffers likely depend on the specific landscape context (e.g., natural disturbance regimes) in which the wetlands occur and composition of the resident herpetofaunal community.
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738. Runoff from tomato cultivation in the estuarine environment: Biological effects of farm management practices.

Arnold, G. L.; Luckenbach, M. W.; and Unger, M. A. *Journal of Experimental Marine Biology and Ecology* 298(2): 323-346. (2004)
NAL Call #: QH91.A1J6; ISSN: 0022-0981
Descriptors: agriculture/ bioindicators/ pesticides/ plastic mulch/ runoff/ toxicity
Abstract: The use of plastic row covers (plastic mulch) on vegetable farms increases runoff of pesticides after rainfall events and has been linked to toxic events in adjacent tidal waters. In coastal Virginia, USA, runoff from tomato fields with plastic mulch was suspected of causing mortality of commercial hard clam larvae at a hatchery located downstream of farming operations. Concern about the putative impacts of this practice on local waters resulted in a collection of studies to: (1) determine the sensitivity of early life stages of bivalves to copper, a commonly used fungicide; (2) examine acute and chronic biological effects of runoff on tidal creeks; and (3) examine the efficacy of management practices designed to reduce the delivery of pesticides to adjacent creeks. Laboratory bioassays revealed that 48-h LC50 values for embryonic clams *Mulinia lateralis* and *Mercenaria mercenaria* were 38 and 20 µg/l, respectively. In situ bioassays with *Palaemonetes pugio* showed that pulsed toxic conditions sometimes occur downstream of some tomato farms in plastic mulch following rainfall events. Growth, mortality rates and bioaccumulation of copper and organic pesticides in oysters were not correlated with the use of plastic mulch in watersheds. Sediment bioassays indicated potential toxicity in sediment collected downstream of some tomato fields in plastic mulch, but the effects were not consistent between years. Closer examination of management practices on the farms suggests that controlling runoff can prevent toxic impacts. Elevated levels of crop protectants measured at the outflow of farm ponds suggested that they may do little

to reduce loadings of some pesticides. However, forested buffer zones and ephemeral sedimentation basins appeared to be effective in reducing pesticide concentrations in runoff and pulsed toxicity in tidal creeks.
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739. Season length indicators and land-use effects in southeast Virginia wet flats.

Burd, A. C.; Galbraith, J. M.; and Daniels, W. L. *Soil Science Society of America Journal* 69(5): 1551-1558. (2005)
NAL Call #: 56.9 So3; ISSN: 0361-5995
Descriptors: wetlands/ wetland soils/ growing season/ land use/ swamps/ water table/ swamp soils/ soil temperature/ ecological succession/ plant ecology/ forests/ fields/ Virginia
Abstract: The growing season concepts used by federal agencies in defining and regulating wetland hydrology ignore land use and rely on published surrogate indicators. This study compared several growing season indicators with measured air and soil temperature and hydrology data on three land-use types in the Great Dismal Swamp ecosystem of Southeast Virginia to determine how accurate the indicators are on each land use. Water-table depths, 1-m air temperatures, and soil temperature at 50-cm depths were measured for 18 mo at plots representing forest, early successional field (field), and tilled (bare ground) land-use treatments at two study areas. Land use affected air and soil temperature through vegetation type and soil surface properties, both of which are important for wetland restoration. Based on soil temperature at 50 cm, the growing season was continuous in forests but was interrupted in January for 1 to 7 d in some field and bare ground plots. Soil temperatures at 50 cm rose above biological zero (5 degrees C) 90 to 128 d before the published -2.2 degrees C growing season started. The published -2.2 degrees C growing season was 28 to 88 d longer than the measured equivalent, and began after the water tables rose and stayed continuously in the upper 30 cm. A continuous growing season declaration is proposed for federal regulations in thermic wet flats on all land uses. Lengthening the growing season did not cause the studied wetlands to fail the minimum federal wetland hydrology requirements for identification or delineation. This citation is from AGRICOLA.

740. Sediment and nutrient accumulation in floodplain and depressional freshwater wetlands of Georgia, USA.

Craft, C. B. and Casey, W. P. *Wetlands* 20(2): 323-332. (June 2000)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: wetlands/ sedimentation/ nutrients (mineral)/ agricultural runoff/ eutrophication/ historical account/ sediment pollution/ flood plains/ organic carbon/ Caesium 137/ Lead 210/ USA, Georgia/ sediments/ nutrients/ cores/ variability/ accumulation/ sinks/ watersheds/ land use/ deposition/ USA, Georgia/ habitat community studies/ sediments and sedimentation/ mechanical and natural changes
Abstract: Soil accretion, sediment deposition, and nutrient (N, P, organic C) accumulation were compared in floodplain and depressional freshwater wetlands of southwestern Georgia, USA to evaluate the role of riverine (2600 km super(2) catchment) versus depressional (<10 km super(2) catchment) wetlands as sinks for sediment and nutrients. Soil cores were collected from three floodplain (cypress-

gum) and nine depressional (three each from cypress-gum forest, cypress-savannah, and herbaceous marsh) wetlands and analyzed for radionuclides (super(137)Cs, super(210)Pb), bulk density, N, P, and organic C to quantify recent (30-year) and long-term (100-year) rates of sediment and nutrient accumulation. There was no significant difference in organic C, N, or sediment accumulation between depressional and floodplain wetlands. However, P accumulation was 1.5 to three times higher in the floodplain (0.12-0.75 g/m super(2)/yr) than in the depressional wetlands (0.08-0.25 g/m super(2)/yr). Sediment and nutrient accumulations were highly variable among depressional wetland types, more so than between depressional and floodplain wetlands. This variability likely is the result of differences in historical land use, hydrology, vegetation type, NPP, and perhaps fire frequency. Mean (n = 12) one-hundred-year rates of sediment deposition (1036 g/m super(2)/yr), organic C (79 g/m super(2)/yr), N (6.0 g/m super(2)/yr), and P accumulation (0.38 g/m super(2)/yr) were much higher than 30-year rates (sediment = 118 g/m super(2)/yr, C = 20 g/m super(2)/yr, N = 1.5 g/m super(2)/yr, P = 0.09 g/m super(2)/yr). Higher 100-year (super(210)Pb) sediment and nutrient accumulations likely reflect the greater numbers of farms, greater grazing by livestock, and the absence of environmentally sound agricultural practices in southwestern Georgia at the turn of the century. Our findings suggest that the degree of anthropogenic disturbance within the surrounding watershed regulates wetland sediment, organic C, and N accumulation. Phosphorus accumulation also is greater in floodplain wetlands that have large catchments containing fine textured (clay) sediments that are co-deposited with P.
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741. Sediment concentrations from intensively prepared wetland sites.

Askew, G. R. and Williams, T. M.
Southern Journal of Applied Forestry 8(3): 152-157. (1984)
Descriptors: sedimentation/ logging/ drainage systems/ bay lands/ South Carolina/ suspended sediments/ erosion/ roads/ drainage ditches/ construction wetlands/ water pollution sources/ water pollution control
Abstract: Conversion of pocosin and bay lands in the southeastern US from natural hardwood stands to loblolly pine plantations usually involves the installation of some form of drainage system followed by logging, site preparation, and planting. The drainage system may provide a pathway for sediment produced by these activities to reach natural streams. Suspended sediment concentrations were measured in water draining from a 5,900-acre Carolina bay located in southeastern Georgetown County, South Carolina, which is undergoing conversion to loblolly pine plantations. Samples were collected during the first storm-flow event of each month between January 1981 and December 1982 from subwatersheds involved in some of several phases of conversion. Suspended sediment concentrations in water draining from the bay averaged 16 mg/l despite logging, site preparation road maintenance and use, and installation of drainage ditches. Road erosion and ditch installation produced the highest suspended sediment concentrations. Suspended sediment concentrations decreased substantially with increasing distance from the sediment source. Logging and site preparation did not lead to increased sedimentation as long as heavy equipment was

not allowed to operate in the ditches. Apparently on the flat coastal soils overload flow normally transports sediment only from roads or from disturbed sites immediately adjacent to drainage ditches. One way to minimize the impact of roads and new drainage ditches is to use a drainage system that contains a length of main channel between sediment sources and sensitive areas. (Moore-IVI)
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742. Sediment deposition in a forested inland wetland with a steep-farmed watershed.

McIntyre, S. C. and Naney, J. W.
Journal of Soil and Water Conservation 46(1): 64-66. (1991)
NAL Call #: 56.8 J822; *ISSN:* 0022-4561
Descriptors: wetlands/ wetland soils/ sediment deposition/ watersheds/ Tennessee
This citation is from AGRICOLA.

743. Sedimentation in bottomland hardwoods downstream of an east Texas dam.

Phillips, J. D.
Environmental Geology 40(7): 860-868. (2001)
NAL Call #: QE1.E5; *ISSN:* 1073-9106
Descriptors: sediment deposition/ alluvium/ floodplains/ lowland forests/ sediments/ Texas
Abstract: Dams and reservoirs are often efficient sediment traps, and conventional wisdom holds that fluvial sediment supplies are reduced well downstream. However, there are reasons to question the extent to which fluvial and alluvial sediment supplies are reduced more than a few kilometers downstream of dams. Sedimentation in bottomlands of Loco Bayou, east Texas, was investigated at a site less than 16 km downstream of Loco Dam and Lake Nacogdoches, which controls 86% of the 265-km² drainage area. Turbidity levels are generally as high or higher than those on Loco Bayou upstream of the lake. Sedimentation rates on the lower floodplain since the dam was completed are 11 mm year⁻¹ or more. This rate is high enough to suggest that the dam has no effect on sediment supplies 16 km downstream. The spatial pattern of sedimentation and the vegetation distribution suggest that the elevation and frequency of flooding, not fluvial sediment availability, are the critical factors in determining sediment supplies to these floodplains.
This citation is from AGRICOLA.

744. Short-term breeding bird response to two harvest practices in a bottomland hardwood forest.

Harrison, Charles A. and Kilgo, John C.
Wilson Bulletin 116(4): 314-323. (2004)
NAL Call #: 413.8; *ISSN:* 0043-5643
Descriptors: animals and man/ disturbance by man/ commercial activities/ conservation/ conservation measures/ ecology/ community structure/ population dynamics/ habitat/ terrestrial habitat/ land zones/ Nearctic region/ USA/ North America/ Aves: forestry/ clearcutting and patch retention harvesting/ short term breeding population responses/ habitat management/ forest management/ species diversity/ breeding species richness/ short term responses to different harvest practices/ population density/ breeding population density/ short term responses to clearcutting vs. patch retention harvesting/ forest and woodland/ short term breeding population responses to clearcutting vs. patch retention harvesting/

South Carolina/ Lower Coastal Plain/ Coosawhatchie River/ short term breeding population responses to different harvest practices/ bottomland hardwood forest/ Aves/ birds/ chordates/ vertebrates

Abstract: Clearcutting is the preferred timber harvest method in bottomland hardwood forests because it is most likely to result in regeneration of preferred species. However, clearcutting generally has negative impacts on forest birds. Patch-retention harvesting may provide similar silvicultural benefits, but its effects on birds are unknown. We surveyed breeding birds in uncut control, clearcut, and patch-retention treatment areas (11-13 ha) for one season prior to harvest and two seasons postharvest in a bottomland hardwood forest in the Lower Coastal Plain of southeastern South Carolina. Bird observations recorded along line transects were analyzed using the software EstimateS to estimate species richness and program Distance to estimate densities. We found greater species richness and bird densities in the patch-retention treatment than in the clearcut in both postharvest seasons. We detected no forest-interior birds in the clearcut after the harvest, but by the second postharvest season in the patch-retention treatment, the density of forest-interior birds had returned to approximately half of its preharvest level. Thus, based on density response, patch-retention harvesting appears to be less detrimental to forest birds than clearcutting. However, additional work is needed to determine whether retained patches influence avian survival and productivity.

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745. Slash incorporation for amelioration of site, soil and hydrologic properties on pocosins and wet flats in North Carolina.

Lakel, W. A.; Aust, W. M.; Carter, E. A.; Stokes, B. J.; Buford, M. A.; and Sanchez, F. G.

In: Proceedings of the tenth biennial southern silvicultural research conference/ Haywood, James D. Southern Research Station, USDA Forest Service (Series: General Technical Report SRS-30), 1999. 298-301

NAL Call #: aSD143 .G46 no. 30

<http://www.treesearch.fs.fed.us/pubs/2141>

Descriptors: incorporation/ mulching/ site preparation/ soil water/ water table/ forests/ tillage/ mounds/ forest soils/ wetland soils/ Ultisols/ groundwater level/ amelioration of forest sites/ slash/ mulches/ soil water content/ soil solution/ chemical composition/ nitrate/ ammonium

Abstract: It was hypothesized that mulching and incorporation of slash as part of site preparation treatments could affect soil water characteristics. Two forested wetland sites, an organic pocosin (Pantego series soil, fine, loamy, siliceous, thermic Umbric Paleaquult) and a mineral wet flat (Lenoir series soil, clayey, mixed, thermic, Aeric Paleaquult), located in the lower coastal plain of North Carolina, were selected for treatments. Treatments consisted of slash mulching and incorporation in combinations with bedding and flat planting. These treatments were arranged in a randomized complete block design and an incomplete block design. Volumetric soil moisture percent, water table depths, and soil water chemical characteristics were monitored for one year following treatment installation. Preliminary results suggest that bedding in general affects soil water characteristics while differing methods of slash incorporation do not.

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746. Soil bulk density, soil strength, and regeneration of a bottomland hardwood site one year after harvest.

Hassan, A. E. and Roise, J. P.

Transactions of the ASAE 41(5): 1501-1508. (1998)

NAL Call #: 290.9 Am32T; ISSN: 0001-2351

Descriptors: soil strength/ bulk density/ soil water content/ forest soils/ regeneration/ lowland forests

Abstract: The first year soil physical properties and regeneration measurements following harvest indicate ample regeneration on all treatments including the landing areas. Comparisons included three machine systems (three skidders) and a helicopter-yarded control that were field tested for harvesting a bottomland hardwood site under adverse conditions. The results also demonstrate a significantly greater number of tree stem count following the winter than the summer harvest. Results of the statistical analysis of soil bulk density indicate that the soil had partially recovered from machine traffic one year after harvest.

This citation is from AGRICOLA.

747. Soil, groundwater, and floristics of a southeastern United States blackwater swamp 8 years after clearcutting with helicopter and skidder extraction of the timber.

Rapp, J.; Shear, T.; and Robison, D.

Forest Ecology and Management 149(1-3): 241-252. (2001)

NAL Call #: SD1.F73; ISSN: 0378-1127

Descriptors: wetlands/ soil chemistry/ organic matter/ ground water/ community composition/ revegetation/ forest management/ USA, South Carolina/ forest hydrology/ lumber/ swamps/ groundwater/ plant populations

Abstract: We compared the impacts of helicopter and rubber-tired skidder extraction of timber after harvesting on the structure and function of a blackwater forested wetland. This study was initiated in 1991, in a cypress-tupelo forest adjacent to the South Fork Edisto River in South Carolina, USA. Our objective, eight growing seasons after harvest, was to focus on the properties that showed effects of the harvest after three years: soil chemistry, organic matter decomposition, groundwater chemistry, and plant community composition. Concentrations of total nitrogen, phosphorous, and magnesium were lower in some of the harvest treatments than in the unharvested control.

Cellulose decomposition at 5 and 10 cm below the soil surface was significantly greater in the harvested treatments than the unharvested, though there were no differences in soil temperature. There were no differences among treatments in the concentrations of NO sub(3) super(-), NH sub(4) super(+), and PO sub(4) in groundwater sampled from depths of 0.2 and 1 m. Sedimentation was significantly greater in the harvested treatments than the unharvested treatment, and had apparently filled the ruts caused by the skidder. Ordination of the canopy vegetation plots using their importance values showed no separation of vegetation communities by treatment. In contrast, ordination of the midstory and understory vegetation plots cover showed a separation of communities between the harvested and unharvested treatments. There was no apparent environmental advantage to using helicopters rather than skidders to extract timber from this forest.

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748. Soil physical and hydrological changes associated with logging a wet pine flat wide-tired skidders.

Aust, W. M.; Reisinger, T. W.; Burger, J. A.; and Stokes, B. J.

Southern Journal of Applied Forestry 17(1): 22-25.

NAL Call #: SD1.S63; ISSN: 0148-4419

Descriptors: wetlands/ logging/ harvesting/ skidders/ tires/ soil physical properties/ bulk density/ hydraulic conductivity/ porosity/ width

Abstract: A wet pine flat in the coastal plain of South Carolina was harvested with a rubber-tired skidder equipped with 68-in.-wide tires. Soil physical properties were measured immediately before and after a salvage harvest to document changes associated with traffic disturbance. Paired t-tests indicate that the wide-tired operation significantly increased soil volumetric water content, bulk, density, and soil strength, and decreased saturated hydraulic conductivity, soil porosity, and depth to the water table. Changes were greatest for the more disturbed areas, and rutting that occurred in the skid trails apparently interrupted subsurface drainage.

This citation is from AGRICOLA.

749. Soil redox potential in small pondcypress swamps after harvesting.

Casey, W. P. and Ewel, K. C.

Forest Ecology and Management 112(3): 281-287. (1998)

NAL Call #: SD1.F73; ISSN: 0378-1127

Descriptors: Taxodium distichum/ swamps/ redox potential/ soil chemistry/ logging/ forest plantations/ Pinus elliotii/ water/ depth/ Florida

This citation is from AGRICOLA.

750. Spatiotemporal responses of reptiles and amphibians to timber harvest treatments.

Goldstein, Michael I.; Wilkins, R. Neal.; and Lacher, Thomas E.

Journal of Wildlife Management 69(2): 525-539. (2005)

NAL Call #: 410 J827; ISSN: 0022-541X

Descriptors: animals and man/ disturbance by man/ commercial activities/ ecology/ habitat/ terrestrial habitat/ land zones/ Nearctic region/ USA/ North America/ Amphibia/ Reptilia: forestry/ clearcut and selective timber harvest treatments/ impact on bottomland hardwood forest communities/ community structure/ forest and woodland/ bottomland hardwood forest/ Texas/ Tyler County/ bottomland hardwood forest communities/ influence of clearcut and selective timber harvest treatments/ amphibians/ chordates/ reptiles/ vertebrates

Abstract: We compared the influence of clearcut and selective timber harvest treatments on spatial and temporal variability of amphibians and reptiles in an east Texas bottomland hardwood forest. The dataset represented a time series of 5 years post-treatment. A total of 18,645 amphibians and reptiles was captured in 144 pitfall arrays. We used 9 plots Q clearcut, 3 select cut, and 3 untreated). Each plot had 16 arrays and was bisected by 1 of 3 streams. Pitfall captures represented 46 species (16 amphibians, 30 reptiles). When analyzed with a traditional ANOVA approach, these data suggested an increase in reptile species richness in response to clearcut treatments; amphibian species richness did not respond to treatment. When analyzed as a time series, however, the data revealed fluctuations in site use by species and species groups, and these fluctuations were independent of

treatment effects. Exploratory analyses of spatio-temporal dynamics showed that species richness and the relative abundance of common species displayed spatial patterns that remained consistent over time. In control and select cut treatments, spatial patterns of richness and abundance shifted over time and were not necessarily confined to areas adjacent to streams. In clearcuts, stationary habitat refugia were located within riparian management zones.
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751. Strategies for protecting Florida's Everglades: The best management practice approach.

Izuno, F. T. and Capone, L. T.

Water Science and Technology 31(8): 123-131. (1995)

NAL Call #: TD420.A1P7; ISSN: 0273-1223

Descriptors: wetlands/ fertilizers/ hydraulics/ sediment/ water quality/ management/ practice/ pollution/ water pollution/ control/ land management

Abstract: The Everglades Agricultural Area (EAA), Florida, USA, consists of an artificially drained area of ~ 280 000 ha of organic cultivated soils. Hydroperiods and excessive nutrients in surface water inflows have been identified as potentially disruptive to the natural ecosystem, with phosphorus (P) the limiting nutrient. Hence, agricultural drainage water from the EAA, containing higher than background P loads and concentrations, has been targeted as a source of the problem. To reduce P loads and concentrations in the drainage water leaving farms in the EAA, on-farm best management practices (BMPs) can be used. These BMPs have been identified and tested at the large plot scale and presently being implemented and their efficacy verified at the farm level. It is currently estimated that P loading from the EAA can be reduced by 20% to 60% using BMPs. A 45% reduction should be attainable while keeping within acceptable cost-benefit ratios. The use of BMPs, however, will require higher levels of farm management and more sophisticated tools for decision-making.
© CAB International/CABI Publishing

752. Stream water quality changes following timber harvest in a coastal plain swamp forest.

Ensign, S. H. and Mallin, M. A.

Water Research 35(14): 3381-3390. (2001)

NAL Call #: TD420.W3; ISSN: 0043-1354

Descriptors: water quality (natural waters)/ streams (in natural channels)/ wood/ swamps/ forests/ bacteria/ logging/ water quality/ streams/ coastal plains/ riparian land/ forest hydrology/ land use/ coastal zone/ deforestation/ physicochemical properties/ environmental impact/ fecal coliforms/ algal blooms/ microbial contamination/ dissolved oxygen/ suspended particulate matter/ watersheds/ phosphorus/ phytoplankton/ biological pollutants/ pollution monitoring/ resource management/ environmental monitoring/ man-induced effects/ anthropogenic factors/ harvesting/ forest industry/ USA, North Carolina, Goshen Swamp/ logging/ coastal plains

Abstract: The Goshen Swamp, a fourth order blackwater creek in southeastern North Carolina, was clearcut of 130 acres of riparian and seasonally flooded forest in late May through September 1998. Downstream water quality had been monitored monthly for 2 1/2 years before the clearcut, during the clearcut, and for two years following the clearcut. The objective of this paper was to test the hypothesis that clearcutting in the Goshen Swamp watershed negatively

impacted downstream water quality. To do so, data from the Goshen Swamp were compared with data collected from a neighboring control creek (Six Runs Creek) of similar size, land use, and hydrologic characteristics. Compared with the control creek, the post-clearcut Goshen Swamp displayed significantly higher suspended solids, total nitrogen, total phosphorus, total Kjeldahl nitrogen and fecal coliform bacteria, and significantly lower dissolved oxygen over a 15 month period. Longer-term deleterious effects included recurrent nuisance algal blooms that had not been present during the 2 1/2 years before the clearcut. Although a 10 m uncut buffer zone was left streamside, this was insufficient to prevent the above impacts to stream water quality.

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753. Sugarcane production impact on nitrogen and phosphorus in drainage water from an Everglades histosol.

Coale, F. J.; Izuno, F. T.; and Bottcher, A. B.
Journal of Environmental Quality 23(1): 116-120. (1994)
NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: agricultural pollution/ drainage/ nitrogen/ phosphorus/ freshwater pollution/ agricultural runoff/ water pollution sources/ drainage water/ saccharum/ USA, Florida, Everglades/ water pollution sources/ drainage water/ agricultural pollution/ saccharum/ freshwater pollution

Abstract: The Everglades Agricultural Area (EAA) in southern Florida is a 280,000-ha tract of land that has come under scrutiny by environmental, agricultural industry, and government water management groups that are concerned with the impact of nutrient-enriched drainage water on the ecology of adjoining bodies of water and wetlands. Sugarcane (*Saccharum* sp.) is grown on 155,000 ha or 78% of the cultivated organic soils in the EAA. The objectives of this study were to determine the N and P concentrations and off-field loads in drainage water from sugarcane and fallow fields. It was concluded that, due to the large quantity of soil N and P mineralized and due to crop N and P uptake, the impact of sugarcane production on drainage water N and P concentrations was minimal.

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754. Surface water nutrient concentrations and litter decomposition rates in wetlands impacted by agriculture and mining activities.

Lee, A. A. and Bukaveckas, P. A.
Aquatic Botany 74(4): 273-285. (2002)
NAL Call #: QK102.A65; ISSN: 0304-3770

Descriptors: wetlands/ phosphorus/ waterlit/ water column/ nutrient recycling/ C:N [carbon to nitrogen] ratio/ sediment/ season/ evaluation/ site specific/ surface water/ litter decomposition/ nutrient concentration/ time scale/ floods/ impact of forestry or agriculture/ climate, weather, current, tide/ experimental research/ impacts of industry or mining/ North America/ United States/ Kentucky/ Insertae/ sedis/ *Typha latifolia*

Abstract: Decomposition rates of a site-specific dominant litter, a standard litter (*Typha latifolia*) and cellulose were quantified in 10 western Kentucky wetlands using the litterbag technique. Short-term (60 and 42 days) incubations were conducted during fall 1998 and spring 1999. The effect of variable tissue nitrogen content on decomposition rates was evaluated by comparing mass

loss among site-specific dominant species from each wetland. Effects of variable surface water and sediment nutrient concentrations on decomposition were assessed by measuring mass loss of standard litter materials (*Typha latifolia* and cellulose) of uniform C:N ratio. Decomposition of the site-specific dominant litter was significantly correlated with tissue C:N ratios and phosphorus concentrations in wetland waters and sediments. Water column and sediment phosphorus were also significant predictors of decomposition rates for the standard litter types. Nitrogen concentrations in surface waters were not significant predictors of decomposition for any of the substrates in either season. Wetlands impacted by mine drainage exhibited slower decomposition rates and lower nutrient levels in comparison to wetlands occurring in predominantly agricultural areas.

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755. Targeting ecosystem features for conservation: Standing crops in the Florida Everglades.

Turner, Andrew M.; Trexler, Joel C.; Jordan, C. Frank; Slack, Sarah J.; Geddes, Pamela; Chick, John H.; and Loftus, William F.

Conservation Biology 13(4): 898-911. (1999)
NAL Call #: QH75.A1C5; ISSN: 0888-8892

Descriptors: ecology/ community structure/ habitat/ pollution/ land and freshwater zones/ Nearctic region/ North America/ USA/ Invertebrata/ Pisces: biomass/ species diversity/ low biodiversity/ semiaquatic habitat/ oligotrophic wetland biomass and biodiversity/ conservation aspects/ enrichment of oligotrophic wetlands/ Florida/ Everglades/ biomass and biodiversity/ conservation significance/ chordates/ fish/ invertebrates/ vertebrates

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756. Temporal and spatial patterns of wetland sedimentation, West Tennessee.

Hupp, C. R. and Bazemore, D. E.
Journal of Hydrology 141(1/4): 179-196. (1993)
NAL Call #: 292.8 J82; ISSN: 0022-1694

Descriptors: wetlands/ forests/ geomorphology/ growth rings/ sediment deposition/ temporal variation/ spatial variation/ streams/ agriculture/ road construction/ altitude/ sediments/ Tennessee

Abstract: Dendrogeomorphic techniques were used to describe and interpret patterns of sedimentation rates at two forested wetland sites in West Tennessee. Fifty-five sampling stations were established along transects upstream and downstream from bridge structures, and 515 trees were examined for depth of sediment accretion and cored for age determination. Temporal variation in sedimentation rate may be related more to stream channelization and agricultural activity than to bridge and causeway construction. Sedimentation rates have increased substantially in the last 28 years, although channelized streams may have overall lower rates than unchannelized streams. Comparisons of sedimentation rates from deposition over artificial markers (short term) with those determined from tree-ring analysis (long-term) indicate that trends are similar where hydrogeomorphic conditions have not been altered substantially. No tendency for increased sedimentation upstream from bridges was observed. Deposition rates were inversely correlated with elevation and degree of ponding. Downstream deposition of sand splays appears to be related to flow constrictions and

may be extensive. Mean overall rates of sedimentation (between 0.24 and 0.28 cm year⁻¹), determined dendrogeomorphically, are comparable with other published rates.

This citation is from AGRICOLA.

757. Timber harvesting effects After 16 years in a tupelo-cypress swamp.

Gellerstedt, Paul A. and Aust, W. Michael.

In: Proceedings of the 12th Biennial Southern Silvicultural Research Conference. (Held 24 Feb 2003-28 Feb 2003 at Biloxi, Mississippi.) Connor, Kristina F. (eds.)

Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station; pp. 524-527; 594 p.

NAL Call #: aSD143 .G46 no. 71

<http://www.srs.fs.usda.gov/pubs/6693>

Abstract: A variety of concerns have been expressed regarding harvesting in forested wetlands. These concerns usually revolve around such issues as potential losses in site productivity, altered wetland functional processes, and development of appropriate best management practices. In 1985 a long-term study was established to evaluate harvest disturbance effects on water quality, soil properties, hydrology, and site productivity in a water tupelo (*Nyssa aquatica*) -baldcypress (*Taxodium distichum*) swamp. The study site is a deltaic red river bottomland within the Mobile-Tensaw River Delta in southwestern Alabama. After 1 year of baseline data collection, three disturbance treatments were installed in 1986: Clearcutting with helicopter removal, clearcutting with rubber-tired skidder trafficking, and clearcutting followed by complete vegetation control via glyphosate application. The three disturbance treatments were installed as three 3 X 3 Latin squares. Data were also collected from adjacent non-disturbed reference areas for comparison with disturbance treatments. Measurements of soil, water, and vegetation have been conducted at treatment ages 0-2, 7-8, 10, 12, and 16. The skidder and helicopter treatment plots have recovered since harvest due to frequent flooding, shrink-sell soils, and sediment accumulation on the site. Sediment accumulation on treatment plots increased after harvest and has returned to near pre-harvest levels at age 16. The skidder treatment has shown somewhat better recovery than the helicopter treatment, although the differences between the helicopter and skidder treatments are becoming less pronounced. As the treatment plots mature, the species composition is becoming similar to that of the reference area, and the treatment areas are expected to fully recover from disturbance.

This citation is from Treesearch.

758. Use of temporary wetlands by anurans in a hydrologically modified landscape.

Babbitt, Kimberly J. and Tanner, George W.

Wetlands 20(2): 313-322. (2000)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: behavior/ freshwater ecology: ecology, environmental sciences/ breeding activity/ breeding sites/ cattle ranch/ dynamic habitats/ habitat use/ hydrologically modified landscape/ localized flooding/ meteorological conditions/ species abundance/ species composition/ temporary wetlands/ water table/ wetland hydrology/ wetland size

Abstract: We examined larval anuran assemblages at 12 temporary wetlands occurring on the MacArthur Agro-

Ecology Research Center (MAERC) in southcentral Florida. MAERC is an active cattle ranch, and the wetlands on the site are heavily influenced by an extensive series of ditches that drain the landscape. Ditching has resulted in a change from a historically extensive marsh system to a series of isolated wetlands surrounded by upland habitats. Because a majority of anurans in Florida breed exclusively or facultatively in wetlands whose drying regime excludes fish, we were interested in determining the value of these modified wetlands as breeding sites. We examined the effect of wetland size and hydrology on anuran use, and compared breeding activity across three summers that varied greatly in rainfall pattern. We sampled tadpoles from May 93 to August 93 and from May 94 to September 95. A total of 3678 tadpoles from 11 species was collected. *Rana utricularia* was the most abundant species and the only species found in every wetland. Species richness was related positively to wetland size ($r = 0.65$, $p = 0.023$) but not hydroperiod ($r = 0.03$, $p = 0.93$). Tadpole abundance was not related to wetland size ($r = 0.35$, $p = 0.29$) nor hydroperiod ($r = 0.40$, $p = 0.22$). Annual variation in rainfall resulted in significant changes in species composition. A drought during 1993 resulted in no breeding. A high water table in the spring of 1995 resulted in localized flooding in early summer on part of the ranch. Wetlands in these areas were exposed to spillover of water from ditches containing fishes. Wetlands so impacted showed significant changes in species composition from the previous year ($x^2 = 1008$, $p < 0.0001$), whereas wetlands that were not impacted did not differ in composition. The wetlands at MAERC provide dynamic habitats that offer varying breeding opportunities that are highly dependent on meteorological conditions.
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759. Vegetation changes and land-use legacies of depression wetlands of the western coastal plain of South Carolina: 1951-1992.

Kirkman, L. Katherine; Lide, Robert F.; Wein, Gary; and Sharitz, Rebecca R

Wetlands 16(4): 564-576. (1996)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ ecology: environmental sciences/ freshwater ecology: ecology, environmental sciences/ soil science/ agricultural disturbance/ hydrology/ land cover/ land use legacy/ terrestrial ecology/ vegetation changes

Abstract: We examined historical patterns of land use of depression wetlands (Carolina Bay and bay-like wetlands) to determine if a relationship between vegetative successional changes over a 41-year period and previous human disturbances (primarily agricultural) could be established. Land cover was interpreted from 1951 (black and white) and 1992 (false color infrared) aerial photography of the Savannah River Site (a 780 km² federal nuclear facility in which wetlands have been relatively undisturbed since 1951). Patterns of change from one land cover to another were detected by constructing a series of frequency tables. About one fourth of the 299 wetlands identified were either pasture or cultivated in 1951, and the majority had been ditched for drainage. Agriculturally disturbed wetlands primarily became mixed hardwood/pine or were converted to pine plantations by 1992; however, no successional differences between wetlands that were cultivated versus pasture were detectable. The type of land use of many of the depression wetlands prior to 1951 probably was determined by

physical characteristics of the wetlands (e.g., topographic position, size, and hydrologic features). Thus, in many cases, separation of recovery trajectories from other successional pathways, initial hydrogeomorphic differences, and/or continued human influences is not possible in this study. However, from this change-detection study, we recognize that many of the currently protected depression wetlands at SRS were disturbed by agricultural practices or were impacted by hydrologic alterations prior to 1951, implying considerable resilience in the recovery toward a functioning wetland condition if hydrologic regimes are restored. A significant finding of this study is the relative stability of herb-dominated bays, which indicates that this vegetation type is not necessarily a successional continuum toward an eventual hardwood forest, at least in the temporal scale of the study. Thus, we suggest that management prescriptions for the restoration/conservation of herb-dominated wetlands should incorporate concepts of temporal stability within a framework of cyclical hydrologic and vegetation changes.
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760. Vegetation responses to helicopter and ground based logging in blackwater floodplain forests.

Jones, R. H.; Stokes, S. L.; Lockaby, B. G.; and Stanturf, J. A.
Forest Ecology and Management 139(1-3): 215-225. (2000)
NAL Call #: SD1.F73; ISSN: 0378-1127
Descriptors: logging/ environmental impact/ forests/ species composition/ forest management/ freshwater ecosystems/ freshwater environments/ soil characteristics/ flood plains/ streams/ harvesting/ vegetation/ community structure/ species richness/ community composition/ soil erosion/ forestry/ water quality/ detritus/ land management/ environmental quality/ *Cliftonia monophylla*/ *Acer rubrum*/ *Cyrilla racemiflora*/ *Liriodendron tulipifera*/ *Magnolia virginiana*/ USA, Alabama/ buckwheat tree/ red maple/ swamp cyrilla/ tulip poplar/ sweetbay
Abstract: Logging in floodplains of low order, blackwater streams may damage existing seedlings and rootstocks, and create soil conditions that inhibit establishment and growth of regeneration after harvest. Removal of logs via helicopters has been advocated to minimize soil damage and facilitate rapid revegetation. We tested impacts of helicopter versus conventional skidder harvest systems on regeneration, woody plant community structure and biomass growth in three blackwater stream floodplains in southern Alabama. The helicopter treatment resulted in significantly greater woody plant density (19,900 versus 14,300 stems/ha by Year 8), but both treatments were well-stocked with commercially valuable species. By Year 8, treatment effects on density of individual species were generally not significant; however, density of *Cliftonia monophylla* was lower on skidder plots ($p=0.001$) and density of *Nyssa sylvatica* var. *biflora* was lower on helicopter plots ($p=0.092$). In both treatments, species richness within 0.004 ha regeneration plots declined slightly between pre- and post harvest, but the Shannon diversity and evenness indices remained essentially unchanged through 8 years after treatment. Post-harvest survival of *Acer rubrum*, *Cyrilla racemiflora* and *C. monophylla* rootstocks was significantly lower on the skidder plots. In both treatments, species dominant before harvest remained so afterwards. Species with the tallest sprouts in Year 8 were *Liriodendron tulipifera*, *Magnolia virginiana*, and *A.*

rubrum. During the first 2 years after logging, aboveground biomass was greater in the helicopter treatment, but the difference was only significant in Year 1. We conclude that both harvesting methods had little effect on species composition. Skidding may result in a stand structure more favorable for commercial timber production; however, impacts of skidding on long-term productivity are not yet known.
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761. Water quality changes associated with forest drainage.

Williams, T. M.
Technical Publication R8 (United States Department of Agriculture, Forest Service, Southern Region) 20: 76-83. (1994)
NAL Call #: aSD11.U5962; ISSN: 0749-5536
Descriptors: wetlands/ forest management/ forest plantations/ water quality/ drainage/ road construction/ evapotranspiration/ hydrology/ nutrients/ sulfates/ cations/ hydrogen ions/ sediments/ literature reviews
This citation is from AGRICOLA.

762. Water quality within lightly-grazed and protected isolated wetlands in south-central Florida.

Tanner, G. W. and Terry, W. S.
Proceedings of the Soil and Crop Science Society of Florida 50: 80-84. (1991)
NAL Call #: 56.9 So32; ISSN: 0096-4522
Descriptors: wetlands/ hydrology/ water quality/ grazing/ animal husbandry/ land types
Abstract: Total N and P, chlorophyll a, dissolved oxygen and pH of surface water collected from wetlands in Florida were measured over an 1.5-yr period. There were no significant differences in these water quality parameters between grazed and ungrazed wetlands. All wetlands were acidic (mean pH about 4.0) and eutrophic in terms of total N and chlorophyll a concn. Dissolved oxygen was always >3 ppm, and mesotrophic in terms of total P concn. Water quality was most degraded during a period of extreme low water. Light to moderate levels of cattle grazing did not degrade water quality within the wetlands studied.
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763. Wet-weather timber harvesting and site preparation effects on coastal plain sites: A review.

Miwa, M.; Aust, W. M.; Burger, J. A.; Patterson, S. C.; and Carter, E. A.
Southern Journal of Applied Forestry 28(3): 137-151. (2004)
NAL Call #: SD1.S63; ISSN: 0148-4419
Descriptors: site preparation/ site productivity/ timber harvesting impacts
Abstract: Increased interest in sustainable forestry has intensified the need for information on the interactions of forest soils, harvesting methods, site disturbances, and the efficacy of methods for ameliorating disturbances. On wet pine flats, such as those commonly found in the Atlantic and Gulf Coastal Plains, conditions such as frequent rainfall, low relief, and poor internal soil drainage often predispose forest soils to harvest disturbances and potential damage. Typical forest operations use heavy logging equipment, such as rubber-tired feller-bunchers and skidders. During dry soil conditions, these machines cause little soil disturbance, but under moist to saturated

conditions, such operations may compact soils and interfere with normal soil drainage. Many studies have been conducted to characterize soil disturbance and site preparation effects on tree seedling survival and growth and to evaluate the amelioration effect of site preparation on disturbed soils. However, results are sometimes contradictory due to site specificity, and results have not been summarized in the context of pine plantation management. This article summarizes previous research results of the wet-weather harvesting and bedding effects on soil properties as related to loblolly pine (*Pinus taeda*) productivity for a variety of Coastal Plain region sites types. © 2004 by the Society of American Foresters. © 2006 Elsevier B.V. All rights reserved.

764. Wetland agriculture in the Everglades: A concept for sustaining agriculture and the ecosystem.

Deren, C. W.; Glaz, B.; and Snyder, G. H.
In: Versatility of Wetlands in the Agricultural Landscape. (Held -17-20 September, 1995 at Hyatt Regency, Tampa)

St Joseph, Mo.: American Society of Agricultural Engineers (ASAE); pp. 35-43; 1995.

NAL Call #: QH87.3.V47 1995

Descriptors: wetlands/ farming systems/ sustainability/ drainage/ soil depth/ subsidence/ flooding/ rice/ sugarcane/ vegetables/ Histosols/ agriculture/ ecosystems/ land types/ arable land

Abstract: Sugarcane, rice, vegetables and grasslands are cultivated on 283 000 ha organic soils (Histosols) of the Everglades Agricultural area (EAA) in Florida, USA. Present farming methods do not sustain a good agricultural production. The drained Histosols subside ~2.5 cm/year mainly because of microbial oxidation and soil depths in some areas are only 40-50 cm over bedrock. It is suggested that a wetland agriculture based on rice and sugarcane or on crops tolerant to flooding or high groundwater levels may help sustain agricultural ecosystems and reduce soil subsidence.

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Wetlands as Agricultural Conservation Practices

765. Acute toxicity of methyl-parathion in wetland mesocosms: Assessing the influence of aquatic plants using laboratory testing with *Hyalella azteca*.

Schulz, R.; Moore, M. T.; Bennett, E. R.; Milam, C. D.; Bouldin, J. L.; Farris, J. L.; Smith, S.; and Cooper, C. M.
Archives of Environmental Contamination and Toxicology 45(3): 331-336. (Oct. 2003)

NAL Call #: TD172.A7; ISSN: 0090-4341

Descriptors: wetlands/ *Hyalella azteca* (amphipoda)/ pollutants/ toxicity/ semiaquatic habitat/ fertilizer and pesticide pollution/ fertilizers and pesticides/ methylparathion pesticide/ physical factors/ aquatic vegetation cover/ Mississippi/ pesticide toxicity/ aquatic vegetation effects

Abstract: Methyl-parathion (MeP) was introduced into constructed wetlands for the purpose of assessing the importance of distance from the source of contamination and the role of emergent vegetation on the acute toxicity to *Hyalella azteca* (Crustacea: Amphipoda). A vegetated (90% cover: mainly *Juncus effusus*) and a nonvegetated wetland (each with a water body of 50 x 5.5 x 0.2 m) were each exposed to a simulated MeP storm runoff event. *H. azteca* was exposed for 48 h in the laboratory to water samples taken from the wetlands at a distance of 5, 10, 20, and 40 m from the pesticide inlet 3 h, 24 h, 96 h, and 10 days following application. Methyl-parathion was detected throughout the nonvegetated wetland, whereas the pesticide was only transported halfway through the vegetated wetland. A repeated-measure three-way analysis of variance (ANOVA) using time, location, and vegetation indicated significantly lower toxicity in the vegetated wetland. Furthermore, the mortality decreased significantly with both increasing distance from the inlet and time (48-h LC50 [plus or minus] 95% CI: 9.0 [plus or minus] 0.3 [µg/L]). A significant three-way interaction of time x vegetation x location confirmed higher toxicity at the inlet area of the nonvegetated wetland immediately after contamination. Significant linear regressions of maximum mortality (independent of time) versus distance from the pesticide inlet indicated that 44 m of vegetated and 111 m

of nonvegetated wetland would reduce *H. azteca* mortality to <=5%. These results suggest that vegetation contributes to reduced MeP effects in constructed wetlands.

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766. Ammonia volatilization from constructed wetlands that treat swine wastewater.

Poach, M. E.; Hunt, P. G.; Sadler, E. J.; Matheny, T. A.; Johnson, M. H.; Stone, K. C.; Humenik, F. J.; and Rice, J. M.

Transactions of the ASAE 45(3): 619-627. (2002)

NAL Call #: 290.9 AM32T; ISSN: 0001-2351

Descriptors: wastewater treatment/ animal wastes/ ammonia/ vaporization/ nitrogen removal/ livestock/ artificial wetlands/ barn wastewater/ testing procedures/ nitrogen

Abstract: Increasingly, large-scale animal production occurs in confinement where large per-unit-area quantities of waste are generated. With the increased scale of production, new environment-friendly technologies are needed to deal with the waste. Constructed wetlands are considered an alternative treatment, but it is not known if volatilization of free ammonia (NH sub(3)) governs nitrogen removal in these systems. The objective of this research was to quantify the NH sub(3) volatilization from constructed wetlands that treat swine wastewater. In May and July of 2000, a specially designed enclosure was used to measure NH sub(3) volatilization from constructed wetlands receiving swine wastewater. Laboratory and field calibration tests indicated that the enclosure was effective at measuring NH sub(3) volatilization. Wetland tests indicated that NH sub(3) volatilization was occurring. From average hourly rates, it was estimated that 7% to 16% of the nitrogen load to the wetlands was removed through NH sub(3) volatilization. Although NH sub(3) losses should not be ignored, results indicated that NH sub(3) volatilization was not responsible for removing the majority of nitrogen from the swine wastewater.

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767. Aquatic invertebrate and plant responses following mechanical manipulations of moist-soil habitat.

Gray, M. J.; Kaminski, R. M.; Weerakkody, G.; Leopold, B. D.; and Jensen, K. C.

Wildlife Society Bulletin 27(3): 770-779. (1999)

NAL Call #: SK357.A1W5; ISSN: 0091-7648

Descriptors: aquatic invertebrates/ hydrophytes/ Mississippi/ moist-soil management/ waterfowl habitat/ wetland management

Abstract: Managers mow, disk, and till moist-soil habitats to set back succession and increase interspersions of emergent vegetation and water for migrant and wintering waterbirds. We evaluated effects of autumn applications of these manipulations on aquatic invertebrates and moist-soil plants during 2 subsequent winters and growing seasons, respectively, at Noxubee National Wildlife Refuge, Mississippi. Greatest seed mass was in tilled and disked plots in 1993 ($P \leq 0.008$) and in tilled plots in 1994 ($P \leq 0.008$). Plant species diversity generally was greatest in tilled plots in both years ($P \leq 0.05$). Mowed and control plots produced greatest aquatic invertebrate mass in winter 1992-93 ($P \leq 0.025$) and diversity in both winters ($P \leq 0.01$). Invertebrate mass and plant standing crop generally did not differ among treatments in winter 1993-94 and both years, respectively. We recommend autumn tilling in small moist-soil habitats to increase plant species diversity and seed yield. For large-scale management, disking may be more practical than tilling and would likely yield similar plant responses. We recommend autumn mowing if moist-soil habitats exist in early seral stages and contain desirable seed-producing plants that are robust and do not readily topple following flooding to create open water areas for waterbirds.

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768. Assessing the functional level of a constructed intertidal marsh in Mississippi.

LaSalle, Mark W.

Vicksburg, Miss.: U.S. Army Engineer Waterways Experiment Station, 1996. 64 p. Wetlands Research Program Technical Report.

NAL Call #: TD756.5.L37 1996

Descriptors: marshes---Mississippi---design and construction/ constructed wetlands---Mississippi
This citation is from AGRICOLA.

769. Avian communities of created and natural wetlands: Bottomland forests in Virginia.

Snell Rood, Emilie C. and Cristol, Daniel A.

Condor 105(2): 303-315. (May 2003)

NAL Call #: QL671.C6; ISSN: 0010-5422

Descriptors: Aves/ habitat management/ created vs. natural forest wetland communities/ community structure/ semiaquatic habitat/ forest and woodland/ created vs. natural forest wetlands/ Virginia/ Chowan River basin/ community structure in created vs. natural forest wetlands/ conservation significance

Abstract: The federal government requires those who destroy wetlands to preserve, restore, or create new ones with the goal of no net loss of wetlands. In the summer of 2000, we tested whether forested wetlands created an average of 8 years earlier had developed avian communities similar to natural wetlands of the same age in southeastern Virginia. We compared six created wetlands

to five natural (reference) wetlands that had undergone ecological succession after clearcutting. We also created a trajectory of expected avian community development by comparing 20 reference wetlands, logged 1-25 years earlier, to mature forested wetlands that had not been logged for 50 years or more. Created wetlands had significantly lower avian richness and diversity, and a different community composition, than reference wetlands. These differences were likely due to the fact that created wetlands supported low numbers of the expected passerine species. In addition, natural wetlands supported species of higher conservation concern, as measured by Neotropical migratory status, trophic level, habitat specificity, and wetland dependency. The trajectory of avian community development indicated that the created wetlands were developmentally behind reference wetlands or were following a different developmental trajectory altogether. We hypothesize that the differences between created and reference forested wetlands were due to unnatural patterns of hydrology or retarded vegetation development on created wetlands. It should not be assumed that created forested wetlands can provide full ecosystem replacement for natural forested wetlands.

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770. Avian use of natural and created salt marsh in Texas, USA.

Darnell, Traci M. and Smith, Elizabeth H.

Waterbirds 27(3): 355-361. (2004)

NAL Call #: QL671; ISSN: 1524-4695

Descriptors: Aransas National Wildlife Refuge/ artificial salt marsh island/ intertidal area/ natural salt marsh island

Abstract: Bird use of three created salt marsh islands, constructed from dredged material near the Aransas National Wildlife Refuge, Texas, USA, was compared with that of natural marsh to provide feedback prior to additional marsh construction. Habitat associations of four bird groups (shorebirds, perching birds, wading birds, and gulls and terns) were similar in all sites, but relative contributions of each group to total avian abundance differed. Differences in site-use by birds were largely explained by differences in ratios of available habitat types, which were products of their geomorphic designs. Created marsh designs differed substantially from the natural marsh, where the unvegetated exposed-substrate and shallow-water habitats preferred by waterbirds were prominent features. The oldest created site (four years old) differed most from the natural marsh. Intertidal areas in the site were almost completely overgrown by vegetation, resulting in dominance of the avian assemblage by perching birds (especially grackles, *Quiscalus* spp.) rather than waterbirds. In the newer created sites (two years old), where vegetation had not completely overgrown the intertidal areas, avian assemblages were more typical of the natural marsh. However, vegetation cover was expanding in these sites, causing a reduction in waterbird habitat area. Efforts to ensure availability of unvegetated habitat in created sites will improve their structural similarity to natural marsh in the study area, and will likely increase their functional similarity for avian species.

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771. Beneficial use of dredged material to enhance the restoration trajectories of formerly diked lands.

Weinstein, M. P. and Weishar, L. L.

Ecological Engineering 19(3): 187-201. (Sept. 2002)

NAL Call #: TD1.E26; ISSN: 0925-8574.

Notes: Special issue: NOAA - Sea Grant Symposium on the beneficial Uses of dredge materials for Coastal Ecosystem restoration.

Descriptors: wetlands/ environmental restoration/ dredge spoil/ coastal zone/ marshes/ spoil banks/ dredging/ waste disposal/ coastal waters/ restoration/ waste utilization/ coastal zone management/ nearshore dynamics/ shore protection/ USA, Delaware Bay/ environmental action/ reclamation/ ultimate disposal of wastes/ general environmental engineering/ protective measures and control

Abstract: Throughout the United States, coastal wetlands are being restored from formerly diked lands drained for agriculture. One such site, the 1620 ha Commercial Township Salt Hay Farm (CTSHF) is located on the southern Delaware Bay, USA. A common problem with these sites is their low elevation associated with long-term lack of tidal inundation and sediment accretion, compaction by heavy equipment, and oxidation associated with exposure to the atmosphere. With the reintroduction of tide, these areas, which have subsided by several meters or more, may become open water and tidal flats for extended periods before they return to wetland habitat. Different levels of subsidence also result in a wide range of marsh planforms including flats with little or no vegetation and/or semblance to the geomorphology of natural systems. The potential use of dredged materials for several aspects of the marsh restoration process - enhancing the sediment budget at low elevations, accelerating the restoration trajectories toward acceptable endpoints, improving the geomorphology of the marsh planform, providing high marsh refugia for species that depend on this habitat type for survival, reestablishing upland dike elevations for off-site protection of people and property, and stabilizing shorelines to reduce erosion rates - are the subjects of this paper. The abundance of dredged materials from channel deepening projects that will occur nation-wide, the maintenance dredging of major ports, on-site construction and other projects provide a wealth of opportunities to combine dredging needs with coastal marsh rehabilitation and restoration.

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772. Biological diversity of created forested wetlands in comparison to reference forested wetlands in the Bay watershed.

Perry, M. C.; Osenton, P. C.; and Stoll, C. S.

In: Proceedings of the conference: Conservation of biological diversity: A key to the restoration of the Chesapeake Bay ecosystem and beyond. (Held 10 May 1998-13 May 1998 at Therres, G. D. (eds.); pp. 261-268; 2001.

Descriptors: wetlands/ ecosystems/ forests/ amphibiotic species/ aquatic reptiles/ aquatic birds/ aquatic mammals/ population structure/ species diversity/ biodiversity/ dominant species/ nature conservation/ habitat improvement/ comparative studies/ watersheds/ Anura/ Scaphiopus holbrookii/ Peromyscus leucopus/ Microtus pennsylvanicus/ Plethodon cinereus/ Rana sylvatica/ Hemidactylium scutatum/ USA, Maryland/ eastern

spadefoot toad/ habitat community studies/ conservation, wildlife management and recreation

Abstract: Amphibians, reptiles, birds, and mammals were surveyed at six created forested wetlands in central Maryland and at six adjacent reference forested wetlands during 1993-1996 to determine comparative biological diversity of these habitats. Amphibians and reptiles were caught in pitfall and funnel traps associated with 15.4-m (50-ft) drift fences. Birds were surveyed with a complete count while walking through each area. Mammals were surveyed by capture in live traps. More species and total individuals of amphibians were caught on the reference wetlands than on the created wetlands. The red-backed salamander (*Plethodon cinereus*), the four-toed salamander (*Hemidactylium scutatum*), the eastern spadefoot (*Scaphiopus holbrookii*), and the wood frog (*Rana sylvatica*) were captured on the reference wetlands, but not on the created sites. The wood frog was captured at all reference sites and may represent the best amphibian species to characterize a forested wetland. Reptiles were not caught in sufficient numbers to warrant comparisons. Ninety-two bird species were recorded on created sites and 55 bird species on the reference sites. Bird species on the created sites represented those typically found in nonforested habitats. Mammal species were similar on both sites, but overall the reference sites had three times the number caught on created sites. The meadow vole (*Microtus pennsylvanicus*) was the dominant species captured on created sites, and the white-footed mouse (*Peromyscus leucopus*) was the dominant species on reference sites, with little habitat overlap for these two species. Although species richness and total number of animals were high for created forested wetlands, these survey results show major differences from species expected for a forested wetland. The created forested wetlands appear to provide good habitat for wildlife, but are probably not providing the full functions and values of the forested wetlands that they were constructed to replace.

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773. Biomass and nutrient dynamics in restored wetlands on the outer coastal plain of Maryland, USA.

Whigham, Dennis; Pittek, Mary; Hofmockel, Kirsten H.; Jordan, Thomas; and Pepin, Antoinette L.

Wetlands 22(3): 562-574. (2002)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: conservation/ ecology/ environmental sciences/ nutrition/ agricultural landscape/ biomass/ depressional wetlands/ hydrologic conditions/ nutrient concentrations/ nutrient dynamics/ nutrient standing stock/ outer coastal plain/ restored wetlands/ vegetation conditions

Abstract: A three-year study of aboveground biomass and nutrient dynamics in twelve restored depressional wetlands of different ages demonstrated significant annual variability among sites. Annual variations appeared to be primarily due to differences in hydrologic conditions over the three years of the study. Differences among wetlands were not related to time since restoration. When data for all sites were combined, annual differences in biomass and most measurements of nutrients (concentrations and standing stocks) did not, however, differ significantly. These results suggest that differences that are measured at individual wetland sites may be less important at the landscape level. Biomass decreased from the outer temporary to inner

submersed zone, and there were few differences among wetlands when the temporary, seasonal, and submersed zones were compared. Nutrient concentrations in the plant biomass increased from the temporary zone to the submersed zone, resulting in few differences in nutrient standing crops across zones. Results from this study demonstrate that some measurements of restoration success (i.e., biomass production) should be used cautiously because they are likely to be highly variable among sites and across years and thus may be of limited use in post-restoration monitoring. Other ecosystem parameters (e.g., nutrient concentrations of biomass) are much more constant spatially and temporally, indicating that nutrient cycling processes in vegetation were established quickly following restoration. Nutrient characteristics of wetland vegetation thus may be a useful metric for evaluating restoration success or failure.

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774. Bird-habitat relationships in a Texas estuarine marsh during summer.

Weller, M. W.

Wetlands 14(4): 293-300. (1994)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: birds/ habitats/ estuarine environment/ marshes/ flooding/ species diversity/ wildlife management/ salt marshes/ plant populations/ rainfall/ habitat utilization/ summer/ habitat selection/ environment management/ marine birds/ ecological zonation/ Aves/ USA, Texas/ Aves/ habitat utilization/ summer/ marine birds/ habitat selection/ environment management/ USA, Texas, San Bernard Natl. Wildlife Refuge/ ecological zonation/ birds/ habitats/ estuarine environment/ plant populations/ wildlife management

Abstract: Birds were surveyed during summer 1985 in five adjacent saline vegetation zones and during summers 1986 and 1991 in 6 adjacent vegetation zones on the San Bernard National Wildlife Refuge on the upper Texas Coast. Although 66 bird species were recorded, numbers and species varied among years, and only 17 were nesting species. A few bird species used all vegetation types at some time, but most were limited by vegetation structure or water presence. Olney's three-square bulrush (*Scirpus olneyi*), saltgrass (*Distichlis spicata*), and mudflats were especially favored feeding and resting areas in response to periodic flooding and had the greatest frequency of use as well as species richness. Reduced rainfall and water depths during 1986 were reflected in a change toward birds favoring drier conditions. Heavy rainfall in 1991 decreased diversity but increased usage and favored freshwater and swimming birds. Although tidally influenced wetlands often are considered uniform, dynamic water and salinity regimes observed along this coast must be considered in the design of any management or conservation program.

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775. Characterization of oxidation-reduction processes in constructed wetlands for swine wastewater treatment.

Szogi, A. A.; Hunt, P. G.; Sadler, E. J.; and Evans, D. E. *Applied Engineering in Agriculture* 20(2): 189-200. (2004)
NAL Call #: S671.A66; ISSN: 0883-8542

Descriptors: aerobic conditions/ anaerobic conditions/ animal wastes/ artificial wetlands/ denitrification/ enzyme activity/ enzymes/ flooded rice/ nitrification/ nitrogen/

phosphorus/ pig manure/ redox potential/ rice/ soybeans/ waste management/ waste water

Abstract: Constructed wetlands designed and properly operated for treatment of swine wastewater may enhance oxidation-reduction processes and nutrient treatment performance. The objective of this investigation was to characterize soil wetland processes related to nitrogen (N) treatment (nitrification-denitrification) and phosphorus (P) removal using soil oxidation-reduction potential (ORP) data. We evaluated three surface-flow wetland systems constructed for treatment of swine wastewater in Duplin Co., North Carolina, in 1992. Each system consisted of two 3.6- x 33.5-m cells connected in series. The three systems were planted to bulrushes, cattails, and agronomic crops (soybean in saturated soil culture and flooded rice), respectively. Soil aerobic/anaerobic conditions were determined by monitoring soil ORP at 18 sites using platinum (Pt) electrodes. Three monitoring sites were established in each wetland cell. Each site consisted of five Pt electrodes at three soil depths (0.02, 0.05, and 0.10 m) and a reference electrode. A data logger was used for hourly acquisition of soil ORP and temperature records. Hourly ORP data were averaged on a 24-h basis and corrected to standard hydrogen electrode readings (Eh). Frequency analysis of daily soil Eh showed that bulrush and soybean cells were moderately reduced (+100<Eh<+300 mV) and anaerobic (Eh<+300 mV) about 70% of the time. However, cattail and rice cells were anaerobic 100% of the time and had reduced (-100<Eh<+100 mV) to highly reduced (Eh<-100 mV) soil conditions. These results indicate that different wetland plant species promote distinct anaerobic and reducing soil conditions. Outflow concentration of ammonia-N (NH₃-N) and soluble P increased with increasing ORP values for bulrush and soybean-rice wetland cells due to lower temperatures during fall and winter, but not for cattails. Denitrification enzyme activities and ORP indicated that soils in bulrush wetlands promoted better conditions for nitrification-denitrification than cattails or rice soils. However, equivalent NH₃-N removal rates (4.8-5.6 kg ha⁻¹ d⁻¹) for cattails and bulrush suggested that treatment occurred mostly in the water column for cattails rather than the wetland soil. Prevalent anaerobic soil conditions and soluble P outflow concentrations determined rather poor P retention capacity for all three wetlands.

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776. Colonization of herpetofauna to a created wetland.

Toure, T'shaka A. and Middendorf, George A.

Bulletin of the Maryland Herpetological Society 38(4): 99-117. (2002)

NAL Call #: QL640.M3; ISSN: 0025-4231

Descriptors: behavior/ terrestrial ecology: ecology, environmental sciences/ dipnetting/ applied and field techniques: drift fence array/ applied and field techniques: frog cell/ applied and field techniques: funnel trapping/ applied and field techniques: pitfall trapping/ applied and field techniques/ clay substrates/ colonization/ conservation biology/ created wetlands: habitat/ flooded areas/ forests: habitat/ hydroperiods/ species diversity/ terraced sites/ vegetation density/ waterbodies

Abstract: The colonization by amphibians and reptiles of a newly created wetland was investigated at a site along Sands Road in Davidsonville, Anne Arundel County, MD. This 52-hectare artificial wetland was constructed in a

gradient design that resulted in four distinct terraced sites that temporarily retain rainwater. This palustrine wetland site, surrounded by an emergent, young, shrub-scrub, forested area, is characterized by the appearance of shallow temporarily flooded areas over a clay substrate that remains wet even during the driest periods of the year with a groundwater depth less than 1.5 m. The adjacent natural forest bordering the Patuxent River served as a natural indicator of amphibian and reptile activity and a source for site colonization. The created wetland site was monitored over two field seasons (March through September 1995-96) using linear transects, frog calls, drift fence arrays, pitfall and funnel traps, and dipnets. Sampling, conducted for 54 days revealed a total of twenty-eight species (16 amphibians and 12 reptiles). The colonization of this created wetland compared favorably in diversity to adjacent, natural forest. Factors best explaining differences in herpetofaunal activity, across the different sites within the created wetland, were density of vegetation surrounding the waterbody and hydroperiod.

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777. Comparative economic analysis of using different sizes of constructed wetlands in recirculating catfish pond production.

Posadas, C.

Journal of Applied Aquaculture 11(3): 1-20. (2001)

NAL Call #: SH135.J69; ISSN: 1045-4438

Descriptors: wetlands/ freshwater aquaculture/ fish culture/ aquaculture economics/ water quality/ recirculating systems/ aquaculture/ fish (catfish families)/ economics/ ponds/ fishing and fisheries/ recycling/ USA, Mississippi/ catfish/ economic aspects/ fisheries/ artificial wetlands/ water circulation/ USA, Mississippi/ fish culture/ fish culture/ industrial effluents/ fisheries engineering

Abstract: Results of experiments using constructed wetlands at the Mississippi State University-Coastal Aquaculture Unit (MSU-CAU) were used to evaluate the investment and operation costs of integrating different sizes of constructed wetlands in recirculating catfish pond production. In order to create the commercial pond-wetland systems used in this analysis, each wetland was placed adjacent to each of the ponds used in catfish production. Hypothetical recirculating catfish production systems consisting of six 3.24-ha ponds and six 0.489-, 0.809- or 1.134-ha constructed wetlands were evaluated. Higher investment and operating costs were required for catfish production systems with larger constructed wetlands.

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778. A comparative study of nitrogen and phosphorus cycling in tidal and non-tidal riverine wetlands.

Verhoeven, Jos T. A.; Whigham, Dennis F.; Van Logtestijn, Richard; and O'Neill, Jay

Wetlands 21(2): 210-222. (2001)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: freshwater ecology: ecology, environmental sciences/ methods and techniques/ soil science/ comparative study/ comparison method/ principal components analysis/ analytical method/ interstitial water chemistry/ nutrient cycling processes: riverine wetlands/ riverine wetlands: forested, geographical separation, hydrodynamic differences, natural, nutrient dynamics, restored, vegetation differences/ soil variables: bulk density, organic matter, total nitrogen, total phosphorus

Abstract: This paper describes a study of nutrient dynamics in 12 tidal and non-tidal freshwater riverine wetlands in The Netherlands, Belgium, and Maryland (USA). The purpose of the study was to investigate the relationships between nutrient cycling processes in riverine wetlands that were geographically separated, that were dominated by different types of vegetation, and that had different hydrodynamics. We also compared restored and natural riverine wetlands. The results showed distinct differences in interstitial water chemistry between the sites in Maryland and Europe. No such regional differences were found in the soil variables, except for soil phosphorus, which was higher in The Netherlands. Soil organic matter, total nitrogen and phosphorus content, and bulk density were higher in tidal freshwater wetland soils. Forested wetland soils had higher organic matter and total nitrogen and lower bulk density and total phosphorus than soils from wetlands dominated by herbaceous species. Restored wetlands had lower soil organic matter and total soil nitrogen and phosphorus than similar types of natural riverine wetlands. There were no differences in nutrient-related process rates nor plant nutrient concentrations in tidal versus non-tidal riverine wetlands. Lower nitrogen and phosphorus concentrations in plants at the restored sites suggest that nutrient uptake by vegetation may be poorly coupled to rates of nutrient cycling during early stages of vegetation development. A principal components analysis of the data identified groupings of soil and water variables that were similar to those that had been previously identified when we applied the same methods to peatlands that were also geographically widely separated. Results of the study demonstrate that the techniques that we have been using are robust and repeatable. They are especially useful for making general comparisons of nitrogen and phosphorus cycling when there are limitations on the number of wetland that can be sampled. The approach that we have developed may also be used to calibrate and refine nutrient cycling models that are incorporated into wetland assessment procedures.

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779. Comparing ecological functions of natural and created wetlands for shorebirds in Texas.

Brusati, Elizabeth D.; DuBow, Paul J.; and Lacher, Thomas E.

Waterbirds 24(3): 371-380. (2001)

NAL Call #: QL671; ISSN: 1524-4695

Descriptors: fecal analysis: analytical method/ fixed point observations: survey method/ inshore transects: survey method/ offshore transects: survey method/ chick provisioning/ diet/ estuaries: habitat/ food resource partitioning/ foraging ecology/ habitat choice/ habitat differences/ intercolony differences/ piscivory/ prey choice/ satellite imagery/ sea surface temperature/ stable isotope ratios/ water masses: delineation

Abstract: We compared shorebird behavior, abundance and prey availability between natural and created wetlands along the Gulf of Mexico, Texas, USA. Locations included Aransas National Wildlife Refuge, the Nueces River Delta, and Mustang Island. Few significant differences existed in invertebrate density or biomass between sites; greater differences were found seasonally than between natural and created sites. Non-metric multidimensional scaling of avian abundance separated Mustang Island from Nueces Delta. Cluster analysis of behavior of Black-bellied Plover

(*Pluvialis squatarola*), Long-billed Curlew (*Numenius americanus*), "peeps" (*Calidris minutilla*, *C. pusilla*), and Willet (*Catoptrophorus semipalmatus*), showed no clear differences in their behavior on natural and created sites. Mustang Island sites were more similar to each other than to Nueces Delta. All created sites had natural hydrology and tidal circulation, which appear to facilitate invertebrate and avian recruitment.

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780. Conceptual assessment framework for forested wetland restoration: The Pen Branch experience.

Kolka, R. K.; Nelson, E. A.; and Trettin, C. C.

Ecological Engineering 15(Suppl 1): S17-S2. (Sept. 2000)

NAL Call #: TD1.E26; ISSN: 0925-8574

Descriptors: wetlands/ environmental restoration/ forests/ pollution control/ ecosystem management/ hydrology/ geomorphology/ vegetation cover/ analytical techniques/ sustainable development/ USA, South Carolina/ reclamation/ protective measures and control/ environmental action

Abstract: Development of an assessment framework and associated indicators that can be used to evaluate the effectiveness of a wetland restoration is critical to demonstrating the sustainability of restored sites. Current wetland restoration assessment techniques such as the index of biotic integrity (IBI) or the hydrogeomorphic method (HGM) generally focus on either the biotic or abiotic components of wetlands. In addition, current methods generally rely on qualitative or semi-quantitative rankings in the assessment. We propose a quantitative, ecosystem level assessment method similar to that developed by the US EPA's Wetland Research Program (WRP approach) that includes both biotic and abiotic metrics. Similar to the IBI and HGM approaches, biotic and abiotic parameters are compared to those of reference communities, however, the proposed comparisons are quantitative. In developing the assessment method, bottomland reference systems at various stages of succession were compared to a recently restored site in South Carolina (Pen branch). Studies involving hydrology, soil organic matter and nutrient dynamics, vegetation communities, seedling establishment and competition, and avian, small mammal, herpetofauna, fish and macroinvertebrate communities were implemented. In this paper, we discuss the conceptual framework in which we developed our assessment technique.

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781. Constructed wetland design and performance for swine lagoon wastewater treatment.

Stone, K. C.; Hunt, P. G.; Szoegi, A. A.; Humenik, F. J.; and Rice, J. M.

Transactions of the ASAE 45(3): 723-730. (2002)

NAL Call #: 290.9 AM32T; ISSN: 0001-2351

Descriptors: artificial wetlands/ livestock/ wastewater treatment/ animal wastes/ lagoons/ nitrogen/ hydraulic loading/ cattails/ phosphorus/ barn/ wastewater/ bulrushes/ natural resources/ regression analysis/ ammonia/ USA, North Carolina, Duplin Cty.

Abstract: Although constructed wetlands have been identified as a potentially important component of animal wastewater treatment systems, their design requirements have been based mainly on municipal systems. The objective of this investigation was to examine various

design approaches for constructed wetlands in relation to the performance of our constructed wetlands for swine wastewater treatment. The free water surface wetlands in Duplin County, North Carolina, investigated in this study were constructed in 1992 based on the Natural Resources Conservation Service (NRCS) presumptive design method. We used four wetland cells (3.6 m x 33.5 m) with two cells connected in series; the two series of cells were planted and predominated, respectively, by either bulrushes or cattails and were studied from 1993 to 1999. The wetlands were effective in treating nitrogen with mean total nitrogen and ammonia-N concentration reductions of approximately 85%; however, they were not effective in the treatment of phosphorus. Regression analyses of outflow concentration vs. inflow concentration and hydraulic loading rate for total N and ammonia-N were reasonably correlated (r super(2) greater than or equal to 0.66 and r super(2) greater than or equal to 0.65, respectively). Our calculated first-order plug-flow kinetics model rate constants (K sub(20)) for total-N and ammonia-N (8.4 and 8.9, respectively) were slightly lower than those reported in the limited literature and currently recommended for use in constructed wetland design. Nonetheless, use of our calculated rate constants would result in about the same size constructed wetland for treating swine lagoon wastewater.

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782. Constructed wetland system for mitigation of nutrient contaminants in offsite drainage from a commercial nursery.

Whitwell, Ted; Taylor, Milton; and Klaine, Steve

Hortscience 38(5): 672. (2003)

NAL Call #: SB1.H6; ISSN: 0018-5345.

Notes: Conference: American Association for Horticultural Science Centennial Conference, Providence, RI, USA; October 03-06, 2003

Descriptors: horticulture: agriculture/ pollution assessment control and management/ bioremediation/ applied and field techniques/ constructed wetland system/ commercial nursery drainage

Abstract: Container-grown plants from commercial nurseries require large amounts of water and nutrients during their production cycle. Nutrients may be delivered through incorporation in potting media, by top-dressing with granular or slow-release fertilizers, or through liquid feeding by injection into irrigation water. Thus, mitigation of offsite movement of nutrients in runoff is a serious concern. Wight Nurseries of Cairo, Georgia has installed 9.31 acres of planted wetlands to receive direct runoff in excess of recapture needs from over 30 acres of growing beds and excess water diverted from a retention basin and pond used to retain water for an adjacent watershed. Water flows through trench drains between wetland cells and eventually into stilling ponds before it is allowed to exit the property. Water flow through the wetlands ranges from 1.6 million to 2.2 million liters per day. Monitoring data indicates strong seasonal differences in nitrate and nitrite nitrogen removal efficiencies. Nitrogen removal between April and November averaged 93.3% while removal during winter months averaged 44.1%. Nitrite was never found in wetland discharge water. Nitrogen as nitrate in discharge water varied from 0.05 ppm to 4.3 ppm, well below drinking water quality standards, and was below 0.6 ppm between June and November except in September during construction activity. Orthophosphate phosphorus removal was highly

variable with highest removal occurring during late spring, averaging 33.6%. and some removal occurring during early fall, averaging 13.8%. However, there was a net export of phosphorus from the wetlands during winter months. Phosphorus levels ranged between 0.9 and 1.9 ppm. While there is currently no legal water quality standard, these levels are above the generally accepted level of 0.01 ppm for preventing downstream eutrophication.
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783. Constructed wetlands as recirculation filters in large-scale shrimp aquaculture.

Tilley, D. R.; Badrinarayanan, H.; Rosati, R.; and Son, J. *Aquacultural Engineering* 26(2): 81-109. (2002)
NAL Call #: SH1.A66; ISSN: 0144-8609

Descriptors: wetlands/ shrimp culture/ water quality/ potential resources/ recirculating systems/ aquaculture engineering/ shellfish culture/ shellfish culture

Abstract: Effluent waters from shrimp aquaculture, which can contain elevated levels of phosphorus, ammonia, nitrate, and organics, must be managed properly if shrimp aquaculture is to achieve sustainability. Constructed wetlands are ecologically beneficial, low cost treatment alternatives proven capable of reducing suspended solids, biochemical oxygen demand (BOD), nitrogen, phosphorus and heavy metals from wastewater of many sources. The goal of this study was to determine how well a constructed wetland performed as a filter in a full-scale shrimp aquaculture operation. A 7.7 ha (19 ac) mesohaline (3-8 ppt) constructed wetland treating 13,600 m³ per day (3.6 MGD) of effluent from 8.1 ha (20 ac) of intensively farmed shrimp ponds at the Loma Alta Shrimp Aquaculture Facility (LASAF), located along the coast of the Gulf of Mexico in semi-arid South Texas, was found to reduce concentrations of total phosphorus (TP), total suspended solids (TSS) and inorganic suspended solids (ISS) by 31, 65 and 76%, respectively, during recirculation, and maintained consistently low levels of mean BOD (< 9 mg l⁻¹ super(-1)), total ammonia (1.8 mg N l⁻¹ super(-1)) and nitrate (< 0.42 mg N l⁻¹ super(-1)). Determination of parameter values for the k-C wetland design model for ISS or TP showed that mean target levels could be achieved, given expected influent concentrations, when the ratio of pond surface to wetland surface was 12. Constructed wetlands can perform satisfactorily as recirculation filters in large-scale shrimp aquaculture operations, reducing the impact of effluent on local water bodies, conserving large quantities of water and providing valuable ecological habitat.

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784. Constructed wetlands for mitigation of atrazine-associated agricultural runoff.

Moore, M. T.; Rodgers, J. H.; Cooper, C. M.; and Smith, S. *Environmental Pollution* 110(3): 393-399. (2000)
NAL Call #: QH545.A1E52; ISSN: 0269-7491

Descriptors: atrazine/ pesticides/ agricultural runoff/ water sampling/ aquatic plants/ sediments/ pollution control/ water pollution treatment/ stormwater runoff/ artificial wetlands/ fate of pollutants/ storm runoff/ agricultural chemicals/ nonpoint pollution sources/ runoff (agricultural)/ pesticides/ runoff/ pollution (nonpoint sources)/ performance assessment/ constructed wetlands/ freshwater pollution/ prevention and control/ wastewater treatment processes/ sewage

Abstract: Atrazine was amended into constructed wetlands (59-73x14x0.3 m) for the purpose of monitoring transport and fate of the pesticide to obtain information necessary to provide future design parameters for constructed wetlands mitigation of agricultural runoff. Following pesticide amendment, a simulated storm and runoff event equal to three volume additions was imposed on each wetland. Targeted atrazine concentrations were 0 mu g/l (unamended control), 73 mu g/l, and 147 mu g/l. Water, sediment, and plant samples were collected weekly for 35 days from transects longitudinally distributed throughout each wetland and were analyzed for atrazine using gas chromatography. Between 17 and 42% of measured atrazine mass was within the first 30-36 m of wetlands. Atrazine was below detection limits (0.05 mu g/kg) in all sediment and plant samples collected throughout the duration of this study. Aqueous half lives ranged from 16 to 48 days. According to these data, conservative buffer travel distances of 100-280 m would be necessary for effective runoff mitigation.

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785. Constructed wetlands for treatment of channel catfish pond effluents.

Schwartz, M. F. and Boyd, C. E. *Progressive Fish Culturist* 57(4): 255-266. (1995)
NAL Call #: 157.5 P94; ISSN: 0033-0779

Descriptors: wetlands/ wastewater treatment/ fish culture/ aquaculture effluents/ pond culture/ pollution control/ plant populations/ ponds/ aquaculture/ effluents/ fish/ Ictalurus punctatus/ USA, Alabama/ fish culture/ aquaculture effluents/ pond culture/ plant populations/ fish/ pollution control/ ictalurus punctatus/ prevention and control/ fish culture/ fish culture/ environmental applications/ impact/ wastewater treatment processes/ sewage & wastewater treatment

Abstract: Water from a production pond for channel catfish (*Ictalurus punctatus*) in Hale County, Alabama, was passed through a constructed wetland consisting of two cells, one planted with California bulrush (*Scirpus californicus*) and giant cutgrass (*Zizaniopsis miliacea*) and one planted with Halifax maidencane (*Panicum hemitomon*). The removal of potential pollutants from water flowing through the wetland was determined for 1-, 2-, 3-, and 4-d hydraulic residence times (HRTs), with hydraulic loading rates of 77-91 L/m² super(2) of wetland per day. Concentrations of potential pollutants were much lower in effluent from the wetland than in influent from the channel catfish ponds. The following reductions in concentrations were recorded: total ammonia nitrogen, 1-81%; nitrite-nitrogen, 43-98%; nitrate-nitrogen, 51-75%; total Kjeldahl nitrogen, 45-61%; total phosphorus, 59-84%; biochemical oxygen demand, 37-67%; suspended solids, 75-87%; volatile suspended solids, 68-91%; and settleable solids, 57-100%. Overall performance of the wetland was best when operated with a 4-d HRT in the vegetative season, but good removal of potential pollutants was achieved for shorter HRTs and when vegetation was dormant.

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786. Constructed wetlands for treatment of swine wastewater from an anaerobic lagoon.

Hunt, P. G.; Szoegi, A. A.; Humenik, F. J.; Rice, J. M.; Matheny, T. A.; and Stone, K. C.

Transactions of the ASAE 45(3): 639-647. (2002)

NAL Call #: 290.9 AM32T; ISSN: 0001-2351

Descriptors: bulrushes/ cattails/ artificial wetlands/ load distribution/ anaerobic lagoons/ denitrification/ barn wastewater/ wastewater treatment/ enzymes/ animal wastes/ nitrates/ USA, North Carolina

Abstract: Animal waste management is a national concern that demands effective and affordable methods of treatment. We investigated constructed wetlands from 1993 through 1997 at a swine production facility in North Carolina for their effectiveness in treatment of swine wastewater from an anaerobic lagoon. We used four wetland cells (3.6 x 33.5 m) with two cells connected in series. The cells were constructed by removing topsoil, sealing cell bottoms with 0.30 m of compacted clay, and covering with 0.25 m of loamy sand topsoil. One set of cells was planted with bulrushes (*Scirpus americanus*, *Scirpus cyperinus*, and *Scirpus validus*) and rush (*Juncus effusus*). The other set of cells was planted with bur-reed (*Sparganium americanum*) and cattails (*Typha angustifolia* and *Typha latifolia*). Wastewater flow and concentrations were measured at the inlet of the first and second cells and at the exit of the second cell for both the bulrush and cattail wetlands. Nitrogen was effectively removed at mean monthly loading rates of 3 to 40 kg N ha super(-1) day super(-1); removals were generally >75% when loadings were <25 kg ha super(-1) day super(-1). In contrast, P was not consistently removed. Neither plant growth nor plant litter/soil accumulation was a major factor in N removal after the loading rates exceeded 10 kg N ha super(-1) day super(-1). However, the soil-plant-litter matrix was important because it provided carbon and reaction sites for denitrification, the likely major treatment component. Soil Eh (oxidative/reductive potential) values were in the reduced range (<300 mV), and nitrate was generally absent from the wetlands. Furthermore, the wetlands had the capacity to remove more nitrate-N according to denitrification enzyme activity determinations. Our results show that constructed wetlands can be very effective in the removal of N from anaerobic lagoon-treated swine wastewater. However, wetlands will need to be augmented with some form of enhanced P removal to be effective in both P and N treatments at high loading rates.

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787. Control of upland bank erosion through tidal marsh construction on restored shores: Application in the Maryland portion of Chesapeake Bay.

Garbisch, E. W. and Garbisch, J. L.

Environmental Management 18(5): 677-691. (1994)

NAL Call #: HC79.E5E5; ISSN: 0364-152X

Abstract: During the period of 1972 through 1993, Environmental Concern Inc. (EC) and its recent (1989) affiliate Environmental Construction Company (ECC) have completed 216 marsh construction projects to control upland bank erosion in tributaries of the Maryland portion of Chesapeake Bay. Of these projects, 26 have involved marsh construction on unaltered existing shores and 190 have utilized marsh construction on shores that have been restored to former increased elevations through shoreline filling and grading. This paper describes the latter

restoration technique. Throughout the 21-year period of applying the technique for long-term upland bank erosion control, refinements to the design standards and criteria for site suitability have been made so as to optimize its successful application. As a result of this experience, a reliable bioengineering restoration technique has evolved to control upland bank erosion. This paper describes the details of this successful technique through a review of: (1) its objectives and benefits, (2) suitability of sites for its application, (3) the design of its shore restoration, (4) its construction, (5) its maintenance, and (6) comparison of its cost with those of structural techniques for bank erosion control. Although the technique has only been applied in the Maryland portions of Chesapeake Bay, its applicability should, with modifications, be broadly applicable to all water bodies.

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788. Creation and restoration of tidal wetlands of the southeastern United States.

Broome, S. W.

In: *Wetland Creation and Restoration: The Status of the Science.*

Covelo, Calif.: Island Press, 1990; pp. 37-72.

Notes: ISBN: 1559630450

NAL Call #: QH541.5.M3W462

Descriptors: artificial wetlands/ habitat restoration/ tidal marshes/ water resources management/ wetland restoration/ economic aspects/ environmental engineering/ management planning/ marsh management/ soil properties/ tidal effects/ water resources development

Abstract: Methods of creation and restoration of tidal wetlands in the southeastern United States have been summarized from published papers, reports, and first-hand experience. Publications by the U.S. Army Corps of Engineers which report research related to marsh habitat creation with dredged material and for shoreline erosion control were significant sources of information. Critical aspects which should be considered in planning and implementing a tidal marsh creation or restoration project are: initial planning, elevation in relation to tide level, wave climate and currents, salinity, slope and tidal range, soil chemical and physical properties, timing of construction, cultural practices, and maintenance. Critical research needs include: site selection, revegetation, and documentation of tidal marsh development. Practical and economical methods are needed to evaluate success of individual marsh creation or restoration.

(Author 's abstract)

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789. Decomposition of roots in a seasonally flooded swamp ecosystem.

Day, F. P. and Tupacz, E. G.

Aquatic Botany 37(3): 199-214. (Aug. 1990)

NAL Call #: QK102.A65; ISSN: 0304-3770.

Notes: NSF grant bsr-8405222

Descriptors: wetlands/ decomposition/ Great Dismal Swamp/ roots/ swamps/ annual floods/ decay rates/ detritus/ environmental effects/ forests/ lakes

Abstract: Decomposition rates of roots to a depth of 40 cm were estimated by two methods in four plant communities in the periodically flooded Great Dismal Swamp. The community dominants were: (1) *Chamaecyparis thuyoides*; (2) *Taxodium distichum*; (3) mixed *Quercus* spp. and (4)

Acer rubrum -*Nyssa* spp. respectively. Modified litter bags and a core method were simultaneously employed on three flooded sites and an unflooded site. Long vertical litter bags were developed to measure root decay over a vertical soil profile with minimal disturbance to the soil. Reciprocal samples (litter from each of the other sites) were placed on each site to examine the effects of litter quality. Roots in the cores exhibited higher decay rates than in the litter bags; rates in the bags ranged from 0.48 to 1.00 mg/g/d and the range for the cores was 1.15-2.74 mg/g/d. The core method was ineffective in estimating decay rates for the >5 mm diameter roots because of high sample variability. Reciprocal samples revealed statistically significant differences between root types, with roots from the mixed *Quercus* site being most resistant to decay. Just as leaf litter quality has been shown to regulate aboveground decomposition, root quality appears to play a major role in belowground decay. The study also demonstrated the importance of environmental influences since root decay was slowest on the sites (*Chamaecyparis* and *Acer-Nyssa*) with the longest duration of soil saturation. Both techniques exhibited slow decay rates with increasing depth. The litter bag technique is the recommended approach; several problems make the core technique a less than satisfactory method. (Author 's abstract)

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790. Demographic, landscape, and meteorological factors controlling the microbial pollution of coastal waters.

Mallin, M. A.; Ensign, S. H.; McIver, M. R.; Shank, G. C.; and Fowler, P. K.

Hydrobiologia 460(1-3): 185-193. (Sept. 2001)

NAL Call #: 410 H992; ISSN: 0018-8158

Descriptors: wetlands/ coastal waters/ pathogens/ water pollution/ fecal coliforms/ landscape/ agriculture/ bacterial demography/ coastal environments/ urban runoff/ urbanization/ biological pollutants/ pollutant persistence/ agricultural pollution/ agricultural runoff/ biodegradation/ microbial contamination/ public health/ environmental factors/ watersheds/ feces/ environmental effects/ shellfish/ USA, North Carolina/ shellfish/ bacteria/ other water systems/ pollution characteristics and fate/ public health, medicines, dangerous organisms/ viruses, bacteria, protists, fungi and plants/ marine pollution/ environment and ecology/ effects of pollution/ effects on water of human nonwater activities

Abstract: Coastal areas in the United States and many other countries are considered to be desirable regions to live and recreate. However, as human use of coastal land and water increases, so does the incidence of aquatic-borne disease from contact with contaminated water and eating contaminated shellfish. Movement of humans into coastal areas both greatly increases the number of sources of microbial pathogens and radically alters the landscape through increased construction activity and paving of former natural areas. On a regional scale, increases in human population over a 14-year period in coastal North Carolina were strongly correlated with increases in shellfish bed closures due to high fecal coliform bacterial counts. On a watershed scale, an analysis of several tidal creeks found strong correlations between mean estuarine fecal coliform bacterial counts and watershed population, percent developed area and especially with percent impervious surface coverage. Conversion of natural landscapes to

impervious surfaces (roads, drives, sidewalks, parking lots and roofs) removes the land's natural filtration capability, allows for increased concentration of pollutants at the land's surface and provides a means of rapid conveyance of pollutants to downstream waterways. An analysis of rural watersheds in the Coastal Plain found that stream fecal coliform counts and turbidity were both strongly correlated with rainfall in the previous 24 h in watersheds containing extensive industrial swine and poultry operations, as well as watersheds containing more traditional agriculture and cattle husbandry. In contrast, in watersheds rich in swamp wetlands these relationships were not significant, even in watersheds containing extensive animal production. Based on these findings, we suggest that waterborne microbial pathogen abundance can be minimized in urbanizing coastal areas through reduced use of impervious surfaces and maximal use of natural or constructed wetlands for passive stormwater runoff treatment. In animal husbandry areas, retention of natural wetlands and management practices designed to minimize sediment runoff can likely reduce inputs of pathogenic microbes into streams.

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791. Denitrification in a restored riparian forest wetland.

Lowrance, Richard; Vellidis, George; and Hubbard, Robert K.

Journal of Environmental Quality 24(5): 808-815. (1995)

NAL Call #: QH540.J6; ISSN: 0047-2425

<http://www.cpes.peachnet.edu/sewrl/Papers/denitrification.PDF>

Descriptors: wetlands/ denitrification/ riparian forests/ ecological restoration/ liquid manure/ nitrogen/ land application/ groundwater contamination/ nutrient management/ hydrogeology/ spatial variation/ temporal variation/ coastal plains/ southeastern United States

792. Depressional wetland vegetation types: A question of plant community development.

Kirkman, Katherine L.; Goebel, Charles P.; West, Larry; Drew, Mark B.; and Palik, Brian

Wetlands 20(2): 373-385. (2000)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

<http://www.treeseearch.fs.fed.us/pubs/12569>

Descriptors: depressional wetlands/ isolated wetlands/ non-alluvial wetlands/ wetland plant communities/ reference wetlands/ wetland restoration/ fire/ succession

Abstract: When wetland restoration includes re-establishing native plant taxa as an objective, an understanding of the variables driving the development of plant communities is necessary. With this in mind, we examined soil and physiographic characteristics of depressional wetlands of three vegetation types (cypressgum swamps, cypress savannas, and grass-sedge marshes) located in a fire-maintained longleaf pine ecosystem in southwestern Georgia, USA. Our objective was to establish whether plant community development in these wetlands is controlled primarily by hydrogeomorphic features or by different disturbance histories. We did not identify physical features that uniquely separate the wetland vegetation types. Instead, we observed a range of topographic conditions that likely drive variations in hydrologic regimes, which in turn, are probable influences on fire regime. We propose that several long-term successional trajectories may be initiated in the prolonged absence of

fire, altered hydrology, or both, which link the distinctive vegetation types. Thus, a range of vegetation types may be suitable as potential restoration goals for these depressional wetlands. We suggest that the opportunities or constraints for use of prescribed fire in the long-term management of restored wetlands and adjacent uplands should be a significant consideration in the development of restoration strategies targeting specific plant communities. This citation is from Treeseearch.

793. Distribution of ammonium-N in the water-soil interface of a surface-flow constructed wetland for swine wastewater treatment.

Szogi, A. A. and Hunt, P. G.

Water Science and Technology 44(11/12): 157-162. (2001)
NAL Call #: TD420.A1P7; ISSN: 0273-1223

Descriptors: ammonia/ ammonium nitrogen/ artificial wetlands/ denitrification/ denitrifying microorganisms/ diffusion/ nitrification/ piggery effluent/ polluted water/ pollution control/ soil water/ volatilization/ waste management/ waste water/ waste water treatment/ water pollution

Abstract: Most livestock waste waters treated in constructed wetlands are typically rich in ammonium N. The objective of this study, which was conducted in North Carolina, USA, was to evaluate the soil-water ammonium distribution and the diffusive flux through the soil-water interface. Wetland system 1 was planted to rush (*Juncus effusus*) and bulrushes (*Scirpus americanus*, *S. cyperinus* and *S. validus*), and wetland system 2 was planted to bur-reed (*Sparganium americanum*) and cattails (*Typha latifolia* and *T. angustifolia*). Nitrogen was applied at a rate of 2.5 g m⁻² day⁻¹. Interstitial soil water was sampled at 9, 24, 50, and 70 m from the inlet. In both wetlands, we found that NH₄⁺ diffusion gradient and N losses were highest in the wetland system with lowest water depth. From other studies, we knew that shallower depths may have promoted a more effective interfacing of nitrifying and denitrifying environments. In turn, this N reduction in the water column may be the reason for steady NH₄⁺-N upward diffusion fluxes. The assumed mechanism for N removal has been nitrification and denitrification but ammonia volatilization could also have occurred. Although diffusion may explain a significant portion of the material transport between the soil-water interface, the large differences in concentrations between outlet and inlet need further explanation.
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794. Ecotone characterization between upland longleaf pine/wiregrass stands and seasonally-ponded isolated wetlands.

Kirkman, L. K.; Drew, M. B.; West, L. T.; and Blood, E. R.
Wetlands 18(3): 346-364. (Sept. 1998)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ seasonal variations/ vegetation/ rehabilitation/ multivariate analysis/ soil properties/ karst/ grasses/ species diversity/ decision making/ moisture/ community composition/ plant populations/ ecological distribution/ fire/ soils/ nature conservation/ ecosystem management/ environment management/ environmental factors/ ecotones/ forests/ fires/ soil/ USA, Georgia, Southwestern/ depressional wetlands/ water and plants/ habitat community studies/ conservation, wildlife management and recreation/ freshwater pollution

Abstract: We examined the physical and ecological

characteristics of ecotones between longleaf pine/wiregrass upland and seasonally-ponded isolated wetlands dominated by herbaceous species in a fire-maintained karst landscape of southwestern Georgia. The purpose of this study was to 1) examine patterns of plant species richness across the upland/wetland transitional zone relative to elevation and moisture gradients; 2) identify discontinuities (boundaries) of soil morphological characteristics, soil moisture, soil nutrient availability, and vegetation and their spatial relationships in the ecotone; and 3) examine the degree of coincidence of ecological thresholds with that of jurisdictional wetland/upland boundaries. Transects from upland to wetland were established relative to hydric soil boundaries for measurements of vegetation abundance, biomass, volumetric soil moisture, oxidation reduction potential, relative elevation, soil textural analysis by horizon, and available nitrogen and phosphorous. We used a moving windows analysis and multivariate analyses to examine ecological discontinuities in the ecotone. Ground-cover species richness was high along all transects with a peak in species richness in the non-hydric ecotonal zone. Abrupt changes in vegetation and environmental variables (soil moisture, soil depth to argillic horizon, and soil texture) were generally located below the hydric soil boundary and are likely related to frequent fire regimes. Discrepancies occurred in the determination of hydrophytic vegetation depending on methodology. These results have implications for the conservation of regional diversity, for depressional wetland restoration, and for regulatory decisions.
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795. Effect of a mesohaline constructed wetland on water chemistry discharged from a shrimp aquaculture facility in South Texas.

Badrinarayanan, H. 2001.

Texas A&M University - Kingsville

Notes: Degree: MS

Descriptors: wetlands/ shrimp culture/ aquaculture effluents/ water quality/ pollution control/ eutrophication/ USA, Texas/ effects of aquaculture on the environment/ effects of aquaculture on the environment/ prevention and control/ water & wastewater treatment

Abstract: A 7.69 ha (19-acre) mesohaline (3-8 ppt) constructed wetland treating 13644 m³/day (3.6 MGD) of effluent from 8.09 ha (20 acres) of intensively farmed shrimp ponds at the Loma Alta Shrimp Aquaculture Facility (LASAF), located in the semi-arid environment of South Texas, was found to reduce concentrations of total phosphorus, total suspended solids and inorganic suspended solids by 19%, 51% and 62%, respectively during the recirculation period and maintained consistently low levels of carbonaceous biochemical oxygen demand, dissolved oxygen, total ammonia and nitrate. Additionally, the size of wetland needed to treat total phosphorus, total suspended solids and inorganic suspended solids in the shrimp pond effluent to minimum achievable levels during recirculation was found to be in the ratio of 13:1, 6:1 and 6:1 (pond:wetland), respectively. The model, MARSH- DO, was developed and simulated to understand the effects of inorganic and organic loads on long-term behavior of dissolved oxygen in the wetland. Based on MARSH-DO, organic loading had the greatest impact on the dissolved oxygen concentration in the system. The goal of this study was to determine how well a constructed wetland

performed as a filter in a full-scale shrimp aquaculture operation. A constructed wetland was shown to perform satisfactorily as a recirculation filter in a full-scale shrimp aquaculture operation, reducing the impact of effluent on local water bodies, saving large quantities of water and providing valuable ecological habitat. (Abstract shortened by UMI.)

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796. Effect of forested wetlands on nitrate concentrations in ground water and surface water on the Delmarva Peninsula.

Phillips, P. J.; Denver, J. M.; Shedlock, R. J.; and Hamilton, P. A.

Wetlands 13(2 Special issue): 75-83. (1993)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ hydrology/ vegetation cover/ agriculture/ water quality/ nitrates/ ground water/ surface water/ forests/ USA, Maryland/ USA, Delaware/ USA, Virginia/ forests/ USA, Delmarva Peninsula/ vegetation cover/ nitrates/ geochemistry of sediments

Abstract: The Delmarva Peninsula is an extensively farmed region in which nitrate from commercial fertilizers and poultry has entered the ground water and streams. The peninsula contains forested wetlands in a variety of settings, and their size and location are a result of the surrounding hydrologic and soil conditions. Three regions, here referred to as hydrogeomorphic regions, were selected for study. Each region has characteristic geologic and geomorphic features, soils, drainage patterns, and distribution of farmland, forests, and forested wetlands. In all three regions, forested wetlands generally occupy poorly drained areas whereas farmlands generally occupy well-drained areas. The three hydrogeomorphic regions studied are the well-drained uplands, the poorly drained uplands, and the surficial-confined region. The well-drained uplands have the largest amount of farmland and the smallest amount of forested wetlands of the three regions; here the forested wetlands are generally restricted to narrow riparian zones. The poorly drained uplands contain forested wetlands in headwater depressions and riparian zones that are interspersed among well-drained farmlands. The surficial-confined region has the smallest amount of farmland and largest amount of forested wetlands of the three regions studied. Wetlands in this region occupy the same topographic settings as in the poorly drained uplands. Much of the farmland in the surficial-confined region was previously wetland. Nitrate concentrations in ground water and surface water on the peninsula range widely, and their distribution reflects (1) the interspersed of forests among farmland, (2) hydrogeologic conditions, (3) types of soils, and (4) the ground-water hydrology of forested wetlands. The well-drained uplands had higher median nitrate concentrations in ground water than the poorly drained uplands or the surficial-confined region. The highest nitrate concentrations were in oxic parts of the aquifer, which are beneath well-drained soils that are farmed, and the lowest were in anoxic parts of the aquifer, which are beneath poorly drained soils overlain by forested wetlands. The effect of forested wetlands on water quality depends on the hydrogeologic conditions, extent of farming, and type of soils. The three regions contain differing combinations of these factors and thus are useful for isolating the effects of forested wetlands on water quality.

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797. Effects of agriculture and wetland restoration on hydrology, soils, and water quality of a Carolina bay complex.

Bruland, G. L.; Hanchey, M. F.; and Richardson, C. J. *Wetlands Ecology and Management* 11(3): 141-156. (2003) NAL Call #: QH541.5.M3 W472; ISSN: 0923-4861

Descriptors: wetlands/ water quality/ agriculture/ soil/ hydrology/ ecosystems/ forests/ restoration/ environment management/ soils/ swamps/ water table/ agricultural pollution/ sediment chemistry/ nutrients (mineral)/ nitrogen/ phosphorus/ outflow/ environmental restoration/ USA, North Carolina, Cumberland ct./ USA, North Carolina/ nitrogen/ phosphorus/ Carolina bays

Abstract: We compared hydrology, soils, and water quality of an agricultural field (AG), a two-year-old restored wetland (RW), and two reference ecosystems (a non-riverine swamp forest (NRSF) and a high pocosin forest (POC)) located at the Barra Farms Regional Wetland Mitigation Bank, a Carolina bay complex in Cumberland County, North Carolina. Our main objectives were to: 1) determine if the RW exhibited hydrology comparable to a reference ecosystem, 2) characterize the soils of the AG, RW, and reference ecosystems, and 3) assess differences in water quality in the surface outflow from the AG, RW, and reference ecosystems. Water table data indicated that the hydrology of the RW has been successfully reestablished as the hydroperiod of the RW closely matched that of the NRSF in 1998 and 1999. Jurisdictional hydrologic success criterion was also met by the RW in both years. To characterize soil properties, soil cores from each ecosystem were analyzed for bulk density (D sub(b)), total carbon (C sub(t)), nitrogen (N sub(t)), and phosphorus (P sub(t)), extractable phosphate (PO sub(4w)), nitrogen (N sub(ex)), and cations (Ca sub(ex), Mg sub(ex), K sub(ex), Na sub(ex)), as well as pH. Bulk density, P sub(t), Ca sub(ex), Mg sub(ex), and pH were greatly elevated in the AG and RW compared to the reference ecosystems. Water quality monitoring consisted of measuring soluble reactive phosphorus (SRP), total phosphorus (TP), nitrate + nitrite (NOX), and total nitrogen (TN) concentrations in surface water from the AG, RW, and reference outflows. Outflow concentrations of SRP, TP, and NOX were highest and most variable in the AG, while TN was highest in the reference. This study suggested that while restoration of wetland hydrology has been successful in the short term, alteration of wetland soil properties by agriculture was so intense, that changes due to restoration were not apparent for most soil parameters. Restoration also appeared to provide water quality benefits, as outflow concentrations of SRP, TP, NOX, and TN were lower in the RW than the AG.

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798. Effects of pumped agricultural drainage water on wetland water quality.

Gilliam, J. W.; Chescheir, G. M.; Skaggs, R. W.; and Broadhead, R. G.

In: *Ecology and management of wetlands: Management, use and value of wetlands.* Hook, D. D. (eds.); Vol. 2. Beckenham, Kent, UK: Croom Helm Ltd.; pp. 275-283; 1988.

Descriptors: wetlands/ drainage systems/ land types/ drainage water/ nutrients/ removal/ sediment

Abstract: Two wetland filter areas in North Carolina were very effective in removing sediment, total P, total Kjeldahl N and nitrate N from pumped drainage water before it

reached an outlet. The occurrence of a "worst case" event (a very wet period during May-June shortly after fertilization and tillage) led to improvement of the design.
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799. Effects of soil pH, redox potential, and elevation on survival of *Spartina patens* planted at a west central Florida salt marsh restoration site.

Anastasiou, C. J. and Brooks, J. R.
Wetlands 23(4): 845-859. (Dec. 2003)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: wetlands/ salt marshes/ survival/ environmental restoration/ soil chemistry/ pH effects/ soils/ redox potential/ transplants/ restoration/ abiotic factors/ plant populations/ vegetation cover/ transplantation/ introduced species/ environmental effects/ sediment chemistry/ aquatic plants/ hydrogen ion concentration/ *Spartina*/ salinity/ grasses/ acidic soils/ *Spartina patens*/ *Casuarina*/ USA, Florida, Tampa Bay/ reclamation/ physiology, biochemistry, biophysics/ conservation, wildlife management and recreation/ chemical processes
Abstract: Planting *Spartina patens* (Salt Meadow Cord Grass) is an integral part of restoring salt marshes along Tampa Bay, Florida, USA. Of the salt marsh species that are planted, *S. patens* often has the lowest survivorship. State managers have hypothesized that this low survivorship is related to transplant shock and to acidic soil conditions commonly found under dense stands of *Casuarina* sp. (Australian Pine), an exotic invasive. This study documents planted *S. patens* health and survivorship over 11 months at a restoration site previously dominated by *Casuarina* sp. Three plots of 100 plants each were established in varying soil pH, with each plot covering above and below the recommended elevation range for *S. patens*. Transplant shock occurred within the first thirty days after planting and affected overall survival. *Spartina patens* survival was not affected by soil pH ($p = 0.827$) as evidenced by the presence of healthy individuals outside the plots, in soil pH ranging from 4.76 to 8.94. However, there was a sharp decline in plant health when redox potentials fell below -50 mV. Although elevation and redox potential were highly correlated ($p < 0.001$, $R^2 = 0.736$), plant health varied more with elevation ($p < 0.001$, $R^2 = 0.387$) than redox potential ($p < 0.001$, $R^2 = 0.950$), suggesting that elevation, while a good coarse predictor of site suitability, may not always be the best measure. Redox potential should be monitored, in addition to measuring elevation, to avoid planting in highly reduced areas. Furthermore, adjusting the lower limit of the target elevation range to a higher elevation will increase the amount of survivorship.

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800. Effects of structural marsh management and winter burning on plant and bird communities during summer in the Gulf Coast Chenier Plain.

Gabrey, S. W.; Afton, A. D.; and Wilson, B. C.
Wildlife Society Bulletin 29(1): 218-231. (2001)
NAL Call #: SK357.A1W5; ISSN: 0091-7648
Descriptors: wetlands/ watershed management/ prescribed burning/ coasts/ Louisiana/ Texas
This citation is from AGRICOLA.

801. Elevation, competition control, and species affect bottomland forest restoration.

McLeod, K. W.; Reed, M. R.; and Wike, L. D.
Wetlands 20(1): 162-168. (2000)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: bottomland hardwood/ competition/ reforestation/ restoration/ southeastern United States/ swamp/ vegetation control
Abstract: This experiment examined how elevation and control of early successional vegetation would affect the growth and survival of tree species used in restoration. Vegetation was controlled by either mowing or spraying with Accord [glyphosate, -(phosphonomethyl)glycine, in the form of its isopropylamine salt] herbicide. These control methods were applied to either the entire plot or a narrow 1-m strip where seedlings were to be planted. A fifth treatment (control) had seedlings planted into the existing vegetation. Species planted were baldcypress (*Taxodium distichum*), water tupelo (*Nyssa aquatica*), willow oak (*Quercus phellos*), Nuttall oak (*Q. nuttallii*), overcup oak (*Q. lyrata*), and cherrybark oak (*Q. falcata* var. *pagodaefolia*). Seedlings were randomly planted in late April 1993 with six rows in each plot and six trees per row on a 2 x 2 m spacing with five replicate plots per treatment. Survival was not enhanced by any competition control treatment, but survival among species differed. All six species had overall survival > 90% in autumn 1993. Species survival was affected by several summer floods during 1994. Baldcypress and overcup oak survival was greater than 89%, while water tupelo, Nuttall oak, and willow oak were all approximately 70%, and cherrybark oak was only 29%. By the end of 1995, survival of all species decreased further, but the species groupings remained the same. Survival and height growth of baldcypress and water tupelo were greatest at lower planting elevations. At higher elevations, survival of cherrybark oak and willow oak were greatest, while overcup oak and Nuttall oak were unaffected by elevation. Thus, controlling the herbaceous vegetation did not affect survival or growth as much as relative planting elevation due to site flooding and the flood tolerance of the species. All of the species in this experiment except cherrybark oak were successfully established.

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802. Environmental impacts to the Everglades ecosystem: A historical perspective and restoration strategies.

Chimney, M. J. and Goforth, G.
Water Science and Technology 44(11-12): 93-100. (2001)
NAL Call #: TD420.A1P7; ISSN: 0273-1223.
Notes: Conference: 7th International Conference on Wetland Systems for Water Pollution Control 2000, Lake Buena Vista, FL [USA], 11-16 Nov 2000; Issue editors: Kadlec, R. H. and Reddy, K. R.; ISBN: 1843394073
Descriptors: regional development/ environmental effects/ nonpoint pollution sources/ storm runoff/ water pollution control/ case studies/ history/ rehabilitation/ hydrology/ pollution (environmental)/ pollution (nonpoint sources)/ runoff/ case study/ renovation/ restoration/ environment management/ introduced species/ eutrophication/ pollution control/ freshwater pollution/ habitat improvement (physical)/ river engineering/ wastewater treatment/ regional planning/ governments/ environmental restoration/ stormwater runoff/ historical account/ nutrient loading/ USA,

Florida, Everglades/ treatment wetlands/ water quality control/ water resources and supplies/ conservation, wildlife management and recreation/ freshwater pollution/ water and wastewater treatment

Abstract: The Everglades is a vast subtropical wetland that dominates the landscape of south Florida and is widely recognized as an ecosystem of great ecological importance. As a result of anthropogenic disturbances over the past 100 years (i.e., agricultural and urban development, eutrophication resulting from stormwater runoff, changes in hydrology and invasion of exotic species), the biotic integrity of the entire Everglades is now threatened. To protect this valuable resource, the state of Florida and the Federal Government, in cooperation with other interested parties, have developed a comprehensive restoration strategy that addresses controlling excess nutrient loading and reestablishment of a more natural hydrology. These efforts include building approximately 17,000 ha of treatment wetlands, referred to as Stormwater Treatment Areas, to treat surface runoff before it is discharged into the Everglades. We briefly discuss the history of the Everglades in the context of environmental disturbance and outline the steps being taken to ensure its survival for future generations.

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803. Estimating the effectiveness of vegetated floodplains/wetlands as nitrate-nitrite and orthophosphorus filters.

Yates, P. and Sheridan, J. M.

Agriculture, Ecosystems and Environment 6(3): 303-314. (May 1983)

NAL Call #: S601.A34; ISSN: 0167-8809

Descriptors: wetlands/ floodplains/ nitrates/ nitrites/ orthophosphorus/ forest watersheds/ agricultural watersheds/ vegetation/ water quality/ nonpoint pollution sources/ fate of pollutants/ dilution/ sources and fate of pollution/ water quality control

Abstract: The role of vegetated floodplains/wetlands on the stream water quality of agroecosystems in the Coastal Plain region of the southeastern United States is reported. Water-borne nitrate plus nitrite nitrogen budgets and orthophosphate phosphorus budgets from a cropped agricultural area were compared with those of a watershed with alluvial forests below the cropped areas. Analyses were made to determine if observed differences in nutrient concentrations and loads were the result of dilution of cropped area runoff by flows from non-cropped areas. Reductions in the observed levels of nitrate plus nitrite nitrogen and orthophosphate phosphorus between upland cropped areas and watershed outlets exceed reductions that would be caused by dilution effects. Significant portions of the observed nutrients leaving cropped areas were retained, utilized and/or transformed in the vegetated floodplains/wetlands characteristic of these Coastal Plain watersheds. (Author's abstract)

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804. Evaluating acute toxicity of methyl parathion application in constructed wetland mesocosms.

Milam, C. D.; Bouldin, J. L.; Farris, J. L.; Schulz, R.; Moore, M. T.; Bennett, E. R.; Cooper, C. M.; and Smith, S.

Environmental Toxicology 19(5): 471-479. (Oct. 2004)

NAL Call #: RA1221.T69; ISSN: 1520-4081

Descriptors: Ceriodaphnia (Cladocera)/ Hyalella azteca (Amphipoda)/ Chironomus tentans (Chironomidae)/ Pimephales promelas (Cyprinidae)/ pollutants/ survival/ semiaquatic habitat/ fertilizer and pesticide pollution/ toxic effects/ fertilizers and pesticides/ methyl parathion/ Mississippi/ Oxford/ toxic effects of methyl parathion/ constructed wetland mesocosms

Abstract: Wetland ecosystems have reduced ambient levels of various organic and metallic compounds, although their effectiveness on agricultural pesticides is not well documented. Five stations within each of two 10 X 50 m constructed wetlands (two vegetated, two nonvegetated) were selected to measure the fate and effects of methyl parathion (MeP). Following a simulated storm event (0.64 cm of rainfall), aqueous, sediment, and plant samples were collected and analyzed spatially (5, 10, 20, and 40 m from the inlet) and temporally (after 3-10 days) for MeP concentrations and for the impact of those concentrations on the aquatic fauna. Aqueous toxicity to fish decreased spatially and temporally in the vegetated mesocosm. Pimephales promelas survival was significantly reduced, to 68%, at the 10-m station of the nonvegetated wetlands (3 h postapplication), with pesticide concentrations averaging 9.6 [µg] MeP/L. Ceriodaphnia in both the vegetated and nonvegetated wetlands was sensitive (i.e., a significant acute response to MeP occurred) to pesticide concentrations through 10 days postapplication. Mean MeP concentrations in water ranged from 0.5 to 15.4 [µg]/L and from 0.1 to 27.0 [µg]/L in the vegetated and nonvegetated wetlands, respectively. Hyalella azteca aqueous tests resulted in significant mortality in the 5-m vegetated segment 10 days after exposure to MeP (2.2 [µg]/L. Solid-phase (10-day) sediment toxicity tests showed no significant reduction in Chironomus tentans survival or growth, except for the sediments sampled 3 h postapplication in the nonvegetated wetland (65% survival). Thereafter, midge survival averaged >87% in sediments sampled from both wetlands. These data suggest that wetlands play a significant role in mitigating the effect of MeP exposure in sensitive aquatic biota. [copyright] 2004 Wiley Periodicals, Inc.

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805. Evaluation of wetland buffer areas for treatment of pumped agricultural drainage water.

Chescheir, G. M.; Skaggs, R. W.; and Gilliam, J. W.

Transactions of the ASAE 35(1): 175-182. (1992)

NAL Call #: 290.9 AM32T; ISSN: 0001-2351

Descriptors: drainage water/ decontamination/ hydrology/ simulation models/ wetland soils/ North Carolina

Abstract: A computer method was developed for predicting nutrient and sediment removal from agricultural drainage water pumped onto wetland buffer areas. The method utilizes a model for simulating drainage from agricultural land and a model for simulating overland flow, and nutrient and sediment removal on wetlands. Both simulation models were calibrated using data collected in field experiments. The simulation models were then coupled to predict the percent removal of sediment, total phosphorus (P), total

Kjeldahl nitrogen (TKN), and nitrate nitrogen (NO₃-N) from drainage water for a 20-year period of climatological data. This method predicted that the 240 ha wetland buffer at the field research site could be expected to remove over 79% of the TKN, NO₃-N, P, and sediment in drainage water from a 1250 ha agricultural watershed. The method was used to evaluate the effects of buffer size and shape on the nutrient and sediment removal effectiveness of the wetland. This citation is from AGRICOLA.

806. Evapotranspiration from Florida pondcypress swamps.

Ewel, K. C. and Smith, J. E.

Water Resources Bulletin 28(2): 299-304.

(Mar. 1992-Apr. 1992)

NAL Call #: 292.9 AM34; ISSN: 0043-1370.

Notes: USDI grant no. 14-08-0001-G899

Descriptors: evapotranspiration/ Florida/ cypress swamps/ clear cutting/ forest management/ coastal plain/ water level/ swamps/ canopy/ trees/ growth/ pine trees/ interception/ wetland enhancement/ water resources management/ evaporation and transpiration/ watershed protection

Abstract: Pondcypress (*Taxodium distichum* var. *nutans*) dominates small isolated swamps throughout Florida and the southeastern coastal plain. The wide distribution of coastal swamps and the increasing interest in managing them for various purposes have made it important that the role of cypress swamps in regional ecological relationships be better understood. Diurnal changes in water levels in 3 swamps dominated by pondcypress, were measured in central Florida for 4 years to obtain additional documentation of relatively low evapotranspiration (ET) rates. Two of these swamps were monitored for another 3 years after one of them was clearcut. Estimated annual ET from undisturbed cypress swamps varied from 38 cm/yr, averaging 60 cm (not including interception). Faster ET rates may have been related to faster pondcypress growth rates, a greater proportion of hardwoods in the canopy, and clearcutting in the surrounding pine plantation. The average ET rate was considerably lower than ET rates that have been estimated for north Florida pine plantations. However, incorporating estimates of interception indicates that overall ET rates in pondcypress swamps may be only slightly lower than ET from pine plantations. ET decreased only 5% in one swamp after it was clearcut, indicating that this management practice is not likely to affect regional water balances. (Author's abstract)

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807. The Everglades nutrient removal project: A constructed wetland designed to treat agricultural runoff drainage.

Abtew, W.; Chimney, M. J.; Kosier, T.; Guardo, M.; Newman, S.; and Obeysekera, J.

In: *Versatility of Wetlands in the Agricultural Landscape.*

(Held 17 Sep 1995-20 Sep 1995 at Hyatt Regency, Tampa, Fla.)

St Joseph, Mo.: American Society of Agricultural Engineers (ASAE); pp. 45-56; 1995.

NAL Call #: QH87.3.V47 1995

Descriptors: wetlands/ marshes/ variation/ aerial photography/ nutrients/ removal/ losses from soil/ runoff/ drainage water/ phosphorus/ land types

Abstract: The 1544 ha Everglades Nutrient Removal Project (ENR) was designed to reduce P contents in

agricultural runoff/drainage. ENR was built on former cropland and consists of 5 cells ranging from 55 (buffer cell) to 525 ha. The Buffer Cell distributes inflow to 2 independent treatment trains. The other cells are either natural cattail marshes, planted mixed marsh or periphyton/submerged macrophyte community. Aerial photography was used to document spatial and temporal changes in the ENR macrophyte community. Preliminary observations showed that total P outflow was about 5 times lower than the inflow amounts.

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808. Extreme spatial variability and unprecedented methylmercury concentrations within a constructed wetland.

Rumbold, D. G. and Fink, L. E.

Environmental Monitoring and Assessment 112(1-3): 115-135. (2006)

NAL Call #: TD194; ISSN: 0167-6369

Descriptors: toxicology/ freshwater ecology: ecology, environmental sciences/ pollution assessment control and management/ bioprocess engineering/ constructed wetland/ applied and field techniques/ spatial variability/ agricultural runoff/ surfacewater/ eutrophication reduction/ stormwater treatment area

Abstract: We began monitoring concentrations of both total mercury (THg) and methylmercury (MeHg) in surface water at Stormwater Treatment Area-2 (STA) on July 20, 2000.

This 2602 hectare STA was constructed with three independent marshes to remove phosphorus from agricultural runoff and reduce eutrophication in the northern Everglades. However, there was concern that in doing so, STA-2 might inadvertently worsen the existing mercury problem in the Everglades. Accordingly, operating permits stipulated that flow-through operation of these treatment cells could not begin until concentrations of THg and MeHg in the interior marsh were not significantly greater than corresponding concentrations in the supply canal. Cells 2 and 3 quickly met the start-up criteria in the fall of 2000. In contrast, Cell 1 exhibited anomalously high MeHg concentrations in the fall of 2000 and 2001, and the summer of 2002. During the last such event, water-column concentrations in Cell 1 reached 32 ng THg/L and an unprecedented 20 ng MeHg/L. Tissue Hg in resident fishes reached levels as high as 430 ng/g in mosquitofish, *Gambusia holbrooki*, 930 ng/g in sunfish, *Lepomis* spp., and 2000 ng/g in largemouth bass, *Micropterus salmoides*. Guided by results from the monitoring program, flow rate and water depth were managed as a means to alter sulfur biogeochemistry and, thereby, reduce in situ mercury methylation. This adaptive management strategy likely played a role in the decline in water-column concentrations of THg and MeHg in Cell 1 by late 2002 and the subsequent declines in tissue Hg levels in resident fishes. Cell 1 finally met formal start-up criteria on November 26, 2002.

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809. Factors affecting phosphate uptake by peat soils of the Florida Everglades.

Amador, J. A.; Richany, G. H.; and Jones, R. D.

Soil Science 153(6): 463-470. (June 1992)

NAL Call #: 56.8 So3; ISSN: 0038-075X.

Notes: National Park Service Grant no. Ca-5280-8-8007.

Descriptors: wetlands/ phosphates/ path of pollutants/ farm

wastes/ peat soils/ Florida Everglades/ environmental impact/ freshwater pollution/ water pollution control/ surface runoff/ soil chemistry/ soil chemistry/ agricultural runoff/ fertilizers/ nutrients/ phosphorus/ sources and fate of pollution/ estuaries

Abstract: The Florida Everglades constitutes a unique, historically oligotrophic ecosystem threatened by the effects of phosphate (PO₄) pollution resulting from agricultural runoff. The Florida Everglades was investigated to determine its capacity to remove PO₄ from solution and to study the effects of total P content of the soil, PO₄ concentration of the water, autoclaving, and glucose and ammonium addition on PO₄ removal by neutral peats of the Florida Everglades. Samples of peat soils were obtained from an area impacted by water with a high total P content and an unimpacted area, both within Everglades National Park. PO₄ removal was determined by passing a solution containing a known PO₄ concentration (0 to 12.5 microM) through a soil column and measuring the difference in concentration between the influent and effluent solutions over time. Removal rates for both soils were nearly constant with time at the lower PO₄ concentrations, but decreased with time at higher PO₄ concentrations; these values were consistently higher for the soil from the unimpacted site than for the impacted site. Autoclaving the unimpacted soil diminished the initial rate and extent of PO₄ removal by the soil. Addition of 100 microM NH₄Cl to the unimpacted soil increased the removal of P from 1.0 and 10.0 microM solutions. Glucose (15 mg C/L) had no effect on the removal from 2.5 and 10 microM PO₄ by the unimpacted soil. PO₄ removal in natural peats is controlled by a combination of biotic and abiotic processes, the relative importance of which is determined by the concentration of PO₄ in the water. (Author's abstract)
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810. Fish recruitment to a constructed wetland.

Langston, M. A. and Kent, D. M.
Journal of Freshwater Ecology 12(1): 123-129. (1997)
NAL Call #: QH541.5.F7J68; ISSN: 0270-5060
Descriptors: USA, Florida/ artificial wetlands/ fish populations/ seasonal variations/ fish establishment/ biological sampling/ Pisces/ fish recruitment/ environmental restoration/ artificial wetlands

Abstract: A 31.6 ha isolated, constructed wetland in east central Florida was sampled for fish over a two year period using a fyke net and minnow traps. A rich and abundant fish community rapidly developed. Cumulatively, 848 fish of 14 species were collected. Variation in abundance was observed, and reflects seasonal conditions. *Gambusia affinis*, *Fundulus chrysotus*, and *Lepomis gulosus* were the most abundant species. This fish community was similar to natural fish communities of the region. Fish may have been introduced to the study wetland by irrigation, transport on terrestrial or volant fauna, or a combination of the two modes.
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811. Has the conversion of natural wetlands to agricultural land increased the incidence and severity of damaging freezes in south Florida?

Marshall, Curtis H.; Pielke, Roger A.; and Steyaert, Louis T.
Monthly Weather Review 132(9): 2243-2258. (2004);
ISSN: 1520-0493
<http://blue.atmos.colostate.edu/publications/pdf/R-281.pdf>

Descriptors: land use effects on temperature/ land use effects on wetlands/ climate and agriculture/ freezing temperatures/ frost damage to crops/ Regional Atmospheric Modeling System (RAMS)/ U.S. satellite, LANDSAT/ energy budget at Earth's surface/ time series analysis/ land use/ climatic changes/ agriculture/ temperature effects/ freezing crops/ man-induced effects/ moisture transfer/ temperature differences/ environment management/ climate/ air temperature/ energy budget/ ocean-atmosphere system/ anthropogenic factors

Abstract: On several occasions, winter freezes have wrought severe destruction on Florida agriculture. A series of devastating freezes around the turn of the twentieth century, and again during the 1980s, were related to anomalies in the large-scale flow of the ocean-atmosphere system. During the twentieth century, substantial areas of wetlands in south Florida were drained and converted to agricultural land for winter fresh vegetable and sugarcane production. During this time, much of the citrus industry also was relocated to those areas to escape the risk of freeze farther to the north. The purpose of this paper is to present a modeling study designed to investigate whether the conversion of the wetlands to agriculture itself could have resulted in or exacerbated the severity of recent freezes in those agricultural areas of south Florida. For three recent freeze events, a pair of simulations was undertaken with the Regional Atmospheric Modeling System. One member of each pair employed land surface properties that represent pre-1900s (near natural) land cover, whereas the other member of each pair employed data that represent near-current land-use patterns as derived from analysis of Landsat data valid for 1992/93. These two different land cover datasets capture well the conversion of wetlands to agriculture in south Florida during the twentieth century. Use of current land surface properties resulted in colder simulated minimum temperatures and temperatures that remained below freezing for a longer period at locations of key agricultural production centers in south Florida that were once natural wetlands. Examination of time series of the surface energy budget from one of the cases reveals that when natural land cover is used, a persistent moisture flux from the underlying wetlands during the nighttime hours served to prevent the development of below-freezing temperatures at those same locations. When the model results were subjected to an important sensitivity factor, the depth of standing water in the wetlands, the outcome remained consistent. These results provide another example of the potential for humans to perturb the climate system in ways that can have severe socioeconomic consequences by altering the land surface alone.
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812. Herpetofaunal response to gap and skidder-rut wetland creation in a southern bottomland hardwood forest.

Cromer, Robert B.; Lanham, Joseph D.; and Hanlin, Hugh H.
Forest Science 48(2): 407-413. (May 2002)
NAL Call #: 99.8 F7632; ISSN: 0015-749X
Descriptors: Amphibia/ Reptilia/ forestry/ gap and skidder rut wetland creation/ conservation/ implications of community responses to forest gap and skidder rut wetland creation/ community structure/ response to gap and skidder rut wetland creation/ forest and woodland/ bottomland

hardwood forest/ man made habitat/ skidder rut wetland/ forest habitat/ community responses/ South Carolina/ Barnwell County/ Savannah River site/ community response to gap and skidder rut wetland creation/ hardwood forests

Abstract: We compared herpetofaunal communities in recently harvested gaps, skidder trails, and unharvested depressional wetlands to assess the effects of group-selection harvesting and skidder traffic on reptiles and amphibians in a southern bottomland hardwood forest. From January 1, 1997 to December 31, 1998 we captured 24,292 individuals representing 55 species of reptiles and amphibians at the Savannah River Site in Barnwell County, South Carolina. Forty-two species (n = 6,702 individuals) were captured in gaps, 43 species (n = 8,863 individuals) were captured along skid trails between gaps and 43 species (n = 8,727 individuals) were captured in bottomland depressions over the 2 yr period. Three vegetation variables and six environmental variables were correlated with herpetofaunal abundance. Salamander abundance, especially for species in the genus *Ambystoma*, was negatively associated with areas with less canopy cover and pronounced rutting (i.e., gaps and skidder trails). Alternatively, treefrog (*Hylidae*) abundance was positively associated with gap creation. Results from this study suggest that group selection harvests and skidder rutting may alter the herpetofaunal species composition in southern bottomland hardwoods by increasing habitat suitability for some species while diminishing it for others.
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813. Hydrodynamic modeling of wetlands for flood detention.

Tsihrintzis, V. A.; John, D. L.; and Tremblay, P. J. *Water Resources Management* 12(4): 251-269. (Aug. 1998)
NAL Call #: TC401.W27; ISSN: 0920-4741 [WRMAEJ]
Descriptors: wetlands/ flood control/ hydrodynamics/ drainage/ hydraulic structures/ simulation models/ mathematical models/ structural design/ water flow/ Florida/ detention basins/ SWMM EXTRAN model
Abstract: The application of a link-node model in modeling hydrodynamics of wetland areas related to flood detention design is presented through the description of modeling and design efforts of an actual project, the first privately-owned wetland mitigation bank in Florida. The 142-ha project is located in the Chapel Trail Preserve of the City of Pembroke Pines, South Florida, where a degraded site is transformed into a healthy, self-sustaining wetland ecosystem. Creation of the wetlands, located adjacent to an existing development, required careful evaluation of drainage conditions. To properly design the wetland site, a hydrodynamic model was developed which allowed sizing of hydraulic structures and computation of maximum water surface elevations. The paper presents model description and calibration using field data, parameter sensitivity, general application in the project and use as a design tool. The model was found to be a valuable tool that can be applied in similar projects.
This citation is from AGRICOLA.

814. Hydrologic balance for a subtropical treatment wetland constructed for nutrient removal.

Guardo, M.
Ecological Engineering 12(3-4): 315-337. (1999)
NAL Call #: TD1.E26; ISSN: 0925-8574

Descriptors: agricultural runoff/ drainage/ constructed wetlands/ environmental restoration/ Everglades ecosystem/ hydraulic retention time/ hydrologic balance/ hydroperiod/ seepage

Abstract: This paper reports on an analysis of a water budget for the Everglades Nutrient Removal (ENR) Project in South Florida, USA, for the first 2 years of operation. Estimates of nominal hydraulic retention time (HRT) based on average monthly values are compared with HRT obtained from steady-state two-dimensional hydrodynamic simulations, and show good agreement. Statistical analysis is performed to develop stage- and depth-duration curves for the ENR Project. The ENR Project was constructed south of Lake Okeechobee by the South Florida Water Management District to begin the process of removing nutrients (especially phosphorus) from agricultural drainage and stormwater run-off before entering the Everglades. The State of Florida's Everglades Forever Act of 1994 mandates, among other things, completion of stormwater treatment areas (STAs), and research to optimize phosphorus retention capacity, and to define threshold phosphorus concentrations that lead to an imbalance of biota. The ENR Project, a 1544-ha wetland, was designed and constructed as a pilot project to gain experience on design, construction, and operation of the STAs. It began operation in August 1994. For the 732 days analyzed (19 August 1994-19 August 1996), the average water inputs into the project were as follows: 86.2% from the inflow pumps, 11.2% from rainfall, and 2.6% as emerging measured and estimated seepage from an adjacent area with higher stages (Water Conservation Area 1). The average water outputs from the project consisted of 85.1% from the outflow pumps, 8.9% as evapotranspiration, and 6.0% as a net seepage and groundwater component. This net component accounts for elements of the surface/subsurface water interaction, either entering or leaving the project, which are unknown at this time. Considering monthly average values, there were only 3 months within the study period with positive values of this net component. These months were June 1995, and March and July 1996. The two most important elements included in the net seepage and groundwater component are expected to be the surficial aquifer recharge (outflow), and the unmeasured seepage (inflow) from Water Conservation Area 1 (subsurface seepage). The unmeasured subsurface seepage has recently been determined from computer model simulations.
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815. Hydrologic characterization of two prior converted wetland restoration sites in eastern North Carolina.

Tweedy, K. L. and Evans, R. O.
Transactions of the ASAE 44(5): 1135-1142. (Sept. 2001-Oct. 2001)
NAL Call #: 290.9 AM32T; ISSN: 0001-2351
Descriptors: wetlands/ USA, North Carolina, Beaufort Cty./ USA, North Carolina, Craven Cty./ water resources management/ hydrology/ agricultural practices/ environmental policy/ restoration/ water management/ topographic effects/ outflow/ water levels/ USA, North Carolina, Beaufort Cty./ USA, North Carolina, Craven Cty./ protective measures and control/ general environmental engineering
Abstract: Wetland losses resulting from conversion to agriculture and other land uses has generated considerable

interest in wetland restoration. Increased federal and local regulations have mandated that wetland areas must be protected, and when loss is unavoidable, mitigation and restoration efforts are required. Establishing appropriate hydrologic functions will inherently influence wetland restoration success. This research involved a three-year field study to develop guidelines for restoring wetland hydrologic function to drained agricultural fields. Two field sites (9.2 ha and 10.4 ha) located in Beaufort and Craven Counties, North Carolina, were instrumented and monitored to evaluate the effectiveness of the restoration treatments used. Experimental treatments included two levels of water table management (high outlet control at 15 cm above average land surface and low outlet control at 15 cm below average land surface) and two types of surface contouring (smooth and rough) to control runoff. The restoration treatments imposed at the Beaufort County site created a range of wet conditions. The high water table management, rough microtopography treatment displayed the most consecutive and total number of days with the water table less than 30 cm deep, while the low water table management, smooth microtopography treatment displayed the driest conditions. The restored wetland status of the Craven County site was marginal. Due to both lateral seepage and seepage around the water control structures, the intended levels of water table management at the Craven County site could not be maintained. Roughing of the soil surface reduced the amount of outflow from restoration treatments by approximately 30% compared to the smooth microtopography treatments. Rough microtopography also reduced peak outflow rates and increased the duration of outflow events.

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816. Hydrologic influence on stability of organic phosphorus in wetland detritus.

Pant, H. K. and Reddy, K. R.

Journal of Environmental Quality 30(2): 668-674. (Mar. 2000-Apr. 2000)

NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: wetlands/ organic matter/ environmental management/ phosphorus/ phosphates/ detritus/ hydrology/ nutrients/ biogeochemistry/ USA, Florida/ nutrient removal/ residence time/ organic phosphorus/ nutrients (mineral)/ aquatic plants/ drainage water/ agricultural runoff/ agricultural pollution/ microorganisms/ dispersion/ flooding/ water table/ typha/ USA, Florida, Everglades/ water resources and supplies/ freshwater pollution/ water in soils/ characteristics, behavior and fate/ water pollution: monitoring, control & remediation

Abstract: Accretion of organic matter in wetlands provides long-term storage for nutrients and other contaminants. Water-table fluctuations and resulting alternate flooded and drained conditions may substantially alter the stability of stored materials including phosphorus (P). To study the effects of hydrologic fluctuation on P mobilization in wetlands, recently accreted detrital material (derived primarily from *Typha* spp.) was collected from the Everglades Nutrient Removal Project (ENRP), a constructed wetland used to treat agricultural drainage water in the northern Everglades. The detrital material was subjected to different periods of drawdown and consecutive reflooding under laboratory conditions. The super(31)P nuclear magnetic resonance (super(31)P NMR) spectroscopy analysis revealed that sugar phosphate,

glycerophosphate, polynucleotides, and phospholipids (glycerophosphoethanolamine and glycerophosphocholine) were the major forms of P in the detrital material. After 30 d of drawdown, polynucleotides were reduced to trace levels, whereas sugar phosphate, glycerophosphate, and phospholipids remained the major fractions of organic P. Microorganisms seemed to preferentially utilize nucleic acid P, perhaps to obtain associated nutrients including carbon and nitrogen. At the end of the 30-d reflooding period, cumulative P flux from detritus to water column accounted for 3% of the total P (less than or equal to 15 d of drawdown) and further decreased to 2% at 30 d of drawdown, but increased to 8% at 60 d of drawdown. The drawdown (less than or equal to 30 d) not only reduced P flux to the water column, but also increased the humification and microbial immobilization of P. Excessive drawdown (60 d), however, triggered the release of P into the water column as the water content of detritus decreased from 95 to 11%.

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817. Hydrology and pollutant removal effectiveness of wetland buffer areas receiving pumped agricultural drainage water.

Chescheir, G. M.; Gilliam, J. W.; Skaggs, R. W.; Broadhead, R. G.; and Lea, R.

Raleigh, N.C.: North Carolina Water Resources Research Institute; Report No. 231, 1987. 170 p.

Notes: NTIS number: PB88-128061

Descriptors: agricultural runoff/ wetland buffers/ swamps/ pumped agricultural drainage/ surface drainage/ North Carolina/ water quality/ drainage effects/ drainage ditches/ nutrients/ sediment loading/ tidewater region/ drainmod model

Abstract: The hydrology and pollutant-removing effectiveness of two wetland areas being used to buffer impacts of pumped agricultural drainage in Eastern North Carolina were studied. Collection and analysis of field data over a two-year period showed that buffer one, originally equipped with an efficient diffuser canal, was essentially 100% effective for pollutant removal for all observed events. Less effective flow distribution, less area and faster drainage resulting from a greater elevation at buffer two resulted in less effective removal. Hydrology of a buffer area was simulated with a wetland simulation model for overland flow through vegetated areas. A routine was added to calculate residence time of the water on the buffer and percent removal of nutrients. Hourly surface and subsurface field drainage volumes calculated by a water management model. The two models estimated that over a 20-year period, study buffer one would remove 79% of total Kjeldahl nitrogen, 82% of nitrate nitrogen, 81% of total phosphorus, and 92% of sediment. Study of the response of wetland forest to pumped agricultural drainage showed pronounced overstory thinning and resultant increased floor regeneration, decreased plant diversity, and decreased annual tree diameter increment at buffer one, and decreased annual tree diameter at buffer two. (Lambert-UNC-WRRI)

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818. Importance of small isolated wetlands for herpetofaunal diversity in managed, young growth forests in the Coastal Plain of South Carolina.

Russell, Kevin R.; Guynn, David C.; and Hanlin, Hugh G. *Forest Ecology and Management* 163(1-3): 43-59. (June 2002)

NAL Call #: SD1.F73; ISSN: 0378-1127

Descriptors: Amphibia/ Reptilia/ community structure/ semiaquatic habitat/ small isolated wetlands in managed forests/ forest and woodland/ managed forests/ South Carolina/ Marion County/ Woodbury tract/ isolated wetlands in managed forests

Abstract: Freshwater wetlands support diverse and unique species assemblages, but the contribution of the smallest of these habitats to regional biodiversity continues to be underestimated, particularly within managed forests. We assessed and compared the richness, abundance, and diversity of herpetofauna at five small isolated wetlands (0.38-1.06 ha) imbedded within a commercial forest landscape in the South Carolina Coastal Plain. Continuous drift fences with pitfall traps that completely encircled the wetlands were used to sample entering and exiting herpetofauna. We also deployed coverboards to sample herpetofauna in the adjacent uplands. We captured 9186 individuals of 56 species (20 amphibians, 36 reptiles) from the five wetlands combined between 1996 and 1998. Although species richness and community composition were similar at the five sites, we found significant differences in herpetofaunal abundance and diversity among wetlands. These differences did not vary with wetland size but were related to environmental and habitat attributes of the surrounding upland stands. Amphibian abundance was positively correlated with basal area of upland conifers but negatively correlated with presence and size of hardwoods, relationships that appeared to be partially influenced by previous stand management. Amphibian diversity (H') increased with conifer diameter but decreased with increasing distance to nearest wetland. Reptile diversity was negatively correlated with upland canopy closure. Our data indicate that small isolated wetlands are focal points of herpetofaunal richness and abundance in managed coastal plain forests and contribute more to regional biodiversity than is implied by their small size or ephemeral hydrology. By incorporating small wetland values and functions into planning objectives, forest managers can significantly enhance the contribution of extensive young-growth forests to regional conservation of biodiversity.

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819. In-stream wetland design for non-point source pollution abatement.

Stone, K. C.; Hunt, P. G.; Novak, J. M.; and Johnson, M. H. *Applied Engineering in Agriculture* 19(2): 171-175. (2003)

NAL Call #: S671.A66; ISSN: 0883-8542

Descriptors: wetlands/ ammonia/ design/ nitrogen

Abstract: Nonpoint source pollution (NPS) of rivers and streams is a major concern worldwide. Most methods for NPS mitigation focus on source reductions; few have been developed to mitigate NPS once nutrients have entered streams. One system that has been shown to be effective in reducing stream nitrogen is by using in-stream wetlands (ISW). The objective of this research was to determine if design approaches used in constructed wetlands could be applied to predict ISW effectiveness in treating NPS. The

3.3-ha ISW studied was located in a 425-ha watershed in eastern North Carolina. We analyzed the data from the ISW to calculate the first-order rate constants (K20 and dimensionless temperature coefficient, θ) for the k-C* model used in constructed wetland design. We found that our calculated rate constants were in close agreement with literature estimates with TN K20 = 19-20 m/y and θ = 1.0-1.03. NO3-N rate constants were K20 = 38 - 54 m/y and θ = 1.07 - 1.13. The design equations used for constructed wetlands can be successfully used to predict the performance of the ISW'S prior to their implementation. © 2006 Elsevier B.V. All rights reserved.

820. Influence of a riparian wetland on nitrate and herbicides exported from an agricultural field.

Angier, J. T.; McCarty, G. W.; Rice, C. P.; and Bialek, K. *Journal of Agricultural and Food Chemistry* 50(15): 4424-4429. (2002)

NAL Call #: 381 J8223; ISSN: 0021-8561

Descriptors: wetlands/ nitrates/ herbicide residues/ losses from soil/ fields/ agricultural land/ streams/ water pollution/ groundwater contamination

Abstract: Agrochemicals are a major source of nonpoint pollution. Forested corridors along stream channels (riparian zones) are thought to be potential sites for removal of agricultural contaminants from ground and surface waters. First-order riparian wetlands are reputed to be especially effective at groundwater remediation. The study site is a fairly typical (for eastern Maryland) small, first-order stream in an agricultural watershed. Preferential flow supplies most of the stream water within the riparian headwater wetland. This upstream area also contains the highest average stream N and pesticide loads in the entire first-order riparian system. Zones of active groundwater emergence onto the surface display high concentrations of nitrate throughout the soil profile and in the exfiltrating water, whereas inactive areas (where there is no visible upwelling) show rapid attenuation of nitrate with decreasing depths. Atrazine degradation products appear to penetrate more readily through the most active upwelling zones, and there is a correlation between zones of high nitrate and high atrazine metabolite levels. Deethylatrazine/atrazine ratios (DAR) seem to indicate that stream flow is dominated by ground water and that much of the ground water may have reached the stream via preferential flow. Remediative processes appear to be very complex, heterogeneous, and variable in these systems, so additional research is needed before effective formulation and application of riparian zone initiatives and guidelines can be accomplished. This citation is from AGRICOLA.

821. Influence of a willow canopy on tree seedling establishment for wetland restoration.

McLeod, K. W.; Reed, M. R.; and Nelson, E. A. *Wetlands* 21(3): 395-402. (Sept. 2001)

Descriptors: wetlands/ plant populations/ microhabitats/ restoration/ interspecific relationships/ riparian environments/ environmental restoration/ canopies/ floods/ canopy/ habitats/ riparian vegetation/ willow trees/ oak trees/ trees/ seedlings/ flooding/ habitat/ Quercus lyrata/ Carya aquatica/ Taxodium distichum/ Salix nigra/ Quercus laurifolia/ black willow/ overcup oak/ baldcypress/ water hickory/ restoration/ laurel oak/ protective measures and control/ reclamation/ environmental action

Abstract: Black willow (*Salix nigra*) is a well-known pioneer

species of disturbed riparian areas. It competes for nutrients, light, and water, but it may also act as a "nurse" crop, providing shelter for other species from high light and temperature; so, the overall effect on species planted under a willow canopy could be positive or negative. This experiment examined the response of container-grown seedlings of four tree species outplanted into three habitats: 1) an existing willow stand, 2) a similar habitat, but with the willow canopy removed, and 3) an adjacent grass-dominated area free of willow. After three years, survival rates of overcup oak (*Quercus lyrata*), baldcypress (*Taxodium distichum*), and water hickory (*Carya aquatica*) were not reduced under the willow canopy relative to the other two treatments. Laurel oak (*Q. laurifolia*) was killed by several floods during the first growing season. Height of baldcypress seedlings planted under a willow canopy was less than for seedlings where the willow had been removed. Water hickory and overcup oak height were not affected by the willow canopy. Elevation of the planting sites, indicating probable soil wetness, was a good indicator of survival when used in conjunction with the species flood-tolerance. The existing willow stand was not detrimental to survival of three of the outplanted tree species. Thus, willow removal is unnecessary for successful outplanting, saving time and money.

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822. Influence of temperature on treatment efficiency of constructed wetlands.

Hill, D. T. and Payton, J. D.

Transactions of the ASAE 41(2): 393-396. (1998)

NAL Call #: 290.9 Am32T; ISSN: 0001-2351

Descriptors: wetlands/ poultry/ slurries/ biological treatment/ water quality/ chemical oxygen demand/ biochemical oxygen demand/ ammonium nitrogen/ nitrate nitrogen/ phosphorus/ water temperature/ animal manures/ excreta/ lagoons/ orthophosphorus/ organic nitrogen

Abstract: An existing free-water-surface constructed wetland system at the Auburn University Poultry Science Unit was used to evaluate the effects of water temperature on the treatment of poultry lagoon effluent. Each wetland consisted of two cells in series. One series was planted with an approximate 10% fill of *Sagittaria lancifolia*. A second series contained *Phragmites australis* and *Scirpus* spp. with an approximate 5% fill of plants. A third series was unvegetated and acted as a control. Wastewater samples were collected approximately every 12 days at the influent and effluent of each cell and analyzed for TKN, ammonia, nitrate, BOD5, COD, total phosphorus, orthophosphorus, and potassium. Water temperature was measured using thermographs placed at the midpoint of each cell with temperature readings being taken each hour from July 1995 until June 1996. The percent removal of each wastewater pollutant from each series was compared to the average water temperature over the sampling period (every 12 days) to determine what effect, if any, temperature had on treatment. For most cases, temperature was not found to significantly affect treatment of poultry wastewater. Treatment efficiency (percent removal) was significantly correlated to temperature in one series for ammonia, one series for nitrate, one series for total phosphorus and one series for orthophosphorus. Mass removal was not correlated to temperature in any of the cases studied.

This citation is from AGRICOLA.

823. Landscape ecological planning process for wetland, waterfowl, and farmland conservation.

Musacchio, L. R. and Coulson, R. N.

Landscape and Urban Planning 56(3-4):

125-147. (Oct. 2001)

NAL Call #: QH75.A1L32; ISSN: 0169-2046

Descriptors: wetlands/ landscape/ habitat/ geographic information systems/ agricultural land/ rice fields/ land use/ grants/ policies/ regional planning/ rice field aquaculture/ nature conservation/ overwintering/ plant culture/ conservation/ waterfowl/ ecological effects/ farms/ geographical information systems/ rice/ anatidae/ *Chen caerulescens caerulescens/ oryza sativa/ USA, Texas/ ducks/ lesser snow goose/ Anser caerulescens caerulescens/ rice/ planning/ development/ law, policy, economics and social sciences/ plant culture/ conservation, wildlife management and recreation/ ecological impact of water development*

Abstract: A landscape ecological planning process (LEP process) is described that addresses the issues of rice production and wetland habitat conservation on privately owned rice farms in Texas. The LEP process was used to evaluate proposed land-use management plans based on alternative policies for the next US Farm Bill, which would be in effect from 2003 to 2009. A system simulation model, geographic information systems (GIS) model based on expert knowledge, as well as expert opinion, were used to evaluate uncertainty about the effects of these plans and policies on different types of farms and the quality of winter habitat of lesser snow geese. The models simulated shifts in land-use, rice and cattle production, farm profitability, and use of habitat by geese. Simulation results suggested that the level of federal subsidies for all policies influenced the continuation of rice production from 2003 to 2009. In addition, the size of the farm influenced whether rice production continued until 2009. The smaller farms were more sensitive to decreases in federal subsidies than larger farms because smaller farms received less income from goose hunting leases. Winter habitat for lesser snow geese was reduced in terms of patch size and nearest neighbor distance when rice production was discontinued by 2009 for all policies. Agricultural policy experts, who were familiar with the study sites, selected the modified version of the conservation policy as the example that would most benefit farmers and geese. The experts emphasized that their policy would offer farmers more flexibility to manage their farms, to diversify their incomes, and to be good land stewards.

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824. Large-scale constructed wetlands for nutrient removal from stormwater runoff: An Everglades restoration project.

Guardo, M.; Fink, L.; Fontaine, T. D.; Newman, S.;

Chimney, M.; Bearzotti, R.; and Goforth, G.

Environmental Management 19(6): 879-889. (1995)

NAL Call #: HC79.E5E5; ISSN: 0364-152X

Descriptors: environmental restoration/ storm water/ nutrient uptake/ agrochemicals/ nutrients/ artificial wetlands/ pollution control/ bioaccumulation/ biodegradation/ water reclamation/ environment management/ stormwater runoff/ agricultural runoff/ storm runoff/ water pollution treatment/ agricultural chemicals/ nutrients (mineral)/ USA, Florida/ USA, Florida, Everglades/ stormwater runoff/ storm runoff/ water pollution treatment/ agricultural chemicals/

agricultural runoff/ nutrients (mineral)/ storm water/ nutrient uptake/ artificial wetlands/ water reclamation/ environmental restoration/ agrochemicals/ pollution control/ environment management/ nutrients/ reclamation/ environmental action/ water quality control/ prevention and control

Abstract: The South Florida Water Management District (SFWMD) constructed a wetland south of Lake Okeechobee to begin the process of removing nutrients (especially phosphorus) from agricultural stormwater runoff entering the Everglades. The project, called the Everglades Nutrient Removal (ENR) project, is a prototype for larger, similarly constructed wetlands that the SFWMD will build as part of the Everglades restoration program. This innovative project is believed to be one of the largest agricultural stormwater cleanup projects in the United States, if not in the world. This publication describes the ENR project's design, construction, and proposed operation, as well as the proposed research program to be implemented over the next few years.

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825. Long-term effects of a lock and dam and greentree reservoir management on a bottomland hardwood forest.

King, Sammy L.; Allen, James A.; and McCoy, John W. *Forest Ecology and Management* 112(3): 213-226. (1998)
NAL Call #: SD1.F73; ISSN: 0378-1127

Descriptors: bottomland hardwood forest/ competition/ dam management/ flooding/ greentree reservoir/ habitat/ lock management/ resource management/ riparian wetland/ stress response/ succession

Abstract: We investigated the long-term effects of a lock and dam and greentree reservoir management on a riparian bottomland hardwood forest in southern Arkansas, USA, by monitoring stress, mortality, and regeneration of bottomland hardwood trees in 53 permanent sampling plots from 1987-1995. The lock and dam and greentree reservoir management have altered the timing, depth, and duration of flooding within the wetland forest. Evaluation of daily river stage data indicates that November overbank flooding (i.e. 0.3 m above normal pool) of 1 week duration occurred only 10 times from 1950 to 1995 and four of these occurrences were the result of artificial flooding of the greentree reservoir. Results of the vegetation study indicate that the five most common dominant and co-dominant species were overcup oak, water hickory, Nuttall oak, willow oak, and sweetgum. Mortality of willow oak exceeded that of all other species except Nuttall oak. Nuttall oak, willow oak, and water hickory had much higher percentages of dead trees concentrated within the dominant and co-dominant crown classes. Probit analysis indicated that differences in stress and mortality were due to a combination of flooding and stand competition. Overcup oak appears to exhibit very little stress regardless of crown class and elevation and, with few exceptions, had a significantly greater probability of occurring within lower stress classes than any other species. Only 22 new stems were recruited into the 5 cm diameter-at-breast height size class between 1990-1995 and of these, three were Nuttall oak, three were water hickory, and one was sweetgum. No recruitment into the 5 cm diameter-at-breast height size class occurred for overcup oak or willow oak. The results of the study suggest that the forest is progressing to a more

water-tolerant community dominated by overcup oak. A conservative flooding strategy would minimize tree stress and maintain quality wildlife habitat within the forested wetland.

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826. Long-term phosphorus removal in Florida aquatic systems dominated by submerged aquatic vegetation.

Knight, R. L.; Gu, B.; Clarke, R. A.; and Newman, J. M. *Ecological Engineering* 20(1): 45-63. (2003)

NAL Call #: TD1.E26; ISSN: 0925-8574

Descriptors: phosphorus cycle/ aquatic environment/ eutrophication/ water treatment/ phosphorus removal/ vegetation/ aquatic plants/ environmental engineering/ rivers/ lakes/ artificial wetlands/ mesocosms/ coastal inlets/ phosphorus/ water quality control/ emergent vegetation/ anthropogenic factors/ fluvial sediments/ inlets/ sediments/ hydraulic loading/ sinks/ pollution load/ river systems/ USA, Florida/ submerged aquatic vegetation

Abstract: Anthropogenic phosphorus (P) loads have been implicated in eutrophication of lakes and wetlands throughout Florida. One technology that holds considerable promise for controlling these loads in a cost-effective manner is the use of treatment wetlands. Preliminary research in south Florida on the use of submerged aquatic vegetation (SAV) as the dominant vegetation in these treatment wetlands is reporting higher P removal performance than wetlands dominated by rooted, emergent plants. This research has been based to-date primarily on relatively small-scale mesocosms (5-2000 m²) and on a larger scale treatment wetland (148 ha) that has been operated for about 7 years. Considering the magnitude of engineering decisions and project costs to implement P control in the Everglades Agricultural Area and elsewhere in Florida, it is prudent to look for additional confirmation of P removal performance from other existing SAV-dominated systems in Florida that have a longer operational period. This paper describes an analysis of existing data collected from a number of SAV-dominated, flow-through lakes and rivers in Florida with characteristics similar to the proposed SAV treatment systems. While these existing input-output data were not specifically collected for the purpose of preparing mass balances and P removal rate estimates, they can be judiciously applied to that analysis. The overall conclusion of this analysis is that SAV-dominated lakes and rivers do typically remove P from the water column. The likely long-term sink for this P is the newly accreted sediment. The long-term average P removal rate for 13 SAV-dominated lake and river systems in Florida was 1.2 g/m² per year. This result compares favorably with an average net sediment P accumulation rate of 1.2 g/m² per year reported by others for 11 SAV-dominated Florida lakes. These estimated long-term P removal rates are higher than those for full-scale wetlands dominated by emergent vegetation. Average first-order P removal rate constants for SAV-dominated lakes (15 m/year) and rivers (46 m/year) are generally less than those estimated in SAV-dominated mesocosms (60-140 m/year) and similar to a large-scale SAV-dominated stormwater treatment area (STA) (40 m/year). P removals in all of these SAV-dominated systems are influenced by inlet P loading rates, with removal rates positively correlated to both P inlet concentration and hydraulic loading rate (HLR). Based on

this analysis, caution is recommended when extrapolating the P removal results from relatively short-term or small-scale mesocosm studies to the design of full-scale, long-term operating SAV-dominated wetlands.

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827. Marsh terracing as a wetland restoration tool for creating fishery habitat.

Rozas, L. P. and Minello, T. J.

Wetlands 21(3): 327-341. (Sept. 2001)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ intertidal environment/ habitat improvement/ marshes/ restoration/ habitat/ fishery resources/ nekton/ marine crustaceans/ biomass/ population density/ terraces/ environmental restoration/ fisheries/ geological terraces/ crustaceans/ fetch/ biological sampling/ habitats/ mullet/ menhaden/ trout/ intertidal areas/ *Litopenaeus setiferus*/ *Palaemonetes pugio*/ *Callinectes sapidus*/ *Farfantepenaeus aztecus*/ *Brevoortia patronus*/ *Mugil cephalus*/ *Cynoscion nebulosus*/ USA, Louisiana/ northern white shrimp/ white shrimp/ daggerblade grass shrimp/ blue crab/ gulf menhaden/ striped mullet/ spotted seatrout/ restoration/ protective measures and control/ conservation and environmental protection/ reclamation

Abstract: Terracing is a relatively new wetland-restoration technique used to convert shallow subtidal bottom to marsh. This method uses existing bottom sediments to form terraces or ridges at marsh elevation. A terrace field is constructed by arranging these ridges in some pattern that maximizes intertidal edge and minimizes fetch between ridges; the intertidal area is planted with marsh vegetation. We examined the habitat value of terracing for fishery species at Sabine National Wildlife Refuge, Louisiana (USA) in spring and fall 1999 by quantifying and comparing nekton densities in a 9-yr-old terrace field and nearby reference area using a 1-m super(2) drop sampler. Decapod crustaceans were more abundant than fishes, composing 62% and 95% of all organisms we collected in spring and fall, respectively. White shrimp *Litopenaeus setiferus*, dagger-blade grass shrimp *Palaemonetes pugio*, blue crab *Callinectes sapidus*, and brown shrimp *Farfantepenaeus aztecus* accounted for 94% of all crustaceans, whereas 60% of all fishes were gulf menhaden *Brevoortia patronus*. Mean densities of white shrimp (fall), daggerblade grass shrimp, blue crab, and brown shrimp (spring) were significantly greater in terrace marsh than on non-vegetated bottom in the reference pond. Densities of most nekton on non-vegetated bottom were similar in the terrace field and the reference pond, but gulf menhaden and white shrimp had higher densities at terrace pond sites and brown shrimp (spring) were more abundant at reference pond sites. The pattern for biomass was similar to that for density in that the mean biomass of most species was significantly greater at terrace marsh sites than reference pond sites and similar at terrace and reference pond sites. Terrace marsh, however, was not functionally equivalent to natural marsh, as mean densities of daggerblade grass shrimp (fall), brown shrimp (spring), and blue crab and mean biomass of white shrimp (fall), striped mullet *Mugil cephalus* (spring), and spotted seatrout *Cynoscion nebulosus* (fall) were greater at reference marsh sites than terrace marsh sites. Using these density and biomass patterns and the percentage of marsh and pond area in the terrace field, we concluded that terrace fields

support higher standing crops of most fishery species compared with shallow marsh ponds of similar size. Future restoration projects could include design changes to increase the proportion of marsh in a terrace field and enhance the habitat value of marsh terraces for fishery species.

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828. Mitigation of metolachlor-associated agricultural runoff using constructed wetlands in Mississippi, USA.

Moore, M. T.; Rodgers, J. H.; Smith, S.; and Cooper, C. M.

Agriculture, Ecosystems & Environment 84(2):

169-176. (2001)

NAL Call #: S601.A34; ISSN: 0167-8809

Descriptors: pesticides/ water quality/ agricultural runoff/ gas chromatography/ water management/ sediments/ aquatic plants/ artificial wetlands/ freshwater pollution/ pollution control/ mesocosms/ agricultural pollution/ chemical pollutants/ herbicides/ restoration/ environment management/ USA, Mississippi/ metolachlor/ constructed wetlands

Abstract: A loss of marginal wetland acreage adjoining agricultural fields has created a potential problem with water quality enhancement of agricultural runoff via wetlands. Current research is investigating the utility of constructed wetlands for pesticide mitigation purposes, thereby restoring water quality enhancement capability to the area. Constructed wetland mesocosms (59-73 m x 14 m), located at the University of Mississippi Field Station (Lafayette County, MS), were amended with metolachlor to simulate a cropland runoff event. Target concentrations for wetlands were 73 and 147 µg/l metolachlor in addition to an unamended control (0 µg/l). Water, sediment, and plant samples were collected weekly for 35 days following metolachlor amendment. Samples were collected from sites, longitudinally distributed within each wetland, and analyzed for metolachlor using gas chromatography. Between 7 and 25% of measured metolachlor mass was in the first 30-36 m (from inflow) of wetlands immediately following application and simulated rainfall. Approximately 10% of measured metolachlor mass was in plant samples. Suggested wetland travel distances for effective mitigation of metolachlor runoff ranged from 100 to 400 m. According to the results from this research, aquatic receiving system impacts due to metolachlor runoff could be mitigated by using constructed wetlands as buffers. Landowners and government agencies can integrate this information into a water management plan, allowing for better control of both quantity and quality of runoff water from individual agricultural fields.

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829. Modeling biogeochemistry and forest management practices for assessing GHGs mitigation strategies in forested wetlands.

Cui, J.; Li, C.; and Trettin, C.

Environmental Modeling and Assessment 10(1):

43-53. (Mar. 2005)

NAL Call #: GE1 .E545; ISSN: 1420-2026

Descriptors: wetlands/ greenhouse gases/ mortality/ forests/ biogeochemistry/ seasonal variations/ sulfur dioxide/ water table/ trees/ carbon cycle/ biomass/ USA, Florida/ air pollution/ air pollution: monitoring, control & remediation

Abstract: Despite the importance of forested wetland in the

global carbon cycle, no widely applicable ecosystem model exists for this ecosystem. This study reports the linkage between Wetland-DNDC and MIKE SHE for carbon dynamics and GHGs mitigation strategies analyses in forested wetland. Wetland-DNDC was modified by parameterizing forest management practices and refining anaerobic biogeochemical processes. Mortality due to senescence was estimated as a function of tree age or as a function of the relative biomass. We used a harvesting damage mortality coefficient as a linear function of time with three parameters: Initial mortality, Duration of the damage and intensity of the initial harvesting. The model was validated against experimental data obtained from the GNF site near Florida. As a preliminary application, we simulated the effect of water table position and forest management practices on GHGs emissions and carbon dynamics to test the capabilities of the models for simulating seasonal and long-term carbon budget in forested wetland.

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830. Modeling phosphorus trapping in wetlands using nonparametric Bayesian regression.

Qian, Song S. and Reckhow, K. H.

Water Resources Research 34(7): 1745-1754. (July 1998)

NAL Call #: 292.8 W295; ISSN: 0043-1397

Descriptors: wetlands/ phosphorus/ agricultural runoff/ phosphorus removal/ water level/ water management/ water pollution/ nonpoint pollution sources/ water quality control/ USA, Florida, Everglades/ environment management/ ecosystem management/ agricultural pollution/ pollution control/ biodegradation/ sources and fate of pollution/ freshwater pollution/ protective measures and control/ composition of water

Abstract: Phosphorus-enriched agricultural runoff from the Everglades Agriculture Area is believed to have caused ecological changes in the northern part of the Everglades wetlands. A number of efforts have been made to assess the effectiveness of using constructed wetlands as a means of phosphorus removal from the agricultural runoff. The objective of this study is to develop a predictive model for the total phosphorus effluent concentration of an Everglades wetland that has received this runoff for over 20 years. We used Bayesian nonparametric regression to develop a predictive model combining information from an Everglades wetland data set and a cross-sectional data set. The prior model was based on the cross-sectional data set and expert opinion; this prior model, when combined with data from the Everglades wetland, yielded the posterior model, which can be used to (1) estimate the probability of an outflow concentration standard violation and (2) provide the posterior distributions of effluent concentrations at different loading rates and water levels. The primary use of this model is to support decision making in sizing the proposed constructed wetlands in south Florida as well as keeping a practical management strategy.

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831. Nitrate removal in riparian wetland soils: Effects of flow rate, temperature, nitrate concentration and soil depth.

Willems, Hans P.; Rotelli, Matthew D.; Berry, Duane F.; Smith, Eric P.; Reneau, Raymond B.; and Mostaghimi, Saied

Water Research 31(4): 841-849. (1997)

NAL Call #: TD420.W3; ISSN: 0043-1354

Descriptors: biochemistry and molecular biophysics/ freshwater ecology: ecology, environmental sciences/ pollution assessment control and management/ soil science/ toxicology/ waste management: sanitation/ biobusiness/ concentrations/ flow rate/ groundwater ecology/ managed agricultural field/ nitrate/ nomini creek watershed/ nutrient contamination removal/ pollution/ removal/ riparian wetland soils/ soil columns/ soil depth/ temperature/ toxicology/ water pollution

Abstract: Riparian zones, located adjacent to intensely managed agricultural fields, are thought to play an important role in removal of nutrient contaminants including NO₃⁻ from groundwater. We studied the effect of flow rate, NO₃⁻ concentration and temperature on NO₃⁻ removal in soil columns under saturated-flow conditions. Bibb (coarse-loamy, siliceous, acid thermic Typic Fluvaquent) sandy loam soil was collected from a riparian forest located in Nomini Creek Watershed, Virginia. Soils included in the study were a permanently inundated surface horizon, a seasonally saturated surface horizon, a shallow subsurface horizon and a deep subsurface horizon. Soil columns were infiltrated with NO₃⁻ amended groundwater at concentrations from 14 to 36 mg NO₃⁻-N L⁻¹. Column operating temperatures varied between 8 and 20 degree C and flow rates between 0.01 and 0.09 mL min⁻¹. Following a 48 h equilibrium period, effluent NO₃⁻ and N-2O concentrations were determined. Denitrification was the primary mechanism of NO₃⁻ removal, with higher denitrification capacities found in the surface horizons. Effluent NO₃⁻ concentrations could be described by a linear combination of temperature, flow rate and influent NO₃⁻ concentrations. Low temperatures and increased flow rates reduced the denitrification capacity in all soils. Our results showed that the NO₃⁻ removal capacity present in the Bibb soil should theoretically be sufficient to remove most, if not all, NO₃⁻ from the groundwater at the Nomini Creek study site. However, on-site measurements of NO₃⁻ concentration in receiving streams indicated that this capacity is not fully realized in the field, suggesting the importance of other factors such as local hydrology and groundwater flow patterns.

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832. Nutrient and sediment removal by a restored wetland receiving agricultural runoff.

Jordan, T. E.; Whigham, D. F.; Hofmockel, K. H.; and Pittek, M. A.

Journal of Environmental Quality 32(4): 1534-1547. (2003)

NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: wetlands/ ammonia/ total suspended solids (TSS)/ agricultural runoff/ runoff/ water contamination

Abstract: Few studies have measured removal of pollutants by restored wetlands that receive highly variable inflows. We used automated flow-proportional sampling to monitor the removal of nutrients and suspended solids by a 1.3-ha restored wetland receiving unregulated inflows from a 14-ha agricultural watershed in Maryland, USA. Water entered the wetland mainly in brief pulses of runoff, which sometimes exceeded the 2500-m³ water holding capacity of the wetland. Half of the total water inflow occurred in only 24 days scattered throughout the two-year study. Measured annual water gains were within 5% of balancing water losses. Annual removal of nutrients differed greatly between the two years of the study. The most removal occurred in the first year, which included a three-month

period of decreasing water level in the wetland. In that year, the wetland removed 59% of the total P, 38% of the total N, and 41% of the total organic C it received. However, in the second year, which lacked a drying period, there was no significant ($p > 0.05$) net removal of total N or P, although 30% of the total organic C input was removed. For the entire two-year period, the wetland removed 25% of the ammonium, 52% of the nitrate, and 34% of the organic C it received, but there was no significant net removal of total suspended solids (TSS) or other forms of N and P. Although the variability of inflow may have decreased the capacity of the wetland to remove materials, the wetland still reduced nonpoint-source pollution.

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833. Nutrient attenuation by a riparian wetland during natural and artificial runoff events.

Casey, R. E. and Klaine, S. J.

Journal of Environmental Quality 30(5): 1720-1731. (2001)

NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: wetlands/ water pollution treatment/ nonpoint pollution sources/ golf courses/ storm runoff/ nitrates/ phosphates/ data collections/ experimental data/ performance evaluation/ pollution (nonpoint sources)/ runoff/ nitrate/ riparian environments/ nutrients (mineral)/ stormwater runoff/ pollution dispersion/ fertilizers/ golf courses/ water quality control/ water treatment/ protective measures and control/ water & wastewater treatment

Abstract: Due to chronic nutrient enrichment of surface water, wetlands adjacent to land managed with fertilizer have been studied to determine their role in nutrient dynamics. We sampled golf course runoff and determined the loads of NO₃⁻ and PO₄³⁻ transported during storms and the attenuation of those loads when runoff passed through a riparian wetland. All sampled storm events contained NO₃⁻ (2 to 1470 g NO₃⁻-N per event) and PO₄³⁻ (1 to 4156 g PO₄³⁻-P per event). Extensive nutrient attenuation occurred when water passed through the riparian wetland. In 11 events, NO₃⁻ and PO₄³⁻ attenuation averaged 80 and 74%, respectively. In subsequent experiments, we created a stream of water flowing into the wetland and amended it with NO₃⁻, PO₄³⁻ and Br⁻, creating an artificial runoff event. The experiments were conducted using conditions similar to those of natural runoff events. We observed rapid and complete attenuation of PO₄³⁻ immediately after runoff water infiltrated into the wetland subsurface. No PO₄³⁻ was observed in discharge from the wetland. Nitrate attenuation occurred following a lag phase of several hours that was probably due to reactivation of denitrifying enzymes. Nitrate attenuation was initially less than 60% but increased to 100% in all experiments. We observed extensive dilution of runoff water in the wetland subsurface indicating mixing with pre-event ground water in the wetland. The results indicated that intermittent inputs of NO₃⁻ and PO₄³⁻ could be successfully attenuated in the wetland on the time scale of natural storm events.

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834. Nutrient removal from eutrophic lake water by wetland filtration.

Coveney, M. F.; Stites, D. L.; Lowe, E. F.; Battoe, L. E.; and Conrow, R.

Ecological Engineering 19(2): 141-159. (2002)

Descriptors: ammonia/ aquatic plants/ artificial wetlands/ bioremediation/ eutrophication/ evapotranspiration/ filtration/ floodplains/ geological sedimentation/ lakes/ nature conservation/ nitrate/ nitrogen/ phosphorus/ phytoplankton/ rain/ seepage/ suspended solids/ water management/ water quality/ plants

Abstract: Lake Apopka is a large (125 km²), shallow (mean depth 1.6 m) lake in Florida, USA. The lake was made hypereutrophic by phosphorus loading from floodplain farms and has high levels of nutrients, phytoplankton (Chl a 80 micro g l⁻¹), and suspended matter. The restoration plan developed by the St. Johns River Water Management District encompasses the biomanipulation concept in which the critical step for large shallow lakes is increasing the transparency of the water to allow the re-establishment of submerged macrophytes. Restoration includes operation of a treatment wetland, reduction in external P loading, harvest of fish, fluctuation of lake levels, and littoral planting. The District constructed a 2-km² pilot-scale treatment wetland to test nutrient-removal and hydraulic performance. Lake water was recirculated for 29 months, and the removal of suspended solids and particle-bound nutrients was assessed. Hydraulic loading rate varied from 6.5 to 65 m year⁻¹ with a mean hydraulic residence time of about 7 days. The inflow contained 40-180 mg l⁻¹ TSS, 80-380 micro g l⁻¹ TP (mostly particulate organic), and 3-9 mg l⁻¹ TN (mostly dissolved and particulate organic). Overall, particulate matter was removed (>90%) by the wetland, and soluble organic compounds were unaffected. Soluble inorganic compounds such as nitrate, ammonia, and soluble reactive phosphate (SRP) were low in the lake water but increased during passage through the wetland. Particulate matter at the outlet was enriched in both N (2-fold) and P (5-fold) compared to particles in the inflow. Mass removal efficiencies were 89-99 (TSS), 30-67 (TP), and 30-52% (TN), but efficiency fell when hydraulic short-circuiting occurred. First-order removal coefficients were 107 (TSS), 63 m year⁻¹ (TP) and 98 m year⁻¹ (particulate N). Areal particulate removal rates were 5.4 g dry matter m⁻² day⁻¹, 0.18 g PON m⁻² day⁻¹, and 0.006 g POP m⁻² day⁻¹. The ratio of N:P removal was 28:1. Total sedimentation rate was 0.4 mm day⁻¹ of very light matter (4.4 g dw l⁻¹). About 40% of the dry matter and nitrogen removed and about 80% of the phosphorus was found in the new sediments. Relative to the inflow of lake water, evapotranspiration (4.3%), seepage (2.6%), and rainfall (2.8%) were low. Major problems were initial leaching of SRP, but not ammonia, from native organic soils and vegetation when this former farmland was flooded; hydraulic short-circuiting via former drainage ditches; and low inflows under drought conditions. After 6 months SRP release declined, and initial SRP leaching could be prevented with soil treatment. Hydraulic short-circuiting occurred only after modifications were made. Low gravity flows were augmented with pumped inflows. With these improvements P-removal should increase from the measured 0.48 to at least 3 g P m⁻² year⁻¹. Based on the

pilot project results, the first phase of an improved 14-km² wetland filter has been constructed. This project should accelerate improvements in the water quality of Lake Apopka and, ultimately, create a new, large wildlife-rich marsh.

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835. Nutrient retention dynamics of the Everglades Nutrient Removal Project.

Moustafa, M. Z.

Wetlands 19(3): 689-704. (Sept. 1999)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ nutrients/ storm runoff/ agriculture/ water quality/ phosphorus/ water quality control/ nutrient removal/ stormwater runoff/ pollution control/ nutrients (mineral)/ agricultural pollution/ water treatment/ USA, Florida, Everglades/ chemical processes/ prevention and control

Abstract: The Everglades Nutrient Removal (ENR) Project was constructed to reduce nutrient concentrations in stormwater runoff water from the Everglades Agricultural Area. Although nutrient concentrations of influent water ranged from 66 to 201 µg TP L⁻¹ and 140 to 541 µg TN L⁻¹ and varied substantially over time, the outlet concentrations remained low, 9 to 39 µg TP L⁻¹ and 99 to 286 µg TN L⁻¹, during the first three years of operation (from August 1994 through August 1997). Nutrient removal efficiency was calculated in terms of decrease in both loads and nutrient concentrations. Nutrient loading rates averaged 1.17 g TP m⁻² year⁻¹ (plus or minus 0.12 SE) and 31.56 g TN m⁻² year⁻¹ (plus or minus 2.92 SE) at the inflow and 0.23 g TP m⁻² year⁻¹ (plus or minus 0.02 SE) and 20.71 g TN m⁻² year⁻¹ (plus or minus 1.63 SE) at the outflow. TP load removal ranged from 66% to 91% and averaged 82% for the period of record, while TN load removal ranged from 11% to 76% and averaged 55%. Rainfall contribution to the ENR Project nutrient budgets was small, averaging only 4% and 3% for TP and TN, respectively. The ENR Project performance results during the first three years suggest that additional Stormwater Treatment Areas (STAs) will be effective in removing TP from stormwater runoff.

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836. Nutrient transport in a restored riparian wetland.

Vellidis, G.; Lowrance, R.; Gay, P.; and Hubbard, R. K.

Journal of Environmental Quality 32(2): 711-726. (Mar. 2003-Apr. 2003)

NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: wetlands/ plumes/ nitrates/ groundwater pollution/ water quality/ nutrient removal/ surface runoff/ denitrification/ ammonium/ phosphorus/ hydrology/ pastures/ preferential flow/ manure/ environmental effects/ ammonium compounds/ nutrients (mineral)/ agricultural runoff/ USA, Georgia/ sources and fate of pollution/ composition of water/ characteristics, behavior and fate/ water resources and supplies

Abstract: We determined the water quality effect of a restored forested riparian wetland adjacent to a manure application area and a heavily fertilized pasture in the Georgia Coastal Plain. The buffer system was managed based on USDA recommendations and averaged 38 m in width. Water quality and hydrology data were collected from 1991-1999. A nitrate plume in shallow ground water with

concentrations exceeding 10 mg NO₃-N L⁻¹ moved into the restored forested riparian wetland. Along most of the plume front, concentrations were less than 4 mg NO₃-N L⁻¹ within 25 m. Two preferential flow paths associated with past hydrologic modifications to the site allowed the nitrate plume to progress further into the restored forested riparian wetland. Surface runoff total N, dissolved reactive phosphorus (DRP), and total P concentrations averaged 8.63 mg N L⁻¹, 1.37 mg P L⁻¹, and 1.48 mg P L⁻¹, respectively, at the field edge and were reduced to 4.18 mg N L⁻¹, 0.31 mg P L⁻¹, and 0.36 mg P L⁻¹, respectively, at the restored forested riparian wetland outlet. Water and nutrient mass balance showed that retention and removal rates for nitrogen species ranged from a high of 78% for nitrate to a low of 52% for ammonium. Retention rates for both DRP and total P were 66%. Most of the N retention and removal was accounted for by denitrification. Mean annual concentrations of total N and total P leaving the restored forested riparian wetland were 1.98 mg N L⁻¹ and 0.24 mg P L⁻¹, respectively.

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837. Nutrient uptake and growth response of six wetland/riparian plant species receiving swine lagoon effluent.

Hubbard, R. K.; Ruter, J. M.; Newton, G. L.; and Davis, J. G.

Transactions of the ASAE 42(5): 1331-1341. (1999)

NAL Call #: 290.9 Am32T; ISSN: 0001-2351

Descriptors: wastewater treatment/ Ilex cassine/ Itea/ Spartina patens/ Juncus effusus/ Panicum/ nutrient uptake/ bioremediation/ filter strips/ Cephalanthus occidentalis/ wetland plants

This citation is from AGRICOLA.

838. Operational restoration of the Pen Branch bottomland hardwood and swamp wetlands: The research setting.

Nelson, E. A.; Duloher, N. C.; Kolka, R. K.; and McKee, W. H.

Ecological Engineering 15(Suppl. 1): S23-S33. (Sept. 2000)

NAL Call #: TD1.E26; ISSN: 0925-8574

Descriptors: wetlands/ environmental restoration/ forests/ rivers/ flood plains/ dams/ USA, South Carolina/ hydrology/ vegetation cover/ habitat improvement (biological)/ ecosystem disturbance/ Taxodium distichum/ Nyssa aquatica/ USA, South Carolina, Aiken, Savannah River Site/ USA, South Carolina, Savannah R./ baldcypress/ water tupelo/ reclamation/ protective measures and control

Abstract: The Savannah River swamp, a 3020 ha forested wetland on the floodplain of the Savannah River, USA is located on the Department of Energy's Savannah River site (SRS) near Aiken, SC. Historically, the swamp consisted of approximately 50% bald cypress-water tupelo (*Taxodium distichum*-*Nyssa aquatica*) stands, 40% mixed bottomland hardwood stands, and 10% shrub, marsh, and open water. Creek corridors were typical of southeastern bottomland hardwood forests. Hydrology was controlled by flooding of the Savannah River and by flow from four creeks that drain into the swamp prior to flow into the Savannah River. Upstream dams have caused some alteration of the water levels and timing of flooding within the floodplain. Major impacts to the swamp hydrology occurred with the completion of the production reactors and one coal-fired

powerhouse at the SRS in the early 1950s. Flow in one of the tributaries, Pen Branch, was typically 0.3 m super(3) s super(-1) (10-20 cfs) prior to reactor pumping and 11.0 m super(3) s super(-1) (400 cfs) during pumping from 1954 to 1988. Sustained increases in water volume resulted in overflow of the original stream banks, the creation of additional floodplains, considerable erosion of the original stream corridor, and deposition of a deep silt layer on the newly formed delta. Heated water was discharged directly into Pen Branch and water temperature in the stream often exceeded 65 degree C. The nearly continuous flooding of the swamp, the thermal load of the water, and the heavy silting resulted in complete mortality of the original vegetation in large areas of the floodplain. In the years since pumping was reduced, no volunteer seedlings of heavy-seeded hardwoods or cypress have been found in the floodplain corridor. Research was conducted to determine methods to reintroduce tree species characteristic of more mature forested wetlands. Species composition and selection were altered based on the current and expected hydrological regimes that the reforestation areas will be experiencing.
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839. Particulate phosphorus removal via wetland filtration: An examination of potential for hypertrophic lake restoration.

Lowe, E. F.; Battoe, L. E.; Stites, D. L.; and Coveney, M. F. *Environmental Management* 16(1): 67-74. (1992)
NAL Call #: HC79.E5E5; ISSN: 0364-152X

Descriptors: wetlands/ phosphorus cycle/ filtration/ particulate pollution/ environmental restoration/ lakes/ hypertrophy/ phosphorus/ USA, Florida, Apopka L./ hypertrophic environments/ phosphorus/ Florida, Apopka L./ particulate pollution/ environmental restoration/ hypertrophy/ reclamation/ prevention and control/ freshwater pollution

Abstract: Lake Apopka in Florida, USA, is a large (area = 124 km super(2)), hypertrophic (mean total phosphorus = 0.220 g/m super(3); mean chlorophyll a = 60 mg/m super(3)) lake, with a large sedimentary store of available P (1635 x 10 super(6) g P). Phosphorus loading from floodplain farms (132 x 10 super(6) g P/yr) has been the primary cause of eutrophication. Assuming elimination of farm P loading, the Vollenweider model predicts a decline in equilibrium P concentration from 0.270 to 0.024 g/m super(3), if the P sedimentation coefficient (sigma) remains constant. Recirculation of lake water through a 21-km super(2), created wetland and elimination of farm P loading is projected to result in a negative P balance for the lake (- 23 x 10 super(6) g P/yr) leading to depletion of P stores in the lake in about 60 yr.
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840. Performance of a recirculating wetland filter designed to remove particulate phosphorus for restoration of Lake Apopka (Florida, USA).

Coveney, M. F.; Lowe, E. F.; and Battoe, L. E. *Water Science and Technology* 44(11-12): 131-136. (2001)
NAL Call #: TD420.A1P7; ISSN: 0273-1223.

Notes: Conference: 7th International Conference on Wetland Systems for Water Pollution Control 2000, Lake Buena Vista, FL [USA], 11-16 Nov 2000; Issue editors: Kadlec, R. H. and Reddy, K. R.; ISBN: 1843394073
Descriptors: USA, Florida, Apopka L./ water quality control/

lake restoration/ recirculated water/ phosphorus removal/ particulate matter/ feasibility studies/ performance evaluation/ model studies/ optimization/ recycled water/ particles/ environment management/ lake reclamation/ eutrophic lakes/ eutrophication/ pollution effects/ particulate organic phosphorus/ pollution control/ filters/ water filtration/ recirculating systems/ performance assessment/ lakes/ hydrology/ environmental restoration/ water pollution control/ artificial wetlands/ treatment wetlands/ water quality control/ water treatment/ prevention and control/ freshwater pollution/ water pollution: monitoring, control and remediation

Abstract: Operation of a 14-km super(2) wetland filter for removal of total phosphorus (TP) from lake water is part of the restoration program for hypereutrophic Lake Apopka, Florida. This system differs from most treatment wetlands because 1) water is recirculated back to the lake, and 2) the goal is removal of particulate phosphorus (P), the dominant form of P in Lake Apopka. The operational plan for the wetland is maximization of the rate rather than the efficiency of P removal. The St. Johns River Water Management District operated a 2-km super(2) pilot-scale wetland to examine the capacity of a wetland system to remove suspended solids and particulate nutrients from Lake Apopka. TP in the inflow from Lake Apopka ranged from about 0.12 to 0.23 mg l super(-1), and hydraulic loading rate (HLR) varied from 6.5 to 42 m yr super(-1). The performance of the pilot-scale wetland supported earlier predictions. Mass removal efficiencies for TP varied between about 30% and 67%. A first-order, area-based model indicated a rate constant for TP removal of 55 m yr super(-1). We compared actual removal of P with model predictions and used modeled performance to examine optimal operational conditions. Correspondence between observed and modeled outflow TP was not good with constant variable values. Monte Carlo techniques used to introduce realistic stochastic variability improved the fit. The model was used to project a maximal rate of P removal of about 4 g P m super(-2) yr super(-1) at P loading 10-15 g P m super(-2) yr super(-1) (HLR 60-90 m yr super(-1)). Data from the pilot wetland indicated that actual rates of P removal may prove to be higher. Further operation of the wetland at high hydraulic and P loading rates is necessary to verify or modify the application of the model.
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841. Phosphorus removal from Everglades agricultural area runoff by submerged aquatic vegetation/Limerock treatment technology: An overview of research.

Gu, B.; Debusk, T. A.; Dierberg, F. E.; Chimney, M. J.; Pietro, K. C.; and Aziz, T. *Water Science and Technology* 44(11-12): 101-108. (2001)
NAL Call #: TD420.A1P7; ISSN: 0273-1223.

Notes: Conference: 7th International Conference on Wetland Systems for Water Pollution Control 2000, Lake Buena Vista, FL [USA], 11-16 Nov 2000; Issue editors: Kadlec, R. H. and Reddy, K. R.; ISBN: 1843394073
Descriptors: United States, Florida, Everglades/ water pollution control/ nonpoint pollution sources/ agricultural runoff/ advanced wastewater treatment/ phosphorus removal/ submerged plants/ accumulation/ feasibility studies/ experimental data/ performance evaluation/ pollution (nonpoint sources)/ runoff (agricultural)/ advanced treatment/ aquatic macrophytes/ aquatic plants/ vegetation/ lime/ macrophytes/ artificial wetlands/ water quality control/

water treatment/ freshwater pollution/ water pollution:
monitoring, control & remediation

Abstract: The 1994 Everglades Forever Act mandates the South Florida Water Management District and the Florida Department of Environmental Protection to evaluate a series of advanced treatment technologies to reduce total phosphorus (TP) in Everglades Agricultural Area runoff to a threshold target level. A submerged aquatic vegetation/limerock (SAV/LR) treatment system is one of the technologies selected for evaluation. The research program consists of two phases. Phase I examined the efficiency of SAV/LR treatment system for TP removal at the mesocosm scale. Preliminary results demonstrate that this technology is capable of reducing effluent TP to as low as 10 $\mu\text{g/L}$ under constant flows. The SAV component removes the majority of the influent soluble reactive P, while the limerock component removes a portion of the particulate P. Phase II is a multi-scale project (i.e., microcosms, mesocosms, test cells and full-size wetlands). Experiments and field investigations using various environmental scenarios are designed to (1) identify key P removal processes; (2) provide management and operational criteria for basin-scale implementation; and (3) provide scientific data for a standardized comparison of performance among advanced treatment technologies.
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842. Phosphorus retention and soil organic carbon in restored and natural freshwater wetlands.

Hogan, D. M.; Jordan, T. E.; and Walbridge, M. R.

Wetlands 24(3): 573-585. (Sept. 2004)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ soil/ sorption/ phosphorus/ soil chemistry/ carbon/ soil properties/ freshwater environments/ restoration/ forests/ aquatic plants/ nitrogen/ nutrients (mineral)/ pH/ soils/ inland water environment/ chemical properties/ physical properties/ total organic carbon/ organic carbon/ water quality/ capacity/ retention/ density/ nutrients/ hydrogen ion concentration/ clays/ USA, Maryland, Kent Island/ reclamation/ habitat community studies/ conservation, wildlife management and recreation/ chemical processes

Abstract: Nutrient (e.g., phosphorus) retention is an important function of wetlands that can improve water quality. We examined soil physical and chemical characteristics and phosphorus (P) sorption capacities in three recently restored herbaceous wetlands (RWs) on previously cultivated soils and three adjacent natural forested wetlands (NWs) on Kent Island, Maryland, USA. Our objective was to compare P retention in these two wetland types. As hypothesized, NW soils differed fundamentally in soil chemistry and had significantly higher total organic carbon (TOC) contents than RW soils (5.7 plus or minus 1.7% vs. 1.2 plus or minus 0.1%, respectively, $p < 0.05$). A number of soil properties (bulk density, pH, labile organic and microbial P, total N, and total N: total P ratios) differed between natural and restored wetlands, as expected from the differences in TOC. Concentrations of pyrophosphate-extractable (organically-bound) Al (Alp) were an order of magnitude larger in NW than in RW soils (2099.1 plus or minus 365.5 vs. 767.0 plus or minus 194.7 kg/ha , respectively). Although past studies have suggested that higher concentrations of organically-bound Al can enhance P sorption, P-sorption capacities were significantly greater in the RW soils, likely due to differences in soil

chemistry. In the RWs, 15 soil chemical parameters were significantly correlated with P sorption (based on single factor regression), including residual Al, oxalate-extractable Al and Fe, clay, HCl-extractable Fe and pyrophosphate-extractable Fe ($r^2 = 0.90, 0.89, 0.87, 0.85, 0.83$ and 0.82 , respectively). In contrast, P sorption in the NWs was correlated only with Alp ($r^2 = 0.68$). As restored wetland soils are likely in transition from a non-hydric to a hydric state, they should be reevaluated periodically to determine the ultimate effects of this transition on their capacity to retain P.

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843. Phosphorus-sorption characteristics of calcareous soils and limestone from the southern Everglades and adjacent farmlands.

Zhou, Meifang and Li, Yuncong

Soil Science Society of America Journal 65(5):

1404-1412. (2001)

NAL Call #: 56.9 So3; ISSN: 0361-5995

Descriptors: soil science/ Langmuir isotherm/ farmland/ fertilizer management/ pineland/ wetland

Abstract: The understanding of P sorption and desorption by soils is important for safeguarding water quality and for fertilizer management. Little is known about the P-sorption characteristics of the calcareous soils and limestone bedrocks in southern Florida. In this study, 19 samples of calcareous soil and subsurface limestone bedrock were collected from the southern Everglades wetland, pineland, and nearby farmland. At very low P concentrations, P sorption in these soils fit the linear isotherm. The equilibrium P concentration at zero-net P sorption (EPCo) of soils correlated positively with P saturation. Phosphorus-sorption data of soils at medium P concentrations fit the Freundlich and Langmuir equations up to a point at high P concentrations where the slope of the isotherm changed abruptly. In bedrock samples the sorption-isotherm-inflection point, which is caused by P precipitation, occurred at much lower solution P concentrations than in the case of soils (4-18 vs. 400-600 mg mL^{-1}). Also bedrock samples had significantly lower Freundlich values, Kf, than soils. The sorption of P in soils occurred at relatively low solution P concentrations (as indicated by Freundlich value, Kf), and appears to be caused by strong affinity of the noncarbonate clay, while the P sorption at relatively high solution concentrations (as indicated by Langmuir maximum sorption, Smax) appears to be caused by the affinities of both the noncarbonate clay and carbonate clay. Phosphorus-sorption values (P_{sorption}) estimated from the one-point isotherm were comparable with the Smax values calculated from the Langmuir isotherm. Phosphorus saturation and the P-retention capacities (Smax or P_{sorption}) were correlated strongly to the percentage of P desorption.
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844. Phosphorus storage and release in response to flooding: Implications for Everglades stormwater treatment areas.

Newman, S. and Pietro, K.

Ecological Engineering 18(1): 23-38. (Oct. 2001)

NAL Call #: TD1.E26; ISSN: 0925-8574

Descriptors: wetlands/ phosphorus/ environmental restoration/ nutrient uptake/ water flow/ agricultural land/ storm runoff/ water pollution control/ artificial wetlands/ ecosystems/ sediment-water interfaces/ nutrient removal/

organic soils/ water quality/ data collections/ storage/ flooding/ stormwater runoff/ agricultural runoff/ nitrogen/ nutrients/ water management/ nutrients (mineral)/ restoration/ environment management/ soils/ uptake/ USA, Florida/ USA, Florida, Everglades/ reclamation/ water quality control/ freshwater pollution/ chemistry of suspended matter/ characteristics, behavior and fate/ general environmental engineering

Abstract: As part of the Everglades restoration program, 16 000 ha of constructed wetlands will be reestablished on land presently in agricultural production. These wetlands will be used to remove Phosphorus (P) from agricultural runoff before it enters the Everglades. Histosols, organic soils, are the predominant soil type in the Everglades Agricultural Area (EAA), and the conversion of these soils from drained to flooded conditions has important implications for P storage. Phosphorus storage in organic soils has been shown to be both positively and negatively affected by anaerobic conditions. In this study, P storage and release was followed in a 146 ha area during its conversion from farmland to wetland. The development of a productive biological community, as evidenced by strong diel dissolved O₂ and pH cycles, occurred within 3 weeks of flooding at one site and 2 months at a second site. This biological community was considered influential in maintaining the low concentrations of both N and P in the water column relative to soil porewater concentrations. Maximum total P (TP) and total Kjeldahl N (TKN) concentrations of 0.3 and 5 mg l⁻¹, respectively, were recorded in the water column following flooding. These concentrations declined to background levels within 2-3 months. Soil porewater TP and total dissolved Kjeldahl N (TDKN) concentrations increased to maxima of 4 and 24 mg l⁻¹, respectively, 2 months following flooding. Nutrient profiles across the soil-water interface were used to estimate flux rates. Calculated NH₄⁺-N flux rates ranged between 0.18 and 0.74 μg cm⁻² d⁻¹ and P fluxes ranged between 0.03 and 0.15 μg cm⁻² d⁻¹. Phosphorus fluxes from the soil to the overlying water are a function of the mobility of different P fractions.

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845. Plant colonization after complete and partial removal of disturbed soils for wetland restoration of former agricultural fields in Everglades National Park.

Dalrymple, G. H.; Doren, R. F.; O'Hare, N. K.; Norland, M. R.; and Armentano, T. V.

Wetlands 23(4): 1015-1029. (Dec. 2003)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ environmental restoration/ agricultural ecosystems/ conservation/ national parks/ soil characteristics/ soils/ colonization/ aquatic plants/ nature conservation/ environment management/ flooding/ canopies/ introduced species/ fire/ agriculture/ chemical fertilizers/ herbicides/ restoration/ pesticides/ land reclamation/ substrates/ Hydrophytes/ agricultural chemicals/ nutrients/ fertilizers/ testing procedures/ Schinus terebinthifolius/ USA, Florida/ USA, Florida, Everglades Natl. Park/ Brazil peppertree/ reclamation/ habitat community studies/ conservation, wildlife management and recreation/ techniques of planning

Abstract: The Hole-in-the-Donut is a 4000-ha region of former farmlands within Everglades National Park that is dominated by a monoculture of the non-indigenous pest

plant *Schinus terebinthifolius* (Brazilian pepper). Prior to extensive farming in the region, the area consisted of short hydroperiod graminoid wetlands and mesic pine savannah. Rock plowing in preparation of these lands for farming created an artificial soil layer that broke up the limestone substrate, mixed and aerated the native marl soil layer with the broken limestone, and elevated the surface slightly. Farming practices also included the use of chemical fertilizers and pesticides. The modified soil substrate quickly became dominated by *S. terebinthifolius* when farming ceased in 1975, despite efforts to control its establishment, such as prescribed fire, herbicide treatment, and mowing. Preliminary evidence indicated that soil removal would prevent re-invasion by *S. terebinthifolius* and could lead to colonization by native wetlands plants. Two trials, a partial soil removal (PSR) and a complete soil removal (CSR), were performed on a pilot test site beginning in 1989 to determine whether all or only a portion of this modified soil substrate needed to be removed to attain desired results. Removal of rock-plowed surface material lowered elevation in both treatments. While the PSR treatment did show an increase in the number and coverage of hydrophytes for a few years, it did not prohibit re-colonization and re-establishment of a canopy of *S. terebinthifolius*, and by 1996, the site was again dominated by a monoculture of *S. terebinthifolius*. By contrast, the CSR treatment showed rapid colonization by hydrophytes and no successful re-colonization by *S. terebinthifolius*. Lowering elevations by 15 to 45 cm allowed for longer periods of flooding and rapid colonization by hydrophytes on both sites. After the sites were cleared, the average difference in elevation between the two treatment areas was less than a tenth of a meter, but this resulted in a slightly shorter hydroperiod on the PSR site. The small amount of residual rock-plowed soil with high levels of nutrients, along with its slightly shorter hydroperiod on the PSR site, appear to have contributed significantly to the success of *S. terebinthifolius* in re-colonizing this treatment area.

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846. Quantifying time-varying ground-water discharge and recharge in wetlands of the northern Florida Everglades.

Choi, Jungyill and Harvey, Judson W.

Wetlands 20(3): 500-511. (2000)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: mathematical biology: computational biology/ freshwater ecology: ecology, environmental sciences/ Everglades nutrient removal project/ agricultural drainage/ chemical budget/ constructed wetland/ ground water discharge/ ground water recharge/ mass balance/ time varying ground water discharge/ time varying ground water recharge/ water budget

Abstract: Developing a more thorough understanding of water and chemical budgets in wetlands depends in part on our ability to quantify time-varying interactions between ground water and surface water. We used a combined water and solute mass balance approach to estimate time-varying ground-water discharge and recharge in the Everglades Nutrient Removal project (ENR), a relatively large constructed wetland (1544 hectare) built for removing nutrients from agricultural drainage in the northern Everglades in South Florida, USA. Over a 4-year period (1994 through 1998), ground-water recharge averaged 13.4

hectare-meter per day (ha-m/day) or 0.9 cm/day, which is approximately 31% of surface water pumped into the ENR for treatment. In contrast, ground-water discharge was much smaller (1.4 ha-m/day, or 0.09 cm/day, or 2.8% of water input to ENR for treatment). Using a water-balance approach alone only allowed net ground-water exchange (discharge - recharge) to be estimated (-12 +/- 2.4 ha-m/day). Discharge and recharge were individually determined by combining a chloride mass balance with the water balance. For a variety of reasons, the ground-water discharge estimated by the combined mass balance approach was not reliable (1.4 +/- 37 ha-m/day). As a result, ground-water interactions could only be reliably estimated by comparing the mass-balance results with other independent approaches, including direct seepage-meter measurements and previous estimates using ground-water modeling. All three independent approaches provided similar estimates of average ground-water recharge, ranging from 13 to 14 ha-m/day. There was also relatively good agreement between ground-water discharge estimates for the mass balance and seepage meter methods, 1.4 and 0.9 ha-m/day, respectively. However, ground-water-flow modeling provided an average discharge estimate that was approximately a factor of four higher (5.4 ha-m/day) than the other two methods. Our study developed an initial understanding of how the design and operation of the ENR increases interactions between ground water and surface water. A considerable portion of recharged ground water (73%) was collected and returned to the ENR by a seepage canal. Additional recharge that was not captured by the seepage canal only occurred when pumped inflow rates to ENR (and ENR water levels) were relatively high. Management of surface water in the northern Everglades therefore clearly has the potential to increase interactions with ground water.

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847. Restoration of a south Florida forested wetland.

Weller, J. D.

Ecological Engineering 4(2): 143-151. (1995)

NAL Call #: TD1.E26; ISSN: 0925-8574.

Notes: Special issue: Restoration and Creation of Wetlands.

Descriptors: wetlands/ environmental restoration/ forests/ land use/ drainage/ ecosystem disturbance/ ecosystem management/ nature conservation/ swamps/ hydrology/ surface water/ groundwater recharge/ groundwater/ habitat improvement/ vegetation cover/ water control/ USA, Florida/ water control

Abstract: A rewatering project conducted at Fern Forest Nature Center in Pompano Beach, Florida, USA, has rejuvenated and restored an area of south Florida forested wetland to its pre-drainage condition in three years. Through the removal of undesirable vegetation such as Brazilian pepper (*Schinus terebinthifolius*) and the re-introduction of water, the following have been accomplished: increase in surfacewater duration time; elevation of groundwater by 70 to 84 cm; rejuvenation of a depressed forested wetland, a deciduous hardwood swamp, and an emergent wetland; and enhancement of a wading bird habitat, a cypress dome, and 3.2 km of shallow stream bed (1.5 m deep or less). These accomplishments have assured the survival of the park's 34 rare and endangered fern species and encouraged the natural return of 16 wetland bird species, 8 fish species, 6 species of

turtles, 6 species of snakes, 5 snails, 2 frog species, and even the American alligator (*Alligator mississippiensis*).

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848. Restoration of pitcher plant bogs in eastern Texas, USA.

Mize, R.; Evans, R. E.; Macroberts, B. R.; Macroberts, M. H.; and Rudolph, D. C.

Natural Areas Journal 25(2): 197-201. (2005)

NAL Call #: QH76.N37; ISSN: 0885-8608

Descriptors: bogs/ environmental restoration/ fires/ soil/ conservation/ revegetation/ succession/ *Sus scrofa*/ USA, Texas/ pig

Abstract: Pitcher plant bogs, also referred to as hillside seepage bogs or hillside bogs, are extremely restricted on the West Gulf Coastal Plain. The number and extent of extant bogs is in the low hundreds, comprising no more than a few thousand hectares of habitat. These bogs support a large number of plant species of significant conservation concern. Threats to existing bogs include: land use changes, silvicultural impacts, fire scarcity, vehicle damage, negative feral hog (*Sus scrofa*) impact, and ground water regime alterations. Two pitcher plant bogs on the Angelina National Forest were subjected to severe damage from vehicular impacts that eliminated herbaceous vegetation, disturbed the soil to substantial depths, and initiated severe erosion. A restoration effort that replaced lost soil, reduced erosion, and allowed subsequent revegetation was implemented. Approximately four years post-treatment, bogs are intact, soil erosion is controlled, revegetation is complete or progressing, and at least some species of conservation concern are present in the revegetated areas. These restoration projects have demonstrated that degraded pitcher plant bogs that have suffered severe damage due to vehicular impacts can be substantially restored if sufficient resources are available. However, pitcher plant bogs on the West Gulf Coastal Plain continue to be threatened by uncontrolled off-road vehicles and other impacts. The most insidious threat may be the widespread lack of sufficient fire required to preclude or reverse succession to communities dominated by woody vegetation and the subsequent loss of the herbaceous bog species.

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849. Restoration of wetland vegetation on the Kissimmee River floodplain: Potential role of seed banks.

Wetzel, P. R.; Van Der Valk, A. G.; and Toth, L. A.

Wetlands 21(2): 189-198. (June 2001)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ vegetation/ rivers/ flood plains/ drainage/ pastures/ shrubs/ species composition/ seed banks/ environmental restoration/ plant communities/ seeds/ vegetation cover/ aquatic plants/ restoration/ *Juncus effusus*/ *Plantae*/ USA, Florida, Kissimmee R./ seed banks/ restoration/ broadleaf marsh/ reclamation/ habitat community studies/ ecological impact of water development

Abstract: The composition of seed banks of areas on the drained Kissimmee River floodplain (Florida, USA) that are currently pasture and formerly had been wet prairie, broadleaf marsh, and wetland shrub communities was compared to that of seed banks of areas that have extant stands of these communities. The species composition of the seed banks of existing wet prairie and former wet prairie

sites were the most similar, with a Jaccard index of similarity of 55. Existing and former broadleaf marsh and wetland shrub communities had Jaccard indices of 38 and 19, respectively. Although existing and former wet prairie seed banks had nearly the same species richness, species richness at former broadleaf marsh and wetland shrub sites was higher than at existing sites. Mean total seed densities were similar in existing and former wet prairies (700 to 800 seeds m²). However, seed densities in former broadleaf marsh and wetland shrub sites were significantly greater than in comparable existing communities (>4,900 seeds m²) at former sites versus 200 to 300 in existing communities). The higher seed densities in former broadleaf marsh and wetland shrub sites was due to over 4,000 seeds m² of *Juncus effusus* in their seed banks. Half of the species that characterize wet prairies were found in the seed banks at former and existing wet prairie sites. At existing broadleaf marsh and wetland shrub sites, most of the characteristic species were found in their seed banks. However, only one characteristic broadleaf species was found in the seed banks of the former broadleaf marsh sites, and no characteristic wetland shrub species were found in the seed banks of the former wetland shrub sites. The seeds of only two non-indigenous species were found in the seed banks of former wetland communities at very low densities. For all three vegetation types, but particularly for the broadleaf marsh and wetland shrub sites, re-establishment of the former vegetation on the restored floodplain will require propagule dispersal from off-site sources.

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850. Seasonal dynamics of bird assemblages in a Texas estuarine wetland.

Weller, Milton W.

Journal of Field Ornithology 65(3): 388-401. (1994)

NAL Call #: 413.8 B534; ISSN: 0273-8570

Descriptors: management strategy/ species richness

Abstract: Bird species richness and seasonality were sampled in diverse habitats of an estuarine wetland complex of San Bernard National Wildlife Refuge on the mid-Texas coast. Observations made between 1985 and 1991 included all months, and form a composite annual view; 121 species were recorded, with 54 taxa identified in 1 mo. Only 23 species occurred regularly over a series of months, and their patterns of wetland use varied markedly by species and season. The wetland complex served different functions for different species, but most used the area for migration stops and wintering. Eleven species were considered breeders in the brackish marsh, but another 33 species probably nested in nearby freshwater wetlands, coastal islands or in shrubs or small trees, and fed or rested in the marsh. Such coastal areas are used by birds year-round and, in addition to protection, need management strategies to ensure habitat diversity and normal water regimes which will maintain natural bird diversity and serve all species for different life stages.

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851. Shrimp farms' effluent waters, environmental impact and potential treatment methods.

Samocha, T. M. and Lawrence, A. L.

In: 24th U.S.-Japan Aquaculture Panel Symposium, TAMU-SG-97-102/ Keller, B. J.; Park, P. K.; McVey, J. P.; Takayanagi, Kazufumi; and Hosoya, Kazumi, 1997.

Notes: Conference: 24. U.S.-Japan Aquaculture Panel Symp., Corpus Christi, TX (USA), 8-10 Oct 1995

Descriptors: wetlands/ aquaculture effluents/ environmental impact/ wastewater aquaculture/ wastewater treatment/ shrimp culture/ aquaculture regulations/ aquaculture enterprises/ pond culture/ aquaculture techniques/ USA, Texas/ shellfish culture

Abstract: Texas has a 2280 km (1,425 mile) coastline and vast amount of coastal land which is not suitable for traditional agriculture crops. This land can be used for the development of a shrimp farming industry with an estimated value of \$100 million or greater within the next 10 yr. However, this industry will face restrictions from regulatory agencies that will limit future growth and may even reduce the present production level of shrimp in Texas. The concern of the agencies lies with the emission of effluent water generated by shrimp farms. In an effort to reduce the potential negative impact on coastal waters, current regulation by the Texas Natural Resources Conservation Commission (TNRCC) requires effluent water from shrimp farms to meet standards set for municipal and industrial wastewaters. Preliminary effluent characterization of three farms in south Texas suggests that in two farms, the total suspended solids (TSS) and ammonia (NH sub(3)-N) levels were higher than the standards set by TNRCC. The TSS and five-day carbonaceous biochemical oxygen demand (CBOD sub(5)) for the third farm were higher than the required standards. Coagulation methods, although effective in decreasing inorganic effluent TSS level, were cost-prohibitive and not adequate for ammonia and algal removal. A research team from Texas Agricultural Experiment Station, Texas Agricultural Extension Service, Texas A&M University-Kingsville (TAMU-Kingsville), Texas A&M University-Corpus Christi and The University of Texas-San Antonio is currently working with the shrimp producers to evaluate potential methods to improve effluent water quality. Studies were initiated to develop alternative feeding and pond management practices including reduction in pond water exchange rates. Development of a low protein, low pollution diet with higher nitrogen and phosphorus digestibility is another promising option to decrease effluent nutrient loads. Circulating effluent waters via settling basins, bivalves and seaweed beds, and constructed wetlands are another potential alternative to give the shrimp farmers cost-effective effluent treatment methods. Due to the recent Taura virus disease outbreak in south Texas, only initial evaluation of the above effluent treatment strategies was carried out during the 1995 season.

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852. Species selection trials and silvicultural techniques for the restoration of bottomland hardwood forests.

McLeod, K. W.

Ecological engineering 15(Suppl. 1): S35-S46. (Sept. 2000)

NAL Call #: TD1.E26; ISSN: 0925-8574

Descriptors: wetlands/ environmental restoration/ silviculture/ forests/ trees/ flooding/ swamps/ USA, South Carolina/ habitat improvement (biological)/ vegetation cover/ flood plains/ ecosystem management/ transplantation/ *Fraxinus pennsylvanica*/ *Carya aquatica*/ USA, South Carolina/ green ash/ water hickory/ reclamation/ protective measures and control

Abstract: Since 1990, a series of experiments has examined the appropriateness of 24 tree species for

restoring a bottomland and swamp forest in the delta of Fourmile Branch in the coastal plain of South Carolina, USA. In addition, various silvicultural techniques used to maximize the survival of tree plantings, have been appraised for effectiveness. While the topographic relief on the delta is small (dm differences between most sites), it is sufficient to utilize woody species with different flood tolerances. Hence, a diverse forest community can be established, using these elevation differences. In the wettest sites where water persists virtually continuously and may be one to two meters deep during large flood events, only the most flood-tolerant species, such as *Taxodium distichum* and *Nyssa aquatica*, can survive. These species will also survive very well at higher elevations, because the permanent water table never fell below one meter deep. In sites that are not flooded, unless the entire swamp is flooded, several additional species can be used. These include *Fraxinus pennsylvanica*, *Carya aquatica*, and *Quercus lyrata*. Finally, in slightly higher areas, *Q. michauxii*, *Q. nuttallii* and *Q. phellos* would have adequate survival. To minimize herbivory and maximize survival, tree shelters should be used if herbivore pressure is high. The prime herbivore of concern is beaver. Thus, any plantings that are frequently flooded may require protection. Other silvicultural techniques, including fertilization and control of herbaceous and willow competition, were not essential to ensure growth and survival. Finally, survival of the least expensive planting stock, bare root saplings, was nearly as good as balled and burlapped stock. Thus, unless absolute maximal survival is required, bare root stock will produce good survival at a fraction of the cost. One critical characteristic of the bare root stock is height, which must exceed the flood depth during the growing season. In the case of the Fourmile Branch delta, this was at least 45-60 cm tall.

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853. Spectral reflectance patterns of wetland vegetation along a water quality gradient in a self-organizing mesohaline constructed wetland in south Texas (*Typha latifolia*, *Borrchia frutescens*).

Ahmed, M. 2001.

Texas A&M University, Kingsville

Notes: Degree: MS

Descriptors: wetlands/ light reflection/ salinity/ phosphorus/ ammonia/ nitrogen/ water quality/ vegetation cover/ shrimp fisheries/ man-induced effects/ aquaculture effluents/ *typha latifolia*/ *Borrchia frutescens*/ USA, Texas/ effects of aquaculture on the environment/ optical properties/ effects on organisms/ effects of aquaculture on the environment/ mechanical and natural changes

Abstract: This study investigated the relationship between the spectral reflectance patterns of wetland plant species (*Typha latifolia* (Cattail), *Borrchia frutescens* (Sea Oxeye)) and water quality parameters (salinity, total phosphorus, total ammonia and nitrogen) in a mesohaline constructed wetland that treated effluent from the Loma Alta Shrimp Aquaculture Facility, located 15 miles east of Raymondville, Texas. A field spectroradiometer [ASD Field Spec, UV/VNIR-Open Sky (300-1100nm)] was used to measure plant reflectance at locations corresponding to water quality sampling stations that were part of a water quality monitoring project. Water quality parameters were determined by USEPA accepted methods. The spectral reflectance of the plant species and the quality of water was

measured along the direction of flow in the wetland at 4 points. Spectral reflectance at specific wavelengths [blue (450nm), green (550nm), red (700nm) and near infrared (700-1100nm)] and indices derived from these wavelengths [Blue normalized difference vegetation index (NDVI), Green NDVI and Red NDVI] were related to water quality parameters for each species. (Abstract shortened by UMI.)
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854. Stability of phosphorus within a wetland soil following ferric chloride treatment to control eutrophication.

Sherwood, L. J. and Qualls, R. G.

Environmental Science and Technology 35(20): 4126-4131. (Oct. 2001)

NAL Call #: TD420.A1E5; ISSN: 0013-936X

Descriptors: wetlands/ water quality control/ eutrophication/ chemcontrol/ phosphorus removal/ iron compounds/ chemical precipitation/ sediment-water interfaces/ redox reactions/ water pollution control/ phosphorus/ agricultural runoff/ chemical treatment/ iron/ sediment-water interface/ soils/ aluminium compounds/ agricultural pollution/ restoration/ runoff (agricultural)/ USA, Florida, Everglades/ ferric chloride/ water quality control/ freshwater pollution/ protective measures and control/ water & wastewater treatment

Abstract: Addition of iron and aluminum compounds has become an increasingly popular method to regulate phosphorus eutrophication in lakes and reservoirs. It has been proposed that ferric chloride addition to agricultural runoff entering the northern Everglades could provide a means for enhancing natural mechanisms of phosphorus removal from the wetland. In this study we added ferric chloride to Everglades water spiked with super(32)PO sub(4), incubating the resulting precipitates in microcosms simulating the Everglades ecosystem. super(32)P activity and reduction-oxidation (redox) potentials were monitored to determine if the super(32)P was released into the overlying water column due to iron reduction. Results of redox potential measurements and super(32)P activity indicate that although reducing conditions exist in the soil, on average less than 1% of the added super(32)P was measured in the water column during the 139-day incubation. Ferric chloride addition thus might prove an effective means of long-term phosphorus retention in the Florida Everglades and perhaps other wetland systems.
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855. Success criteria and adaptive management for a large-scale wetland restoration project.

Weinstein, M. P.; Balletto, J. H.; Teal, J. M.; and Ludwig, D. F.

Wetlands Ecology and Management 4(2): 111-127. (1997)

Notes: Special issue: Hydrologic restoration of coastal wetlands

Descriptors: wetlands/ management planning/ photography/ dikes/ salt marshes/ land reclamation/ *Spartina*/ macrophytes/ water reclamation/ coastal zone management/ habitat improvement/ environmental restoration/ USA, Delaware/ USA, New Jersey, Delaware Bay/ habitat improvement/ USA, Delaware Bay

Abstract: We are using a 20+ year photographic history of relatively undisturbed and formerly diked sites to predict the restoration trajectories and equilibrium size of a 4,050 ha salt marsh on Delaware Bay, New Jersey (USA). The

project was initiated to offset the loss of finfishes from once-through cooling at a local power plant. We used a simple food chain model to estimate the required restoration size. This model assumed that annual macrophyte detritus production and benthic algal production resulted in production of finfishes, including certain species of local interest. Because the marsh surface and intertidal drainage system are used by many finfishes and are the focal points for exchange of detrital materials, the restoration planning focused on both vegetational and hydrogeomorphological parameters. Recolonization by *Spartina* spp. and other desirable taxa will be promoted by returning a natural hydroperiod and drainage configuration to two types of degraded salt marsh: diked salt hay (*Spartina patens*) farms and brackish marsh dominated by *Phragmites australis*. The criteria for success of the project address two questions: What is the "bound of expectation" for restoration success, and how long will it take to get there? Measurements to be made are macrophyte production, vegetation composition, benthic algal production, and drainage features including stream order, drainage density, channel length, bifurcation ratios and sinuosity. A method for combining these individual parameters into a single success index is also presented. Finally, we developed adaptive management thresholds and corrective measures to guide the restoration process.

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856. Surmounting the engineering challenges of Everglades restoration.

Goforth, G. F.

Water Science and Technology 44(11-12): 295-302. (2001)

Notes: Conference: 7th International Conference on Wetland Systems for Water Pollution Control 2000, Lake Buena Vista, FL [USA], 11-16 Nov 2000; Issue editors: Kadlec, R. H. and Reddy, K. R.; ISBN: 1843394073

Descriptors: water pollution control/ storm runoff/ artificial wetlands/ phosphorus removal/ environmental engineering/ design criteria/ case studies/ environmental protection/ rehabilitation/ runoff/ engineering/ design data/ case study/ pollution control (environmental)/ renovation/ restoration/ environment management/ ecosystem management/ water quality control/ pollution control/ nutrients (mineral)/ phosphorus/ stormwater runoff/ eutrophication/ river engineering/ environmental restoration/ nutrient loading/ hydrology/ USA, Florida, Everglades/ water treatment/ conservation, wildlife management and recreation/ freshwater pollution/ water pollution: monitoring, control and remediation/ prevention and control

Abstract: The South Florida Water Management District, in partnership with other agencies and stakeholders, is undertaking one of the world's largest ecosystem restoration programs. The foundation of the nutrient control program for the Everglades is a set of six large constructed wetlands, referred to as Stormwater Treatment Areas (STAs). The initial treatment goal is to reduce phosphorus entering the Everglades to 50 parts per billion. The STAs comprise almost 17,000 hectares with a capital cost of approximately \$700 million. Approximately 4,720 hectares are currently operational, another 2,600 hectares are in the start-up phase, and construction is just getting under way on the remaining areas. Throughout the design process, engineers and scientists collaborated to capture the best available information on wetland treatment systems, and to develop the most appropriate design criteria. Some of the

more challenging issues included characterizing stormwater inflows and phosphorus loads, determining appropriate nutrient removal performance characteristics, and estimating hydraulic design parameters relating to densely vegetated systems. The design process combined in-house staff with engineering consultants, construction contractors, external review groups and independent peer-review. This paper summarizes major design aspects and key assumptions, and sets the stage for addressing future challenges associated with achieving long-term water quality goals of Everglades restoration.

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857. Toxicological evaluation of constructed wetland habitat sediments utilizing *Hyalella azteca* 10-day sediment toxicity test and bacterial bioluminescence.

Steevens, J. A.; Vansal, S. S.; Kallies, K. W.; Knight, S. S.; Cooper, C. M.; and Benson, W. H.

Chemosphere 36(15): 3167-3180. (June 1998)

NAL Call #: TD172.C54; ISSN: 0045-6535

Descriptors: toxicity tests/ agricultural runoff/ pesticides/ erosion/ indicator species/ underwater habitats/ pollution control/ sediment contamination/ toxicity/ habitats/ bioassay/ interstitial water/ water pollution effects/ sediments/ artificial wetlands/ toxicity testing/ bioassays/ agricultural practices/ pore water/ bacteria/ luminescence/ habitat/ *Hyalella azteca*/ methods and instruments/ network design/ toxicity testing/ toxicology and health

Abstract: A toxicological evaluation was conducted on wetland habitats created as a result of run-off from agricultural areas. These temporary wetlands were created by using drop pipes as a means of reducing erosional cutting in agricultural fields. Toxicity bioassays utilizing bacterial bioluminescence and *Hyalella azteca* were used to assess sediment pore water and whole sediment, respectively. Inhibition of bacterial bioluminescence was initially used to determine relative toxicities of pore water from ten wetland sites. Constructed wetland sites were compared to the University of Mississippi Biological Field Station, a relatively pristine reference site. The *H. azteca* ten day sediment toxicity test was utilized to assess sediment from four selected sites using survival and growth as toxicological endpoints. Results from the toxicological evaluation, along with extensive ecological evaluations, were used to assess the best approach for implementation of temporary wetland habitats with existing agricultural practices.

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858. Treatment of swine wastewater using a saturated-soil-culture soybean and flooded rice system.

Szögi, A. A.; Hunt, P. G.; and Humenik, F. J.

Transactions of the ASAE 43(2): 327-336. (2000)

Descriptors: wetlands/ wastewater treatment/ rice/ crops/ soybeans/ livestock

Abstract: Constructed wetlands have potential for treatment of livestock wastewater, but they generally contain wetland plants rather than agronomic crops. We evaluated two agronomic crops, saturated-soil-culture (SSC) soybean and flooded rice, in a constructed wetland system used for swine wastewater treatment. Both crop production and treatment efficiency were evaluated from 1993 to 1996 in two 4-m x 33.5-m constructed wetland cells that were connected in series. The first cell contained SSC soybean - four cultivars planted in a randomized complete

block design with four replications. Flooded rice 'Maybelle' was planted in the second cell. From the first to fourth year, wastewater application rates were gradually increased to obtain rates of 2.0 to 8.8 and 0.5 to 2.2 kg ha super(-1) d super(-1) for total N and P, respectively. The best soybean grain and dry matter yields were 4.0 and 9.1 Mg ha super(-1), respectively. These were obtained with soybean 'Young' at the lowest wastewater application rate. Increasing total N loading rates and the associated higher NH sub(4)-N concentrations depressed soybean seed yield and dry matter production. On the other hand, both rice grain and dry matter production were stable over the application range; mean values were 4.0 and 10.9 Mg ha super(-1), respectively. Nutrient mass reductions were good; removal values increased linearly with loading rates ($y = 0.69N \text{ load} + 0.45$, $R \text{ super}(2) = 0.99$ and $y = 0.45P \text{ load} + 0.20$, $R \text{ super}(2) = 0.95$). At the highest loading rate, the system removed 751 and 156 kg ha super(-1) yr super(-1) N and P, respectively. It appears that the SSC soybean and flooded rice system could be useful for liquid manure management in confined livestock production. The system produced comparable treatment to systems with natural wetland plants; moreover, the soybean and rice are marketable crops. However, the flooded rice seems to be the more robust component for high wastewater application rates.

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859. Using historical records of land use to improve wetland mitigation.

Ewing, J. M.; Vepraskas, M. J.; and Zanner, C. W. *Southeastern Geographer* 45(1): 25-43. (2005);

Descriptors: Carolina bays/ historical records/ organic soils/ subsidence/ wetland mitigation

Abstract: Successful wetland mitigation is determined by goals and performance standards of a U.S. Army Corp of Engineers approved mitigation plan. This study collected and reviewed historical data for a mitigation site prior to construction to reduce the cost and risk of mitigation failure. Historical records were reviewed to evaluate the hydrology, vegetation, and soils of a drained Carolina bay wetland. Historical data were obtained from courthouse records, aerial photographs, personal interviews, the local Natural Resources Conservation Service, and the National Railroad Historical Society. Photographs and interviews indicated there was open water before drainage, suggesting a potential source of consistent hydrology. Organic soils subside when influenced by land clearance, drainage, and agricultural activities and could result in a water table above the soil surface once hydrology is restored. Aerial photographs show that several drainage systems have existed over the last 90 yr. Soils along the lines of the earlier drainage ditches and a former railroad line still show disturbance to depths of 1 m. These areas of disturbance could affect vegetation establishment. Records of agricultural practices suggest higher nutrient levels than those of undisturbed Carolina bays, indicating that undesired vegetation could compete with desired vegetation. Historical information verified that Juniper Bay is a viable restoration site and identified areas where design change could help improve chances for success. Similar historical reviews with other mitigation sites can help reduce cost and risk through evaluation of hydrology, soils, and vegetation.

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860. Vertebrate use of habitats created by installation of field-scale erosion control structures.

Cooper, C. M.; Smiley, P. C.; Wigginton, J. D.; Knight, S. S.; and Kallies, K. W.

Journal of Freshwater Ecology 12(2): 199-207. (June 1997) *NAL Call #:* QH541.5.F7J68; *ISSN:* 0270-5060

Descriptors: Vertebrata/ farming and agriculture/ agricultural field runoff control by drop pipe installation/ community structure/ habitat utilization/ semiaquatic habitat/ wetland habitats created by drop pipe installation in field/ community structures and habitat use survey/ Mississippi/ Panola County/ agriculture field runoff control by drop pipe installation/ created wetland habitats use and community structures

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861. Wetland buffer areas for treatment of pumped agricultural drainage water.

Chescheir, G. M.; Skaggs, R. W.; Gilliam, J. W.; and Broadhead, R. G.

In: Coastal water resources: Proceedings of a symposium held in Wilmington, North Carolina. Bethesda, Maryland: American Water Resources Association; 255-263; 1988. *NAL Call #:* TC401.A5 no.88-1

Descriptors: agricultural runoff/ coastal waters/ nutrients/ wastewater treatment/ wetland wastewater treatment/ field tests/ hydrologic properties/ model studies/ nitrates/ nitrogen/ phosphorus/ sediment load/ water pollution control/ water sampling/ water quality control/ wastewater treatment processes/ estuaries

Abstract: The hydrology and pollutant removal effectiveness of wetland buffer areas receiving agricultural drainage water are analyzed. Field experiments were conducted on two wetland buffer areas. During selected pumping events, water level measurements and water quality samples were taken over a network of stations. Automatic water samplers and water level recorders were used to monitor water quality and water table elevations between sampling events. Rhodamine dye studies were conducted to determine water velocities and wetland roughness coefficients. The hydrology of the buffer areas was simulated using a model for overland flow through vegetated areas. A routine was added to the model to calculate the residence time of the water on the wetland and to calculate the percent removal of nutrients and sediment. The water management model, DRAINMOD was used to determine the frequency and intensity of pumping events by calculating drainage and runoff volumes from the drained agricultural areas. Results from the two models compared well to the field data. It was found that pumping agricultural drainage water through wetland buffer areas will significantly reduce the concentration of sediments and other nutrients in the water before it reaches an outlet. The effectiveness of removing these pollutants can be increased by facilitating even distribution of the water over the buffer area with a diffuser canal. Lower water velocities were observed on the Laurel Bay buffer than on the Northwest Fork buffer. Of the two buffers, the Laurel Bay buffer was larger with less gradient and greater resistance to flow. Estimates of the percent of nutrient removal from the total mass of nutrient pumped onto the buffer over a 20 year period was 79% for total Kjeldahl nitrogen, 82% for nitrate nitrogen, 81% for total phosphorus, and 92% for sediment. (Author 's abstract)

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862. Wetland use by non-breeding ducks in coastal Texas, USA.

Anderson, James T.; Muehl, George T.; Tacha, Thomas C.; and Lobpries, David S.

Wildfowl 51: 191-214. (2000)

NAL Call #: SK351.W575; ISSN: 0954-6324

Descriptors: aquatic vegetation/ habitat use/ management priorities/ population density/ wetland types

Abstract: Wetland use by nonbreeding ducks in coastal Texas in the areas between Galveston Bay and the Rio Grande were studied, September 1991 to March 1993, to determine the most important wetland types based on density. Twenty-five species of ducks were observed using wetlands on a stratified (based on dominant land use) random sample of 64.75 ha (one-quarter section) plots. Ranks of density for all ducks, as a group, were highest in lacustrine littoral emergent nonpersistent wetlands. Anatini density ranks were greatest in wetlands with scrub-shrub vegetation, but individual species' ranks varied.

Dendrocygnini and Aythyini density ranks were highest in lacustrine littoral wetlands, particularly those with aquatic-bed vegetation. Ducks depend on a wide array of wetland types (including 48 of 82 available subclasses), and management should provide complexes of wetlands.

Management should concentrate on protecting, enhancing, and/or creating 15 of 1,201 wetland types occurring in the coastal plains of Texas that were prioritized for management actions. These wetlands were predominantly aquatic-bed, scrub-shrub, and unconsolidated substrate types.

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863. Winter feeding ecology of northern shovelers on freshwater and saline wetlands in south Texas.

Tietje, W. D. and Teer, J. G.

Journal of Wildlife Management 60(4): 843-855. (1996)

NAL Call #: 410 J827; ISSN: 0022-541X

Descriptors: wetlands/ foraging behavior/ food preferences/ activity patterns/ overwintering/ marshes/ salt marshes/ behavior/ aquatic birds/ feeding behaviour/ foods/ waterfowl/ USA, Texas, Welder Wildlife Refuge/ food organisms/ behavior/ *Anas clypeata*

Abstract: During October-May 1982-84, we compared food availability, food use, and gut morphology of northern shovelers (*Anas clypeata*) on coastal estuarine wetlands in South Texas and on several freshwater lakes 18 km inland to evaluate the relative importance of estuarine versus freshwater habitats. Of 3 seasons and 3 times of day examined, shovelers spent more time feeding in saltwater than freshwater during early winter ($P = 0.005$) and afternoon ($P = 0.005$). Available biomass of plankton, nekton, and seeds was greater ($P < 0.001$) in freshwater than saltwater. Animal foods composed 80% of the saltwater compared to 50% of the freshwater diet. Although plankton composed similar ($P = 0.56$) proportions of the freshwater and saltwater diets, shovelers ingested more vegetation ($P < 0.001$) in freshwater and more nekton ($P < 0.001$) in saltwater. A preference assessment of 8 taxa of shoveler animal foods ranked plankton first and freshwater shrimp (*Palaemonetes* spp.) last in both habitats. Shoveler intestines were heavier in freshwater during 1982-83 ($P < 0.001$), but heavier in saltwater ($P = 0.048$) in 1983-84. During midwinter, shoveler intestines were longer ($P = 0.0044$) and gizzards were heavier ($P < 0.001$) in saltwater than freshwater. Overall, ceca mass ($P < 0.001$) and length ($P < 0.001$) were greater in freshwater. Food availability and gut morphology data suggest that freshwater wetlands were of higher quality than saltwater wetlands for wintering shovelers. Management of waterfowl habitats in the Texas Gulf Coastal Zone should emphasize protection of freshwater areas from saltwater intrusion and other development activities to maintain optimal wintering habitat for northern shovelers, and perhaps other waterfowl as well.

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High Plains Wetlands General Information

864. Aquatic macroinvertebrate diversity of playa wetlands: The role of landscape and island biogeographic characteristics.

Hall, D. L.; Willig, M. R.; Moorhead, D. L.; Sites, R. W.; Fish, E. B.; and Mollhagen, T. R.

Wetlands 24(1): 77-91. (2004)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ macrofauna/ species diversity/ biogeography/ community composition/ ecology/ fauna/ biodiversity/ aquatic organisms/ life history/ regression analysis/ USA, Texas/ USA, Texas, Southern High Plains/ landscape ecology/ island biogeography

Abstract: Wetland habitats continue to be lost at a unsettling rate, especially freshwater emergent wetlands that are isolated geographically. These are the predominant wetlands found in arid and semi-arid environments, where they serve as foci of regional biodiversity. This is especially true of the playa wetlands of the Southern High Plains of Texas, USA. The factors that determine and maintain biotic diversity in these wetlands are understood poorly.

Consequently, this study examined the effect of island biogeographic and landscape features on the diversity of aquatic macroinvertebrates in playa wetlands.

Macroinvertebrates were collected from playas three times during the spring and summer of 1994 and categorized as resident or transient taxa based on life history strategies.

Diversity was estimated using taxonomic richness (richness) and Fisher's log-series alpha (alpha).

Surrounding land-use practices influenced resident richness, whereas playa surface area affected resident and transient richness, as well as resident alpha. However, relationships differed among sampling dates. Regression analyses suggested that transient richness and alpha were influenced more by insular characteristics than by landscape features. The converse was true for resident richness and alpha. Therefore, both insular and landscape characteristics affected the diversity of macroinvertebrates in playa wetlands, but impacts were dependent on life-history strategy and time since inundation (i.e., sampling date). Consequently, conservation and management efforts targeting macroinvertebrates in playa wetlands will need to focus on the wetlands and characteristics of adjacent watershed features.

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865. Behavior of migrant shorebirds in playas of the Southern High Plains, Texas.

Davis, Craig A. and Smith, Loren M.

Condor 100(2): 266-276. (1998)

NAL Call #: QL671.C6; ISSN: 0010-5422

Descriptors: activity budget/ fall/ feeding/ playas/ sleeping/ spring

Abstract: Playas in the Southern High Plains (SHP) are important for migrant shorebirds, but the functional role of playas to migrant shorebirds is not clearly understood. We conducted diurnal time-activity budgets on American Avocets (*Recurvirostra americana*), Long-billed Dowitchers (*Limnodromus scolopaceus*), Least Sandpipers (*Calidris minutilla*), and Western Sandpipers (*C. mauri*) in spring and fall 1993 and 1994 in 69 play as on the SHP of Texas. During both seasons, Least and Western Sandpipers spent

70-80% of their time feeding. Long-billed Dowitchers spent 77% of their time feeding in spring, but spent more time sleeping and less feeding in fall. American Avocets spent 41-50% of their time feeding and 34-40% of their time sleeping during each season. All four species spent minimal time engaged in locomotion, body maintenance, alert, and aggressive behaviors. American Avocets and Long-billed Dowitchers fed most during the midday and late periods and slept most during the early period. Least Sandpipers fed most during the early period, whereas feeding activities of Western Sandpipers remained 70-80% throughout the day. Each of these species use different behavioral strategies in response to such factors as migration distances, energetic needs, differential predation, nocturnal foraging, and diet. Playas appear to serve as important intermediate stopover sites for shorebirds during migration.

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866. Breeding ducks and their habitats in the High Plains of Texas.

Ray, James D.; Sullivan, Brian D.; and Miller, Harvey W.

Southwestern Naturalist 48(2): 241-248. (2003)

NAL Call #: 409.6; ISSN: 0038-4909

Descriptors: roadside survey: applied and field techniques/ central flyway/ breeding areas/ impoundments: habitat/ occupancy rates/ playa lakes: habitat/ ponds: habitat/ species density

Abstract: The High Plains of Texas is one of the southernmost nontraditional breeding areas for many duck species in North America. Because of a paucity of information on breeding ducks there, we conducted roadside surveys of breeding ducks and their habitats during May and June from 1988 through 1992. Breeding pairs of 15 species were observed on 6 types of ponds (natural and man-made wetlands containing surface water). Mallard (*Anas platyrhynchos*) density ranged from 9.1 to 23.1 pairs/100 km², and density for all species combined ranged from 14.8 to 46.7 pairs/100 km² (all years and survey periods included). Occupancy rates were highest on playa lakes and impoundments, though all pond types had occupancy rates exceeding 26% (all surveys and years). Duck pairs per occupied pond were highest on playa lakes (>7 and >4 on May and June surveys, respectively), followed by impoundments (> 5 and > 2) and entrenched draws (>2 and >3). Although the density of breeding pairs in the High Plains of Texas (47 pairs/100 km²) is generally lower than in prominent nesting areas (e.g., >200 in the San Luis Valley, CO; >600 in central Montana; >2,000 in California; >4,000 in the Prairie Pothole Region), information reported here further confirms the use of the Playa Lakes Region by breeding ducks and illustrates its importance as a major habitat area for waterfowl in the Central Flyway.

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867. Composition of seed banks along an elevational gradient in playa wetlands.

Haukos, D. A. and Smith, L. M.

Wetlands 14(4): 301-307. (1994)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ seeds/ vegetation/ water level fluctuations/ soil water/ elevation/ species composition/ aquatic plants/ playas/ seed banks/ gradients/ community composition/ resource management/ water levels/ eolian transport/ vegetation cover/ plant reproductive structures/ USA, Texas/ seed banks/ gradients/ community composition/ eolian transport/ vegetation cover/ resource management/ water levels/ plant reproductive structures/ water level fluctuations/ soil water/ elevation/ playas/ vegetation/ species composition

Abstract: We analyzed the composition of seed banks along an elevational gradient (0-1 m) in playa wetlands of the Southern High Plains of Texas. Differing seed-bank composition along such a gradient may be one mechanism in the determination of vegetation structure in wetlands. We used the seedling-emergence technique under moist-soil and submerged treatments to ascertain the composition of seed banks in 8 playas. There were no differences ($P > 0.05$) in overall or common species seedling densities along the elevational gradient. Fluctuating water levels in a relatively shallow wetland, combined with the short linear distance of the gradient into a flat bottom, results in the uniform distribution of seed in playas. Additionally, wind action during periods when playas are dry may serve to distribute seeds throughout the wetland. Structure of vegetation in playas is determined principally by the varying soil moisture regime, which regulates composition of species germinating when other environmental conditions are suitable. When environmental conditions, including soil-moisture content, are appropriate for germination, each species in the seed bank could potentially be found throughout the wetland. When managing playas for specific plant species through manipulation of soil moisture, we can expect a comparable species response to similar treatments anywhere in the playa.

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868. Ecology and management of migrant shorebirds in the Playa Lakes Region of Texas.

Davis, Craig A. and Smith, Loren M.

Wildlife Monographs(140): 1-45. (1998)

NAL Call #: 410 W64; ISSN: 0084-0173

Descriptors: body size/ diet/ feeding ecology/ habitat selection/ migration/ sex differences/ stopover site

Abstract: During spring and fall migration, shorebirds rely on stopover areas to replenish energy reserves and fulfill nutrient requirements. Most studies of stopover areas have focused on wetlands in the Northern Great Plains; little attention has been given to wetlands in the Southern Great Plains, especially the Playa Lakes Region (PLR). Our objectives were to determine migrant-shorebird species compositions, abundances, migration chronologies, use of habitats, and feeding ecologies in the PLR during spring and fall migration. More than 130 playa wetlands were surveyed for shorebirds in a 34,000-km² area of western Texas. We selected American avocet (*Recurvirostra americana*), long-billed dowitcher (*Limnodromus scolopaceus*), least sandpiper (*Calidris minutilla*), and western sandpiper (*C. mauri*) as a subset of all shorebirds present to examine feeding ecologies; these 4 species

were common species during both migration periods and represent a wide range of body sizes and guilds. We also evaluated the influence of sex on the feeding ecologies of the 4 species. Thirty shorebird species used playa wetlands during spring and fall, 1993-94. The most abundant species during spring were American avocet, long-billed dowitcher, and Wilson's phalarope (*Phalaropus tricolor*), whereas the most abundant species during fall were American avocet, long-billed dowitcher, long-billed curlew (*Numenius americanus*), stilt sandpiper (*Calidris himantopus*), and lesser yellowlegs (*Tringa flavipes*). Migration chronologies of each species were distinct in spring with peak abundances occurring over 2-4 weeks and were protracted in fall with peak abundances occurring over 5-8 weeks. In general, most shorebird species selected playas that contained sparse vegetation (<25% vegetation cover), adequate amounts of mudflat (10-15%) and shallow (<4 cm depth) water (10-20%) habitats, and higher invertebrate populations. Invertebrates were the most important component in the diets of American avocets, long-billed dowitchers, least sandpipers, and western sandpipers, and diets varied little between males and females. In the spring, all 4 species consumed mostly chironomids, whereas in the fall, all 4 consumed a wider variety of invertebrates. important invertebrate foods during the fall included chironomids, hydrophilids, leeches, planorbids, corixids, conchostracans, and hydracarinas. The 4 species also consumed more plant material (predominantly seeds) in the fall than in the spring. Differences in spring and fall diets of the 4 shorebird species were attributed to seasonal differences in invertebrate abundances and diversities; invertebrate abundances and diversities were higher in the fall than in the spring. Shorebird diets were compared with availabilities of foods within and across individual playas. For most foods, overall selection patterns (i.e., selection across playas) were different from selection patterns within individual playas. In general, all 4 species exhibited a wide range of selection patterns for invertebrates as availability of invertebrates changed, suggesting that the 4 species used an opportunistic foraging strategy. Shorebird foraging appeared to decrease invertebrate populations in spring, but not in fall. Management of playas in the PLR should focus on creating and maintaining sparse vegetation cover, and adequate mudflat (at least 10-15%) and shallow water (at least 10-20%) habitats. Because invertebrates are important foods of migrant shorebirds, management also should focus on enhancing invertebrate populations in playas. Gradual drawdowns of playas with deep water and flooding of dry playas should be used to provide available habitat for shorebirds throughout migration. Mowing and shallow disking can be used to create preferred habitat conditions and provide a detrital food base to enhance invertebrate populations. Managers that can manage only a few playas should consider managing playas during periods of maximum shorebird diversity in the PLR. During spring, maximum shorebird diversity occurred in late April and early May, whereas during fall, maximum shorebird diversity occurred in late August.

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869. Factors affecting condition of northern pintails wintering in the Southern High Plains.

Smith, Loren M. and Sheeley, Douglas G.

Journal of Wildlife Management 57(1): 62-71. (1993)

NAL Call #: 410 J827; ISSN: 0022-541X

Descriptors: body weight/ carcass composition/ climate/ diet/ energetic cost/ fat/ gizzard mass/ lipid/ nutrient reserve/ paired male/ population ecology/ protein/ reproduction/ sex difference/ survival/ wetland management
Abstract: Because nutrient reserves affect survival and subsequent reproduction, it is necessary to examine factors affecting nutrient reserves to understand the population ecology of northern pintails (*Anas acuta*). Thus, we examined variation in carcass composition and organ mass of northern pintails wintering on the Southern High Plains (SHP) of Texas(USA) with respect to time (month, year; which varied in wetland availability), age, sex, and pair status. Carcass mass for males, and fat-gizzard mass, and percent fat were higher ($P < 0.05$) in 1985-86 (wet year) than 1985 (normal year) for males and females. This was attributed to precipitation that was 70% above normal in 1985-86, and resulted in increased availability of wetlands. Adult and immature birds did not differ ($P > 0.10$) with the exception of ash mass. Males were heavier ($P < 0.001$), had heavier ($P < 0.001$) organs (gizzard and liver), and had more ($P < 0.001$) protein and ash than females. Females had a higher ($P < 0.001$) percentage of fat than males. Fat and protein decreased from November to December in both years. In the normal year, fat did not vary ($P > 0.05$) from January to March. A decline ($P < 0.05$) in fat in February of the wet year may have been an endogenous response to reduce energetic costs. Changes in gizzard mass over time probably reflected dietary changes during winter. Paired males had greater ($P < 0.01$) lipid levels than unpaired birds in the wet year but not in the normal year. We could not make this comparison for females because there were so few unpaired females. Management in the SHP should focus on improving playa wetlands in winter because pintail body condition can be improved by increased wetland availability, and improved condition has been associated with increased survival and reproduction.

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870. High plains wetlands of southeast Wyoming: Salinity, vegetation, and invertebrate communities.

Lovvorn, James R.; Wollheim, Wilfred M.; and Hart, E. Andrew

In: *Invertebrates in freshwater wetlands of North America: Ecology and management/* Batzer, Darold P.; Rader, Russell B.; and Wissinger, Scott A.

New York: John Wiley & Sons, 1999; pp. 603-633.

Notes: ISBN: 0471292583

NAL Call #: QL365.4.A1158

Descriptors: Invertebrata/ biomass/ food webs/ community structure/ shallow saline lakes/ brackish habitat/ lake/ shallow saline lakes community structure/ biomass and food web/ Wyoming/ south east Wyoming/ Laramie Basin/ biomass and food web in shallow saline lakes

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871. An historical overview of playas and other wetland/riparian areas of "Nuevo Mexico".

Deason, M. G.

New Mexico Journal of Science 38: 189-218. (1998);

ISSN: 0270-3017

Descriptors: wetlands/ USA, New Mexico/ history/ riparian land/ water resources/ playas
Abstract: This journal article briefly examines the history of Nueva Espana (New Spain) since 1541, in the context of playas and other wetland/riparian areas in the Region of Nuevo Mexico (New Mexico). Particular attention is given to their importance and use by indigenous people, early Spanish explorers, and the subsequent settlers of Nuevo Mexico. Furthermore, 1998 marks the 150th anniversary of the original signing of the Treaty of Guadalupe Hidalgo. This event is briefly presented along with several historical periods that influenced the course of water in Nuevo Mexico.
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872. Hydrologic influences on insect emergence production from Central Platte River wetlands.

Whiles, M. R. and Goldowitz, B. S.

Ecological Applications 11(6): 1829-1842. (2001)

NAL Call #: QH540.E23; ISSN: 1051-0761

Descriptors: wetlands/ hydrology/ emergence/ ecological effects/ insects/ species diversity/ aquatic insects/ Insecta/ Diptera/ Chironomidae/ Culicidae/ Ceratopogonidae/ Sciomyzidae/ Muscidae/ USA, Nebraska/ USA, Kansas, Platte R./ insects/ midges/ mosquitoes/ biting midges/ no-see-ums/ punkies/ marsh flies/ face flies/ horn flies/ house flies/ muscid flies/ stable flies

Abstract: The physical template of freshwater ecosystems has a pervasive influence on biological communities and processes. To examine the influence of hydrology on wetland insect communities, we quantified insect emergence from five riparian sloughs in the central Platte River valley. Annual hydroperiods of the wetlands ranged from 94 to 365 d/yr, and frequency and magnitude of drying events were inversely proportional to hydroperiod length. Three emergence traps were placed in each wetland from April through November 1997. Most insects collected in traps were identified to genus, and individual dry mass (DM) also was determined. Abundance of emerging insects (24 124 individuals/m²) and emergence production (5.1 g DM times m⁻² times yr⁻¹) were highest from the site with an intermediate hydroperiod of 296 d. Sites with longer and shorter hydroperiods had lower emergence abundance and production. Emergence production from the perennial site, which contained fish year-round, was only 0.26 g DM times m⁻² times yr⁻¹. Diptera generally dominated emergence trap catches. Chironomidae, Culicidae, and Ceratopogonidae were among the dominant contributors to abundance, whereas Sciomyzidae and Muscidae were important contributors to biomass at most sites. Quadratic equations best described relationships between taxa richness and annual hydroperiod ($r^2 = 0.78$, $P < 0.05$) or number of drying events/yr ($r^2 = 0.81$, $P < 0.05$), reflecting a peak in richness at intermediate levels of both. These relationships followed predictions of the intermediate disturbance hypothesis, but specific mechanisms underlying patterns were difficult to discern. Like emergence production, taxa richness was also highest at intermediate hydroperiods. Hence, insect diversity

(measured as richness) and emergence production were positively correlated ($r_{\text{super}(2)} = 0.85$, $P < 0.05$). Results indicate that the hydrology of central Platte River wetlands exerts a strong influence on insect species richness and emergence production, and that intermittent sites harbor the highest insect diversity and produce more emergent insect biomass. However, trends in seasonal emergence patterns and taxonomic shifts across the hydrologic gradient in this study suggest that a landscape containing a mosaic of hydrologically distinct wetlands will maximize aquatic insect diversity and productivity at larger spatial and temporal scales.

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873. The importance of playa wetlands to biodiversity of the Southern High Plains.

Haukos, David A. and Smith, Loren M.

Landscape and Urban Planning 28(1): 83-98. (Feb. 1994)

NAL Call #: QH75.A1L32; ISSN: 0169-2046.

Notes: Special issue

Descriptors: comprehensive zoology/ farming and agriculture/ threats to playa wetland habitats/ habitat management/ conservation importance and needs/ New Mexico and Texas/ species diversity/ importance of playa wetlands/ semiaquatic habitat/ playa wetlands/ conservation importance in prairie biodiversity/ grassland/ prairie/ biodiversity and conservation importance of playa wetlands/ chemical pollution/ USA/ New Mexico/ southern High Plains/ playa wetlands importance to biodiversity/ conservation implications

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874. Inventory and floristics of Sandhills fens in Cherry County, Nebraska.

Steinauer, G.; Rolfsmeier, S.; and Hardy, J. P.

Transactions of the Nebraska Academy of Sciences (23): 9-21. (1996)

NAL Call #: Q11.N4; ISSN: 0077-6351

Descriptors: wetlands/ ecological distribution/ fens/ plants/ indicators/ flora/ USA, Nebraska/ community composition/ aquatic plants/ indicator species/ USA, Nebraska/ plants/ species composition/ indicator species/ ecological distribution/ fens/ USA, Nebraska

Abstract: The Sandhills of north-central Nebraska and south-central South Dakota are the largest sand-dune area in the Western Hemisphere. In 1991 and 1992, an inventory of Sandhills fens in Cherry County, Nebraska, documented 39 fens ranging in size from 4 to 280 ha. The majority of these sites had been ditched and were used as hay meadows. In 1996, a detailed floristic survey of six fens in Cherry County documented 191 species and one subspecies of vascular plants, including 21 species considered rare in Nebraska. Fifteen Sandhills fen indicator species were identified. The Sandhills populations of the indicator species are disjunct from their primary ranges to the north and east of the Great Plains, suggesting these populations to be glacial relicts.

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875. Macroinvertebrate communities in Central Platte River wetlands: Patterns across a hydrologic gradient.

Whiles, M. R. and Goldowitz, B. S.

Wetlands 25(2): 462-472. (2005)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ biomass/ abundance/ seasonal variations/ community structure/ freshwater environments/ flooding/ macroinvertebrates/ insects/ mollusks/ river basins/ structure/ organic matter/ rivers/ annelids/ crustaceans/ hydrology/ wildlife habitats/ Hydrophilidae/ Ceratopogonidae/ Mollusca/ Chironomidae/ Dytiscidae/ USA, Nebraska, Platte R./ water scavenger beetles/ biting midges/ midges/ predaceous diving beetles

Abstract: Wetlands provide critical wildlife habitat in the central Platte River basin of Nebraska, USA, but little is known about their macroinvertebrate communities or how factors such as hydrology affect them. In 1997, we quantified macroinvertebrate abundance, biomass, and community structure and organic matter resources in four natural wetlands that represented a gradient from ephemeral to permanent flooding. All four wetlands had abundant macroinvertebrate communities when flooded, and we observed unique taxa at all sites. Mean annual macroinvertebrate abundance and biomass increased with hydroperiod length, but taxon richness and diversity were greatest in intermittent sites. Non-insect groups, mostly crustaceans, annelids, and mollusks, were important at all sites, and their taxonomic composition shifted across the hydrologic gradient. Insect communities were dominated by dipterans (mostly Chironomidae and Ceratopogonidae) and Coleopterans (mostly Hydrophilidae and Dytiscidae), and these also varied across the hydrologic gradient. Collector-gatherers, scrapers, and predators were the dominant functional groups in terms of biomass, and biomass was most evenly distributed among these groups in intermittent sites. Macroinvertebrate communities in these riparian wetlands vary across natural hydrologic gradients, and diversity peaks in intermittent sites. Patterns of abundance, biomass, and diversity, along with seasonal patterns, suggest that, at a landscape level, a diversity of wetland habitats with different hydrologic regimes will maximize abundance and diversity of freshwater macroinvertebrate communities in this region.

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876. Nutrients in a playa wetland receiving wastewater.

Pezzolesi, T. P.; Zartman, R. E.; Fish, E. B.; and Hickey, M. G.

Journal of Environmental Quality 27(1): 67-74. (1998)

NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: wetlands/ *Typha domingensis*/ wild plants/ wastewater/ nutrients/ Texas

Abstract: We determined nutrient sequestration differences in soil and vegetation within two regions of a playa wetland that receives agricultural runoff and secondarily treated wastewater. Playas are small, topographically closed, ephemeral wetlands that serve as catchments for surface runoff in the Southern High Plains of the USA. The wetland studied received natural runoff and secondarily treated wastewater from the U.S. Department of Energy, Pantex facility near Amarillo, TX. Soil and aboveground biomass N, P, Cu, and Fe and water N and P were evaluated seven times during a 2-yr period in cattail (*Typha domingensis* Pers.) and pink smartweed [*Persicaria pensylvanica* (Raf.) Nieuw.] dominated regions of the playa. Spatial and

temporal variabilities were observed in water, vegetation, and soil-nutrient concentrations. These variabilities were likely due to fluctuation of water depth and quality in the playa. Water was deeper ($P < 0.05$) in the cattail region compared with the smartweed region. Water quality [Total Kjeldahl N (TKN) and total P (TP)] was not effected ($P > 0.05$) by vegetation type. Soil concentrations of TKN, TP, Cu, and Fe were not significantly different ($P > 0.05$) between cattail and smartweed vegetative types. Cattail had significantly greater ($P < 0.05$) levels of TKN, TP, Cu, and Fe than did smartweed. Aboveground biomass was greatest in August. Based on nutrient sequestration this playa wetland functioned quite well as a receptor for added nutrients from runoff and the wastewater treatment facility. This citation is from AGRICOLA.

877. Past and future impacts of wetland regulations on playa ecology in the southern Great Plains.

Haukos, D. A. and Smith, L. M.

Wetlands 23(3): 577-589. (2003)

Descriptors: wetlands/ legislation/ environmental regulations/ conservation/ education/ government regulations/ government policy/ playas/ regulations/ solid wastes/ feedlot runoff/ excavation/ aquifers/ watersheds/ groundwater recharge/ municipal wastewater/ urban planning/ degradation/ surface drainage/ environmental legislation/ environmental protection/ policies/ man-induced effects/ nature conservation/ USA, Southern Great Plains/ USA, Texas/ USA, New Mexico/ USA, Great Plains

Abstract: Playa wetlands provide functions critical to the existence of life on the High Plains portion of the Great Plains, including surface drainage, aquifer recharge, and wildlife habitat. These small, circular, isolated depressional wetlands with closed watersheds have a dynamic, unpredictable hydroperiod, which is essential to the maintenance of biodiversity. Most numerous in the Southern High Plains of northwestern Texas and eastern New Mexico, playas have been impacted by sedimentation, pit excavation, road construction, industrial and municipal wastewater, feedlot runoff, urban development, overgrazing, and deliberate filling. Despite being declared, as a wetland class, jurisdictional 'waters of the United States' since 1977, regulations and laws for conservation of wetland functions have seldom been applied to playas. The January 2001 Supreme Court decision, *Solid Waste Agency of Northern Cook County (SWANCC) v. United States Army of Corps of Engineers*, likely eliminated federal regulation of impacts covered by the Clean Water Act in all but a few playas. Although still subject to the Federal 'Swampbuster' provision enacted by the 1985 Food Security Act, extended natural dry periods allows for frequent cultivation and other activities in playas without incurring violation, contributing to the continued degradation of playa functions. None of the states with significant numbers of playas have regulations for the conservation of playa functions. Suggestions for the successful future conservation of playas and their associated functions include (1) increased promotion and implementation of existing federal and state conservation programs specifically for playas; (2) proposed state regulations for playa conservation; (3) recognition of agricultural impacts on wetland determinations; (4) creation of Wetland Management Districts to preserve intact, functioning playas; and (5) increased public education on the value of playas.

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878. Playa lakes on the southern High Plains in Texas: Reevaluating infiltration.

Zartman, R. E.; Evans, P. W.; and Ramsey, R. H.

Journal of Soil and Water Conservation 49(3):

299-301. (1994)

NAL Call #: 56.8 J822; *ISSN:* 0022-4561

Descriptors: wetlands/ lakes/ long-term planning/ water management/ infiltration rate/ surface water/ water conservation/ soil types/ playas/ temporary ponds/ fate/ USA, Texas/ temporary ponds/ fate/ infiltration rate/ soil types

Abstract: The fate of water in playa lakes determines the long-term water management strategy for the Southern High Plains of Texas. To determine the fate of water within playa wetlands, initial (1 min) and long-term (>48 h) infiltration rates were determined using double ring infiltrometers at three relative elevations in three Southern High Plains playa lakes. The high elevation treatments were at least 150 mm above the highest intermediate elevation and the low elevation treatments were at least 150 mm below the lowest intermediate elevation. The hydric playa soils [Randall clay (fine, smectitic, thermic Udic Pellusterts)] were vegetated with facultative wetland plants. Particle size analysis, soil pH, and electrical conductivity were also determined at each infiltrometer location. There were no significant differences of infiltration for the three elevational treatments. Initial infiltration rates ranged from 2490 to 10 mm/min while arithmetic means were greater than 100 mm/min. Long-term infiltration rates ranged from 996 to 0.004 mm/min while arithmetic means were approximately 5 mm/min. These rapid initial and measurable long-term infiltration rates demonstrate that infiltration occurs within playas. Furthermore, these high infiltration rates indicate that playa wetlands are important zones in determining the fate of surface water on the Southern High Plains.

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879. Playa lakes: Prairie wetlands of the Southern High Plains, USA.

Bolen E. G.; Smith L. M.; and Schramm H. L.

Bioscience 39(9): 615-623. (1989)

Descriptors: agriculture/ ecology/ irrigation/ hydrology/ flora/ fauna/ grazing/ livestock/ biological diversity/ New Mexico, USA/ Texas, USA

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880. Playas of the Southern High Plains: The macroinvertebrate fauna.

Hall, Dianne L.; Sites, Robert W.; Fish, Ernest B.;

Möllhagen, Tony R.; Moorhead, Daryl L.; and

Willig, Michael R.

In: *Invertebrates in freshwater wetlands of North America:*

Ecology and management/ Batzer, Darold P.; Rader,

Russell B.; and Wissinger, Scott A.

New York: John Wiley & Sons, 1999; pp. 635-665.

Notes: ISBN: 0471292583

NAL Call #: QL365.4.A1158

Descriptors: Macroinvertebrata/ habitat management/ playa lakes overview/ food webs/ community structure/ playa lakes/ emigration/ immigration/ playa lakes fauna overview/ habitat colonization/ playa lakes colonization patterns/ temporary water/ USA/ southern Great Plains/ playa lakes community ecology and conservation

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881. Preserving Nebraska 's wetlands: Now and in the future.

Christensen, M. A.

Nebraska Law Review 63(3): 473-513. (1984);

ISSN: 0047-9209

Descriptors: wetlands/ legal aspects/ water resources development/ Nebraska/ preservation/ sandhills/ groundwater/ flood control/ water quality/ land acquisition/ cost-sharing

Abstract: In an effort to increase public awareness of the importance of Nebraska 's wetlands and to evaluate the means presently available to aid in wetlands preservation, this summary of wetlands and their role in Nebraska is offered. Suggestions for further protective measures are also made. The destruction of Nebraska 's wetlands is described as it relates to the rainwater basin and the sandhills. Consequences of wetlands destruction include a loss of nutrients, groundwater supplies and recycling center for water, and a lessening of the holding power of water from rainfall. Wetland protections afforded under the Clean Water Act are discussed, specifically section 404. Other means of preservation include federal land acquisition, state land acquisition, state cost sharing practices, and water bank programs. (Baker-IVI)

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882. Protein and energy production in playas: Implications for migratory bird management.

Anderson, J. T. and Smith, L. M.

Wetlands 18(3): 437-446. (1998)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ proteins/ energy/ playas/ birds/ biomass/ invertebrates/ habitats/ migration/ waterfowl/ soil management/ migratory species/ environment management/ Invertebrata/ animal feeds/ aquatic birds/ habitat/ nature conservation/ nutrition/ overwintering/ bioenergetics/ animal nutrition/ food availability/ food organisms/ seeds/ sediment properties/ water content/ USA, Texas, High Plains/ USA, Texas, Southern High Plains/ Invertebrata/ USA, Texas/ moist-soil management

Abstract: We examined protein and energy production of potential migratory bird foods produced in moist-soil managed versus unmanaged playa wetlands on the Southern High Plains of Texas (SHP) during fall and winter 1994-95 and 1995-96 to assess potential carrying capacity for wintering migratory birds. Total food (seeds and invertebrates) biomass, crude protein production, and gross energy production were greater in managed playas than unmanaged playas. There was no difference in food biomass or energy production between invertebrates and seeds when managed and unmanaged playas were combined, but protein production from invertebrates was greater than production from seeds. The estimated 160,000 ha of unmanaged playa wetland habitat in the SHP produces about 24.3 million kg of seeds and invertebrates, 9.2 million kg of protein, and 108.6 billion kcal of energy. When these playas have water, there are enough seeds and invertebrates to support 3 million ducks for 3 months. However, water is often limited, making much of this habitat unavailable to waterbirds in most years. Therefore, conservation of existing playas should be supplemented with intensive moist-soil management in some areas as the most economical strategy for providing proper nutrition to migratory birds and other wildlife in playas.

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883. Quaternary evolution of ephemeral playa lakes on the Southern High Plains of Texas, USA: Cyclic variation in lake level recorded in sediments.

Hovorka, S. D.

Journal of Paleolimnology 17(1): 131-146. (1997)

NAL Call #: QE39.5.P3 J68; ISSN: 0921-2728.

Notes: Conference: Modern and Ancient Lake Environments of the Great Plains. Theme Session of the Geological Society of America Meeting, Lincoln, NE (USA), 27-28 Apr 1995

Descriptors: playas/ quaternary/ lake deposits/ water levels/ lake sediments/ water level recorders/ USA, Texas/ lake sediments/ water level recorders/ quaternary/ lake deposits/ water levels

Abstract: Ephemeral playa lakes on the Southern High Plains northeast of Amarillo, Texas, are underlain by more than 10 m of Quaternary lake deposits. Sediments beneath 12 lakes were examined in 76 hollow-stem auger cores and in excavations. Stacked depositional cycles recognized in lake sediments record repeated phases of (1) initial highstand, (2) ephemeral lake, and (3) lake shrinkage and prolonged exposure. Sedimentary and soil structures show that during all phases the lakes were ephemeral, but that the duration and frequency of flooding varied, which caused variation in the relative amounts of accumulation, deflation, and soil formation. The highstand phase is documented by wave-cut benches and lake sediments that extend beyond present lake margins. Mud transported as suspended load was deposited from ponded water. Desiccation resulted in mudcracks and allowed deposition of eolian sand, but exposure episodes were relatively short or infrequent, and vertic soil formation, oxidation of organic material, and deflation of sand were minimal. Decreased frequency and duration of flooding resulting in increased pedogenic modification under conditions similar to those under which modern playa lake sediments accumulate. Eolian silt deposited on dry lake beds and clays deposited in flooded lakes were mixed by vertic soil processes during repeated wetting and drying. Organic material was partly oxidized and partly translocated down roots and cracks, and interbedded upland facies were gleyed. Episodes of lake shrinkage and more frequent exposure are recorded by reddening and formation of calcic horizons within lake muds. Red-brown eolian loam prograded across lake sediments, and calcic soils developed on it. These grassland slope facies record decrease in the size of the playa lakes.

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884. The saline wetland-meadow vegetation and flora of the North Platte River Valley in the Nebraska panhandle.

Rolfmeier, S. B.

Transactions of the Nebraska Academy of Sciences 20: 13-24. (1993)

NAL Call #: Q11.N4; ISSN: 0077-6351

Descriptors: wetlands/ vegetation cover/ community composition/ rare species/ distribution records/ saline water/ aquatic plants/ flora/ salt marshes/ vegetation/ USA, Nebraska, Platte R./ vegetation/ vegetation cover/ community composition/ rare species/ distribution records/ *Aster brachyactis*/ *Haplopappus annuus*/ *Thelypodium integrifolium*/ *Althaea officinalis*/ *Najas marina*/ *Spergularia marina*

Abstract: The saline wetlands associated with the Platte River have received very little attention from botanists since the 1890s, and several plants widespread in these habitats, such as rayless salt-marsh aster (*Aster brachyactis*), annual goldenweed (*Haplopappus annuus*) and thelypody (*Thelypodium integrifolium*) have been considered rare in the State. A floristic inventory of sixteen tracts of saline lowlands near the North Platte River in Garden, Morrill, and Scotts Bluff counties reveals the presence of 231 species of vascular plants (169 native and 62 introduced), including three Eurasian halophytes (*Althaea officinalis*, *Najas marina*, *Spergularia marina*) not previously reported from Nebraska. Saline habitats along the North Platte River have a larger number of halophytic species than similar habitats in eastern Nebraska, though data from eastern salt marshes are insufficient for quantitative comparisons of species richness.

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885. Shallow subsurface characterization of gas transport in a playa wetland.

Nicot, J. P. and Bennett, P. C.

Journal of Environmental Engineering 124(11): 1038-1046. (1998)

NAL Call #: 290.9 Am3Ps; ISSN: 0733-9372

Descriptors: wetlands/ soil gases/ advection/ playas/ permeability/ tracers/ gases/ soil gases

Abstract: Controls on vadose-zone gas transport beneath and adjacent to a southern High Plains ephemeral lake (playa) were investigated. Under dry conditions, vertical gas permeability and tortuosity were enhanced by cracks and root tubules in the upper 2.5 m. Below this depth, the horizontal components of both permeability and tortuosity tensors were dominant. Both atmospheric pumping and pneumatic tests were used to determine the gas permeability tensor; whereas gas tracer tests were used to estimate the tortuosity tensor. The field data were elevated in a multilayer numerical model. The results suggest that gas movement can be dominated by both advection and diffusion, with vertical movement dominating in the shallow zone under dry conditions. After a large precipitation event, vertical gas permeability was reduced and large pressure differentials (as high as 1.5 kPa) were produced, creating driving forces for advective gas transport.

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886. Shorebird breeding biology in wetlands of the Playa Lakes, Texas, USA.

Conway, Warren C.; Smith, Loren M.; and Ray, James D. *Waterbirds* 28(2): 129-138. (2005)

NAL Call #: QL671; ISSN: 1524-4695

Descriptors: hatching success/ clutch size/ nesting/ breeding behavior/ wetlands habitat

Abstract: Wetlands in the Playa Lakes Region of Texas are important habitats for North American wintering waterfowl and migrant shorebirds. However, shorebird breeding biology has been overlooked in characterizing the region's ecological importance. In 1998 and 1999, American Avocet (*Recurvirostra americana*), Black-necked Stilt (*Himantopus mexicanus*), Killdeer (*Charadrius vociferous*), and Snowy Plover (*C. alexandrinus*) breeding ecology were studied in playas, saline lakes, and riparian wetlands in the Playa Lakes Region of Texas. Chronology of nest initiation, clutch sizes, and hatching success for 298 Snowy Plover, 111 American Avocet, 43 Killdeer, and 26 Blacknecked Stilt

clutches were measured. All four species nested in saline lakes, American Avocet and Killdeer also nested in playas, and Snowy Plover nested on riparian wetlands. American Avocet had higher hatching success in 1999 (52%) than 1998 (8%), because of more suitable hydrological conditions and lower predation. Hatching success was higher in 1998 than 1999 for Killdeer (1998, 63%; 1999, 21%) and Snowy Plover (1998, 47%; 1999, 33%) due to failures caused by flooding and hail in 1999. In other regions, clutch predation limits shorebird productivity, but hatching success in the Playa Lakes Region appears to be limited by unpredictable precipitation patterns and wetland hydroperiod. As such, breeding shorebird conservation and management should focus upon maintaining wetland hydrological integrity.

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887. Soils, surficial geology, and geomicrobiology of saline-sodic wetlands, North Platte River Valley, Nebraska, USA.

Joeckel, R. M. and Clement, B. J. A.

Catena 61(1): 63-101. (2005)

NAL Call #: GB400.C3; ISSN: 0341-8162

Descriptors: wetlands/ salts/ rivers/ groundwater/ conductivity/ collapse/ sulfates/ ecology/ salinization/ saturated soils/ surface water/ calcite/ drying/ standards/ dewatering/ evaporation/ sediments/ fluvial sediments/ spring water/ hydrogen ion concentration/ mineralogy/ geology/ capillarity/ illite/ USA, Nebraska/ USA, Wyoming, North Platte R.

Abstract: Saline-sodic wetlands along a 200-km stretch of the North Platte River Valley in western Nebraska, USA lie within an important agricultural region, but their processes, salt mineralogy, and geomicrobiology have not previously been investigated. Putative anthropogenic salinization has long been a concern, yet early historical accounts of widespread surface salts in the area have never been applied as comparative standards. Surface salts in the area originate from soil capillarity and surface evaporation. Thenardite (Na_2SO_4) and/or mirabilite ($\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$) dominate, depending on ambient conditions. Bloedite ($\text{Na}_2\text{Mg}[\text{SO}_4]_2 \cdot 4\text{H}_2\text{O}$), halite (NaCl), burkeite ($\text{Na}_6\text{CO}_3[\text{SO}_4]_2$), and calcite (CaCO_3) are minor constituents. Historical accounts indicate that salts accumulated naturally long before Euramerican settlement, apparently as a result of rock-water interaction in nearby volcanoclastic sediments of the Brule Formation. Ephemeral to permanent water-holding basins in the wetlands contain Na^+ -rich waters that vary widely in electrical conductivity (as high as 159 mS/cm) and in ionic composition, but local spring waters are extremely dilute. Basin floors exhibit a unique type of microrelief, which appears to form by the filling of microlows with water and the dispersal of soil material therein by Na^+ , followed by dewatering and collapse of the soil with drying. Illite dominates basin surface soils, but smectite dominates at depth; high soil pH, available K^+ , and frequent wetting-drying cycles in the wetlands suggest that in-situ illitization may have occurred. Soil crusts and vesicular surface horizons are common as are upward increases in electrical conductivity. The activity of sulfate-reducing microbes forms prominent near-surface horizons of sulfate reduction in saturated soils, which retract or disappear entirely during dry episodes. Saline-sodic wetland soils in

the study area change on daily to seasonal scales. Cycles of surface salt development, microbial activity, and microrelief genesis are all controlled by regular wetting-drying cycles and the interaction of ponded surface waters and shallow groundwaters. Relatively unique aspects of microbial ecology and surface processes make the soils important as "geomicrobial reactors" wherein important parts of hydrological and geochemical cycles occur.
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888. Succession of macroinvertebrates in playas of the Southern High Plains, USA.

Moorhead, D. L.; Hall, D. L.; and Willig, M. R.
Journal of the North American Benthological Society 17(4): 430-442. (1998)

NAL Call #: QL141.F7; ISSN: 0887-3593

Descriptors: wetlands/ trophic structure/ community composition/ species diversity/ temporal variations/ predators/ filter feeders/ detritus feeders/ ecological succession/ colonization/ temporary ponds/ playas/ succession/ macrofauna/ species richness/ trophic levels/ trophic level/ macroinvertebrates/ sampling/ aquatic insects/ Ostracoda/ Branchiopoda/ Notonectidae/ Hydrophilidae/ Invertebrata/ ostracods/ branchiopods/ water scavenger beetles/ freshwater crustaceans/ backswimmers/ USA, Texas

Abstract: Playas are seasonal wetlands that constitute the principal surface-water features of the semiarid, Southern High Plains, USA. They are shallow pools that usually persist for 2-4 mo following inundation by spring rains. The

development of macroinvertebrate assemblages in 10 playas located in West Texas was examined during the summer of 1994. Playas were sampled 3 times at approximately monthly intervals, beginning shortly after initial inundation in early May. All playas were dry within 90 d. Species richness and diversity (Fisher's log-series alpha) increased significantly over time ($p < 0.05$). Thirteen of the 16 species representing at least 1% of collected individuals, showed significant differences in abundances over time ($p < 0.05$). Some taxa increased in abundance (especially insects), whereas others decreased (most crustaceans). Trophic structure of assemblages also changed over time, with a significant reduction in the abundances of detritivores ($p < 0.05$) and filter-feeders ($p < 0.05$) occurring concurrently with an increase in the abundance of predators ($p < 0.05$). The composition of macroinvertebrate assemblages became more similar among playas over time (Ochai's index, $p < 0.05$), and changes in composition within individual playas tended to decrease with time ($p < 0.05$). These results suggest a rapid development of macroinvertebrate assemblages in playas, beginning with early dominance of crustacean detritivores and filter-feeders (e.g., phyllopoets and ostracods), followed by later dominance of herbivorous and predaceous insects (e.g., hydrophilids and notonectids). Increases in species richness, diversity, and similarity in assemblage composition among playas over time are consistent with a pattern of progressive colonization by a finite set of species capable of exploiting these ephemeral habitats.

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Effects of Agricultural Conservation Practices on Wetlands

889. Breeding bird response to cattle grazing of a cottonwood bottomland.

Sedgwick, J. A. and Knopf F. L.

Journal of Wildlife Management 51(1): 230-237. (1987)

Abstract: We studied avian habitat relationships and the impact of grazing on breeding densities of selected migratory birds in a plains cottonwood (*Populus sargentii*) bottomland in northeastern Colorado. Five 16-ha plots served as controls and 5 were fenced and fall-grazed October-November 1982-84 following a season of pre-treatment study in the spring of 1982. We focused our analysis on bird species directly dependent on the grass-herb-shrub layer of vegetation for foraging, nesting, or both. The guild included house wren (*Troglodytes aedon*), brown thrasher (*Toxostoma rufum*), American robin (*Turdus migratorius*), common yellowthroat (*Geothlypis trichas*), yellow-breasted chat (*Icteria virens*), and rufous-sided towhee (*Pipilo erythrophthalmus*). Moderate, late-fall grazing had no detectable impact on calculated densities of any of the 6 species, implying that proper seasonal grazing of a cottonwood floodplain is, at least initially (3 years), compatible with migratory bird use of a site for breeding. Habitat associations suggested that common yellowthroats and yellow-breasted chats were most unique and most likely to respond negatively to higher levels of grazing. We suggest that these latter 2 species are appropriate ecological indicators of the quality of ground-shrub vegetation as breeding bird habitats in lowland floodplains of the Great Plains.

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890. Diversity of Salmonella serovars in feedyard and nonfeedyard playas of the Southern High Plains in the summer and winter.

Purdy, C. W.; Straus, D. C.; and Clark, R. N.

American Journal of Veterinary Research 65(1): 40-44. (2004)

NAL Call #: 41.8 Am3A; ISSN: 0002-9645

Descriptors: wetlands/ microbial contamination/ playa soils/ seasonal variation/ serovars/ summer/ water/ water quality/ winter/ *Salmonella enterica*

Abstract: Objective: To compare *Salmonella* isolates cultured from feedyard and nonfeedyard (control) playas (ie, temporary shallow lakes) of the Southern High Plains in Texas, USA. Sample Population: Water and muck (sediment) samples were obtained from 7 feedyard playas and 3 nonfeedyard playas in the winter and summer. Procedure: Each water and muck sample was enriched with sulfur-brilliant-green broth and incubated in a shaker at 37 degrees C for 24 h. A sample (100 ml) of the incubated bacterial-enriched broth was then mixed with 100 ml of fresh sulfur-brilliant-green enrichment broth and incubated in a shaker at 37 degrees C for 24 h. After the second incubation, a swab sample was streaked on differential media. Suspect *Salmonella* isolates were further identified by use of biochemical tests, and *Salmonella* isolates were confirmed and serovar determinations made. Results: *Salmonella* isolates were not recovered from the 3 control playas. Seven *Salmonella enterica* serovars were isolated from 5 of 7 feedyard playas in the summer, and 13 *S. enterica* serovars were isolated from 7 of 7 feedyard playas

in the winter. In the summer, 296 isolates were cultured, and 47 were *Salmonella* organisms. In the winter, 288 isolates were cultured, and 171 were *Salmonella* organisms. Conclusions and Clinical Relevance: Results indicated that feedyard playas are frequently contaminated with many *Salmonella* serovars. These pathogens should be considered whenever feedyard managers contemplate the use of water from these playas. Water from feedyard playas should not be used to cool cattle in the summer or for dust abatement.

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891. Effects of agricultural cultivation on demographics of Southern High Plains amphibians.

Gray, Matthew J.; Smith, Loren M.; and Brenes, Roberto
Conservation Biology 18(5): 1368-1377. (Oct. 2004)
NAL Call #: QH75.A1C5; ISSN: 0888-8892

Descriptors: Amphibial/ farming and agriculture/ agricultural cultivation/ population responses/ community structure/ population density/ agricultural cultivation effects/ semiaquatic habitat/ Texas/ southern high plains/ population responses to agricultural cultivation/ playa wetlands

Abstract: Anthropogenic disturbance of landscapes surrounding wetlands is considered a factor in local and global amphibian declines. Few data exist on the effects of agricultural cultivation of wetland watersheds on amphibians, and results from previous studies are contradictory. Our objective was to test the effects of general anthropogenic land use (cultivation vs. grassland) on the demographics of seven species and three age classes of amphibians in the Southern High Plains of Texas. We partially enclosed 16 playa wetlands (4 per land use per year) with drift fences and pitfall traps and monitored relative daily abundance and diversity from 16 May to 17 October 1999 and 19 April to 18 August 2000. In general, relative abundance (i.e., average daily capture) of New Mexico and plains spadefoots (*Spea multiplicata*, *S. bombifrons*) was greater at cropland than grassland playas; the abundance of other species and diversity of the amphibian assemblage was not affected by land use. Also, abundance generally was greater in 1999 than 2000 for metamorph spadefoots and barred tiger salamanders (*Ambystoma tigrinum mavortium*). Differences in spadefoot abundance between land-use types may have been related to low species-specific vagility, resulting in increased nestedness within disturbed landscapes and reduced abundance of a potential keystone intraguild predator in cropland playas. The yearly difference in amphibian abundance was likely related to annual precipitation, which influenced wetland hydroperiod. Agricultural cultivation surrounding wetlands is associated with the increased abundance of some amphibian species, but other demographic and fitness parameters—such as temporal demographics, body size, and diet diversity—may be negatively affected.

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892. Effects of land use on nongame wetland birds in western South Dakota stock ponds, USA.

May, Shawn M.; Naugle, David E.; and Higgins, Kenneth F.
Waterbirds 25(Special Publication 2): 51-55. (2002)
NAL Call #: QL671; ISSN: 1524-4695

Descriptors: wetlands/ Landsat (tm) imagery data/ national wetlands inventory maps/ cattle grazing/ cropland landscapes/ grasslands/ habitat use/ land use change/ landscape types/ nesting habitat/ prairie landscapes/ stock ponds/ tillage agriculture/ vegetation cover

Abstract: Tillage agriculture is expanding into western prairie landscapes without knowledge of the effects of land use change on habitats used by nongame wetland birds. In 1999-2000, we surveyed 196 stock ponds within grassland (>95% grass) and cropland (>75% tillage) landscapes to evaluate effects of land use on nongame wetland bird densities in western South Dakota. Land use and wetlands were delineated from Landsat TM imagery and National Wetlands Inventory maps. Sixteen nongame wetland bird species used stock ponds in western South Dakota, of which nine species were obligate wetland-nesting species. Although densities of seven nongame obligate wetland bird species were similar between landscape types, abundance of Wilson's Phalarope (*Phalaropus tricolor*) was greater in grassland study areas where cattle grazing limited growth of thick-stemmed emergent vegetation and reduced overall vegetative cover in stock ponds. In contrast, the Red-winged Blackbird (*Agelaius phoeniceus*) and Yellow-headed Blackbird (*Xanthocephalus xanthocephalus*) were more abundant in cropland landscapes where stock ponds provide abundant over-water nesting habitat (e.g., cattail). If grasslands continue to be converted to cropland, Wilson's Phalarope numbers will likely decrease as blackbird densities increase in stock ponds dominated by monotypic stands of cattail. To circumvent such changes, we recommend that resource managers conserve large tracts of grassland through aggressive easement programs in landscapes at highest risk of agricultural tillage.

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893. Effects of sedimentation on playa wetland volume.

Luo, Hong-Ren; Smith, L. M.; Allen, B. L.; and Haukos, D. A.

Ecological Applications 7(1): 247-252. (1997)

NAL Call #: QH540.E23; ISSN: 1051-0761

Descriptors: wetlands/ sedimentation/ watersheds/ soil texture/ land use/ agriculture/ vegetation cover/ playas/ sediment texture/ sediment texture/ soil texture/ vegetation cover/ playas/ USA, Texas, Southern High Plains/ USA, Texas, High Plains

Abstract: Over 50% of the wetlands in the conterminous United States have been lost; however, few studies have investigated the more insidious effects of sedimentation on wetland volume. We examined the effects of sedimentation on playa wetland volume in the Southern High Plains (Texas, USA). We compared 20 playas with watersheds dominated by rangeland to 20 playas that had cropland watersheds. Playas were located in fine- and medium-texture soil zones. Playas with cultivated watersheds contained more sediments than those with rangeland watersheds. Playas with cultivated watersheds had lost all of their original volume, on average, whereas playas with rangeland watersheds had lost only about one third of their volume. Of the approximately 30 000 playas in the region, most have cultivated watersheds, and therefore the

hydroperiod of playas has been drastically altered over the last 60 yr, changing the structure and function of these ecosystems. Also, sedimentation in playas in the medium-texture soil zone was greater than in the fine-texture soil zone. Therefore, management efforts should first focus on the coarser soil areas to prevent the greatest sedimentation rates. Permanent vegetative cover (e.g., buffer strips) should be encouraged on playa watersheds to prevent further degradation.

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894. Fate of wetlands associated with the central Nebraska irrigation canal system.

Ekstein, J. D. and Hygnstrom, S. E.

Great Plains Research 6(1): 41-60. (1996)

NAL Call #: QH104.5.G73 G755; ISSN: 1052-5165

Descriptors: wetlands/ irrigation districts/ canals/ aerial photography/ environmental effects/ water table rise/ flooding/ wildlife management/ nature conservation/ environmental impact/ USA, Nebraska/ nature conservation/ environmental impact/ irrigation districts/ water table rise/ wildlife management

Abstract: Changes in wetlands in the vicinity of the Phelps and E65 canals operated by Central Nebraska Public Power and Irrigation District in Southcentral Nebraska were examined using aerial photographs taken on seven occasions from 1938 to 1981. According to previous research, nearly 90% of the original wetlands within the surrounding Rainwater Basin were destroyed or altered by draining and filling between 1900 and 1980. Within a zone extending 10 kilometers on each side of the Phelps and E65 canals, however, we observed an increase in the number and total area of wetlands, which we hypothesize to have been caused by an elevated groundwater table. Of additional importance for wildlife management, there was a notable decrease in wetlands temporarily flooded for 2 months or less, and a notable increase in wetlands seasonally flooded for 3 to 5 months each year. These changes were most conspicuous after 1969.

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895. Grass buffers for playas in agricultural landscapes: A literature synthesis.

Melcher, Cynthia P.; Skagen, Susan K.; Fort Collins Science Center (U.S.); and Geological Survey (U.S.) Reston, Va.: U.S. Geological Survey; Open-file report 2005-1220, 2005.

NAL Call #: QH541.15.B84 M46 2005

<http://www.fort.usgs.gov/products/publications/21485/21485.asp>

Descriptors: buffer zones (ecosystem management)---High Plains (U.S.)/ water quality management---High Plains (U.S.)/ agricultural pollution High Plains (U.S.)/ playas---High Plains (U.S.)/ lake ecology---High Plains (U.S.) This citation is from AGRICOLA.

896. Influence of agricultural landscape structure on a Southern High Plains, USA, amphibian assemblage.

Gray, Matthew J.; Smith, Loren M.; and Leyva, Raquel I.

Landscape Ecology 19(7): 719-729. (2004)

NAL Call #: QH541.15.L35 L36; ISSN: 0921-2973

Descriptors: biogeography: population studies/ freshwater ecology: ecology, environmental sciences/ wildlife management: conservation/ agricultural landscape structure/ amphibian assemblage

Abstract: Landscape structure can influence demographics of spatially structured populations, particularly less vagile organisms such as amphibians. We examined the influence of agricultural landscape structure on community composition and relative abundance of the 4 most common amphibians in the Southern High Plains of central USA. Amphibian populations were monitored using pitfall traps and drift fence at 16 playa wetlands (8 playas/year) in 1999 and 2000. We quantified landscape structure surrounding each playa via estimating 13 spatial metrics that indexed playa isolation and inter-playa landscape complexity. Multivariate ordination and univariate correlations and regressions indicated that landscape structure was associated with community composition and relative abundance for 2 of the 4 amphibians. Spadefoots (*Spea multiplicata*, *S. bombifrons*) generally were positively associated with decreasing inter-playa distance and increasing inter-playa landscape complexity. Great Plains toads (*Bufo cognatus*) and barred tiger salamanders (*Ambystoma tigrinum mavortium*) usually were negatively associated with spadefoots but not influenced by landscape structure. Composition and relative abundance patterns were related to amphibian body size, which can influence species vagility and perception to landscape permeability. Spatial separation of these species in the multivariate ordination also may have been a consequence of differential competitive ability among species. These results suggest agricultural landscape structure may influence abundance and composition of spatially structured amphibian populations. This also is the first applied documentation that inter-patch landscape complexity can affect intra-patch community composition of amphibians as predicted by metapopulation theory. In the Southern High Plains, landscape complexity is positively associated with agricultural cultivation. Agricultural cultivation increases sedimentation, decreases hydroperiod, alters amphibian community dynamics, and negatively impacts postmetamorphic body size of amphibians in playa wetlands. Thus, conservation efforts should focus on preserving or restoring native landscape structure, hydroperiod, and connectivity among playas to maintain native amphibian populations and historic inter-playa movement.

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897. Influence of land use on postmetamorphic body size of playa lake amphibians.

Gray, M. J. and Smith, L. M.

Journal of Wildlife Management 69(2): 515-524. (2005)

NAL Call #: 410 J827; ISSN: 0022-541X

Descriptors: wetlands/ body size/ grasslands/ reproduction/ conspecifics/ rainfall/ drift/ land use/ amphibiotic species/ hydrology/ playas/ habitat improvement/ growth rate/ *Spea multiplicata*/ *Bufo cognatus*/ *Ambystoma tigrinum mavortium*/ USA, Southern High Plains/ Great Plains toad/ barred tiger salamander

Abstract: Agricultural land use may indirectly affect the body size of amphibians by altering the hydroperiods of nearby wetlands and influencing amphibian densities--both factors which can limit the larval and postmetamorphic growth rates of amphibians. We measured postmetamorphic body size for 4 species (*Spea multiplicata*, *S. bombifrons*, *Bufo cognatus*, *Ambystoma tigrinum mavortium*) and 3 age classes (metamorph, subadult, adult) of amphibians captured at playa wetlands

surrounded by one of 2 general land-use types (cultivation, grassland) in the Southern High Plains. Sixteen playas (4 per land-use type in 1999 and 2000) were partially enclosed with drift fence and pitfall traps, and mass and snout-vent length (SVL) were measured from a subsample of captured individuals. Mass and SVL were 10-148% greater for amphibians captured at grassland wetlands than at cropland wetlands for most species and age classes. Mass and SVL also were 3-124% greater in 1999 than in 2000 for most species and age classes. We attribute differences in body size between land-use types to differences in the hydroperiods of the associated wetlands, and potentially to variation in the density of terrestrial conspecifics and aquatic predators. We attribute differences in body size between years to differences in rainfall. Body size is positively related to the probability of survival, reproduction, and evolutionary fitness in amphibians. Thus, if cultivation of landscapes surrounding wetlands negatively influences postmetamorphic body size of amphibians, restoration of native grasslands surrounding playa wetlands may help prevent local amphibian declines.
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898. Microbial pathogen survival study in a High Plains feedyard playa.

Purdy, Charles W.; Straus, David C.; Harp, James A.; and Mock, Richard

Texas Journal of Science 53(3): 247-266. (2001)

Descriptors: feedyard shallow lake/ microbial pathogen survival

Abstract: Sixteen microbes and one enteric protozoal parasite were secured in screw-cap vials (CV) and dialysis tubes (DT) and placed in a feedyard shallow lake (playa) in the West Texas High Plains, USA. They were removed weekly or monthly depending on their susceptibility to the water environment. There were two overlapping studies; one started in September 1996 and was terminated 390 days later. The second study started in May 1997 and was terminated 188 days later. These controlled studies were used to determine the decrease in titers of 10 bacteria (*Pasteurella haemolytica* A1, *Pasteurella multocida* A:3, *Staphylococcus aureus*, *Escherichia coli*, *Enterococcus faecalis*, *Actinomyces pyogenes*, *Salmonella enterica* serovar dublin, *Bacillus thuringiensis*, *Klebsiella pneumoniae* and *Pseudomonas aeruginosa*); two fungi (*Aspergillus fumigatus* and *Aspergillus niger*); four viruses (*Infectious Bovine Rhinotracheitis* (IBR), *Bovine Virus Diarrhea Virus* (BVD), *Bovine Respiratory Syncytial Virus* (BRSV), *Bovine Parvovirus* (BPV) and one protozoal parasite (*Cryptosporidium parvum*), over time. The *Pasteurella* isolates died in both studies within seven to 35 days. *Actinomyces pyogenes* died within 84 days in the 1996 study and survived for 188 days in the 1997 study. The remaining bacterial isolates in 1996 survived for 390 days with low titers, except for *P. aeruginosa*. Both fungal isolates died by 390 days in the 1996 study. All bacteria and fungi survived the 188 day study in 1997, except for the *Pasteurella* isolates. The titers of the viruses decreased rapidly over 42 days, except for BPV in the 1996 study, and all viruses were inactivated by day 42 in the 1997 study. *Cryptosporidium parvum* survived the 1996 winter but lost its ability to infect infant mice during the month of May, 1997. Microbial survival decreased more rapidly in DT samples compared to CV samples.

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899. Occurrence of cotton herbicides and insecticides in playa lakes of the High Plains of west Texas.

Thurman, E. M.; Bastian, K. C.; and Mollhagen, T.
Science of the Total Environment 248(2-3): 189-200. (2000)
NAL Call #: RA565.S365; ISSN: 0048-9697.

Notes: Special issue: Fate and transport of agricultural chemicals in the Mississippi River Basin.

Descriptors: playas/ herbicides/ insecticides/ water pollution/ agricultural pollution/ pollution surveys/ lakes/ water sampling/ pesticides/ agriculture/ drainage/ metabolites/ cotton/ degradation/ fate of pollutants/ water analysis/ phosphates/ USA, Texas

Abstract: During the summer of 1997, water samples were collected and analyzed for pesticides from 32 playa lakes of the High Plains that receive drainage from both cotton and corn agriculture in West Texas. The major cotton herbicides detected in the water samples were diuron, fluometuron, metolachlor, norflurazon, and prometryn. Atrazine and propazine, corn and sorghum herbicides, were also routinely detected in samples from the playa lakes. Furthermore, the metabolites of all the herbicides studied were found in the playa lake samples. In some cases, the concentration of metabolites was equal to or exceeded the concentration of the parent compound. The types of metabolites detected suggested that the parent compounds had been transported to and had undergone degradation in the playa lakes. The types of metabolites and the ratio of metabolites to parent compounds may be useful in indicating the time that the herbicides were transported to the playa lakes. The median concentration of total herbicides was 7.2 mu g/l, with the largest total concentrations exceeding 30 mu g/l. Organophosphate insecticides were detected in only one water sample. Further work will improve the understanding of the fate of these compounds in the playa lake area.

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900. Organochlorine residues in ducks on playa lakes of the Texas panhandle and eastern New Mexico USA.

Flickinger E. L. and Krynskiy A. J.

Journal of Wildlife Diseases 23(1): 165-168. (1987)

NAL Call #: 41.9 W64B; ISSN: 0090-3558

Descriptors: DDT/ heptachlor/ insecticide/ nontarget organism

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901. Sources of recently deposited sediments in playa wetlands.

Luo, H. R.; Smith, L. M.; Haukos, D. A.; and Allen, B. L.
Wetlands 19(1): 176-181. (1999)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ sedimentation/ playas/ watersheds/ clays/ erosion/ deposition/ volumetric analysis/ nutrients (mineral)/ USA, Southwest

Abstract: There are more than 20,000 playa wetlands in the Southern High Plains of Texas and New Mexico. Playas with cropland watersheds have lost most of their basin volume due to sedimentation, and they have lost more volume than playas with rangeland watersheds. To determine the source (wind vs. water transport) of sedimentation in playas and develop management recommendations to lessen sediment impacts, we examined the particle size distribution (PSD) of soils in 8 playas with rangeland and cropland watersheds. The distribution curves of sand in playa sediments plotted

against relative distance coincided with playa elevational profiles, and the PSD of deeper sediments contained more sand, especially at the playa margins. In contrast, more clay had been deposited in the central portion of the playa basin, and clay content decreased with sediment depth. Sand content at playa edges was greater in crop than in range playas. Sediments eroded from the surrounding watershed resulted in deposition of coarser soil particles at the playa margin, whereas finer particles dominated playa centers. Because most sediments in playa wetlands originate from the immediate watershed and are deposited through water erosion, management activities should concentrate on practices that reduce watershed erosion.
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902. Water quality in cattle feedyard playas in winter and summer.

Purdy, C. W.; Straus, D. C.; Parker, D. B.; Williams, B. P.; and Clark, R. N.

American Journal of Veterinary Research 62(9): 1402-1407. (2001)

NAL Call #: 41.8 Am3A; ISSN: 0002-9645

Descriptors: wetlands/ animal health/ coliform count/ endotoxins/ faecal coliforms/ health hazards/ public health/ summer/ water pollution/ water quality/ water resources/ winter

Abstract: To determine the impact of feedyards on endotoxin concentration, faecal coliform count, and other water quality measurements during winter and summer in feedyard playas (shallow lakes), water samples were obtained from seven feedyard playas and three nonfeedyard control playas. Surface water samples were collected from each playa and at various depths from three feedyard playas. Endotoxin concentrations, 22 water quality variables, and faecal coliform counts were determined in samples collected in summer and winter from various combinations of playas. Cattle numbers per feedyard ranged from 40 000-175 000 head/year. Mean endotoxin concentrations were significantly lower in control than in

feedyard playas in winter and summer. Endotoxin concentration appeared to be homogenous at various water depths. Values for 20 of 22 water quality variables were higher in the feedyard than in control playas in winter and summer. Only in winter, mean total faecal coliform concentration in feedyard playas was significantly greater than in control playas. These results indicate that feedyards have a potential impact on water quality in playas, and cattle should not be allowed access to them. Feedyard playa water should not be used under high pressure to settle dust in pens with cattle or to cool cattle, because aerosols containing pathogens and high concentrations of endotoxin are a health hazard for humans and cattle.
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903. Wetland impacts of center pivots in Wheeler Co, NE.

Lewis, G. L.

In: Planning Now for Irrigation and Drainage in the 21st Century: Proceedings of a Conference. (Held 18 Jul 1988-21 Jul 1988 at Lincoln, Neb.) Hay, DeLynn R. (eds.) New York; pp. 235-241; 1988.

NAL Call #: TC823.P52; ISBN: 0872626660

Descriptors: wetlands/ center pivot irrigation/ surface water/ water table/ irrigation/ Nebraska

This citation is from AGRICOLA.

904. Wildlife on ungrazed and grazed bottomlands on the South Platte River, northeastern Colorado: Habitats, land management, adverse effects.

Crouch, G. L.

In: Proceedings of the Wildlife-Livestock Relationships Symposium. (Held 20 Apr 1981-22 Apr 1981 at Coeur D'alene, Idaho.) Peek, James M. and Dalke, P. D. (eds.) Moscow, Idaho: Forest, Wildlife & Range Experiment Station, University of Idaho; pp. 186-197; 1982.

NAL Call #: SF84.84.W5 1981

Descriptors: Colorado

This citation is from AGRICOLA.

Wetlands as Agricultural Conservation Practices

905. Carrying capacity and diel use of managed playa wetlands by nonbreeding waterbirds.

Anderson, J. T. and Smith, L. M.

Wildlife Society Bulletin 27(2): 281-291. (1999)

NAL Call #: SK357.A1W5; ISSN: 0091-7648

Descriptors: wetlands/ management/ habitat utilization/ carrying capacity/ flooding/ ecosystem management/ migratory species/ playas/ activity patterns/ nighttime/ daytime/ diurnal variations/ aquatic birds/ nature conservation/ USA, Texas, Southern High Plains/ USA, New Mexico, Southern High Plains/ waterfowl/ monitoring/ habitats/ species diversity/ soil management/ seeds/ invertebrates/ Aves/ USA, Texas/ USA, New Mexico/ birds/ winter/ moist-soil management practices

Abstract: Playa wetlands on the Southern High Plains of Texas and New Mexico provide essential wintering habitat for migratory waterbirds. Moist-soil management practices have been implemented in playas, yet no variations on the timing of management have been attempted. In addition, previous evaluation of wetland management has considered only diurnal use by waterfowl and has not

considered invertebrates. We compared waterbird diversity, waterfowl abundance, and waterfowl carrying capacity based on seeds and invertebrates among playas varying in flooding date (September vs. November) and management regimes (moist-soil managed vs. unmanaged) during nocturnal and diurnal periods during the winters of 1994-1995 and 1995-1996. Waterbird species richness and diversity were greater in November flooded, moistsoil managed than in September flooded, managed; September flooded, unmanaged; and November flooded, unmanaged playas. Waterfowl were more abundant in November flooded, moist-soil managed playas than in the other treatments, and counts were 10.5 times higher during nocturnal than diurnal counts. Evaluation of moist-soil management using diurnal counts only showed no waterfowl-use benefit. Carrying capacity, based on seed biomass, was greater in managed than in unmanaged playas. Potential use days, using invertebrate abundance, was higher in playas flooded in September than in November. Moist-soil management of playas is effective in increasing waterbird diversity and waterfowl abundance. If

the main purpose is to evaluate effectiveness of wetland management for waterfowl, then monitoring of nocturnal and diurnal use is essential.

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906. Effects of moist-soil management on playa wetland soils.

Haukos, D. A. and Smith, L. M.

Wetlands 16(2): 1443-149. (June 1996)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ playas/ soil water/ drawdown/ irrigation/ hydrogen ion concentration/ phosphorus/ limiting nutrients/ germination/ plant populations/ vegetation cover/ nutrient cycles/ nitrogen/ limiting factors/ atmospheric precipitations/ nutrients (mineral)/ soils/ water content/ ecosystem management/ arid environments/ environment management/ water in soils/ ecosystems and energetics/ protective measures and control

Abstract: We evaluated effects of moist-soil management on soils of eight playa wetlands for 2 years. Moist-soil management involves timed drawdown and irrigation of wetlands to promote germination, growth, and seed production of mudflat annuals for use by wintering waterfowl. Moist-soil management reduced soil resistance for germination ($P = 0.02$), raised pH closer to neutrality ($P = 0.002$), but had no effect on soil moisture in the top 4 cm of soil ($P = 0.16$; influence on soil moisture in the root zone is unknown) or on salinity measured as conductivity ($P = 0.51$). Moist-soil management did not affect nitrogen and phosphorus levels in playa soils over 2 seasons ($P = 0.61$). As a percentage of available nutrients, more soil nitrogen was lost during the wetter year compared to the dryer year ($P = 0.02$) -- a trend that was reversed for soil phosphorus ($P = 0.004$). More nitrogen was lost in the wetter year ($P = 0.02$); whereas, more phosphorus was lost in the dryer year ($P = 0.004$). This indicates potential changes in limiting nutrients depending upon local precipitation events. Apparently, nutrient cycling is rapid in playas, producing large amounts of biomass despite having lower soil nutrient pools compared to other inland freshwater wetlands. Moist-soil management is a sustainable and compatible practice for playa wetlands because it enhances naturally occurring events.

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907. Evaluation of farmed playa wetlands as avian habitat using survey data and two rapid assessment techniques.

Rivers, J. W. and Cable, T. T.

Transactions of the Kansas Academy of Science 106(3): 155-165. (2003)

NAL Call #: 500 K13T; ISSN: 0022-8443

Descriptors: wetlands/ playas/ agriculture/ aquatic birds/ biological surveys/ sampling/ habitat/ USA, Kansas
Abstract: Playa wetlands contribute to the biological diversity of the southern Great Plains, yet many are modified by current farming practices. We surveyed 12 farmed playa wetlands from 1998-99 to (1) document seasonal avian use of these habitats and (2) assess the performance of two rapid assessment techniques, the Habitat Assessment Technique and the Wetland Evaluation Technique. Thirty-six bird species were observed on farmed playa wetlands, 42% of which are dependent on wetland habitats. In contrast, only 5 species were observed on upland reference sites in 1999, and none were

dependent on wetlands. Collectively, both rapid assessment techniques rated farmed playa wetlands as poor habitats because of the physical characteristics of study sites. Based on field observations and published work, we conclude that farmed playa wetlands provide habitat for many avian species and the rapid assessment techniques examined are unsuitable for assessing playa wetlands as avian habitat in Kansas.

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908. Hydrologic analysis model for screening wetland restoration sites in the Rainwater Basin, Nebraska.

Clemetson, D. J.

In: *Hydraulics/Hydrology of Arid Lands (H2a)*. (Held 30 Jul 1990-2 Aug 1990 at San Diego, Calif.)

New York: American Society of Civil Engineers; pp. 675-680; 1990.

NAL Call #: TC5.H845 1990; ISBN: 0872627713

Descriptors: wetlands/ hydrologic models/ mathematical models/ model studies/ Nebraska/ rainwater basin/ site selection/ wetland restoration/ agriculture/ aquatic habitats/ capital costs/ economic aspects/ hydrologic budget/ reservoirs/ statistical analysis/ storage volume/ water depth
Abstract: Historically, the Rainwater Basin in south central Nebraska contained approximately 4000 wetlands. Today, over 90% of the wetlands have been lost, primarily due to drainage for agricultural purposes. With an increasing interest in the restoration of wetland habitats, a need has arisen for prioritizing candidate wetland restoration sites, which would ensure expenditure of funds on the best available sites. A hydrologic model has been developed as a tool to assist in screening candidate wetland sites for restoration in the Rainwater Basin. The Wetland Hydrologic Analysis Model (WHAM) was developed to perform daily analysis of the hydrologic budget of individual wetland basins. Inflows to the wetland, which are input data for the WHAM, were derived with the Streamflow Synthesis and Reservoir Regulation model, which was developed by the North Pacific Division of the US Army Corps of Engineers. Statistical analysis was performed on the simulated hydrologic parameters including surface area, water surface elevation, storage volume, and average depth to evaluate the hydrologic effectiveness of the proposed restoration for each site. Priorities for acquisition and restoration can be assigned to the individual wetlands based on the results of these analyses.

(Author's abstract)

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909. Identifying sites for riparian wetland restoration: Application of a model to the Upper Arkansas River Basin.

O'Neill, M. P.; Schmidt, J. C.; Dobrowolski, J. P.; Hawkins, C. P.; and Neale, C. M.

Restoration Ecology 5(Suppl. 4): 85-102. (Dec. 1997)

NAL Call #: QH541.15.R45R515; ISSN: 1061-2971.

Notes: Special issue: Riparian Restoration.

Descriptors: wetlands/ USA, Upper Arkansas R./ rehabilitation/ river basins/ riparian land/ site selection/ priorities/ soil water/ preservation/ reach/ model studies/ geographical information systems/ aerial photography/ energy/ environmental restoration/ models/ riparian environments/ geographic information systems/ vegetation patterns/ USA, Colorado/ rivers/ habitat improvement/ environmental protection/ pollution control/

USA, Arkansas R./ streamflow and runoff/ modeling, mathematics, computer applications/ protective measures and control/ reclamation

Abstract: We present a conceptual model for identifying restoration sites for riparian wetlands and discuss its application to reaches within the Upper Arkansas River basin in Colorado. The model utilizes a Geographic Information System (GIS) to analyze a variety of spatial data useful in characterizing geomorphology, hydrology, and vegetation of riparian wetland sites. The model focuses on three basic properties of riparian wetland sites: relative soil moisture, disturbance regime, and vegetative characteristics. A relative wetness index is used to define nominal soil moisture classes within the watershed. These classes generally coincide with uplands (low), channel margins (moderate), and channels or open water (high). Vegetative conditions are characterized using color infrared aerial photographs. Land cover types are grouped into five major land cover classes: riparian, moist herbaceous, bare ground, upland, and open water. Disturbance regime is characterized by a reach-based index of specific power (ω). Preliminary results indicate that reaches within the Upper Arkansas River basin can be classified as high energy (ω greater than or equal to $8 \text{ W/m super}(2)$) or low energy (ω less than or equal to $3 \text{ W/m super}(2)$), using discharge estimates that reflect the 10-year flood event. Field surveys of channel and floodplain conditions show that high-energy reaches (ω greater than or equal to $8 \text{ W/m super}(2)$) are characterized by sites where the channel occupies a large proportion of the valley bottom. By contrast, low-energy reaches (ω less than or equal to $3 \text{ W/m super}(2)$) are characterized by meandering channels with wide alluvial valleys. Restoration potential is evaluated as a combination of nominal scores from wetness, land cover, and disturbance indices. Application of these methods to field sites within the Upper Arkansas River basin identifies a wide range of riparian wetland sites for preservation or restoration. Potential sites within identified reaches are prioritized using size and proximity criteria.

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910. Little Salt Fork Marsh Preserve: Restoration of an inland saline wetland.

Zlotsky, A. and Yost, J.

Land and Water 42(5): 49-51. (Sept. 1998-Oct. 1998);
ISSN: 0192-9453

Descriptors: wetlands/ salt marshes/ land management/ environmental quality/ environmental restoration/ nature conservation/ research programs/ marshes/ inland water/ USA, Nebraska, Little Salt Fork Marsh/ restoration/ refuges/ sanctuaries/ ecosystem management/ environment management/ land use/ land restoration/ environmental quality standards/ land restoration/ water quality control/ environmental action/ protective measures and control/ water quality

Abstract: The Little Salt Fork Marsh Preserve restoration project initially began in 1995 when The Nature Conservancy purchased a 60-acre tract near Lincoln, Nebraska. The Conservancy was interested in the acquisition and preservation of a large, inland saline wetland complex. About the same time, the Burlington

Northern Railroad Company (BNSF) was in the process of creating the first wetland mitigation bank in the state. Together, the two entities forged an agreement for the restoration, enhancement and expansion of the Little Salt Fork Marsh into a 180-acre nature preserve.

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911. Short-term response of wetland birds to prescribed burning in Rainwater Basin wetlands.

Brennan, E. K.; Smith, L. M.; Haukos, D. A.; and Lagrange, T. G.

Wetlands 25(3): 667-674. (2005)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ burning/ species richness/ abundance/ migration/ recruitment/ basins/ introduced species/ incineration/ birds/ species diversity/ forest fires/ litter/ Aves/ USA, Nebraska/ birds

Abstract: Prescribed burning is often used in wetlands to remove plant litter, decrease woody or invasive species, and increase use by wetland birds. However, little is known about the within-season, short-term response of wetland birds to prescribed burning, especially during spring migration. We surveyed use of 19 burned and 19 unburned (reference) wetlands by migratory birds in the Rainwater Basin region of Nebraska, USA during three spring migrations, 2002-2004. We calculated the change in avian abundance and species richness, as well as generating the Soerenson's similarity index for burned and reference wetlands in the weeks immediately before and after burning. We compared Soerenson's index values and percent change in abundance and species richness between burned and reference wetlands using an analysis of covariance with week and wetland area as covariates to account for migration chronology and differences in the area of experimental units. Following removal of effects due to wetland area and week, burning had no effect on the percent change in avian abundance and species richness. Soerenson's index also did not differ between burned and reference wetlands. Prescribed burning did not improve use of wetlands by migratory birds in the short term. Understanding the immediate and long-term effects of prescribed burning on migratory avian abundance, species richness, and community composition is imperative for management decisions.

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Mississippi Alluvial Valley Wetlands General Information

912. **Afforestation of bottomland hardwoods in the Lower Mississippi Alluvial Valley: Status and trends.**

Schoenholtz, S. H.; James, J. P.; Kaminski, R. M.; Leopold, B. D.; and Ezell, A. W.

Wetlands 21(4): 602-613. (2001)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: afforestation/ lowlands/ forests/ Mississippi/ trends/ wetland restoration

This citation is from AGRICOLA.

913. **Bottomland Hardwoods of the Mississippi Alluvial Valley: Characteristics and Management of Natural Function, Structure, and Composition.**

Hamel, Paul B. and Foti, Thomas L.

Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station; GTR-SRS-042, 2001. 109 p.

NAL Call #: aSD143 .G46 no. 42

<http://www.srs.fs.usda.gov/pubs/2474>

Descriptors: bottomland hardwoods/ forest history/ mammals/ Mississippi Alluvial Valley/ old growth/ songbirds/ wetland restoration

Abstract: A symposium entitled "Bottomland hardwoods of the Mississippi Alluvial Valley: characteristics and management of natural function, structure, and composition" convened on October 28, 1995, as part of the Natural Areas Conference, October 25-28, 1995, in Fayetteville, AR. The symposium's goal was to provide information that managers need to begin restoring the composition, structure, and function of off rest ecosystems in the Mississippi Alluvial Valley. Included in the proceedings from that symposium are 8 of 13 presentations. These peer-reviewed contributions address historical conditions of forests in the Mississippi Alluvial Valley (two papers), historical changes that are reflected in today's forests (one paper), the effect of historic and prehistoric rainfall patterns (one paper), forest fauna in the region (two papers), the effect of herbivory on forest vegetation (one paper), and management of bottomland hardwood forests for multiple outputs (one paper). A ninth paper, concerning characteristics of old-growth forests, is a posthumous submission authored by Dr. James T. Tanner; and the tenth paper was published in another venue. The intended audience of these proceedings includes managers of private, State, and Federal lands, as well as land management planners from a range of jurisdictions.

914. **A cumulative impact management plan for a forested wetland watershed in the Mississippi River floodplain.**

Shaffer, G. P.; Burdick, D. M.; Gosselink, J. G.; and Lee, L. C.

Wetlands Ecology and Management 1(4): 199-210. (1992)

NAL Call #: QH541.5.M3 W472; ISSN: 0923-4861

Descriptors: wetlands/ forest watersheds/ management planning/ degradation/ environmental quality/ forest industry/ environment management/ environmental impact/ USA, Louisiana, Tensas Basin/ forest industry/ environment management/ environmental impact/ forest watersheds/ management planning/ environmental quality

Abstract: A management plan using a watershed-scale

approach was devised to limit loss of wetland functions in the one million ha Tensas Basin, Louisiana, U.S.A. Proposals to develop wetland areas are evaluated for their potential to affect the structure and function of the landscape as a whole. The plan required two prior steps. First, we assessed the structural and functional status of the landscape through time. Second, using the assessment, we formulated a set of environmental goals. The assessment indicated that the landscape is severely degraded; of the original forest, 85% has been lost, and the deforestation has negatively affected water quality and biota. Specific goals were devised to conserve remaining wetland resources and to restore functional integrity to the basin as a whole. On the basis of these two prior steps and principles of landscape ecology and conservation biology, we devised a plan that would establish two large tracts of bottomland forest (BLF) totaling 102000 and 63000 ha. These tracts would be established by reforesting about 1000 ha of corridors, primarily along streams, linking existing forest patches. In addition, set-back levees and man-made diversions would be incorporated to restore natural flooding to certain areas of remaining BLF. Existing wetlands would be prioritized on the basis of size and density of patches and placed in one of three management categories. Implementation of such a plan is possible under the present regulatory authority of U.S. federal government programs administered by regulatory agencies responsible for wetland protection (DBO).

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915. **A density-dependent matrix model for bottomland hardwood stands in the Lower Mississippi Alluvial Valley.**

Zhao, Dehai; Borders, Bruce; and Wilson, Mabelle

Ecological Modelling 184(2-4): 381-395. (2005)

NAL Call #: QH541.15.M3E25; ISSN: 0304-3800

Descriptors: density dependent matrix model: mathematical and computer techniques/ wildlife habitat/ biodiversity/ timber production/ Lower Mississippi Alluvial Valley/ water quality protection

Abstract: Bottomland hardwoods in the Lower Mississippi Alluvial Valley (LMAV) have become one of the most endangered ecosystems in the United States. This ecosystem is an important ecological resource providing many functions and values such as wildlife habitat, water quality protection, biodiversity, and timber production. Active management and restoration of bottomland hardwoods stress the need for tools to support decision-making, but no reliable quantitative information, such as developed growth and yield models, is available for such forests with high species diversity. A density-dependent matrix model, which recognizes differences in tree species and size, was developed for these bottomland mixed-species hardwoods in LMAV. The model was calibrated using data from continuous forest inventory plots. Trees were placed in one of 13 diameter classes of soft hardwoods or hard hardwoods, or four diameter classes of non-commercial species. Five-year predictions show good agreement between the actual and predicted diameter distributions. In terms of value of stand basal area, the model predicted well for stands with densities ranging from

13.8 to 41.3 m(2)/ha (60-180 ft(2)/acre). The model will be useful for short-term inventory projections and simulation studies of the development of these stands using different management regimes. (c) 2004 Elsevier B.V. All rights reserved.

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916. Development and application of the wetlands dynamic water budget model.

Walton, Raymond; Chapman, Raymond S.; and Davis, Jack E.

Wetlands 16(3): 347-357. (1996)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: ecology: environmental sciences/ forestry/ freshwater ecology: ecology, environmental sciences/ mathematical biology: computational biology/ models and simulations: computational biology/ black swamp/ bottomland hardwood forest/ Cache River/ canopy interception/ computer models and simulations/ evapotranspiration/ flooding/ forested wetlands/ freshwater ecology/ groundwater ecology/ infiltration/ precipitation/ wetlands dynamic water budget model

Abstract: A Wetlands Dynamic Water Budget Model was developed and applied to support a large field investigation of processes in the Black Swamp wetlands of the Cache River between Patterson and Cotton Plant, Arkansas. The model is called the Wetlands Dynamic Water Budget Model because it provides magnitudes for the water budget components, as well as water depths, discharges, and flow velocities throughout the modeled system. The development of the computer program is based on concepts and approaches of a number of programs in common use. It includes three dynamically-linked modules that include all the major components of a typical water budget, including precipitation, canopy interception, overland flow, channel flow, infiltration, evapotranspiration, and horizontal ground-water flow. The surface-water module of the model was applied to the Cache River in Arkansas, and augmented a comprehensive hydrologic field study by filling data gaps that occurred due to gage problems and by providing long-term simulation data for broad areas of the wetland, particularly those far away from any measurement station. The results demonstrated that these wetlands are inundated primarily from the backwater produced at downstream constrictions, rather than from the forward-moving flood wave.

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917. The effects of varied hydraulic and nutrient loading rates on water quality and hydrologic distributions in a natural forested treatment wetland.

Blahnik, Theodore and Day, John

Wetlands 20(1): 48-61. (2000)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: freshwater ecology: ecology, environmental sciences/ waste management: sanitation/ forested waste water treatment wetland/ hydraulic loading/ hydrology/ nutrient loading/ water quality

Abstract: Hydrology and water quality distributions in a Louisiana forested waste-water treatment wetland were studied under four different hydraulic loading rates (HLR). Pond discharge, surface-water elevations, and fluorescent dye travel times were recorded to assess surface-water hydrology, and water samples were collected for nitrate, ammonium, phosphate, and suspended solids analyses.

Wetted surface area increased with pond discharge rate, and 58 to 66 percent of surface-water flow was concentrated in shallow channels covering only 10 to 12 percent of the total study area. Water residence times were much longer (0.9 to 1.1 days) than minimum dye travel times (2 to 3 hours) through the 4-hectare study area. Relative to study area influent concentrations, study area outflow concentrations of nitrate and total and organic suspended solids were lower, ammonium was higher, and phosphate was generally unchanged. However, there was an increase in concentrations of nitrate, ammonium, and phosphate within 50 m of the study area inflow location. Ammonium and phosphate did decrease from these peak concentrations. Net nitrate production was observed within 50 m of the pond outfall and was probably due to nitrification. Net nitrate removal was observed beyond this distance and ranged up to 0.10 g nntdot m-2 cntdot d-1 probably due primarily to denitrification. In general, nitrate removal rates increased linearly with changes in nitrate loading rates. Results show that nutrient distributions are linked to hydrology. Higher pond discharge rates created more treatment surface area, and higher constituent loading rates produced higher removal rates. Therefore, discharge rates could be manipulated, and physical control structures could be installed to increase wetted surface area and increase removal efficiency within the wetland. Higher loading rates could then be processed without requiring significant increases in treatment area.

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918. Hydrologic, vegetation, and substrate characteristics of floating marshes in sediment-rich wetlands of the Mississippi River delta plain, Louisiana, USA.

Sasser, C. E.; Gosselink, J. G.; Swenson, E. M.; and Evers, D. E.

Wetlands Ecology and Management 3(3): 171-187. (1995)

NAL Call #: QH541.5.M3 W472; ISSN: 0923-4861

Descriptors: wetlands/ hydrology/ vegetation/ marshes/ sediments/ deltas/ environmental effects/ degradation/ aquatic plants/ vegetation cover/ ecosystem disturbance/ USA, Louisiana, Terrebonne Basin/ vegetation cover/ ecosystem disturbance/ vegetation

Abstract: Floating marshes occur over 70% of the western Terrebonne Basin, Louisiana, USA, freshwater coastal wetlands. They are of several types: A free-floating thick-mat (45-60 cm) marsh dominated by *Panicum hemitomon* and *Sagittaria lancifolia*; a thick mat marsh dominated by *Panicum hemitomon* and *Sagittaria lancifolia* that floats part of the year, but whose vertical floating range is damped compared to adjacent water; and an irregularly-floating thin mat (<30 cm) dominated by *Eleocharis* spp. in the spring and *Ludwigia leptocarpa* and *Bidens laevis* in the summer and fall. Floating mats must be almost entirely organic in order to be buoyant enough to float. The western Terrebonne wetlands receive large winter/spring supplies of suspended sediments from the Atchafalaya River. Even though sediment concentrations in the adjacent bayou are as high as 100 mg l super(-1), the *Panicum hemitomon*/*Sagittaria lancifolia* free-floating marsh probably receives no over-surface sediments since it floats continuously. The bulk density data of the damped-floating marsh, however, suggest some mineral sediment input, probably during winter when this marsh is submerged. These two types of floating marsh could not have

developed in the present sediment regime of the Atchafalaya River, but as long as they remain floating can continue to exist. Thin floating mats are found in areas receiving the least sediment (<20 mg l super(-1) suspended sediment concentration in adjacent bayous). This low sediment environment probably made possible their formation within the past 20 years. They may represent a transitional stage in mat succession from (1) existing thick-mat floating marsh to a degrading floating marsh, or (2) a floating marsh developing in shallow open water.
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919. Hydrology of the black swamp wetlands on the Cache River, Arkansas.

Walton, Raymond; Davis, Jack E.; Martin, Thomas H.; and Chapman, Raymond S.

Wetlands 16(3): 279-287. (1996)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: climatology: environmental sciences/ freshwater ecology: ecology, environmental sciences/ black swamp/ bottomland hardwood forest/ Cache River/ flood storage/ forested wetlands/ freshwater ecology/ hydrology/ hydroperiod/ river discharge/ water budget

Abstract: The hydrologic characteristics of the Cache River wetlands between Patterson and Cotton Plant, Arkansas, were investigated. The Cache River is an underfit stream with wetlands predominantly located in abandoned channels and backswamps. Much of the Cache River upstream of the study area has undergone extensive channelization to allow agricultural development in the basin. Hydrologic measurements included streamflow gages at the upstream and downstream limits of the study area, water-level recorders inside the study area, a nest of deep and shallow ground-water wells that monitored variations in the underlying aquifer, a meteorological recording station that collected precipitation, air temperature, and solar radiation data inside the study area, and regional precipitation data. Analysis of the wetland's water budget showed that the system is dominated by river discharges and that the magnitudes of other water-budget components are less than the error associated with well-maintained streamflow gages (5-10%). The system is characterized by floods occurring from late fall to late winter and again in mid-to-late spring. Peak flood discharges are approximately 185 ml/s for a 2-year event and 270 ml/s for a 5-year event. Peak discharges between the upstream and downstream gages are reduced by 10-20% with greater attenuation occurring when the system is initially drier. Peak discharge at the downstream gage lags the peak at the upstream gage by 4-8 days depending on antecedent conditions. The majority of overbank flooding is produced by backwater from several constrictions in the downstream reach of the study area, rather than from the forward movement of the flood wave. Floodpeak attenuation between the upstream and downstream gages is due mainly to floodplain storage, with flow resistance contributing minimally. Finally, the relationship between the hydroperiods at different water-surface elevation gages was examined to determine if a long-term record could be used to estimate long-term hydroperiods at interior gage locations (or perhaps at interior computer model locations) with shorter-term information.

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920. Inorganic nitrogen processing and assimilation in a forested wetland.

Lindau, C. W.; Delaune, R. D.; and Pardue, J. H.

Hydrobiologia 277(3): 171-178. (1994)

NAL Call #: 410 H992; ISSN: 0018-8158

Descriptors: ammonium/ bottomland hardwood forest/ denitrification/ direct measurement technique/ Mississippi Valley/ nitrate/ nitrogen assimilation/ soil/ swamp

Abstract: A field study was conducted to assess the capacity of a lower Mississippi Valley, USA forested wetland to process and assimilate inorganic N. Elevated levels of N-15 labeled N-4 + and NO-3 --N were added to field plots and emissions of 15N-2 and N-2O and NH-4 + and NO-3 --N concentrations in the floodwater were measured over a 67 d study period. Results are given which show the forested wetland soil can remove significant quantities of NH-4 + and NO-3 - from the surface water by assimilation and denitrification processes.

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921. Limnology of a wetland complex in the Mississippi Alluvial Valley of southeast Missouri.

Wylie, G. D. and Jones, J. R.

Archiv fuer Hydrobiologie 74 Suppl(3): 288-314. (Dec. 1986); ISSN: 0081-0001

Descriptors: wetlands/ reservoirs/ forests/ flooding/ missouri/ limnology/ cycling nutrients/ seasonal variation/ biomass/ limiting nutrients/ macrophytes/ phytoplankton/ aquatic plants/ aquatic habitats/ zooplankton/ salinity/ litter/ leachate/ duckweed/ lakes

Abstract: Productive wetlands in southeast Missouri, characterized by low salinity, were studied from 1981-1983. Nutrient chemistry was related to water level management of individual sites. A permanently flooded reservoir had the lowest nutrient concentrations, periodically drained marsh sites contained moderate nutrient levels, and autumnally-flooded forest sites had the highest nutrient concentrations derived from leachate of leaf litter. Nutrient concentrations in the forested sites reached maximum values within a few months after inundation and decreased thereafter. Algal biomass was typically nitrogen-limited in the sites, but high macrophyte production in the largest sites did not depend on nutrients in the water. In addition, rates of community metabolism were related to relative dominance of phytoplankton, rooted macrophytes or duckweeds in the respective sites rather than to nutrient content of the water. Zooplankton concentrations in managed forested sites increased and decreased over time patterns similar to changes in nutrient concentrations, which, together with results from other investigations, suggests that detritivore production in temporarily flooded forest is initially high and subsequently decreases with duration of flooding. (Author's abstract)

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922. Loss of bottomland hardwood forests and forested wetlands in the Cache River basin, Arkansas.

Kress, Margaret R.; Graves, Mark R.; and Bourne, Scott G.

Wetlands 16(3): 258-263. (1996)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: conservation/ forestry/ freshwater ecology: ecology, environmental sciences/ black swamp/ bottomland hardwood forest/ Cache River/ conservation/ forest cover loss/ forested wetlands/ geographic information system/ image processing/ remote sensing

Abstract: Data related to forest cover in the Cache River Basin, Arkansas, USA were collected and analyzed to quantify changes in forest cover since 1935. Forest cover loss during the period 1935 to 1987 was characterized using data derived from aerial photography, historical map products, and Landsat satellite multispectral imagery. Forest cover in the basin declined from 65% to 15% over the 52-year period (a loss of 108,000 ha of forest cover). There was little change in forest cover between 1975 and 1987. Remaining forest stands in the basin are fragmented and small in size. Comparing forest-stand data with Soil Conservation Service data revealed that 90% of the forest loss in the southern half of the basin occurred in hydric soil areas, thus indicating a significant loss of forested wetlands.

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923. Marsh vegetation types of the Mississippi River deltaic plain.

Visser, J. M.; Sasser, C. E.; Chabreck, R. H.; and Linscombe, R. G.

Estuaries 21(4B): 818-828. (1998)

NAL Call #: GC96.E79; ISSN: 0160-8347

Descriptors: wetlands/ vegetation/ deltas/ coastal marshes/ sampling/ salt marshes/ vegetation cover/ indicator species/ ecological zonation/ USA, Mississippi R. Delta/ community composition

Abstract: Marshes of the Mississippi River Deltaic Plain represent 17% of the coastal marshes in the continental United States. However, only a few detailed descriptions of the diverse plant communities that occur in this large expanse of wetlands exist and none are based on detailed vegetation analysis. The objective of this study was to quantitatively analyze the vegetation data collected in the wetlands of the Barataria and Terrebonne estuary to determine naturally occurring vegetation associations. Two-way indicator species analyses (TWINSPAN) revealed nine vegetation types: polyhaline mangrove, polyhaline oystergrass, mesohaline mix, mesohaline wiregrass, oligohaline wiregrass, oligohaline mix, fresh bulltongue, fresh maidencane, and fresh cutgrass. These nine types form a logical expansion on the four salinity zones described for the region by previous studies and form a basis to compare the vegetation types of the Mississippi River Delta region with other regions of the Atlantic and Gulf coasts.

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924. Methane flux from Mississippi River deltaic plain wetlands.

Alford, Douglas P.; Delaune, Ronald D.; and Lindau, Charles W.

Biogeochemistry 37(3): 227-236. (1997)

NAL Call #: QH345 .B564; ISSN: 0168-2563

Descriptors: atmospheric methane source/ bulltongue/ climatology/ deltaic plain wetlands/ methane flux/ Mississippi river delta/ pollution/ seasonal variation/ soil temperature/ water tupelo

Abstract: Methane emissions from three wetland habitats in the Mississippi River deltaic plain were measured over a three year period. Flux data collected indicate that each habitat was a net source of methane to the atmosphere throughout the year. Average emission from a *Taxodium distichum*/*Nyssa aquatica* (bald cypress/water tupelo) swamp forest was 146 +/- 199 mg CH₄ m⁻²d⁻¹ while

emissions from a *Sagittaria lancifolia* (bulltongue) freshwater marsh averaged 251 +/- 188 mg CH₄ m⁻²d⁻¹. Methane flux from a *Spartina patens*/*Sagittaria lancifolia* intermediate marsh was significantly higher, 912 +/- 923 mg CH₄ m⁻²d⁻¹. Seasonal variation was significant with emissions being higher in the late summer and early fall. Significant diurnal emissions were observed from the *Sagittaria lancifolia* marsh site. Soil temperature (5 and 10 cm depths) was found to be significantly con-elated with methane emission from the three sites.

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925. Mississippi River Delta: An overview.

Coleman, J. M.; Roberts, H. H.; and Stone, G. W.

Journal of Coastal Research 14(3): 698-716. (1998);

ISSN: 0749-0208

Descriptors: wetlands/ fluvial morphology/ deltas/ deltaic deposits/ coastal morphology/ deltaic features/ USA, Mississippi R./ USA, Louisiana/ reviews/ economic aspects/ social aspects/ subsidence/ water level fluctuations/ saline water intrusion/ population dynamics/ sea level

Abstract: Over the last century, the river-dominated Mississippi delta has received increasing attention from geoscientists, biologists, engineers, and environmental planners because of the importance of the river and its deltaic environments to the economic well-being of the state of Louisiana and the nation. Population growth, subsurface resource extraction, and increased land-water use have placed demands on the delta's natural geologic, biologic, and chemical systems, therefore modifying the time and spatial scales of natural processes within the delta and its lower alluvial valley. As a result, the combined effects of natural and human-induced processes, such as subsidence, eustatic sea level rise, salt water intrusion, and wetland loss, have produced a dynamically changing landscape and socioeconomic framework for this complex delta.

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926. Nest survival of forest birds in the Mississippi Alluvial Valley.

Twedt, D. J.; Wilson, R. R.; Henne-Kerr, J. L.; and Hamilton, R. B.

Journal of Wildlife Management 65(3): 450-460. (2001)

NAL Call #: 410 J827; ISSN: 0022-541X

Descriptors: nests/ survival/ riparian environments/ forests/ breeding success/ wildlife management/ ecological effects/ birds/ nesting/ riparian land/ Aves/ USA/ birds/ USA, Mississippi Alluvial Valley

Abstract: In the Mississippi Alluvial Valley, flood control has led to a drastic reduction in the area of forest habitat and altered the patchwork of forest cover types. Silvicultural management of the remaining fragmented forests has changed to reflect the altered hydrology of the forests, current economic conditions of the area, and demand for forest products. Because forest type and silvicultural management impact forest birds, differences in avian productivity within these forests directly impact bird conservation. To assist in conservation planning, we evaluated daily nest survival, nest predation rates, and brood parasitism rates of forest birds in relation to different forest cover types and silvicultural management strategies within this floodplain. Within bottomland hardwood forests, nest success of blue-gray gnatcatcher (*Poliophtila caerulea*, 13%), eastern towhee (*Pipilo erythrophthalmus*, 28%),

indigo bunting (*Passerina cyanea*, 18%), northern cardinal (*Cardinalis cardinalis*, 22%), and yellow-billed cuckoo (*Coccyzus americanus*, 18%) did not differ from that within intensively managed cottonwood plantations. However, average daily survival of 542 open-cup nests of 19 bird species in bottomland hardwoods (0.9516 plus or minus 0.0028, similar to 27% nest success) was greater than that of 543 nests of 18 species in cottonwood plantations (0.9298 plus or minus 0.0035, similar to 15% nest success). Differences in daily nest survival rates likely resulted from a combination of differences in the predator community - particularly fire ants (*Solenopsis invicta*) - and a marked difference in species composition of birds breeding within these 2 forest types. At least 39% of nests in bottomland hardwood forests and 65% of nests in cottonwood plantations were depredated. Rates of parasitism by brown-headed cowbirds (*Molothrus ater*) were greater in managed cottonwoods (24%) than in bottomland hardwoods (9%). Nest success in planted cottonwood plantations for 18 species combined (similar to 14%), and for yellow-breasted chat (*Icteria virens*, 7%), eastern towhee (14%), indigo bunting (14%), and northern cardinal (17%) did not differ from nest success in cottonwood plantations that were coppiced from root sprouts following pulpwood harvest. Within bottomland hardwood forests, uneven-aged group-selection timber harvest reduced the combined daily nest survival of all species from 0.958 to 0.938, which reduced nest success by about 14%. Specifically, timber harvest reduced nest success of species that nest in the forest midstory and canopy, such as Acadian flycatcher (*Empidonax virescens*) - from 32% before harvest to 14% after harvest. Conversely, those species that nest primarily in the shrubby understory - such as northern cardinal - were not affected by timber harvest and maintained an overall nest success of about 33%. Thus, birds nesting in the understory of bottomland hardwood forests are not adversely impacted by selective timber harvest, but there is a short-term reduction in nest success for birds that nest in the canopy and midstory.

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927. Pattern and process of land loss in the Mississippi Delta: A spatial and temporal analysis of wetland habitat change.

Day, J. W.; Shaffer, G. P.; Britsch, L. D.; Reed, D. J.; Hawes, S. R.; and Cahoon, D.

Estuaries 23(4): 425-438. (2000)

NAL Call #: GC96.E79; ISSN: 0160-8347

Descriptors: wetlands/ deltas/ habitats/ dredging/ land management/ canals/ sediments/ rivers/ environmental degradation/ coastal environments/ salt marshes/ degradation/ man-induced effects/ coastal engineering/ navigational channels/ coastal zone management/ environment management/ habitat/ dredging operations/ land/ sediment/ streams (in natural channels)/ USA, Louisiana, Mississippi Delta

Abstract: An earlier investigation concluded that most of the coastal wetland loss in Louisiana was caused by the effects of canal dredging, that loss was near zero in the absence of canals, and that land loss had decreased to near zero by the late 1990s. This analysis was based on a 15-min quadrangle (approximately 68,000 ha) scale that is too large to isolate processes responsible for small-scale wetland loss and too small to capture those responsible for large-scale loss. We conducted a further evaluation of the

relationship between direct loss due to canal dredging and all other loss from 1933-1990 using a spatial scale of 4,100 ha that accurately captures local land-loss processes. Regressions of other wetland loss on canal area (i.e., direct loss) for the Birdfoot, Terrebonne, and Calcasieu basins were not significant. Positive relationships were found for the Breton ($r_{\text{super}(2)} = 0.675$), Barataria ($r_{\text{super}(2)} = 0.47$), and Mermentau ($r_{\text{super}(2)} = 0.35$) basins, indicating that the extent of canals is significantly related to wetland loss in these basins. A significant negative relationship ($r_{\text{super}(2)} = 0.36$) was found for the Atchafalaya coastal basin which had statistically lower loss rates than the other basins as a whole. The Atchafalaya area receives direct inflow of about one third of the Mississippi discharge. When the data were combined for all basins, 9.2% of the variation in other wetland loss was attributable to canals. All significant regressions intercepted the y-axis at positive loss values indicating that some loss occurred in the absence of canals. Wetland loss did not differ significantly from the coast inland or between marsh type. We agree with Turner that canals are an important agent in causing wetland loss in coastal Louisiana, but strongly disagree that they are responsible for the vast majority of this loss. We conclude that wetland loss in the Mississippi delta is an ongoing complex process involving several interacting factors and that efforts to create and restore Louisiana's coastal wetlands must emphasize riverine inputs of freshwater and sediments.

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928. A review of ecological impacts of oil and gas development on coastal ecosystems in the Mississippi Delta.

Ko, J.-Y. and Day, J. W.

Ocean and Coastal Management 47(11-12 SPEC. ISS.): 597-623. (2005)

NAL Call #: GC1000.O3; ISSN: 0964-5691

Abstract: We review the multiple ecological impacts of oil and gas development on coastal ecosystems in the Mississippi Delta. This area has one of the greatest developments of oil and gas production in the world. This activity has generated significant impacts on coastal ecosystems due to the toxicity of spilled oil and the secondary and indirect effects of petroleum-related activities, such as alteration of hydrology. Effects on plant communities include disruption of plant-water relationships, direct impacts to plant metabolism, toxicity to living cells, and reduced oxygen exchange between the atmosphere and the soil. Effects on consumers include growth inhibition, reduced production, altered metabolic systems, and biomagnification of hydrocarbon compounds. Petroleum-related activities have contributed significantly to wetland loss in the Delta. Subsidence was increased by 2-3 times due to fault activation. Canals altered natural hydrology by altering water flow pathways, increasing saltwater intrusion, and reducing overland flow and sediment inputs. The combination of these factors increased plant stress and plant death.

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929. The role of the Mississippi River in wetland loss in southeastern Louisiana USA.

Kesel R. H.

Environmental Geology and Water Sciences 13(3): 183-194. (1989)

NAL Call #: QE1.E5; ISSN: 0177-5146

Descriptors: overbank flow/ sedimentation/ reservoir dam/ resource management

Abstract: The suspended load of the Lower Mississippi River has decreased almost 80 percent since 1850. The long-term suspended sediment record can be loosely subdivided into three phases: a historic interval prior to 1900, a predam period (1930-1952) and a postdam period (1963-1982). The suspended load decreased 43 percent from the historic to the predam period and 51 percent from the predam to the postdam period. The decreases in suspended load after 1952 coincide with the construction of reservoirs and dams on the Missouri and Arkansas rivers. Earlier decreases may be the result of changes in land use measurement practices. The decrease in suspended load and the elimination of overbank flow by the construction of artificial levees are considered to be major causes of coastal wetland loss in southeastern Louisiana. During the historic period sediment accumulation of the marsh surface was greater than the rate of water level rise. During the pre and postdam periods, the rate of water level rise exceeded sediment accretion on the marsh surface. Although the elimination of overbank sediment clearly exacerbated the wetlands loss, an accelerated rate of water level rise during the past 25 years has been a dominant factor. Based on estimates of available overbank sediment, it is suggested that the most viable management strategy for the wetlands would be the diversion of sediment into selected areas where the land loss is most critical.

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930. Sixteen years of old-field succession and reestablishment of a bottomland hardwood forest in the Lower Mississippi Alluvial Valley.

Battaglia, L. L.; Minchin, P. R.; and Pritchett, D. W.

Wetlands 22(1): 1-17. (2002)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: bottomland/ reforestation/ vegetation establishment/ succession/ species composition/ distribution patterns/ elevation/ ecology/ on-site investigations/ old fields/ forests/ trees/ *Celtis laevigata*/ *Fraxinus pennsylvanica*/ USA, Louisiana/ USA, Louisiana, Mississippi R./ sugarberry/ green ash

Abstract: In the Lower Mississippi Alluvial Valley (LMAV), losses of bottomland hardwood forests have been severe, with less than 30% of the original 10 million ha remaining. Reforestation of abandoned farmland is occurring, but there has been little research on natural reestablishment of these forests. We examined understory succession and tree establishment patterns in a 3.2-ha field in northeast Louisiana, USA, abandoned in 1984. Relative elevation, strongly correlated with flooding depth and frequency, varied by approximately 1m. Ground-layer composition was monitored from 1985 to 1999 in twenty 1-m super(2) quadrats stratified along the elevation gradient. In 2000, shrubs and tree saplings were mapped and their relative elevations determined. Ordination of the ground-layer data revealed that the major trends in species composition were related to time-since-abandonment and elevation. Annual species gradually declined, woody perennials became more

abundant, and a shrub and young tree layer emerged from beneath the ground layer, but species composition in low and high elevation plots did not converge. Obligate species were more common at lower elevations, while facultative species were more common at upper elevations. By 16 years after abandonment, a total of 16 tree and shrub species had established in the field; eleven of these had potential local seed sources on levees adjacent to the study site. Abundance of dominant species was significantly related to elevation in most cases. In addition, distance to seed source influenced density and spatial distribution of *Celtis laevigata* and *Fraxinus pennsylvanica*. Our study suggests that rate and pattern of secondary succession in LMAV bottomlands are strongly influenced by elevation, dispersal mode of species, and the composition and proximity of forest remnants. Successful restoration of bottomland forests will require an improved understanding of these factors.

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931. Spring bird migration in Mississippi alluvial valley forests.

Wilson, R. Randy and Twedt, Daniel J.

American Midland Naturalist 149(1): 163-175. (2003)

NAL Call #: 410 M58; ISSN: 0003-0031

Descriptors: alluvial valley forests/ bottomland hardwood forest/ silvicultural management/ spring bird migration

Abstract: We surveyed forest songbirds during migration in bottomland hardwood forest stands and managed cottonwood (*Populus deltoides*) plantations in northeast Louisiana and west-central Mississippi between 24 March and 24 May 1996 and 1997. We detected more bird species in bottomland hardwood stands than in cottonwood stands. Within hardwood stands, we detected more individuals in stands subjected to uneven-aged timber harvest than in unmanaged stands. Early in migration, avian species composition was similar in both forest types, being comprised mainly of short-distance migrants. Bird species composition in these forest types became increasingly disparate as long-distance neotropical-nearctic migrants arrived. Ten bird species were characteristic of bottomland hardwood forests, whereas eight different species were characteristic of managed cottonwood plantations. Because these two forest types supported different bird communities, both forest types provide important inland stopover habitat during migration. Silvicultural management of bottomland hardwood forests that increases their understory vegetation will provide forested habitat for a more species rich and abundant population of songbirds during migration.

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932. Structure and composition of three swamp forests on the Mississippi alluvial plain of Kentucky's Jackson Purchase Region.

Bryant, William S.

Transactions of the Kentucky Academy of Science 58(2): 85-91. (1997)

NAL Call #: 500 K13T; ISSN: 0023-0081

Descriptors: basal areas/ composition/ structure/ three swamp forests

Abstract: Three swamp forests on the Mississippi alluvial plain of the Jackson Purchase Region of Kentucky are described. One forest was dominated by *Taxodium distichum*, one by *Nyssa aquatica*, and one by *T. distichum*

and *N. aquatica*. In terms of basal areas and densities, these forests compared favorably to other little disturbed swamps in the southeastern United States. Basal areas of 56.5, 72.8, 84.6 ml/ha were two to three times greater than most mature upland forests of Kentucky. These swamps are remnants of a once more abundant wetland system on the Mississippi alluvial plain.

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933. The use of wetlands in the Mississippi Delta for wastewater assimilation: A review.

Day, J. W.; Ko, J. Y.; Rybczyk, J.; Sabins, D.; Bean, R.; Berthelot, G.; Brantley, C.; Cardoch, L.; Conner, W.; Day, J. N.; Englande, A. J.; Feagley, S.; Hyfield, E.; Lane, R.; Lindsey, J.; Mistich, J.; Reyes, E.; and Twilley, R.

Ocean & Coastal Management 47(11-12): 671-691. (2004)
NAL Call #: GC1000.O3; ISSN: 0964-5691

<http://www.clemson.edu/baruch/pubs/wetlandtreatment.pdf>

Descriptors: wetlands/ sewage disposal/ marshes/ accretion/ water quality/ sedimentation/ wastewater treatment/ waste water/ nutrients (mineral)/ economic benefits/ subsidence/ environmental effects/ deltas/ economic analysis/ effluents/ coastal zone management/ nitrogen/ denitrification/ nutrients/ benefits/ productivity/ accumulation/ vegetation/ capital/ surface water/ reviews/ case studies/ phosphorus/ USA, Louisiana, Mississippi Delta/ coastal zone management/ pollution - control and prevention/ protective measures and control/ wastewater treatment processes/ water and wastewater treatment

Abstract: The use of wetlands for treatment of wastewaters has a number of important ecological and economic benefits. Adding nutrient rich treated wastewater effluent to selected coastal wetlands results in the following benefits: (1) improved effluent water quality; (2) increased accretion rates to help offset subsidence; (3) increased productivity of vegetation; and (4) financial and energy savings of capital not invested in conventional tertiary treatment systems. We present as case studies results from several wetlands that are receiving secondarily treated wastewater in coastal Louisiana. At one site where sedimentation accumulation was measured, rates of accretion increased significantly after wastewater application began in the treatment site (from 7.8 to 11.4 mm yr super(-1)) and approached the estimated rate of regional relative sea level rise (RSLR) (12.0 mm yr super(-1)). No corresponding increase was observed in an adjacent control site. This suggests that the application of nutrient-rich wastewater can help coastal wetlands survive sea level rise. In the same site, surface water nutrient reduction, from the effluent inflow to outflow (1600 m), ranged from 100% for nitrate-nitrogen (NO sub(3)-N) to 66% for total phosphorus (P). At a second site, a forested wetland that has been receiving wastewater effluent for 50 years, N and P were both reduced by more than 90%. Nutrient reduction is due to three main pathways: burial, denitrification and plant uptake. Dendrochronological analysis at the second site revealed that stem growth increased significantly in the treatment site after wastewater applications began, and was significantly greater than an adjacent control site. Similar increases in productivity have been measured in a number of wetland treatment sites. Economic analyses comparing conventional and wetland systems indicate savings range from \$500, 000 to \$2.6 million. In addition there are substantial energy savings.

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934. Vegetation, substrate and hydrology in floating marshes in the Mississippi River Delta Plain wetlands, USA.

Sasser, C. E.; Gosselink, J. G.; Swenson, E. M.; Swarzenski, C. M.; and Leibowitz, N. C.

Vegetatio 122(2): 129-142. (1996)

NAL Call #: 450 V52; ISSN: 0042-3106

Descriptors: wetlands/ marshes/ hydrology/ vegetation patterns/ buoyancy/ substrates/ plant populations/ *Spartina*/ USA, Louisiana/ USA, Louisiana, Mississippi Delta/ plant populations/ substrata/ vegetation patterns/ substrates/ *Panicum*/ *Sagittaria*/ *Eleocharis*

Abstract: In the 1940s extensive floating marshes (locally called 'flotant') were reported and mapped in coastal wetlands of the Mississippi River Delta Plain. These floating marshes included large areas of *Panicum hemitomon*-dominated freshwater marshes, and *Spartina patens*/*Scirpus olneyi* brackish marshes. Today these marshes appear to be quite different in extent and type. We describe five floating habitats and one non-floating, quaking habitat based on differences in buoyancy dynamics (timing and degree of floating), substrate characteristics, and dominant vegetation. All floating marshes have low bulk density, organic substrates. Nearly all are fresh marshes. *Panicum hemitomon* floating marshes presently occur within the general regions that were reported in the 1940's by O'Neil, but are reduced in extent. Some of the former *Panicum hemitomon* marshes have been replaced by seasonally or variably floating marshes dominated, or co-dominated by *Sagittaria lancifolia* or *Eleocharis baldwinii*.
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935. Waterfowl use of forested wetlands of the southern United States: An overview.

Fredrickson, L. H. and Heitmeyer, M. E.

In: *Waterfowl in winter*/ Weller, M. W.

Minneapolis: University of Minnesota Press, 1988; pp. 307-323

NAL Call #: QL696.A52W38

Descriptors: Anatidae/ wildlife management/ habitat exploitation/ semiaquatic habitat/ forest/ wetland/ USA/ South/ wetland forests/ habitat exploitation and wildlife management/ overview

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936. Wetland soil formation in the rapidly subsiding Mississippi River Deltaic Plain USA mineral and organic matter relationships.

Nyman J. A.; Delaune R. D.; and Patrick W. H.

Estuarine, Coastal and Shelf Science 31(1): 57-70. (1990)

NAL Call #: GB451.E72; ISSN: 0272-7714

Descriptors: coastal marsh/ soil structure/ erosion/ planning/ mineral/ vertical accretion/ organic matter/ submergence rate/ inactive delta zone/ active delta zone/ marine vs. fresh water/ marsh

Abstract: The elevation of submerging coastal marshes is maintained by vertical accretion of mineral and organic matter. Submergence rates currently exceed 1.0 cm year⁻¹ in the Mississippi Deltaic Plain and are expected to increase. Mineral matter-organic matter relationships were examined in surface profiles of Mississippi Deltaic Plain soil from both Active Delta Zone marsh (which receives freshwater and mineral sediment from the Atchafalaya or Mississippi Rivers) and Inactive Delta Zone marsh (which relies on rainfall for freshwater and on reworked sediments

for mineral matter) to gain insights into marsh soil structure and formation. Mineral and organic matter accounted for 4-14% of soil volume. The remainder was pore space and was occupied by water and entrapped gases. Organic matter occupied more volume than mineral matter in all but saline marsh soil. The regular influx of mineral matter to active fresh marsh resulted in active fresh marsh soil containing twice as much mineral and organic matter as inactive fresh marsh soil. Within the Inactive Delta Zone, the volume of mineral and organic matter increased from fresh (inland) to saline (seaward) marshes. Saline marsh soil required 1.7 times as much mineral matter as brackish marsh soil to vertically accrete at similar rates, possibly as a result of soil bulk density requirements of the dominant saline marsh plant, *Spartina alterniflora*. Vertical accretion rates were highest in the Active Delta Zone, probably as a

result of increased mineral matter availability and delivery. Current, best estimates of the combination of mineral and organic matter required ($\text{g m}^{-2} \text{ year}^{-1}$) to maintain marsh surface-water level relationship are fresh marsh: organic matter= $1700+269x$, mineral matter= $424x$; brackish marsh: organic matter= $553+583x$, mineral matter= $1052x$; saline marsh: organic matter= $923+601x$, mineral matter= $1798x$, where x =the rate of submergence (cm year^{-1}).
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937. Wetlands: Impacts of energy development in the Mississippi Delta.

Ko, Jae-Young and Day, John W.
In: Encyclopedia of Energy; Vol. 6 Elsevier, 2004; pp. 397-408
http://www.lsu.edu/cei/research_projects/Wetlands_final.pdf

Effects of Agricultural Conservation Practices on Wetlands

938. Agronomic implications of waterfowl management in Mississippi ricefields.

Manley, Scott W.; Kaminski, Richard M.; Reinecke, Kenneth J.; and Gerard, Patrick D.
Wildlife Society Bulletin 33(3): 981-992. (2005)
NAL Call #: SK357.A1W5; ISSN: 0091-7648
Descriptors: wetlands/ habitat management/ winter flooding/ agronomic benefit/ straw disposal
Abstract: Ricefields are important foraging habitat for waterfowl and other waterbirds in several North American wintering areas, including the Mississippi Alluvial Valley (MAV). Rice growers are likely to adopt management practices that provide habitat for waterfowl if agronomic benefits also occur. Therefore, we conducted a replicated field experiment during autumn through spring 1995-1997 to study effects of postharvest field treatment and winter-water management on agronomic variables including biomass of residual rice straw, cool-season grasses and forbs (i.e., winter weeds), and viability of red rice (*oryza sativa* var.). The treatment combination of postharvest disking and flooding until early March reduced straw 68%, from 9,938 kg/ha after harvest to 3,209 kg/ha in spring. Treatment combinations that included flooding until early March were most effective in suppressing winter weeds and decreased their biomass in spring by 83% when compared to the average of other treatment combinations. Effects of treatment combinations on spring viability of red rice differed between winters, but no significant effects were found within winters. Autumn disking followed by flooding until early March reduced rice straw and suppressed winter weeds the most, but with additional costs. To obtain the most agronomic benefits, we recommend that rice growers forgo autumn disking and flood fields until early March, which will provide moderate straw reduction, good weed suppression, and predicted savings of \$22.24-62.93/ha (U.S.) (\$9.00-25.47/ac). Maintenance of floods on ricefields until early March also benefits waterfowl and other waterbirds by providing foraging habitat throughout winter.
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939. Arsenic and mercury concentrations in major landscape components of an intensively cultivated watershed.

Cooper, C. M. and Gillespie, W. B.
Environmental Pollution 111(1): 67-74. (2000)
NAL Call #: QH545.A1E52; ISSN: 0269-7491
Descriptors: wetlands/ arsenic/ mercury/ watersheds/ bioaccumulation/ stormwater runoff/ water pollution/ sediment pollution/ agricultural runoff/ flood plains/ aquatic organisms/ soil contamination/ sediment contamination/ fish/ runoff/ mercury-197/ pollution (soil)/ pollution (water)/ contaminated sediments/ fish/ catchment areas/ Pisces/ freshwater fish/ USA, Mississippi R.
Abstract: To provide an understanding of arsenic (As) and mercury (Hg) concentrations in soil, sediment, water, and fish tissues, samples were collected from a Mississippi River alluvial floodplain located in northwest Mississippi. As concentrations increased approximately an order of magnitude from water (5.12 $\mu\text{g/l}$) to fish tissues (36.99 $\mu\text{g/kg}$) and an additional two orders of magnitude in soils, lake sediments, and wetland sediments (5728, 5614, and 6746 $\mu\text{g/kg}$), respectively. Average Hg concentrations in water, soils, lake sediments, and fish were 2.16 $\mu\text{g/l}$, 55.1, 14.5 and 125 $\mu\text{g/kg}$, respectively. As and Hg concentrations were within published ranges for uncontaminated soil, water, and sediments. As concentrations represented a low risk. Hg concentrations were also low but showed a greater tendency to concentrate in fish tissue. The dominant mode of entry of these materials into aquatic systems is through storm-generated runoff. Since both metals accompany sediments, agricultural conservation practices such as reduced tillage, buffer riparian strips, and bordering sediment ponds or drainage wetlands will minimize watershed input to aquatic systems.
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940. Assessment of cumulative impacts to water quality in a forested wetland landscape.

Childers, D. L. and Gosselink, J. G.

Journal of Environmental Quality 19(3): 455-464. (1990)

NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: wetlands/ water quality/ land use/ environmental impact/ river basin management/ nutrients (mineral)/ nitrogen/ phosphorus/ resuspended sediments/ turbidity/ agricultural runoff/ rivers/ basins/ USA, Louisiana, Tensas Basin/ river basin management/ nutrients (mineral)/ turbidity/ mechanical and natural changes/ freshwater pollution

Abstract: Assessment of cumulative impacts requires a landscape approach and large-scale analysis. In the authors' procedure for determining cumulative impacts in bottomland hardwood forests (BLHF), changes in landscape integrity over time were assessed using structural and functional ecosystem indices. In this article researchers present a historical analysis of water quality in the Tensas Basin, Louisiana, USA, as part of the cumulative impacts analysis of this BLHF landscape. Historical records of suspended sediment, N, P, and turbidity from three streams in the Tensas Basin were analyzed. Significant positive relationships between water levels in these streams and concentrations of total P, total Kjeldahl N, total suspended sediment, and turbidity confirmed a loading phenomenon characteristic of watersheds in which much of the original forest cover has been cleared. Eighty-five percent of the original forest in the Tensas Basin has been converted to agricultural fields. Temporal trends in nutrient concentration show that water quality has been declining steadily since 1958 in one river, whereas in the other two the decline largely occurred before then. A goal-oriented management plan for improved water quality in the Tensas Basin was devised based on this cumulative impact assessment.

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941. Associations between changes in agriculture and hydrology in the Cache River Basin, Arkansas, USA.

Wilber, D. H.; Tighe, R. E.; and O'neil, L. J.

Wetlands 16(3): 366-378. (1996)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: agriculture/ hydrology/ ground water/ land use/ rivers/ rice fields/ groundwater/ forest hydrology/ USA, Arkansas, Cache R./ forested wetlands/ groundwater/ forest hydrology/ flow rate/ ground water/ rice fields

Abstract: Impacts to the hydrology of the Cache River, a major river system in the Mississippi Alluvial Valley, were assessed by integrating hydrologic analyses with a review of historical land use changes. Extreme low flows have become more frequent in recent years, coincident with a dramatic increase in rice farming in the basin and its associated irrigation. Annual drawdowns in the alluvial aquifer were positively correlated with the annual area of rice crops. There is no evidence that a change in climatic conditions accounts for the increase in extreme low flow frequency. In fact, multiple regression analyses indicate the relationship between climate and flow is weakest in more recent decades when extreme low flows were more prevalent. Low flows in the summer (when rice irrigation occurs) were least associated with climate in most recent decades. Average monthly flows for August and September have increased, which is also an impact consistent with rice agriculture practices. Water is drained from rice fields to

surface-water drainages at the end of the summer and may eventually reach the Cache River, thus increasing late summer flows. The timing and nature of changes in agricultural practices within the Cache River basin suggest agricultural impacts have contributed to the observed changes in hydrology.

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942. Harvesting impacts on selected floral and faunal communities in the Mississippi River batture lands: Pre-treatment measurements.

Lockhart, Brian R.; Thompson, Lynne C.; Tappe, Philip A.; Peitz, David G.; Weih, Robert C.; Guo, Yanfei; Brown, Nicholas R.; Lawson, Edwin R.; and Ku, Timothy T.

In: Proceedings of the southern forested wetlands ecology and management conference/ Flynn, Kathryn M.

Clemson: Consortium for Research on Southern Forested Wetlands, 1996; pp. 30-35

Descriptors: animals and man/ disturbance by man/ commercial activities/ ecology/ habitat/ terrestrial habitat/ land and freshwater zones/ Nearctic region/ North America/ USA/ Carabidae/ Aves: forestry/ practices/ community structure relationship/ USA/ community structure/ forestry practices effect/ forest and woodland/ Mississippi/ Issaquena County/ Pittman Island/ influence of forestry practices/ bottomland forest/ Carabidae/ Caraboidea, Adephaga, Coleoptera, Insecta/ arthropods/ birds/ chordates/ Coleopterans beetles/ insects/ invertebrates/ vertebrates

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943. Impact of forest type and management strategy on avian densities in the Mississippi Alluvial Valley, USA.

Twedt, D. J.; Wilson, R. R.; Henne-Kerr, J. L.; and Hamilton, R. B.

Forest Ecology and Management 123(2-3): 261-274. (1999)

NAL Call #: SD1.F73; ISSN: 0378-1127

Descriptors: agro-forestry/ avian density/ bottomland hardwood forests/ cottonwood plantations/ forest birds/ forest management effects/ silviculture/ avifauna/ density/ forest management/ species richness/ United States/ *Geothlypis trichas*/ *Hylochichla mustelina*/ *Icteria virens*/ *Passerina cyanea*/ *Populus deltoides*/ *Vireo griseus*

Abstract: Avian territory densities were determined from 20 Breeding Bird Censuses in mature (>30 years) bottomland hardwood stands and 18 Breeding Bird Censuses in young (6-9 years old) cottonwood (*Populus deltoides*) plantations in the Mississippi Alluvial Valley. Avian species richness, diversity, and territory density were greater ($p < 0.01$) in bottomland hardwood stands than in intensively-managed cottonwood stands but these parameters were not impacted by selective timber harvest within bottomland hardwood stands nor by method of regeneration within cottonwood plantations ($p > 0.05$). Even so, detrended correspondence analysis based on avian territory densities readily segregated forest types and silvicultural treatments. Timber harvest within bottomland hardwood stands resulted in a shift in bird communities toward those found in cottonwood stands by increasing the densities of early-successional species such as Indigo Bunting (*Passerina cyanea*), Yellow-breasted Chat (*Icteria virens*), and Common Yellowthroat (*Geothlypis trichas*). Conversely, regenerating cottonwood stands from root sprouts; rather than planting stem cuttings, resulted in a shift in bird communities toward those found in bottomland hardwood

stands by increasing densities of species such as White-eyed Vireo (*Vireo griseus*) and Wood Thrush (*Hylocichla mustelina*). Tree species diversity, angular canopy cover, and midstory density were positively associated with bird species assemblages in bottomland hardwood stands, whereas vegetation density at ground level was positively associated with bird communities in cottonwood plantations. Conversion of agricultural fields to short-rotation cottonwood plantations results in increased breeding bird populations by adding up to 140 additional territories 40 ha⁻¹. Even so, relative conservation values, derived from indicator species analysis and Partners in Flight concern scores, suggest that mature bottomland hardwood forests are twice as 'valuable' for bird conservation as are cottonwood plantations.
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944. Insecticide concentrations in ecosystem components of an intensively cultivated watershed in Mississippi.

Cooper C. M.

Journal of Freshwater Ecology 6(3): 237-248. (1991)

NAL Call #: QH541.5.F7J68; ISSN: 0270-5060

Descriptors: fish/ contamination/ cotton/ soybean/ rice/ bioaccumulation/ lake/ sediment/ wetland/ insecticide/ persistence/ watershed management

Abstract: Concentrations of three currently used insecticides (fenvalerate, permethrin, and methyl parathion) were documented in major watershed components of Moon Lake, Mississippi, [USA] and its 166 km² watershed over a three year period. Moon Lake (10.1 km²), an oxbow of the Mississippi River, receives flow through a series of wetlands from a flatland watershed intensively cultivated in cotton, soybeans, and rice. None of the three insecticides were detected in watershed soils, but they were found sporadically in wetland and lake sediments, water and fish. Twenty-six percent of the 110 fish collected had measurable concentrations of the insecticides. Detection of all three insecticides, especially methyl parathion, in fish tissue suggested that they have sufficient persistence for uptake and, perhaps, bioaccumulation. The occurrence of banned organochlorine insecticides in the ecosystem was also observed, especially during runoff, and it also indicated the importance of watershed management practices on long term water quality.

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945. Water quality of seasonally flooded agricultural fields in Mississippi, USA.

Maul, J. D. and Cooper, C. M.

Agriculture, Ecosystems & Environment 81(3): 171-178. (2000)

NAL Call #: S601.A34; ISSN: 0167-8809

Descriptors: wetlands/ water quality/ seasonal variations/ flooding/ agriculture/ runoff/ water quality (natural waters)/ seasons/ floods and flooding/ USA, Mississippi

Abstract: Planned flooding of agricultural fields is performed to prevent erosion (e.g. sheet, gully, and rill) and provide habitat for waterfowl. As a post-harvest field treatment, flooding is becoming more common in the agriculturally dominated landscape of the Mississippi Alluvial Valley (MAV) in the southeastern United States. Despite this trend, information pertaining to water quality characteristics of water remaining on fields during the winter and subsequent relationships with environmental

and biological processes is sparse. Because the water retained on fields is eventually released into adjacent waterways prior to planting, it is critical to monitor water quality parameters of these flooded fields. Water quality parameters of flooded agricultural fields were assessed from January to March and compared to those observed in impounded wetlands. Temporal variation of parameters among sampling dates was also examined. Mean (plus or minus S.E.) suspended solids concentration was greater ($p < 0.05$) in flooded agricultural fields (283.3 plus or minus 98.7 mg l super(-1)) than impounded wetlands (79.5 plus or minus 25.3 mg l super(-1)) and an interaction of habitat and sampling date was detected on dissolved solids concentration ($p < 0.05$). Water temperature, pH, dissolved oxygen, ammonia, nitrate, total phosphorus, enterococci bacteria, and fecal coliform bacterial concentrations exhibited temporal variation among sampling dates ($p < 0.05$). For both flooded fields and wetlands, fecal coliform and enterococci concentrations peaked at 2887.5 and 675.0 colony forming units (CFU) 100 ml super(-1), respectively, during the first sampling date (January) and declined to 133.2 and 33.3 CFU 100 ml super(-1), respectively, in March. Results of this study indicated that: (1) flooded agricultural fields had greater variability of water quality parameters than wetlands; (2) 53% of measured water quality parameters exhibited temporal variation and (3) impounding water may facilitate decreases in bacterial concentrations. Holding water on agricultural fields and knowledge of temporal water quality trends may provide a means to decrease contaminant concentrations, thus improving quality of potential runoff that may enter adjacent bodies of water.

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Wetlands as Agricultural Conservation Practices

946. Addressing global warming and biodiversity through forest restoration and coastal wetlands creation.

Williams, J. R.

Science of the Total Environment 240(1-3): 1-9. (Oct. 1999)

Notes: Special issue: Managing for biodiversity for the protection of nature

Descriptors: wetlands/ habitat improvement/ climatic changes/ biodiversity/ environment management/ global warming/ forests/ environmental restoration/ biological diversity/ greenhouse gases/ soil erosion/ wood wastes/ compost/ research programs/ USA, Louisiana/ USA, Mississippi River Valley/ research priorities/ habitats/ erosion control/ USA/ protective measures and control/ environmental action/ air pollution

Abstract: The Climate Challenge is a partnership between the Department of Energy and the electric utility industry to reduce, avoid, and sequester greenhouse gases. A portion of the initiative, the sequestration of greenhouse gases, is the focus of this presentation. Over 4 million acres of bottomland hardwood forests were cleared for agriculture in the Mississippi River Valley in the 1970s. Reestablishing these forests would improve depleted wildlife habitats, serve as wildlife corridors, increase biodiversity, and decrease soil erosion. Also, Louisiana is losing coastal wetlands at a rate of approximately 25 square miles/year. This coastal erosion is due to a number of factors and many efforts are currently underway to address the matter. One such effort is the use of material generated in the dredging of navigational canals; however, this material is low in nutrient value, making the regeneration of marsh grasses more difficult. In addition, bottomland hardwood forests and coastal wetland grasses are excellent 'carbon sinks' because they take carbon dioxide out of the atmosphere and store it in living plant tissue. Entergy Services, Inc. is an electric utility with a service territory that comprises portions of both the Lower Mississippi River Valley and the Gulf of Mexico coastline. This provides an opportunity to positively address both habitat losses noted above while at the same time addressing global warming, forest fragmentation, and biodiversity. Entergy, through its affiliation with the UtiliTree Carbon Company, is participating in projects that will investigate the feasibility of using bottomland hardwood reforestation on cleared marginal farmlands now managed by the Louisiana Department of Wildlife and Fisheries and the US Fish and Wildlife Service. Entergy has also begun a research project with the Environmental Protection Agency and the state of Louisiana. The research is a compost demonstration project that will utilize wood waste generated through our tree-trimming program as a compost material that will be mixed with low nutrient dredge material to create new coastal wetlands. Taken together, Entergy's initiatives will be able to address global warming through carbon sequestration, restore fragmented forest habitats, reduce coastal erosion and improve the quality of a vital coastal aquatic nursery habitat. Efforts will be made to manage the created habitats for biodiversity. Pulling all these ideas together creates an effect in which the whole is greater than the sum of the parts. In such a synergy of ideas, there are no losers and the winners are both industry participants and the environment.

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947. Avian response to bottomland hardwood reforestation: The first 10 years.

Twedt, Daniel J.; Wilson, R. Randy; Henne-Kerr, Jackie L.; and Grosshuesch, David A.

Restoration Ecology 10(4): 645-655. (2002)

NAL Call #: QH541.15.R45R515; *ISSN:* 1061-2971

Descriptors: conservation/ conservation measures/ ecology/ habitat utilization/ habitat/ terrestrial habitat/ land and freshwater zones/ Nearctic region/ North America/ USA/ Aves: habitat management/ reforestation strategies/ habitat colonization relations/ habitat colonization/ reforestation strategy relations/ Louisiana and Mississippi/ forest and woodland/ bottomland hardwood/ Louisiana/ Madison Parish/ Mississippi/ Issaquena County/ reforestation strategy relations/ Aves/ birds/ chordates/ vertebrates

Abstract: Bottomland hardwood forests were planted on agricultural fields in Mississippi and Louisiana predominantly using either *Quercus* species (oaks) or *Populus deltoides* (eastern cottonwood). We assessed avian colonization of these reforested sites between 2 and 10 years after planting. Rapid vertical growth of cottonwoods (circa 2-3 m/year) resulted in sites with forest structure that supported greater species richness of breeding birds, increased Shannon diversity indices, and supported greater territory densities than on sites planted with slower-growing oak species. Grassland birds (*Spiza americana* [Dickcissel] and *Sturnella magna* [Eastern Meadowlark]) were indicative of species breeding on oak-dominated reforestation no more than 10 years old. *Agelaius phoeniceus* (Red-winged Blackbird) and *Colinus virginianus* (Northern Bobwhite) characterized cottonwood reforestation no more than 4 years old, whereas 14 species of shrub-scrub birds (e.g., *Passerina cyanea* [Indigo Bunting]) and early-successional forest birds (e.g., *Vireo gilvus* [Warbling vireo]) typified cottonwood reforestation 5 to 9 years after planting. Rates of daily nest survival did not differ between reforestation strategies. Nest parasitism increased markedly in older cottonwood stands but was overwhelmed by predation as a cause of nest failure. Based on Partners in Flight prioritization scores and territory densities, the value of cottonwood reforestation for avian conservation was significantly greater than that of oak reforestation during their first 10 years. Because of benefits conferred on breeding birds, we recommend reforestation of bottomland hardwoods should include a high proportion of fast-growing early successional species such as cottonwood.

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948. Bottomland hardwood forest management for black bears in Louisiana.

Weaver, K. M.; Tabberer, D. K.; Moore, L. U.; Chandler, G. A.; Posey, J. C.; and Pelton, M. R.

In: Proceedings of the 44th Annual Conference Southeastern Association of Fish and Wildlife Agencies. (Held 24 Oct 1990 at Richmond, Va.); Vol. 44.: Southeastern Association of Fish and Wildlife Agencies; pp. 342-350; 1990.

NAL Call #: SK1.S6

Descriptors: telemetry/ forest practices/ techniques/ North America/ United States/ Louisiana/ Northeast Region

Abstract: Recommendations were outlined for bear habitat management based on a review of the literature and preliminary evidence from ongoing studies that were developed in concert with the Tensas River National Wildlife Refuge Forest Habitat Management Plan.
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949. Bottomland hardwood reforestation for neotropical migratory birds: Are we missing the forest for the trees?

Twedt, Daniel J. and Portwood, Jeff
Wildlife Society Bulletin 25(3): 647-652. (1997)
NAL Call #: SK357.A1W5; ISSN: 0091-7648
Descriptors: behavior/ birds/ bottomlands/ ecosystems/ forestry practices/ forests, deciduous/ habitat management/ habitat use/ management/ migration/ succession/ wildlife/ bottomland forests/ afforestation/ wild birds/ natural resources/ forest practices/ forests/ growth/ habitat management for wildlife/ hardwoods/ land, private/ oak/ plant succession/ planting/ rehabilitation/ seeding/ species diversity/ wildlife management/ neotropical migrant
Abstract: The authors identify the benefits derived by land managers and wildlife resources when fast-growing trees, such as cottonwood or sycamore, alone or mixed with oaks, are established on lands under cultivation. Reforestation with fast-growing species promotes rapid colonization of sites by forest-breeding neotropical migrants. The authors recommend silvicultural practices to promote succession from the fast-growing trees to forests dominated by heavy-seeded, slow-growing species. klf.
© NISC

950. Bottomland hardwood reforestation in the lower Mississippi Valley.

Allen, James A. and Kennedy, Harvey E.
Slidell, La.: U.S. Dept. of the Interior, Fish and Wildlife Service, National Wetlands Research Center, 1989. 28 p.
NAL Call #: SD409.A46
Descriptors: reforestation---Mississippi River Valley/ reforestation---southern states/ hardwoods---Mississippi River Valley/ hardwoods---southern states/ forests and forestry---Mississippi River Valley/ forests and forestry---southern states
This citation is from AGRICOLA.

951. Characterization of soil processes in bottomland hardwood wetland-nonwetland transition zones in the lower Mississippi River valley.

Faulkner, S. P.; Patrick, W. H.; Gambrell, R. P.; Parker, W. B.; and Good, B. J.
Washington, D.C.: U.S. Army Corps of Engineers; WRP 91-1, 1991. 308 p., 55 fig., 11 tab., 212 ref., 19 append.
Notes: "Final Report." Army Corps of Engineers Contract Report WRP-91-1
Descriptors: bottomland/ floodplain forests/ hardwood/ Mississippi-Missouri River basin/ soil properties/ wetland soils/ oxidation-reduction potential/ oxygen/ soil saturation/ water table/ lakes/ water in soils
Abstract: The results of a 4-yr study of bottomland hardwood soils, the purpose of which was to characterize the effects of saturation and inundation on soil processes in nonwetland, transitional, and wetland habitats are presented. Data are provided for identifying and delineating wetlands from non-wetlands in the Lower Mississippi River Valley, and detailed technical information for constructing

and installing equipment to measure soil redox potential and oxygen content is provided. Soil redox potential, oxygen content, water table depth were measured at several soil depths on five transects in Louisiana and Mississippi. These data were compared with soil profile descriptions, hydrologic zonal classification, and the presence of hydric soils to determine the relationships among soil redox conditions and diagnostic wetland indicators. Tree-coating constituents were also measured to determine if plant adaptations are effective indicators of wetland soil conditions. The results indicated that large areas of bottomland hardwood forests in the Lower Mississippi River Valley are not inundated or saturated for long periods during the growing season. There are very wet, almost permanently inundated sites, but those areas that are seasonally inundated are oxidized and aerobic throughout the root zone for most of the growing season. Saturated, anaerobic conditions for as little as 110-15% of the growing season appear sufficient to induce wetland soil characteristics (mottling, gleying, low chroma colors) in the soil profile. These wetland soil characteristics were generally more reliable than the plant root coatings in delineating wetlands. (Author's abstract) 35 002621009
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952. A decision-support system for prioritizing restoration sites on the Mississippi River Alluvial Plain.

Llewellyn, D. W.; Shaffer, G. P.; Craig, N. J.; Creasman, L.; Pashley, D.; Swan, M.; and Brown, C.
Conservation Biology 10(5): 1446-1455. (Oct. 1996)
NAL Call #: QH75.A1C5; ISSN: 0888-8892
Descriptors: environmental restoration/ geographic information systems/ nature conservation/ ecosystem management/ environment management/ land use/ river basins/ information systems/ forests/ alluvial fans/ river basin management/ geographical reference systems/ decision making/ decision support systems/ USA, Mississippi R./ USA, Louisiana, Mississippi Delta/ wetland forest/ geographic information systems/ nature conservation/ ecosystem management/ environment management/ reclamation/ protective measures and control/ evaluation process/ environmental action
Abstract: Conversion of forested wetlands to agricultural use and the resulting fragmentation of the landscape has led to concerns for the functional integrity of the Mississippi River Alluvial Plain ecosystem. We describe an effort spearheaded by The Nature Conservancy to initiate a multi-decade partnership dedicated to creating and implementing a viable, cooperative, landscape-level restoration project in the Mississippi River Alluvial Plain. Important phases of the process during the first 5 years were (1) initiation of the development of an extensive network of partners, including state and federal agencies, private land owners, conservation groups, academicians, and other interested citizens; (2) development of a geographic information system (GIS) for the entire extent of the ecosystem; and (3) for one watershed, the Tensas basin in northeastern Louisiana, refinement of a high resolution GIS to generate more detailed land-use conversion statistics to demonstrate the feasibility of a semi-objective, landscape-scale restoration planning procedure, including methodology for prioritization of existing wetland forest patches and areas most suitable for reforestation and connection via corridors.
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953. Effects of managed impoundments and herbivory on wetland plant production and stand structure.

Johnson Randall, L. A. and Foote, A. L.

Wetlands 25(1): 38-50. (2005)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: annual production/ *Myocastor coypus*/ *nutria*/ plant stand structure/ *Schoenoplectus americanus*/ *Spartina patens*/ wetland management

Abstract: Managed impoundments, a form of structural marsh management, have been used to enhance plant production in the rapidly-eroding marshes of coastal Louisiana, USA, yet few studies have quantified their effects by measuring plant production before and after impoundment construction. We tested the effects of structural marsh management on the annual aboveground production and plant stand structure (stem density and stem height) of *Spartina patens* and *Schoenoplectus americanus* by collecting measurements before and after the construction of two shallow impoundments. We manipulated the water level in each impoundment by adjusting a single flap-gated culvert fitted with a variable crest weir. Because *nutria* herbivory also seemed to have a strong influence on plant production in these marshes, we tested the effects of *nutria* herbivory on the annual aboveground production and plant stand structure of both plant species by collecting data from fenced (ungrazed) and unfenced (grazed) plots located in both managed and unmanaged areas. There were no significant differences in *Spartina* annual production, stem density, and stem height between managed and unmanaged areas, and *Schoenoplectus* annual production, stem density, and stem height were greater in unmanaged marsh, indicating that the management method used in this study was not effective in promoting plant production in the rapidly-eroding, brackish, deltaic marshes of coastal Louisiana. *Nutria* herbivory dramatically reduced the annual aboveground production, stem density, and stem height of *Schoenoplectus*, a preferred forage species, and thus altered the structure of the mixed species stand. Herbivory had no significant effect on the annual aboveground production and stem density of *Spartina*. In the absence of herbivory, the stem height of *Spartina* increased significantly and coincided with significant increases in the stem density and height of *Schoenoplectus*. The changes in plant stand structure caused by *nutria* herbivory may facilitate marsh erosion and ultimately contribute to wetland loss. © 2005, The Society of Wetland Scientists. © 2006 Elsevier B.V. All rights reserved.

954. Evaluation of reforestation in the Lower Mississippi River Alluvial Valley.

King, S. L. and Keeland, B. D.

Restoration Ecology 7(4): 348-359. (1999)

NAL Call #: QH541.15.R45R515; ISSN: 1061-2971

Abstract: Only about 2.8 million ha of an estimated original 10 million ha of bottomland hardwood forests still exist in the Lower Mississippi River Alluvial Valley (LMAV) of the United States. The U.S. Fish and Wildlife Service, the U.S. Forest Service, and state agencies initiated reforestation efforts in the late 1980s to improve wildlife habitat. We surveyed restorationists responsible for reforestation in the LMAV to determine the magnitude of past and future efforts and to identify major limiting factors. Over the past 10 years, 77,698 ha have been reforested by the agencies represented in our survey and an additional 89,009 ha are

targeted in the next 5 years. Oaks are the most commonly planted species and bare-root seedlings are the most commonly used planting stock. Problems with seedling availability may increase the diversity of plantings in the future. Reforestation in the LMAV is based upon principles of landscape ecology; however, local problems such as herbivory, drought, and flooding often limit success. Broad-scale hydrologic restoration is needed to fully restore the structural and functional attributes of these systems, but because of drastic and widespread hydrologic alterations and socioeconomic constraints, this goal is generally not realistic. Local hydrologic restoration and creation of specific habitat features needed by some wildlife and fish species warrant attention. More extensive analyses of plantings are needed to evaluate functional success. The Wetland Reserve Program is a positive development, but policies that provide additional financial incentives to landowners for reforestation efforts should be seriously considered.

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955. Functional comparison of created and natural wetlands in the Atchafalaya Delta, Louisiana.

Faulkner, Stephen P. and Poach, Matthew E.

Vicksburg, Miss.: U.S. Army Engineer Waterways Experiment Station, 1996. 106 p. Wetlands Research Program Technical Report .

NAL Call #: TD756.5.F38 1996

Descriptors: wetlands---Louisiana/ constructed wetlands---Louisiana/ Atchafalaya River Watershed (La.)

This citation is from AGRICOLA.

956. Groundwater flow patterns and water budget of a bottomland forested wetland, Black Swamp, eastern Arkansas.

Gonthier, G. J. and Kleiss, B. A., WRIR 95-4192; Denver, CO: U.S. Geological Survey

Notes: Water-Resources Investigations Report: 95-4192; Branch of Information Services

Descriptors: wetlands/ groundwater movement/ flow pattern/ hydrologic budget/ surface-groundwater relations/ swamps/ bottomland/ forests/ interagency cooperation/ water level fluctuations/ USA, Arkansas, Black Swamp/ groundwater

Abstract: The U.S. Geological Survey, working in cooperation with the U.S. Army Corps of Engineers, Waterways Experiment Station, collected surface-water and ground water data from 119 wells and 13 staff gages from September 1989 to September 1992 to describe ground water flow patterns and water budget in the Black Swamp, a bottomland forested wetland in eastern Arkansas. The study area was between two streamflow gaging stations located about 30.5 river miles apart on the Cache River. Ground water flow was from northwest to southeast with some diversion toward the Cache River. Hydraulic connection between the surface water and the alluvial aquifer is indicated by nearly equal changes in surface-water and ground water levels near the Cache River. Diurnal fluctuations of hydraulic head ranged from more than 0 to 0.38 feet and were caused by evapotranspiration. Changes in hydraulic head of the alluvial aquifer beneath the wetland lagged behind stage fluctuations and created the potential for changes in ground water movement. Differences between surface-water levels in the wetland and stage of the Cache River created a frequently occurring

local groundwater flow condition in which surface water in the wetland seeped into the upper part of the alluvial aquifer and then seeped into the Cache River. When the Cache River flooded the wetland, ground water consistently seeped to the surface during falling surface-water stage and surface water seeped into the ground during rising surface-water stage. Groundwater flow was a minor component of the water budget, accounting for less than 1 percent of both inflow and outflow. Surface-water drainage from the study area through diversion canals was not accounted for in the water budget and may be the reason for a surplus of water in the budget. Even though groundwater flow volume is small compared to other water budget components, groundwater seepage to the wetland surface may still be vital to some wetland functions.

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957. Hand planting versus machine planting of bottomland red oaks on former agricultural fields in Louisiana's Mississippi Alluvial Plain: Sixth-year results.

Michalek A. J.; Lockhart B. R.; Dean T. J.; Keeland B. D.; and McCoy J. W.

In: General Technical Report, Southern Research Station, SRS 48/ Outcalt K. W.; Outcalt P. A.; and Tucker R. B., 2002. 352-357

Notes: Conference: Proceedings of the Eleventh Biennial Southern Silvicultural Research Conference, Knoxville, Tennessee, 20-22 March 2001.

Descriptors: wetlands/ afforestation/ artificial regeneration/ bottomland forests/ forests/ planting/ seedlings/ survival/ Quercus texana

Abstract: Interest in restoring bottomland hardwoods on abandoned agricultural fields has gained considerably over the past 15 years, due primarily to federal cost-share programmes such as the Conservation Reserve Program and the Wetlands Reserve Program. While a variety of artificial regeneration techniques are available to afforest these lands, none have met with consistently successful results, especially in the Mississippi Alluvial Plain. Therefore, a study was initiated to compare a variety of regeneration techniques for afforesting previously farmed bottomland hardwood sites. In this paper we report the results from hand planted versus machine planted 1-0 bare-root bottomland red oak seedlings. Four sites in the MAP in Louisiana were planted with either 1 or 2 species in a randomized complete block design. Sites and species planted included Bayou Macon Wildlife Management Area (WMA; Nuttall oak (*Quercus nuttallii*) and willow oak (*Q. phellos*)), Lake Ophelia National Wildlife Refuge (NWR; Nuttall oak), Ouachita WMA (willow oak), and the Tensas NWR (Nuttall oak and water oak (*Q. nigra*)). Results after 6 growing seasons indicated little difference in density, survival, planting success, and stocking between planting methods. Densities ranged from 280 Nuttall oak seedlings per acre machine planted at the Tensas NWR to 67 willow oak seedlings per acre machine planted at the Bayou Macon WMA. Nuttall oak also tended to have higher survival (81%) compared to willow oak (56%) and water oak (38%). When volunteer oak and ash were included, all site-species-planting method combinations met the minimum criteria for successful afforestation, but all combinations failed to meet minimum stocking levels necessary for quality sawtimber production.

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958. Impacts of flooding regime modification on wildlife habitats of bottomland hardwood forests in the lower Mississippi Valley.

Klimas, C. V.; Martin, C. O.; and Teaford, J. W. Vicksburg, Miss.: U.S. Army Engineer Waterways Experiment Station; Technical Report EI-81-13, 1981. 200 p.

Descriptors: flood plain management/ floods/ forests/ wildlife habitats/ hardwood/ aquatic animals/ literature review/ logging/ land clearing/ Mississippi River

Abstract: This is a literature review concerning the impacts of flooding regime modification on bottomland hardwood forest wildlife habitats of the lower Mississippi Valley. The composition and structure of the bottomland forest are an important determinant of the quality and type of wildlife habitat available. These forest characteristics are largely influenced by the flooding regime. Overstory diversity and perennial understory diversity and productivity are lowest in near-permanently flooded habitats and increase in areas flooded less frequently and for shorter periods of time. Nonflooded areas are often, but not always, less diverse and productive than infrequently flooded areas. Tree growth, regional habitat diversity, and land clearance patterns may also be influenced by modifications to the hydrologic regime. Bottomland forests are considered productive wildlife habitat due to high soil fertility, abundant moisture, and the diversity and abundance of wildlife food and cover. Modifications in the magnitude, frequency, and duration of flooding are expected to bring about a wide variety of impacts on different species. Impacts of flooding regime modifications are discussed for mammals, birds, reptiles, and amphibians. Aquatic and semiaquatic species are generally adversely affected by flood reduction and are benefitted by normal flooding conditions. Species that are principally terrestrial may be severely impacted by major flooding events, but they may respond more to secondary influences such as land clearing and logging. Where known, both direct and indirect impacts of flooding regime modifications are discussed by species or species groups occurring in the study area.

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959. Long-term impacts of agricultural runoff in a Louisiana swamp forest.

Day, J. W. and Kemp, G. P.

In: Ecological Considerations in Wetlands Treatment of Municipal Wastewaters/ Godfrey, Paul J.

New York: Van Nostrand Reinhold, 1985; pp. 317-326.

Notes: ISBN: 0442230095

NAL Call #: QH545.S49E3

Descriptors: wetlands/ agricultural runoff/ water pollution effects/ Louisiana/ swamps/ nitrogen/ phosphorus/ agriculture/ nutrients/ denitrification/ path of pollutants/ dissolved oxygen/ phosphates

Abstract: A summary of a two-year research project on the dynamics of nutrient retention and release in a swamp receiving upland runoff is presented. The central objective was to estimate the capacity of this type of wetland for removing nutrients from upland runoff. The role of redox in determining floodwater nutrient concentrations, both in the field and in laboratory microcosms is examined, along with testing the hypothesis that water quality deterioration in the region can be directly related to the cessation of overland water processing formerly performed by the swamp. Under overland flow conditions, the swamp can remove significant

amounts of incoming nutrients: 21% of total N and 41% of total P were retained in the swamp. Practically all of the removal takes place because of the settling of particulate N and P. For two reasons, it is not likely that the swamp will become saturated with N and P. First, the results indicate that denitrification is a significant pathway for the permanent loss of N. Second, the swamp is subsiding at a significant rate. In spite of nutrient retention in the swamp, significant amounts are still exported to swamp bayous and lakes. The swamp, however, acts as a buffer in time and composition, as, well as in concentration. Dissolved oxygen in the water column is the single most important factor determining sediment-water exchange of PO₄.

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960. Managing forested wetlands.

Fredrickson, L. H.

In: Ecosystem management: Applications for sustainable forest and wildlife resources. (Held 3 Mar 1994-5 Mar 1994 at Stevens Point, Wisc.) Boyce, M. S. and Haney, A. (eds.) New Haven, Conn.: Yale University Press; pp. 147-177; 1997.

NAL Call #: QH75.E295 1997

Descriptors: wetlands/ biodiversity/ bottomland forests/ forest management/ forests/ resource management

Abstract: Focusing on southern forested wetlands of the Mississippi Alluvial Valley, the discussion identifies key factors associated with wetlands and describes characteristics of forested wetlands and their current status. Current management, strategies to restore ecosystem functions and values, and the associated biodiversity are also discussed.

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961. Potential nitrate removal from a river diversion into a Mississippi delta forested wetland.

Lane, R. R.; Mashriqui, H. S.; Kemp, G. P.; Day, J. W.; Day, J. N.; and Hamilton, A.

Ecological Engineering 20(3): 237-249. (July 2003)

NAL Call #: TD1.E26; ISSN: 0925-8574

Descriptors: wetlands/ water quality/ swamps/ resuspended sediments/ deltas/ water sampling/ ammonium compounds/ algal blooms/ nitrates/ baseline studies/ levees/ sediment chemistry/ river water/ sediment samples/ phosphorus/ chlorophylls/ phytoplankton/ rivers/ forested wetlands/ nutrient retention/ hydrodynamics/ lakes/ sediments/ environmental restoration/ forests/ chlorophyll/ USA, Mississippi R./ USA, Louisiana, Mississippi Delta/ ecosystems and energetics/ sediments and sedimentation/ characteristics, behavior and fate/ water/ freshwater pollution/ water pollution: monitoring, control & remediation

Abstract: The objectives of this study were: (1) to carry out a baseline study of water quality parameters in the Maurepas forested wetland in Louisiana, USA; and (2) to estimate potential nitrate uptake of a proposed Mississippi River diversion into the wetland. Water sampling trips were carried out monthly from April to October 2000. Average water quality parameter concentrations and ranges were: nitrate 0.008 mg-N l super(-1) (non-detectable (n.d)-0.143 mg-N l super(-1)); ammonium 0.007 mg-N l super(-1) (n.d.-0.048 mg-N l super(-1)); total nitrogen 0.577 mg-N l super(-1) (0.193-1.285 mg-N l super(-1)); phosphate 0.034 mg-P l super(-1) (n.d.-0.369 mg-P l super(-1)); total phosphorus 0.055 mg-P l super(-1) (0.022-0.424 mg-P l super(-1)); total suspended sediment 16 mg l super(-1) (4-101 mg l super(-1)),

salinity 3 (0-12), and chlorophyll a 11 mu g l super(-1) (1-31 mu g l super(-1)). A UNET hydrodynamic model was constructed to predict hydrologic patterns as diverted water flowed through the Maurepas swamp. The study area was divided into 53 storage cells based on topographical features that mostly consisted of natural bayous and degraded artificial levees. Nitrate loading was high in the initial cells and removal efficiencies were on the order of 40-70%. Loading in subsequent cells was much lower and simulated nitrate retention was greater than 90%. Since most nutrients will be retained in the swamp, the proposed diversion of Mississippi River water should not cause adverse water quality conditions or extreme or persistent algal blooms in the Lake Maurepas.

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962. Reforestation of Frequently Flooded Agricultural Fields: A Compendium of Results from Research Conducted at the Lake George Wetland and Wildlife Restoration Project, Mississippi.

Williams, H. M.; Craft, M. H.; and Young, G. L. Vicksburg, MS.: Army Engineer Waterways Experiment Station; WES/TR/WRP-RE-18, 1997.

Notes: NTIS accession number: ADA3311321

Descriptors: wetlands/ flood plains/ agriculture/ land use/ reclamation/ ecosystem management/ environment management/ plant populations/ vegetation cover/ habitat/ USA, Mississippi, George L./ bottomland hardwood reforestation/ habitat community studies/ conservation, wildlife management and recreation

Abstract: The objective of the Lake George Bottomland Hardwood Wildlife and Wetland Restoration Project is to restore functioning bottomland hardwood wetland habitat by reforesting 3,600 ha of agricultural fields located in the Mississippi Delta. The Lake George Project provided an opportunity to conduct applied research on several bottomland hardwood reforestation topics. University and Federal agency scientists conducted studies on matching tree species to the site, selecting plant stock type, selecting when to plant, and monitoring early habitat development following planting.

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963. Removal of solids, nitrogen, and phosphorus in the Cache River wetland.

Dortch, Marks S.

Wetlands 16(3): 358-365. (1996)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: biochemistry and molecular biophysics/ forestry/ freshwater ecology: ecology, environmental sciences/ black swamp/ bottomland hardwood forest/ Cache River/ field method/ forested wetlands/ freshwater ecology/ inorganic suspended solids/ mass flux measurement/ mathematical model/ nitrogen/ phosphorus/ removal efficiency

Abstract: Mass flux measurements collected between April 1987 and September 1990 at the upstream and downstream boundaries of the Cache River Wetland (CRW), a bottomland hardwood forest in eastern Arkansas, were used to estimate long-term, average removal efficiencies (RE, %) for inorganic suspended solids (ISS), total nitrogen (TN), and total phosphorus (TP). The observed removal efficiencies were used with a steady-state, first-order removal model to compute removal rate constants. Detention time of the CRW was determined with

a time-varying, two-dimensional, depth-averaged, numerical flow and transport model. The computed average detention time of 5.02 da was close to the average hydraulic retention time of 5.15 da, justifying the plug flow assumption of the model. The removal rate constants estimated from the CRW data for ISS, TN, and TP were 0.066 m/da, 0.048 da⁻¹, and 0.0058 m/da (2.1 m/yr), respectively. The denitrification rate constant estimated for the CRW was 0.24 da⁻¹. These rate constants are in general agreement with values obtained from the literature.
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964. Restoration of bottomland hardwood forests in the lower Mississippi Valley.

Newling, Charles J.

Restoration and Management Notes 8(1): 23-28. (1990)

NAL Call #: QH76.R47; ISSN: 0733-0707

Descriptors: ecological restoration/ land restoration/ lowland forests

965. Shorebird use of managed wetlands in the Mississippi Alluvial Valley.

Twedt, D. J.; Nelms, C. O.; Rettig, V. E.; and Aycock, S. R.

American Midland Naturalist 140(1): 140-152. (1998)

NAL Call #: 410 M58; ISSN: 0003-0031

Descriptors: wetlands/ habitat utilization/ agricultural land/ wildlife management/ aquatic birds/ artificial substrata/ population density/ migratory species/ ecosystem management/ birds/ land management/ environmental protection/ habitats/ Aves/ Charadrius vociferus/ Gallinago gallinago/ USA, Mississippi R./ USA/ birds/ killdeer/ common snipe

Abstract: We assessed shorebird use of artificial wetlands within the Mississippi Alluvial Valley during the winters of 1991-1992 and 1992-1993 and during the autumn of 1994. On agricultural fields managed to provide habitat for waterfowl from November to March, mean shorebird density was 58.6 birds/100 ha, but shorebird densities were greater on soybean fields than on rice or moist-soil fields. Killdeer (*Charadrius vociferus*) and common snipe (*Gallinago gallinago*) were common throughout winter, but shorebird abundance and species richness along survey routes increased from November through April. During the late summer and autumn, wetlands on public lands in the Mississippi Alluvial Valley are managed by the U.S. Fish and Wildlife Service specifically to provide foraging habitat for shorebirds. From August through October 1994, we observed 14,564 individual shorebirds of 22 species using these anthropogenic wetlands. Mean shorebird density on wetlands managed by flooding previously dry, disked fields was 695 birds/100 ha, whereas mean density on wetlands managed by drawing down water reservoirs was 1224 birds/100 ha. We recommend increased shallow-water flooding of agricultural fields, particularly soybean fields, during winter to provide habitat for wintering and early spring migrant shorebirds. More importantly, we recommend continued water management on public wetlands from July through October, preferably by drawing down water reservoirs, to provide foraging habitat for southward migrating shorebirds.

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966. Soil, hydroperiod and bedding effects on restoring bottomland hardwoods on flood-prone agricultural lands in North Louisiana, USA.

Patterson, William B. and Adams, John C.

Forestry 76(2): 181-188. (2003)

NAL Call #: 99.8 F767; ISSN: 0015-752X

Descriptors: artificial regeneration: applied and field techniques/ site preparation method: applied and field techniques/ afforestation/ bottomland hardwood site restoration: bedding effects, hydroperiod effects, soil effects/ flood prone agricultural lands/ seasonality/ soil properties

Abstract: Many of the bottomland hardwood forests of the Lower Mississippi Alluvial Valley, USA have been converted to agriculture, thus constituting a sizable loss in ecological and socio-economic functions. Bottomland hardwood forest afforestation on marginal agricultural lands has grown considerably since 1990. However, many failures in bottomland hardwood afforestation have occurred for various reasons, including misunderstandings or ignoring the relationships between species, soil and hydrology. In October 1996, a 32-ha tract on an abandoned agricultural field in Catahoula Parish, Louisiana, USA was site prepared for afforestation by bedding (moulding soil in parallel ridges). The following January it was planted with seedlings of Nuttall oak (*Quercus nuttallii* Palmer) and green ash (*Fraxinus pennsylvanica* Marsh.), and direct seeded with Nuttall oak. The objective of this study was to evaluate the effects of bedding (within three soil types) on species survival and growth. Soil redox potential measurements indicated that the soils were intensely anaerobic during frequent prolonged seasonal inundation and saturation events. Bedding clayey soils significantly increased mean height of planted and direct-seeded Nuttall oak, but not that for green ash. Bedding appears to be somewhat effective in restoring site microtopography, reducing soil hydroperiod and enhancing planted Nuttall oak height growth on poorly drained, clayey soils.

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967. Soil seed banks and the potential restoration of forested wetlands after farming.

Middleton, B. A.

Journal of Applied Ecology 40(6): 1025-1034. (2003)

NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: baldcypress swamp/ flood pulsing/ regeneration dynamics/ seed dispersal/ seed longevity/ self-design theory/ *Taxodium distichum*/ weed ecology

Abstract: 1. Changes in farming practice provide an opportunity to restore once extensive forested wetlands on agricultural land. In some parts of the world, however, it has proved difficult to restore the full complement of plant species through natural regeneration. Similarly, the restoration of forested wetlands by replanting has often resulted in ecosystems of low diversity. Better methods of restoring these important ecosystems are now required and baldcypress swamps provide an opportunity to investigate alternative approaches to the restoration of forested wetlands. This study examined the composition of seed banks of farmed fields to determine their value in restoring swamps in the south-eastern United States. 2. A seed bank assay of soils from baldcypress swamps was conducted to determine the extent to which seeds are maintained during farming for various lengths of time. Soils from swamps that were farmed for 0-50 years were collected near the

northern boundary of the Mississippi Alluvial Valley along the Cache River, Illinois. Soils were placed in a glasshouse setting in flooded and freely drained conditions, and the numbers and species of seeds germinating were recorded. 3. Woody species including trees, shrubs, and vines were poorly represented in seed banks of both farmed and intact sites (51 and 9 sites, respectively). Missing dominants in the seed banks included tree species with short-lived seeds such as *Taxodium distichum* and *Nyssa aquatica*. *Cephalanthus occidentalis* constituted the most abundantly dispersed seed of all woody species. 4. Herbaceous species were well represented in the seed banks of both farmed and intact swamps (species richness of 207 vs. 173 species, respectively) suggesting that herbaceous species may live longer than woody species in seed banks. Few of the herbaceous species decreased in seed density in seed banks with time under cultivation, although seed density was lower at sites that had not been farmed. Species that relied on vegetative organs for dispersal were absent in the seed banks of farmed sites including *Heteranthera dubia*, *Hottonia inflata*, *Lemna minor*, *Lemna trisulca* and *Wolffia columbiana*. These species may require active reintroduction during restoration. 5. Synthesis and applications. Both restoration ecologists and managers of nature conservation areas need to be cognizant of seed bank and dispersal characteristics of species to effectively restore and manage forested wetlands. In the case of baldcypress swamps, critical components of the vegetation are not maintained in seed banks, which may make these floodplain wetlands difficult to restore via natural recolonization. Ultimately, the successful restoration of abandoned farm fields to forested wetlands may depend on the re-engineering of flood pulsing across landscapes to reconnect dispersal pathways.
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968. Stand development on reforested bottomlands in the Mississippi Alluvial Valley.

Twedt, Daniel J.

Plant Ecology 172(2): 251-263. (2004)

NAL Call #: QK900.P63; ISSN: 1385-0237

Descriptors: cluster analysis: mathematical and computer techniques/ reforested bottomlands: natural regeneration, planting, stand development

Abstract: Reforestation of bottomland hardwood sites in the southeastern United States has markedly increased in recent years due, in part, to financial incentives provided by conservation programs. Currently > 250,000 ha of marginal farmland have been returned to hardwood forests. I observed establishment of trees and shrubs on 205 reforested bottomlands: 133 sites were planted primarily with oak species (*Quercus* spp.), 60 sites were planted with pulpwood producing species (*Populus deltoides*, *Liquidambar styraciflua*, or *Platanus occidentalis*), and 12 sites were not planted (i.e., passive regeneration). Although oak sites were planted with more species, sites planted with pulpwood species were more rapidly colonized by additional species. The density of naturally colonizing species exceeded that of planted species but density of invaders decreased rapidly with distance from forest edge. Trees were shorter in height on sites planted with oaks than on sites planted with pulpwood species but within a site, planted trees attained greater heights than did colonizing species. Thus, planted trees dominated the canopy of reforested sites as they matured. Planted species acted in concert with natural invasion to influence the current condition of woody vegetation on reforested sites. Cluster analysis of species importance values distinguished three woody vegetation conditions: (1) *Populus deltoides* stands (2) oak stands with little natural invasion by other tree species, and (3) stands dominated by planted or naturally invading species other than oaks. Increased diversity on reforested sites would likely result from (a) greater diversity of planted species, particularly when sites are far from existing forest edges and (b) thinning of planted trees as they attain closed canopies.

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Northwest Wetlands General Information

969. Amphibian occurrence and aquatic invaders in a changing landscape: Implications for wetland mitigation in the Willamette Valley, Oregon, USA.

Pearl, Christopher A.; Adams, Michael J.; Leuthold, Niels; and Bury, R. Bruce

Wetlands 25(1): 76-88. (2005)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetland mitigation/ breeding occurrence/ landscape characteristics

Abstract: Despite concern about the conservation status of amphibians in western North America, few field studies have documented occurrence patterns of amphibians relative to potential stressors. We surveyed wetland fauna in Oregon's Willamette Valley and used an information theoretic approach (AIC) to rank the associations between native amphibian breeding occurrence and wetland characteristics, non-native aquatic predators, and landscape characteristics in a mixed urban-agricultural landscape. Best predictors varied among the five native amphibians and were generally consistent with life history differences. Pacific tree frog (*Pseudacris regilla*) and long-toed salamander (*Ambystoma macrodactylum*) occurrence was best predicted by the absence of non-native fish. Northern red-legged frog (*Rana a. aurora*) and northwestern salamander (*Ambystoma gracile*) were most strongly related to wetland vegetative characteristics. The occurrence of rough-skinned newts (*Taricha granulosa*), a migratory species that makes extensive use of terrestrial habitats, was best predicted by greater forest cover within 1 km. The absence of non-native fish was a strong predictor of occurrence for four of the five native species. In contrast, amphibians were not strongly related to native fish presence. We found little evidence supporting negative effects of the presence of breeding populations of bullfrog (*Rana catesbeiana*) on any native species. Only the two *Ambystoma* salamanders were associated with wetland permanence. Northwestern salamanders (which usually have a multi-year larval stage) were associated with permanent waters, while long-toed salamanders were associated with temporary wetlands. Although all the species make some use of upland habitats, only one (rough-skinned newt) was strongly associated with surrounding landscape conditions. Instead, our analysis suggests that within-wetland characteristics best predict amphibian occurrence in this region. We recommend that wetland preservation and mitigation efforts concentrate on sites lacking non-native fish for the conservation of native amphibians in the Willamette Valley and other western lowlands.

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970. Amphibian occurrence and wetland characteristics in the Puget Sound Basin.

Richter, Klaus O. and Azous, Amanda L.

Wetlands 15(3): 305-312. (1995)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: breeding habitat/ hydrology/ land use/ predation/ vegetation class

Abstract: We studied the pattern of amphibian distributions within 19 wetlands of the Puget Sound Basin in King County, Washington State from 1988 through 1991.

Amphibian richness was compared to wetland size, vegetation classes, presence of bullfrog and fish predators, hydrologic characteristics of water flow, fluctuation, and permanence, and land use. Low velocity flow and low fluctuation were correlated with high species richness. Seasonal persistence of water was unrelated to species richness. Wetland size, distance to other wetlands favorable for breeding, fish and bullfrog predators, and the number of vegetation classes found at a wetland were unrelated to total number of species. Increasing mean water-level fluctuation and percent watershed urbanization were correlated with low species richness. Small and structurally simple wetlands often have high value amphibian habitat, and traditional reliance on wetland size and broad vegetation classes without site-specific studies should be avoided when assessing habitat value for amphibians.

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971. Application of the synoptic approach to wetland designation: A case study in Washington.

Abbruzzese, B.; Leibowitz, S. G.; and Sumner, R., EPA/600/3-90/072, 1990.

Notes: NTIS Order No.: PB90-270604/GAR

Descriptors: wetlands/ nature conservation/ environmental protection/ resource management/ classification systems/ USA, Washington/ conservation, wildlife management and recreation

Abstract: The synoptic approach is a rapid assessment method designed to provide a context for evaluating landscape sensitivity to cumulative wetland loss and to complement site specific information used in reviewing permit applications to alter wetlands. The objectives of the study were to: (1) test the utility of the synoptic approach in prioritizing wetland 'functional uses' (including State surface water designated uses) within the State of Washington; (2) demonstrate and improve this method's ability to identify wetland resources that are ecologically important or sensitive to change; (3) investigate the applicability of the synoptic approach in the landscape assessment of a relatively small watershed; and (4) implement the transfer of the research products to State wetland managers. Readily available data were compiled for Washington into a set of map overlays. The overlays were synthesized to produce indices of landscape input and wetland capacity for hydrologic, water quality, and life support functions, cumulative impacts and future wetland losses for watersheds within the State. The synoptic approach identifies wetland functions not included in Washington's designated uses of surface waters. The approach is appropriate for a state with a generalized set of water quality standards such as Washington's, i.e., one that has no specific designated uses relative to wetland hydrologic and water quality improvement functions. The products of this assessment will be useful in regional planning and in the development of State wetland conservation plans. Contract EPA-68-C8-0006 Sponsored by Corvallis Environmental Research Lab., OR (DBO). © CSA

972. Characterization of wetland hydrology using hydrogeomorphic classification.

Shaffer, P. W.; Kentula, M. E.; and Gwin, S. E. *Wetlands* 19(3): 490-504. (1999)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ hydrology/ geomorphology/ classification/ decision making/ land management/ water management/ water level/ drainage/ classification systems/ water levels/ decision theory/ land/ USA, Oregon, Portland/ hydrogeomorphic classification

Abstract: Hydrologic data are essential for understanding relationships between wetland morphology and function and for characterizing landscape-scale patterns of wetland occurrence. We monitored water levels in 45 wetlands for three years to characterize the hydrology of wetlands in the vicinity of Portland, Oregon, USA and classified wetlands by hydrogeomorphic (HGM) class to determine whether hydrologic regimes differed in wetlands in different HGM classes. We also compared hydrologic regimes in naturally occurring wetlands (NOWs) and mitigation wetlands (MWs) and in wetlands with/without a human-made water-retention structure to determine whether and how human modifications are changing the hydrology of wetlands. We found no relationship between hydrologic attributes and land use, soil association, or wetland area. We did find significant differences related to presence of a water-retention structure and to wetland type (NOW or MW). Water levels were higher and had less temporal variability and more extensive inundation (as % wetland area) in MWs and in wetlands modified to include a retention structure. HGM class was very effective for characterizing wetland hydrology, with significant differences among HGM classes for water level and for extent and duration of inundation. For three regional classes, we found the lowest water levels and lowest extent/duration of inundation in slope wetlands, intermediate conditions in riverine wetlands, and the highest water levels and greatest extent and duration of inundation in depressions. In "atypical" classes, average water level and extent of inundation were similar to conditions in depressions, but the within-site variability in water levels in depressions-in-slope-setting and in-stream-depressions was significantly smaller than in the regional classes (p less than or equal to 0.001). Results highlight the importance of both geomorphic setting and wetland structure in defining wetland hydrology and support the use of HGM for wetland classification. Because hydrology is an important determinant of many wetland functions, resource managers using restoration and mitigation to offset wetland losses should strive for project design and siting that re-establish the hydrogeomorphology of natural wetlands to improve the likelihood of replacing wetland functions.

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973. Classification and management of aquatic, riparian, and wetland sites on the national forests of Eastern Washington: Series description.

Kovalchik, B. L. and Clausnitzer, R. R.; 593, 2004. 354 USDA Forest Service General Technical Report PNW.

NAL Call #: aSD11.A46 no. 593

<http://www.fs.fed.us/pnw/publications/gtr593/>

Descriptors: aquatic/ Eastern Washington/ plant association/ plant community/ riparian/ riparian ecosystems/ riparian vegetation/ series description/ vegetation classification/ wetland

Abstract: This is a classification of aquatic, wetland, and riparian series and plant associations found within the Colville, Okanogan, and Wenatchee National Forests. It is based on the potential vegetation occurring on lake and pond margins, wetland fens and bogs, and fluvial surfaces along streams and rivers within Forest Service lands. Data used in the classification were collected from 1,650 field plots sampled across the three forests. This classification identifies 32 series separated into four physiognomic classes: coniferous forests, deciduous forests, shrubs, and herbaceous vegetation. In addition, keys to the identification of 163 plant associations or community types are presented. The report includes detailed descriptions of the physical environment, geomorphology, ecosystem function, and management of each series. This classification supplements and expands information presented in upland forest plant association classifications previously completed for the three eastern Washington forests. It is a comprehensive summary of the aquatic, riparian, and wetland series and contributes to the understanding of ecosystems and their management in eastern Washington.

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974. Classification of aquatic and semiaquatic wetland natural areas in Idaho and western Montana.

Rabe, F. W. and Chadde, S. W.

Natural Areas Journal 14(3): 175-187. (1994)

NAL Call #: QH76.N37; ISSN: 0885-8608

Descriptors: wetlands/ classification systems/ hydrology/ water analysis/ nature conservation/ classification/ aquatic environment/ geochemistry/ natural areas/ geochemistry/ classification systems/ nature conservation

Abstract: A hierarchical classification of aquatic and semiaquatic zones associated with lentic (standing water) systems in Idaho and western Montana is proposed. This classification is structured like Cowardin et al. (1979), but is modified to apply to conditions in the Northern Rocky Mountains. Aquatic or open water sites are defined as having a depth greater than 0.5 m. Sites less than 0.5 m deep are considered semiaquatic. At the subsystem level our classification differs by separating size and depth of the aquatic area, making it possible to have both shallow and deep lakes and ponds. At the class and subclass levels only minor changes to the aquatic and semiaquatic descriptors used by the Cowardin system are proposed. We utilize water chemistry and hydrology as modifiers, similar to Cowardin, but do not employ water regime or soil as modifiers. We add geomorphic forms and special aquatic features not recognized by Cowardin. Wetland types found in Idaho and Montana such as peatlands, marshes, potholes, swamps, and vernal pools are described and classified. Photographs of selected study sites illustrate the classification process.

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975. Distribution of soil organic matter in freshwater emergent/open water wetlands in the Portland, Oregon metropolitan area.

Shaffer, P. W. and Ernst, T. L.

Wetlands 19(3): 505-516. (1999)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ hydrology/ geomorphology/ land management/ water management/ decision making/ resources management/ land use/ soil organic matter/ land/

decision theory/ resources/ organic matter/ USA, Oregon, Portland/ standing water

Abstract: We measured soil organic matter (SOM) concentrations in a large sample (n = 95) of freshwater emergent and open water wetlands in the Portland, Oregon, USA, area as part of a study of the ecological development of mitigation wetlands. Mean SOM concentrations were higher in naturally occurring wetlands (NOWs) than in mitigation wetlands (MWs) at 0-5 cm (SOM = 9.75 and 5.83%, respectively, p = 0.0001) and at 15-20 cm (SOM = 6.85, 4.68%, p = 0.0551). If temporal accumulation of SOM is occurring, it is slow; we found no significant relationship between SOM and wetland age (p = 0.6003) and no significant change in SOM concentration in soils in MWs sampled in 1987 and 1993. Concentrations of SOM were not significantly related to land use but were related to soil series, texture class, and association, and to hydrogeomorphic class. For a subset of wetlands monitored for hydrology, we also found a significant negative relationship between SOM and the extent of inundation by standing water. Mitigation may be leading to direct loss of SOM, probably resulting from soil management practices during project construction. We also show that hydrologic regime significantly affects SOM. Because most projects in our study were built in pre-existing wetlands and have extensive areas of open water, our results suggest that low concentrations of SOM are likely to persist. For SOM and probably for SOM-supported wetland functions, fundamental goals of mitigation and wetland management (in-kind wetland replacement, no-net-loss of structure and function) are not being achieved, at least in the short term. The success of mitigation, in terms of SOM, could be improved by better project design and better management of soils during project construction.

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976. Environmental gradients in Northwest USA freshwater wetlands.

Sanville W. D.; Eilers H. P.; Boss T. R.; and Pflieger T. G.

Environmental Management 10(1): 125-134. (1986)

NAL Call #: HC79.E5E5; ISSN: 0364-152X

Descriptors: vegetation/ moisture/ model/ seasonality

Abstract: Wetland environmental characteristics are examined to determine their spatial and temporal relationships. Two very different Oregon freshwater wetlands provided a range of wetland types. Results are evaluated to determine the possible use of environmental characteristics in defining wetlands and their boundaries. Representative physical, hydrological, and edaphic properties were periodically measured in microplots along upland/wetland transects. A multivariate approach is stressed in the data analysis; correlation, cluster analysis, and principal components analyses were used. The results indicate the environmental characteristics change in a quantifiable manner both spatially and temporally. The controlling mechanism is moisture, spatially in terms of the upland/wetland transect and temporally with respect to seasonal response. These changes do not correlate well with vegetation. Several hypotheses are offered as an explanation. Correlation within environmental characteristics is variable but definite patterns are discernible. These data suggest both single and combinations of environmental characteristics that could

serve as "keys" in wetland identification and boundary determination. However, before extensive use is made of this information additional long-term monitoring of wetland environmental characteristics will be required.

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977. Forms and accumulation of soil P in natural and recently restored peatlands--Upper Klamath Lake, Oregon, USA.

Graham, S. A.; Craft, C. B.; McCormick, P. V.; and Aldous, A.

Wetlands 25(3): 594-606. (2005)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ marshes/ phosphorus/ peatlands/ drainage/ lakes/ storage/ soil

Abstract: Forms, amounts, and accumulation of soil phosphorus (P) were measured in natural and recently restored marshes surrounding Upper Klamath Lake located in south-central Oregon, USA to determine rates of P accumulation in natural marshes and to assess changes in P pools caused by long-term drainage in recently restored marshes. Soil cores were collected from three natural marshes and radiometrically dated to determine recent (super(137)Cs-based) and long-term (super(210)Pb-based) rates of peat accretion and P accumulation. A second set of soil cores collected from the three natural marshes and from three recently restored marshes was analyzed using a modification of the Hedley procedure to determine the forms and amounts of soil P. Total P in the recently restored marshes (222 to 311 $\mu\text{g cm}^{-2}$) was 2-3 times greater than in the natural marshes (103 to 117 $\mu\text{g cm}^{-2}$), primarily due to greater bulk density caused by soil subsidence, a consequence of long-term marsh drainage. Occluded Fe- and Al-bound P sub(i), calcium-bound P sub(i) and residual P were 4 times, 22 times, and 5 times greater, respectively, in the recently restored marshes. More than 67% of the P pool in both the natural and recently restored marshes was present in recalcitrant forms (humic-acid P sub(o) and residual P) that provide long-term P storage in peat. Phosphorus accumulation in the natural marshes averaged 0.45 $\text{g m}^{-2} \text{yr}^{-1}$ (super(137)Cs) and 0.40 $\text{g m}^{-2} \text{yr}^{-1}$ (super(210)Pb), providing a benchmark for optimizing P sequestration in the recently restored marshes. Effective P sequestration in the recently restored marshes, however, will depend on re-establishing equilibrium between the P-enriched soils and the P concentration of floodwaters and a hydrologic regime similar to the natural marshes.

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978. Historical wetlands in Oregon's Willamette Valley: Implications for restoration of winter waterbird habitat.

Taft, O. W. and Haig, S. M.

Wetlands 23(1): 51-64. (2003)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ environmental restoration/ overwintering/ historical ecology/ valleys/ habitats/ waterfowl/ agriculture/ river basins/ habitat improvement/ ecosystem management/ restoration/ anthropogenic factors/ biological surveys/ river valleys/ aquatic birds/ habitat/ Aves/ Cygnus buccinator/ Chen caerulescens/ Grus canadensis/ Numenius americanus/ USA, Oregon, Willamette Valley/ birds/ trumpeter swan/ snow goose/ sandhill crane/ long-billed curlew/ Anser caerulescens/ Olor buccinator

Abstract: Before agricultural expansion in the 19th century, river valleys of North America supported expanses of wetland habitat. In restoring these landscapes, it is important to understand their historical condition and biological function. Synthesizing historical primary accounts (from explorers, travelers, settlers, and farmers) with contemporary knowledge of these wetland systems, we developed a profile of the wetlands and their use by nonbreeding waterbirds (e.g., waterfowl, wading birds, and shorebirds) within the Willamette Valley, Oregon, ca. 1840. We found evidence for three types of wetlands used by non-breeding waterbirds in fall, winter, and spring: emergent wetlands, riverine wetlands, and wetland prairie. The most extensive wetland type was wetland prairie, which functioned as fall/winter habitat for waterbirds, but only while native Kalapuyans managed the region with fire. Since the mid-1800s, four species, in particular, have decreased their use of the Willamette Valley: trumpeter swan (*Cygnus buccinator*), snow goose (*Chen caerulescens*), sandhill crane (*Grus canadensis*), and long-billed curlew (*Numenius americanus*). Information suggests that ca. 1840, waterbirds and their habitats were more abundant in the Willamette Valley than today. Restoration of the Willamette Valley landscape is warranted, and today's agricultural wetlands-former wetland prairie-hold highest restoration potential.

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979. Hydric soils in a southeastern Oregon vernal pool.

Clausnitzer, David; Huddleston, J. Herbert; Horn, Edward; Keller, Mark; and Leet, Curtis

Soil Science Society of America Journal 67(3): 951-960. (2003)

NAL Call #: 56.9 So3; ISSN: 0361-5995

Descriptors: hydric soils/ ponding/ vernal pool/ wetlands soil

Abstract: Vernal pools on the High Lava Plain of the northern Great Basin become ponded in most years, but their soils exhibit weak redoximorphic features indicative of hydric conditions. We studied the hydrology, temperature, redox potentials, soil chemistry, and soil morphology of a vernal pool to determine if the soils are hydric, and to evaluate hydric soil field indicators. We collected data for 3 yr from piezometers, Pt electrodes, and thermocouples. Soil and water samples were analyzed for pH, organic C, and extractable Fe and Mn. Soils were ponded from January through April or May, but subsurface saturation was never detected. Soil temperatures 50 cm below the surface rose above 5°C by March. Clayey Bt horizons perched water and limited saturation to the upper 10 cm. Redox potentials at a 5-cm depth were often between 200 and 300 mV, indicating anaerobic conditions, but producing soluble Fe²⁺ concentrations <1 mg L⁻¹. Extractable soil Fe contents indicated Fe depletion from pool surface horizons and accumulation at or near the upper Bt1 horizon. Depletions and concentrations did not satisfy the criteria of any current hydric soil indicators. We recommend development of new indicators based on acceptance of fewer, less distinct redox concentrations for recognition of a depleted A horizon, and on presence of a thin zone containing redox concentrations located in the upper part of the near-surface perching horizon.

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980. Managing Oregon's estuarine resource lands.

Jackson, P. L.

Journal of Soil and Water Conservation 46(1): 23-26. (1991)

NAL Call #: 56.8 J822; ISSN: 0022-4561

Abstract: Reviews one of the first attempts at mitigation banking to balance development with maintenance of fragile ecosystems. Estuarine mitigation has become an important phase in the planning and management of Oregon's coastal wetlands. As a part of a coordinated program of local comprehensive planning, land use regulation, and waterway alteration laws, mitigation banking is used to maintain the integrity of estuarine ecosystems by restoring or enhancing substitute habitat where planned development would otherwise result in the loss of resource lands. Oregon had adopted mitigation banking as the bank concept presents an alternative to applicants for state permits for material removal or fill in development estuaries. The article describes Oregon's first mitigation bank, the Astoria mitigation bank, established in 1987 at Young's Bay in the Columbia River Estuary. This project's objective was to restore a 33.8 acre diked pasture to its former condition as tidal marsh and swamp habitat. Another example of a large-scale habitat restoration is studied - the Salmon River Estuary project. Although this project was not a mitigation bank, it provides excellent evidence that diked pastureland along the Oregon coast can be returned to functioning salt-marsh habitat by restoration actions. The article finally assesses the prospects for estuarine mitigation. -from Author

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981. Nesting ecology of waterbirds at Grays Lake, Idaho.

Austin, J. E. and Pyle, W. H.

Western North American Naturalist 64(3): 277-292. (2004)

NAL Call #: QH1 .G7; ISSN: 1527-0904

Descriptors: wetlands/ nesting behavior/ lakes/ montane environments/ aquatic birds/ mountains/ nesting/ breeding success/ reproductive behaviour/ Aves/ *Fulica americana*/ *Aythya americana*/ *Gallinago delicata*/ *Phalaropus tricolor*/ *Podiceps nigricollis*/ *Recurvirostra americana*/ *Anas platyrhynchos*/ *Oxyura jamaicensis*/ *Rallus limicola*/ *Branta canadensis*/ *Circus cyaneus*/ *Asio flammeus*/ *Grus canadensis tabida*/ *Numenius americanus*/ *Anas strepera*/ USA, Idaho, Grays L./ birds/ gadwall

Abstract: Montane wetlands provide valuable habitat for nesting waterfowl and other waterbirds in the western United States, but relatively little information is available about the nesting ecology of their waterbird communities. We describe the general nesting ecology of breeding waterbirds at a large, shallow, montane wetland in southeastern Idaho during 1997-2000. Habitats include upland grasslands and intermittently to semipermanently flooded wetland habitats. We located a total of 1207 nests of 23 bird species: Eared Grebe (*Podiceps nigricollis*), Canada Goose (*Branta canadensis*), Mallard (*Anas platyrhynchos*), Gadwall (*A. strepera*), American Wigeon (*A. americana*), Green-winged Teal (*A. crecca*), Blue-winged Teal (*A. discors*), Cinnamon Teal (*A. cyanoptera*), Northern Shoveler (*A. clypeata*), Northern Pintail (*A. acuta*), Redhead (*Aythya americana*), Canvasback (*A. valisineria*), Lesser Scaup (*A. affinis*), Ruddy Duck (*Oxyura jamaicensis*), Northern Harrier (*Circus cyaneus*), American Coot (*Fulica americana*), Virginia Rail (*Rallus limicola*),

Greater Sandhill Crane (*Grus canadensis tabida*), American Avocet (*Recurvirostra americana*), Long-billed Curlew (*Numenius americanus*), Wilson's Snipe (*Gallinago delicata*), Wilson's Phalarope (*Phalaropus tricolor*), and Short-eared Owl (*Asio flammeus*). Most nests were initiated in May-early June and were terminated (hatched or destroyed) by the 3rd week of June. Mean daily survival rate (DSR) for Canada Goose nests was 0.954 plus or minus 0.005 (s sub(x); n = 127 nests), equivalent to Mayfield nest success of 21%. Mean DSR for dabbling duck nests over all 4 years was 0.938 plus or minus 0.006 (n = 41), equivalent to Mayfield nest success of 11%. For all other species where we found >10 nests each year (Eared Grebe, Redhead, Canvasback, Coot, Sandhill Crane, American Avocet, and Wilson's Snipe), >50% of nests found hatched at least 1 young. Success rates for geese, cranes, and ducks were lower than reported for Grays Lake during 1949-1951 and lower than most other wetlands in the region.

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982. *Quercus garryana* communities in the Puget Trough, Washington.

Thyssel, David R. and Carey, Andrew B.
Northwest Science 75(3): 219-235. (2001)
NAL Call #: 470 N81; ISSN: 0029-344X

Descriptors: biodiversity/ terrestrial ecology: ecology, environmental sciences/ vashon glaciation/ community composition/ exogenous disturbances/ forest types/ plant cover/ prairies: habitat/ species diversity/ species richness/ tree diameter/ tree height/ tree regeneration/ wetlands: habitat

Abstract: Among the legacies of the Vashon Glaciation are Oregon white oak (*Quercus garryana*), prairie, wetland, and Douglas-fir (*Pseudotsuga menziesii*) communities arrayed in a mosaic in the Puget Sound Area (PSA). Much of this mosaic has been destroyed. The largest remaining portion is on Fort Lewis Military Reservation. We examined oak communities on Fort Lewis to assess encroachment by exotic plants and by Douglas-fir, to determine amounts of regeneration of oak and other tree species, and to compare oak community diversity with that of nearby Douglas-fir forests and glacial till prairies. For the 22 largest communities, we determined densities of trees, distributions of tree diameters and heights, amounts of regeneration for each tree species, evidence of exogenous disturbances, and covers of vascular understory species. For study sites, we calculated basal areas of tree species, richness and diversity of vascular plants, and percentages of species that were exotic. We constructed species accumulation curves for oak communities, Douglas-fir forests, and prairies. We performed Bray-Curtis and weighted averaging ordinations for 176 sampling plots from the 22 sites. Oak communities were typically more diverse than either Douglas-fir forests or prairies and were transitional in species composition between them. However, oak communities contained numerous exotics, particularly Scot's broom (*Cytisus scoparius*) and colonial bentgrass (*Agrostis capillaris*). Most oak communities contained large-diameter Douglas-firs and other tree species and appeared to be transforming to conifer or conifer/mixed hardwood forests. With succession, exotic species become less prevalent, but the extent and abundance of oaks is diminished. Maintenance of oak communities, and the PSA natural mosaic, may require

tree-density management in oak stands, removal of Douglas-fir, development of replacement oak sites, prescribed burning, and mechanical suppression of exotics before burning.

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983. Recent wetlands trends (1981/82-1994) in the Willamette Valley, Oregon, USA.

Bernert, J. A.; Eilers, J. M.; Eilers, B. J.; Blok, E.; Daggett, S. G.; and Bierly, K. E.

Wetlands 19(3): 545-559. (1999)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ land use/ runoff/ land management/ farms/ classification/ resources management/ agriculture/ tile drains/ irrigation/ ecosystem disturbance/ mapping/ land/ farms and farming/ resources/ drains/ irrigation

Abstract: A two-stage, stratified, systematic sample design was implemented in the Willamette Valley, Oregon, USA, to quantify wetland and land-use changes from the 1980s to the 1990s. The Stage I sample (n = 711) was drawn from public land survey sections and was stratified by land use and runoff potential. The Stage II sample (n = 114) re-sampled the Stage I sample stratified by the amount of hydric soils identified in the Stage I sample. Wetland and upland classes were delineated on large-scale aerial photographs, digitized into ARC/Info coverages, and compared to quantify land-cover changes. Total loss of wetlands to uplands during the study period was about 3,800 ha, representing a 2.1 percent wetland loss from the 1980s. The net loss after adjusting for wetland gains was about 2,750 ha. During the study period, 70 percent of the wetland loss was associated with agriculture, six percent was lost to urbanization, and 24 percent was lost to other changes. The loss of wetlands to agriculture and the conversion of wetland types was consistent with a pronounced climatic component related to below-normal precipitation from 1985 to 1994, although continued installation of tile drains and expansion of irrigated agriculture also may have contributed to the changes. The loss of wetlands to agriculture raised questions regarding the effectiveness of current agricultural wetland policy, which appears ill-prepared to protect small wetlands or to deal with loss of wetlands from intensified use of existing farmland. This study identified a larger number and area of wetlands compared with national wetland surveys because of the larger scale data used in this study, the nature of the strata used in the statistical design, and the inclusion of palustrine farmed wetlands in the land-use classification.

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984. Restoration of degraded riverine/riparian habitat in the Great Basin and Snake River regions.

Platts, W. S. and Jensen, S. E.

In: *Wetland Creation and Restoration: The Status of the Science.*

Covelo, Calif.: Island Press, 1990; pp. 367-404.

Notes: ISBN: 1559630450

NAL Call #: QH541.5.M3W462

Descriptors: habitat restoration/ riparian land/ stream restoration/ water resources management/ wetland restoration/ environmental impact/ planting management/ riparian waters/ soil-water-plant relationships/ water resources development/ watershed management/ wildlife habitats

Abstract: Riverine/riparian habitat (RRH) includes interdependent aquatic (riverine) and streamside (riparian) resources that are valuable for fish and wildlife habitat, flood storage and desynchronization, nutrient cycling and water quality, recreation, and heritage values. RRH includes resources both wetter and drier than stipulated for wetlands. Whereas the 'natural or achievable state' of a riparian habitat may be wetland, the 'existing state' may be non-wetland because of natural or anthropogenically-induced changes in the hydrologic character of RRH. There are many different types of RRH, each with distinctive structure, function, and values. Restoration commonly requires: planning to identify preliminary goals and a general approach; baseline assessments and inventories; designs from which the feasibility of accomplishing goals can be assessed; evaluation to assure compliance with designs; and monitoring of variables important to goals and objectives. The goals, approach, and design of restoration projects must be tailored to each type of RRH. Some general elements important to restoration of degraded RRH are: establishment of hydrologic conditions compatible with project goals; efficient handling of soil and substrates in construction; selection and propagation of plants suited to the site and project goals; evaluation of features to enhance habitat for target species; maintenance and control of impacts; and scheduling construction to reflect site constraints and goals.

(Author's abstract)

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985. Saturation, reduction, and the formation of iron-manganese concretions in the Jackson-Frazier Wetland, Oregon.

D'Amore, David V.; Stewart, Scott R.; and Huddleston, J. Herbert

Soil Science Society of America Journal 68(3): 1012-1022. (2004)

NAL Call #: 56.9 So3; ISSN: 0361-5995

Descriptors: redoximorphic features: hydric soils, wetting drying cycles

Abstract: The Jackson-Frazier wetland is a rare, relatively undisturbed wetland in the Willamette Valley of Oregon that experiences repetitive annual flooding and drying cycles. Redoximorphic features formed by these wetting and drying cycles have not been calibrated with saturation and reduction. Long-term measurements of soil saturation and soil redox potential (EH) were combined with measurements of Fe and Mn concentrations to understand the formation of these redoximorphic features in the wetland soils. The Jackson-Frazier wetland is underlain by three stratigraphic units that control its hydrology: Holocene alluvium (A and Bss horizons), Malpass clay (2Bt horizon), and Irish Bend silts (3BC horizon). All three units are saturated for up to 9 mo each year, leading to EH values that fall below the Fe reduction threshold. Extractable Fe and Mn in nodules, concretions, and soft masses document substantial depletions from the matrix soil in all three units. In the 3BC, diffuse halos of Fe accumulation and matrix chromas from two to four indicate a source of Fe that can be reduced, translocated, and concentrated in nodular form. In the Bss and 3BC horizons, soft masses surrounding concentrations and higher ratios of oxalate to dithionite-citrate-bicarbonate Fe (Fe_{ox}/FeDCB) in the larger concentrations suggest that nodules and concretions are currently forming by accretion of Fe. In the 2Bt, virtually all

of the Fe and Mn is gone from the matrix, and concretion boundaries are sharp. These are not relict features, as the current conditions would favor continued formation had the supply of Fe and Mn not been exhausted.

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986. Sensitive wetlands delineation using multitemporal satellite imagery: A comparative study in the intermountain western U.S.

Cheney, B.; Jackson, M.; and Hardin, P.

In: Proceedings of SPIE - The International Society for Optical Engineering.; Vol. 4171.; pp. 340-350; 2001.

Descriptors: Kauth-Thomas transformation/ multitemporal image analysis/ wetland delineation

Abstract: This paper details an effort to develop an operational methodology to distinguish lacustrine, palustrine and riverine wetlands from irrigated agriculture in a continental area using archived multi-temporal/multi-spectral Landsat Tm data. Archival Landsat Tm data were acquired over the Little Wood River Valley of Idaho in April, August and September of 1985. All dates of imagery were subjected to a Kauth-Thomas transformation and then stacked into a single 9-band image and submitted to a supervised classification. Dem data was used to remove spectral confusion with mountain vegetative systems with similar temporal signatures to the wetlands of interest. Field checks and comparison to National Wetland Inventory (nwi) maps completed in 1984 revealed a 98.3% agreement in classification of non-wetland areas. 54% of the areas classified as wetland on the Nwi were classified as wetland using our method. This is attributed to practice of generalization of the Nwi maps in which several small wetlands are circumscribed into a single large area. The digital method correctly identified the wetland patches and classified the interstices as dry land. Confusion with irrigated agriculture was almost completely absent. © 2006 Elsevier B.V. All rights reserved.

987. Tidal wetlands of the Puget Sound region Washington USA.

Boule M. E.

Wetlands 1: 47-60. (1981)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: spruce/ alder/ pine/ inundation/ salinity/ climate/ zonation/ plant evolution/ topography/ tide/ river/ freshwater/ marine/ marsh/ swamp

Abstract: Wetland plant associations in the Puget Sound region are controlled by the same physical factors identified in wetlands throughout the world: frequency and/or duration of inundation, and salinity. Physiographic and climatic features and plant evolutionary responses to them have resulted in an unusual diversity and zonation of tidal wetlands. Substantial freshwater runoff and fjord-like topography results in diminished baseline ("marine") salinity conditions within Puget Sound. The steep topography/bathymetry also means there is little suitable wetland habitat in Puget Sound waterways. Tide ranges of up to 4m at river mouths may result in tidal fluctuations 40 km or more upstream, while high river flows often limit measurable surface salinities to less than 2km upstream. As a consequence, Puget Sound wetlands are found predominantly in tidal, freshwater rivers. Plant communities vary from low salt marsh associations at river mouths with

brackish marshes immediately above them to fresh marshes and shrub swamps upriver. In undeveloped locations, forested swamps of spruce, alder, or occasionally pine, may be found in upstream tidal areas.

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988. Tracking changes in wetlands with urbanization: Sixteen years of experience in Portland, Oregon, USA.

Kentula, Mary E.; Gwin, Stephanie E.; and Pierson, Suzanne M.

Wetlands 24(4): 734-743. (2004)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: hydrologic modifications/ geographic information system: GIS, applied and field techniques/ field survey: applied and field techniques/ national wetlands inventory/ human manipulation/ rainfall/ residential use/ wetland urbanization

Abstract: Long-term studies are essential to understanding the effects of urbanization on wetlands and the effectiveness of management actions. Using data from the National Wetlands Inventory (NWI) in combination with GIS analyses and field surveys, we tracked changes over 16 years (1982-1998) in small (ltoreq2 ha), palustrine emergent/open water wetlands (PEM/POW) in Portland, Oregon, USA. Wetlands identified on NWI maps and that had not been converted to other land uses at the time of the 1992 survey were surveyed in 1998. Data were collected on 164 of the 171 wetlands in the target population. Despite development pressure throughout the 1990s, loss of small PEM/POW wetlands slowed between 1992 and 1998, with only 6% of the sites being destroyed as compared to 40% between 1982 and 1992. Of 11 sites that were not identifiable due to drought in 1992, eight had recovered with the return of typical rainfall; three had been destroyed. Most of the wetlands existing in 1998 were in hydrogeomorphic (HGM) classes atypical to the region due to human manipulation. Hydrologic modifications were observed on 60% of the sites, but on-site disturbances like mowing, dumping, and trail building had decreased since the 1992 survey. Over the time period studied, land uses adjacent to the study sites shifted from undeveloped and agricultural to urban and residential use. Reflecting the common occurrence of on- and off-site stressors and modifications, we rated the condition of only 11 % of the

sites as good, with 46% fair and 43 % poor. Our results demonstrate the utility of combining field surveys with GIS analyses to track the status of wetland resources over time. The next challenge is to use such data to develop strategies to manage urban wetlands in ways that maintain and ultimately improve the condition of the resource.

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989. Wetland determination of a southeast Oregon vernal pool and management implications.

Clausnitzer, D. and Huddleston, J. H.

Wetlands 22(4): 677-685. (2002)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ steppes/ classification/ on-site investigations/ hydrology/ soil properties/ vegetation/ water holes/ livestock/ ecological effects/ ecosystem management/ soil/ sediment properties/ temporary ponds/ classification systems/ biota/ plant populations/ nature conservation

Abstract: Numerous landscape depressions on the High Lava Plain of southeast Oregon, USA are ponded in most years, but their wetland status has not been examined closely. We applied the standard wetland criteria (hydrology, soils, and vegetation) to one such pool to evaluate whether the pool meets federal criteria as a jurisdictional wetland. Wetland hydrology was determined to be present based on data from piezometer and ponding observations. Soils were determined to be hydric based on hydrology, soil temperature, and redox potentials. Vegetation met wetland criteria according to the 50/20 rule. Vegetation was similar to that of California Northern Basalt Flow vernal pools. Oregon pools are locally called 'upland playas,' but they fit the definition of vernal pools. Many southeast Oregon vernal pools are dug out as waterholes for livestock, increasing ponding depth and duration. Increased water availability can alter biological communities within pools and on surrounding semi-arid uplands. Effects due to grazing and excrement inputs have not yet been investigated. Vernal pools constitute distinct habitat sites within semi-arid landscapes and, therefore, probably play an important, and so far poorly understood, ecological role on the southeast Oregon steppe.

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Effects of Agricultural Conservation Practices on Wetlands

990. Controls on selenium distribution in wetland sediment, Benton Lake, Montana.

Zhang, Yiqiang and Moore, J. N.

Water, Air, and Soil Pollution 97(3-4): 323-340. (1997)

NAL Call #: TD172 .W36; ISSN: 0049-6979

Descriptors: wetlands/ selenium/ sediment pollution/ water management/ carbon/ agricultural runoff/ distribution/ pumping plants/ water supply/ drainage/ land management/ pollution monitoring/ USA, Montana, Benton L.

Abstract: The distribution of selenium in sediment in Benton Lake is mainly controlled by the location of the dissolved selenium inputs. Selenium concentrations in sediment decrease along flow paths downgradient within the wetland system. Construction in 1961 of a pump station to increase water supply and dikes to facilitate water management, along with current water management, has

increased the rate of selenium accumulation in sediments as compared to the pre-1961 natural lake. Agricultural practices (alternate crop/fallow rotation) in the non-irrigated farm land of the seleniferous Benton Lake basin also have increased selenium loading to Benton Lake. Carbon content is an important factor affecting selenium distribution in sediment but this relationship is greatly affected by dissolved selenium inputs. Amelioration of selenium contamination in Benton Lake will require a combination of land and water management modifications. Within the wetland system, minimizing the duration of inlet-perennial ponds would minimize selenium accumulation and increase the life of the refuge.

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991. Effects of RodeoReg. and GarlonReg. 3A on nontarget wetland species in central Washington.

Gardner, S. C. and Grue, C. E.

Environmental Toxicology and Chemistry 15(4): 441-451. (1996)

NAL Call #: QH545.A1E58; ISSN: 0730-7268

Descriptors: wetlands/ herbicides/ toxicity/ effects/ weeds/ weed control/ aquatic organisms/ aquatic weeds/ control/ chemical control/ glyphosate/ triclopyr/ nontarget effects/ aquatic invertebrates/ *Lythrum salicaria*/ *Daphnia*/ rainbow trout/ *Lemna*

Abstract: Purple loosestrife, *Lythrum salicaria*, is an invasive wetland perennial that became established in northeastern North America in the early 1800s. Despite its designation as a noxious weed, its distribution has continued to expand. Treatment with herbicides is the most widely used means of controlling purple loosestrife. This study examined the nontarget effects of two herbicides, Rodeo [glyphosate] and Garlon 3A [triclopyr amine], currently used or being considered for use in controlling purple loosestrife in Washington State, resp. Growth and/or survival of duckweed [*Lemna* spp.], *Daphnia*, and rainbow trout were monitored for at least 24 h following an application of each herbicide. Free-living water column and benthic invertebrates were monitored 24 h and 7 d post-spray using activity traps and sediment cores. Neither chemical was associated with significant decreases in survival or growth of the bioassay organisms, with the exception that growth of duckweed was reduced 48 h after exposure to Rodeo. Nor were significant decreases in the abundance of free-living aquatic invertebrates detected following the herbicide applications. Results suggest that neither herbicide, at the application rates used, poses a hazard to aquatic invertebrates in wetlands in central Washington. However, Rodeo, because it is a broad-spectrum herbicide, may pose a greater hazard to nontarget aquatic vegetation.

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992. Home ranges, movements, and habitat selection of Oregon spotted frogs (*Rana pretiosa*).

Watson, James W.; McAllister, Kelly R.; and Pierce, D. John

Journal of Herpetology 37(2): 292-300. (June 2003)

NAL Call #: QL640.J6; ISSN: 0022-1511

Descriptors: *Rana pretiosa* (Ranidae)/ home range/ home range use/ distribution within habitat/ movement patterns/ habitat selection and home range use relationships/ habitat utilization/ range use/ habitat preference/ semiaquatic habitat/ wetland upland pasture mosaic/ grassland/ Washington/ Thurston County/ Dempsey Creek/ habitat selection/ home range use and movement patterns/ upland pasture wetland mosaic

Abstract: From 1997-1999 we studied one of four known populations of Oregon Spotted Frogs (*Rana pretiosa*) in Washington State to investigate patterns of range use, movements, and habitat selection. Sixty telemetered frogs occupied a range that was a mosaic of wetlands (15.6 ha) and upland pasture (13.2 ha) grazed by dairy cows. Mean (. [plus or minus] SE) home-range size for four frogs was 2.2 [plus or minus] 1.0 ha. Patterns of spatial use, determined from 654 telemetry locations, were closely related to season and changing surface water conditions. During the breeding season (February to May), frogs occupied >=50% of the area they used the entire year, and oviposited in

shallow pools (depth = 16.9 [plus or minus] 0.6 cm) on the margins of an ephemeral creek. In the dry season (June to August), frogs moved down stream to deeper, permanent pools (depth = 23.6 [plus or minus] 1.0 cm), significantly reduced their movements, and occupied the smallest ranges of any season. During the wet season (September to January), frogs moved back up stream and reoccupied the breeding range. During the coldest weather, frogs buried themselves at the base of dense vegetation in shallow water under ice (depth = 17.4 [plus or minus] 0.8 cm). Frogs avoided dry uplands. Frogs selected sedge (*Carex obnupta*, and *Carex utriculata*)/rush (*Juncos effuses*) habitat during breeding and hardhack (*Spiraea douglasii*) cover during the dry season that shaded and maintained remnant pools. Frogs preferred microhabitats with 50-75% water surface exposure based on comparisons between telemetry locations and nearby locations that were randomly selected. Aquatic requirements necessary to complete the life cycle of Oregon Spotted Frogs in this population include (1) stable, shallow water areas for egg and tadpole survival in the breeding season, (2) deep, moderately vegetated pools for adult and juvenile survival in the dry season, and (3) shallow water levels over emergent vegetation for protecting all age classes during cold weather in the wet season.

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993. The importance of flood irrigation in water supply to wetlands in the Laramie Basin, Wyoming, USA.

Peck, D. E. and Lovvorn, J. R.

Wetlands 21(3): 370-378. (Sept. 2001)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ flood irrigation/ irrigation effects/ irrigation efficiency/ environmental effects/ hydrology/ percolation/ ecosystems/ salinity/ conductivity/ irrigation water/ agriculture/ water supply/ nature conservation/ canals/ water policy/ water management/ irrigation/ flooding/ water supplies/ USA, Wyoming, Laramie Basin/ groundwater management/ mechanical and natural changes/ freshwater pollution

Abstract: As in many areas of western North America, flood irrigation for hay production has created many wetlands in the Laramie Basin, Wyoming. Since the early 1900s, water from mountain snowmelt has reached wetlands via ditches and as interflow and ground water percolating from flooded fields and unlined ditches. Such systems are viewed as inefficient for irrigation and other human uses because they reduce the volume and increase the salinity of downstream flows. Increasing irrigation efficiency by lining ditches or installing sprinklers would decrease wetland habitat, but such effects are seldom considered. To assess potential impacts of increased irrigation efficiency, we determined how flood irrigation affects the hydrology and types of wetlands in the Laramie Basin. For 74 wetlands with 80 total inflows, just 14% of inflows were as surface flow from natural stream channels. In contrast, 65% of inflows were directly from irrigation: 30% as surface flow from ditches and 35% as interflow percolating from ditches and irrigated fields. Fifteen percent of inflows were as surface flow from other wetlands, and 6% of inflows were from ground water with unknown recharge source (probably either natural streams or irrigation). In this year of high water availability (1999), wetlands receiving surface water generally were fresh or

oligosaline regardless of whether that flow was from natural streams, other wetlands, or ditches (mean plus or minus 1 SD = 3.28 plus or minus 5.07 mS/cm, median = 1.60, range 0.07-22.10). In contrast, wetlands receiving water as interflow percolating from ditches or irrigated fields, or as ground water with unknown recharge source, were more likely to have conductivities of mesosaline or higher (mean plus or minus 1 SD = 22.45 plus or minus 32.71 mS/cm, median = 9.08, range 0.60-112.00). Conductivity of surface water in the 74 wetlands (mS/cm) ranged from fresh (0.07) to hypersaline (112.00), with a mean of 10.89 plus or minus 22.80 (SD) and median of 2.60; this range of salinity corresponds to substantial variation in wetland community structure. In the Laramie Basin and similar areas, flood irrigation is critical to the existence, hydrology, and community types of most wetlands, and these effects should be considered in plans to increase irrigation efficiency.

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994. Nitrogen and phosphorus loading from drained wetlands adjacent to Upper Klamath and Agency Lakes, Oregon.

Snyder, Daniel T. and Morace, Jennifer L.
Portland, Ore.: U.S. Dept. of the Interior, U.S. Geological Survey 67 p. Water-resources investigations report.
NAL Call #: GB701.W375 no.97-4059
http://or.water.usgs.gov/pubs_dir/Pdf/97-4059.pdf
Descriptors: nutrient pollution of water---Oregon/ lakes---fertilization---Oregon/ eutrophication---Oregon/ water quality biological assessment---Oregon
This citation is from AGRICOLA.

Wetlands as Agricultural Conservation Practices

995. Constructed wetland systems in the arid and semi-arid west to treat irrigation wastewater.

Hoag, J. C.

In: Wetlands and Remediation: An International Conference. (Held 16 Nov 1999-17 Nov 1999 at Salt Lake City, UT .) Means, J. L. and Hinchee, R. E. (eds.); pp. 295-300; 1999.

Descriptors: wetlands/ irrigation water/ waste utilization/ pollution control/ water pollution treatment/ agricultural pollution/ water pollution control/ agriculture/ irrigation/ precipitation/ irrigation/ precipitation (atmospheric)/ wastewater treatment/ phosphorus removal/ nitrogen removal/ construction/ arid environments/ environmental engineering/ constructed wetlands/ USA, Idaho, Magic Valley/ protective measures and control/ wastewater treatment processes/ water treatment/ sewage & wastewater treatment

Abstract: Three Constructed Wetland Systems for water quality improvement of irrigation wastewater were built in the Magic Valley of Idaho in 1994, 1995, and 1996. The Nature Conservancy CWS is the oldest CWS. Preliminary data indicates that in it has a removal efficiency of 88% of Total Suspended Solids, 72.5% Total Phosphorous, 73.4% Ortho-phosphorous, and 65% nitrogen. Preliminary data indicates that the Cedar Draw CWS has a removal efficiency of 65.2% TSS, 43.2% TP, 16% OP, and 16% N (very limited sampling data). CSI CWS is the youngest wetland and little sampling has been completed on it. The plant communities have filled in significantly since planting with a few problems associated with water control.

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996. Created and restored marshes in the Lower Fraser River, British Columbia: Summary of their functioning as fish habitat.

Levings, C. D. and Nishimura, D. J. H.

Water Quality Research Journal of Canada 32(3): 599-618. (1997); ISSN: 1201-3080

Descriptors: Canada, British Columbia, Fraser R./ marshes/ aquatic habitats/ estuaries/ invertebrates/ smolt/ salmon/ aquatic plants/ artificial wetlands/ rehabilitation/

comparison studies/ environmental restoration/ Oncorhynchus

Abstract: Ecological comparisons of transplanted, natural (reference) and disrupted (unvegetated) marsh sites on the Fraser River estuary, British Columbia, were conducted between 1991 and 1994. The study examined vegetative biomass and cover, invertebrate abundance, fish abundance, fish residency, fish food, and submergence time for the three habitats. Standing crop biomass at three transplant sites was within the range of values for reference sites, but was much lower at an unstable site where sediment slumping had occurred. The percent cover of Lyngbyei's sedge (*Carex lyngbyei*) in eight transplant sites was <50% of that observed in adjacent reference sites when data were averaged over the study area; rushes (*Juncus* spp.) were more abundant in transplant sites. In all study reaches, abundance of invertebrates at transplant and reference sites was significantly higher than at disrupted sites. In several instances, invertebrate abundance at transplant sites was greater than at reference sites. No significant difference ($p > 0.05$) was observed among marsh sites when chum salmon (*Oncorhynchus keta*) and chinook salmon (*O. tshawytscha*) fry abundance were compared. However, chinook and sockeye smolt catches were significantly different ($p < 0.05$) among marsh sites and were usually higher at disrupted sites. In nine sites in the North Arm and Deas Slough area chum fry residency was examined. At one transplant site (DE1) marked chum fry were caught up to 48 h after release. No fry were caught 1 h after release at a transplant site (D11) and a disrupted site (DE4). At the remaining sites, fry were caught up to 1 and 3 h after release. At all sites, over 80% of the total number of food organisms examined in chum fry stomachs were harpacticoid copepods. Mean submergence time for reference marshes ranged from 33.2 to 50.7%, but for transplanted sites the value ranged from 26.4 to 60.1%. Our study shows that numerous factors need to be examined in determining if restored marshes will function as natural habitats. The development of a standardized set of reference criteria would assist in evaluating whether or not transplanted marshes are functioning as designed.

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997. Duwamish River Coastal America restoration and reference sites: Results from 1997 monitoring studies.

Cordell, J. R.; Tear, L. M.; Jensen, K.; and Higgins, H. A. Seattle, WA: Fisheries Research Institute; FRI-UW-9903, 1999.

Notes: Other numbers: Technical report. School of Aquatic and Fishery Science, Fisheries Research Institute, Washington University [Rep. Fish. Res. Inst. Wash. Univ.]. No. 9903

Descriptors: wetlands/ habitat improvement/ water resources/ riprap/ restoration/ brackishwater environment/ man-induced effects/ tidal currents/ riparian vegetation/ fishery sciences/ environmental protection/ coastal zone/ fishery management/ coastal inlets/ anthropogenic factors/ *Oncorhynchus*/ *Carex lyngbyei*/ *Scirpus maritima*/ USA, Washington, Seattle, Duwamish Waterway/ habitat community studies

Abstract: In this report, we present the results of 1997 biological monitoring at three wetland restoration sites in the Duwamish River estuary, Seattle, Washington. Restoration at these sites was originally facilitated by the federal Coastal America program and was carried out by a partnership of the City of Seattle, U.S. Fish & Wildlife Service, the U.S. Army Corps of Engineers, and the U.S. Environmental Protection Agency. Two of these sites are in the middle portion of the Duwamish Waterway, in a region dominated by tidal influence and mixed fresh- and marine water. The first of these sites consists of the General Service Administration (GSA) site located adjacent to the Federal Center South, which is a long, narrow intertidal strip running parallel to the east bank of the Duwamish Waterway adjacent to the Seattle District Corps of Engineers. Restoration at this site included removal of rock riprap and a large overwater wharf structure to allow natural colonization by existing wetland plants, construction of a sediment "bench" at 0.0-m elevation to promote use by juvenile salmon (*Oncorhynchus* spp.), and planting of upland riparian vegetation. The second site is at Terminal 105 (T-105); this site originally consisted of a vacated street end and a large pipe that drained a small degraded wetland area. Restoration included removal of debris and replacement of the pipe with an estuarine channel that restored tidal flow to the area. The third Coastal America restoration site is at the upper Turning Basin at the head of the Duwamish Waterway. This site/comprises an upland riparian buffer planted with native vegetation and a small regraded upper intertidal basin planted with fringing native sedge, *Carex lyngbyei*, and rush, *Scirpus maritima*.

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of the effect of fire in wetland prairies, which are also threatened with encroachment of woody species. The present study investigated wetland species responses to experimental burning, hand-removal of woody species, and mowing with removal of cut material. The possible ecological mechanisms responsible for individualistic responses of species, including direct mortality, ability to resprout, and release from competition are considered. We also evaluated these treatments as tools for meeting restoration objectives of reducing the abundance of woody species, reducing or preventing spread of non-native pest species, and increasing or at least maintaining native species' abundance. After two years of treatments (1994 and 1996) three patterns emerged. 1) Woody species: Burning and hand-removal caused the greatest reductions in cover of woody species. Mowing with removal of cut material, however, did not reduce the cover of woody species compared to controls. As woody plant cover decreased, plant mortality increased, indicating that treatments influenced woody plant cover at least partially through mortality. 2) Native herbaceous species: Burning significantly decreased inflorescence production of *Deschampsia cespitosa*, the dominant wetland prairie grass. In contrast, burning, along with mowing, significantly increased flowering of *Juncus tenuis*. Flowering and cover of all native graminoids combined, however, showed no significant responses to treatments. Burning and hand-removal significantly promoted the cover of native forbs as a group, with *Lotus purshiana* and *Veronica scutellata* showing the greatest increases. 3) Non-native herbaceous species: Burning and hand-removal significantly reduced the cover of non-native forbs as a group and particularly reduced the cover of *Hypericum perforatum*. The number of inflorescences of non-native grasses (*Holcus lanatus* and *Anthoxanthum odoratum*) increased with hand-removal and mowing. Overall, no treatment was clearly superior in fulfilling the restoration objectives. Burning was effective in reducing woody cover and did not promote abundance of non-native herbaceous species. Burning, however, reduced the flowering of the key native grass, *Deschampsia cespitosa*. Hand-removal of woody species was also effective at reducing woody cover and promoted the abundance of some native species, but it sometimes increased the cover of non-native herbaceous species. Because mowing with removal of cut material was ineffective in reducing woody cover and tended to promote non-native herbaceous species, this treatment is not recommended as a management tool.

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998. Fire, mowing, and hand-removal of woody species in restoring a native wetland prairie in the Willamette Valley of Oregon.

Clark, D. L. and Wilson, M. V.

Wetlands 21(1): 135-144. (2001)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ prairies/ fires/ mowing/ mortality/ indigenous species/ environmental restoration/ flowering/ plant communities/ freshwater environments/ land use/ land management/ environmental quality/ ecosystem management/ ecosystem disturbance/ introduced species/ vegetation cover/ fire

Abstract: The invasion of prairies by woody species is a worldwide conservation concern. Fire is frequently used to inhibit this invasion. However, there is little documentation

999. Hydrologic design considerations of constructed wetlands for urban stormwater runoff.

Koob, T.; Barber, M. E.; and Hathhorn, W. E.

Journal of the American Water Resources Association

35(2): 323-332. (Apr. 1999)

NAL Call #: GB651.W315; ISSN: 1093-474X

Descriptors: artificial wetlands/ hydrology/ urban runoff/ vegetation/ water stress/ drought/ tolerance/ design criteria/ storm runoff/ land reclamation/ stormwater runoff/ water budget/ droughts/ environmental engineering/ agricultural runoff/ runoff (urban)/ design data/ runoff/ USA, Washington, Spokane/ control of water on the surface/ protective measures and control/ environmental action/ water & wastewater treatment/ underground services and water use/ wastewater treatment processes

Abstract: The successful design of constructed wetlands requires a continuous supply of water or vegetation that can withstand drought conditions. Having a constant water source is the best alternative to insure species diversity throughout the season. Consequently, detention structure designs should be based on times between events as well as on hydrologic return periods, since between events is when most evaporation and infiltration losses are likely to occur. In arid or semi-arid environments, this is a difficult process because of long interevent times and seasonal changes in precipitation patterns. This discussion is predicated on the assumption that phytoplankton, epiphytic algae, and emergent vegetation require moist conditions to be effective at removing nutrients, metals and other pollutants. There are drought tolerant species of vegetation that can be used in constructed wetlands but it may take several days to re-establish the attached bacteria communities necessary for optimum pollutant removal. This paper examines a stochastic framework to examine the probability of extended dry periods based on historic rainfall data. The number of consecutive dry days is selected for a specified level of assurance. By multiplying this value by the sum of daily system losses, an overall pond volume can be determined that ensures a minimum depth of water. To illustrate the utility of the approach, the method is applied to a site in Spokane, Washington.

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1000. Hydrologic regime controls soil phosphorus fluxes in restoration and undisturbed wetlands.

Aldous, Allison; McCormick, Paul; Ferguson, Chad; Graham, Sean; and Craft, Chris

Restoration Ecology 13(2): 341-347. (June 2005)

NAL Call #: QH541.15.R45R515; ISSN: 1061-2971

Descriptors: wetlands/ soil/ flooding/ mineralization/ phosphorus/ environmental restoration/ lakes/ habitat improvement/ fertilizers/ hydrology/ ecosystem disturbance/ agriculture/ USA, Oregon, Upper Klamath L./ reclamation/ habitat community studies/ mechanical and natural changes

Abstract: Many wetland restoration projects occur on former agricultural soils that have a history of disturbance and fertilization, making them prone to phosphorus (P) release upon flooding. To study the relationship between P release and hydrologic regime, we collected soil cores from three restoration wetlands and three undisturbed wetlands around Upper Klamath Lake in southern Oregon, U.S.A. Soil cores were subjected to one of three hydrologic regimes-flooded, moist, and dry-for 7.5 weeks, and P fluxes were measured upon reflooding. Soils from restoration wetlands released P upon reflooding regardless of the hydrologic regime, with the greatest releases coming from soils that had been flooded or dried. Undisturbed wetland soils released P only after drying. Patterns in P release can be explained by a combination of physical and biological processes, including the release of iron-bound P due to anoxia in the flooded treatment and the mineralization of organic P under aerobic conditions in the dry treatment. Higher rates of soil P release from restoration wetland soils, particularly under flooded conditions, were associated with higher total P concentrations compared with undisturbed wetland soils. We conclude that maintaining moist soil is the means to minimize P release from recently flooded

wetland soils. Alternatively, prolonged flooding provides a means of liberating excess labile P from former agricultural soils while minimizing continued organic P mineralization and soil subsidence.

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1001. Integrated pest management to control reed canarygrass in seasonal wetlands of southwestern Washington.

Kilbride, K. M. and Paveglio, F. L.

Wildlife Society Bulletin 27(2): 292-297. (1999)

NAL Call #: SK357.A1W5; ISSN: 0091-7648

Descriptors: wetlands/ weed control/ control methods/ herbicides/ integrated control/ mowing/ spraying/ sprays/ disking/ weeds/ cultural control/ Phalaris/ Phalaris arundinacea

Abstract: Reed canarygrass (*Phalaris arundinacea*) is an exotic, invasive species that threatens to degrade wetlands throughout North America. Although efficacies of control methods for canarygrass have been studied in the Midwest, little information is available regarding efficacies for treatments in the Pacific Northwest. Here, integrated pest management techniques for the control of canarygrass in seasonal wetlands of southwestern Washington were investigated. Techniques used included mechanical (disking or mowing) and chemical (RodeoReg.) treatments, and combinations of disking and Rodeo together with water-level control for 3 growing seasons. Stem densities of canarygrass were reduced most by spraying and disking with a follow-up application of Rodeo during the next growing season. Disking with a follow-up application of Rodeo during the next growing season generally had similar canarygrass control as the most efficacious treatment. Canarygrass that germinated and grew from viable rhizomes following drawdown after the initial Rodeo application or disking made a follow-up treatment with herbicide imperative for effective control. To prevent canarygrass re-infestation, treatments should not be initiated until the ability to manage consistent water levels throughout the winter and early spring exists for a wetland.

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1002. Nutrients in salmon hatchery wastewater and its removal through the use of a wetland constructed to treat off-line settling pond effluent.

Michael, J. H.

Aquaculture 226(1-4): 213-225. (Oct. 2003)

NAL Call #: SH1 .A6; ISSN: 0044-8486

Descriptors: aquaculture effluents/ biodegradation/ water pollution treatment/ water quality control/ wastewater treatment/ phosphorus/ hatcheries/ solid impurities/ fish culture/ nutrients/ habitat/ fisheries/ settling basins/ artificial wetlands/ salmonidae/ USA, Washington/ salmonids/ effects of aquaculture on the environment/ effects of aquaculture on the environment/ sewage & wastewater treatment/ water & wastewater treatment

Abstract: The presence of nutrients in the wastewater of salmonid hatcheries is of growing concern to water quality managers. Presently, Washington State regulations require quiescent settling to remove settleable and suspended solids from the water but do not as yet address nutrient concerns. In order to evaluate the load of nutrients discharged by salmon hatcheries, the Washington Department of Fish and Wildlife (WDFW) initiated two studies. Water from the Issaquah Hatchery, located in a

watershed with identified excessive levels of anthropogenic phosphorus in the aquatic system, was monitored for total phosphorus for more than a year at the points of diversion from the creek, at the points of water return to the creek, and at the point of discharge from the off-line settling pond. Monitoring showed that the hatchery's contribution to watershed phosphorus levels was low and that the primary phosphorous input from the hatchery appeared to be the process water as opposed to water from the off-line settling system. In order to evaluate the efficacy of a constructed wetland in the removal of nutrients from a conventional offline settling system, WDFW installed a constructed wetland at the Dungeness Hatchery. Over the course of 4 years of monitoring, the wetland removed most of the solids, phosphorus, and nitrogenous compounds, which resulted in a reduction in biological oxygen demand (BOD) of the influent water. At times, the offline settling system actually increased the level of some of the nutrients, suggesting that treatment of hatchery effluent will need to include a combination of quiescent settling, constructed wetland, and some sort of process water treatment if anthropogenic solids and nutrients are to be more completely removed. The constructed wetland also provided habitat used by amphibians and birds for breeding and foraging. At facilities in locations with sufficient land base available to develop a constructed wetland, it should be possible to reduce the nutrient input to receiving waters and provide additional habitat for aquatic animals.
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1003. Prescribed fire and the response of woody species in Willamette Valley wetland prairies.

Pendergrass, K. L.; Miller, P. M.; and Kauffman, J. B. *Restoration Ecology* 6(3): 303-311. (1998)
NAL Call #: QH541.15.R45R515; ISSN: 1061-2971
Descriptors: fire management/ fire suppression/ fuel biomass/ fuel properties/ height growth/ prescribed burning/ wetland prairies/ woody species density
Abstract: A single fall-season prescribed burn and two consecutive fall-season prescribed burns were conducted in 1988 and 1989 to quantify the effects of fire intensity and frequency on woody species in two Willamette Valley wet prairies. Fuel biomass, fuel properties, fire behavior, biomass consumption, and changes in woody species density and height were documented before and after the burns. Before burning, *Rosa nutkana* (Nootka rose) was the most abundant woody species at both sites. In 1988, burns were significantly more intense, produced more heat per unit area at Fisher Butte than at Rose Prairie, and were fairly complete, with 37% and 35% woody biomass consumption, respectively. In 1989, burns were spotty; only 11% of woody biomass was consumed at Fisher Butte. The one-burn treatment did not affect *R. nutkana* density in 1 approx 15 m transects at either site; the two-burn treatment significantly increased its density in three of the five communities sampled. Burning significantly reduced height growth by eliminating taller individuals while stimulating sprouts from belowground tissues. Redistribution of *R. nutkana* and trees into shorter height classes indicates the possibility of reducing the visual dominance of woody species if periodic burns were conducted in native Willamette Valley prairie. The low-intensity burns in this study were sufficient to remove the woody shoots under 3 m tall but did not reduce their capacity to regenerate and did not reduce the density of woody species. After decades

of fire suppression, two burns were not sufficient to reestablish the desired balance between native herbaceous and woody species or to reduce the presence of introduced woody species. A long-term commitment to the reintroduction of fire as a management tool will be required to maintain native wetland prairies in the Willamette Valley.
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1004. Reduction potential of selenate in wetland sediment.

Zhang, Y. Q. and Moore, J. N. *Journal of Environmental Quality* 26(3): 910-916. (1997)
NAL Call #: QH540.J6; ISSN: 0047-2425
Abstract: Laboratory and field experiments were conducted to examine the reduction potential of dissolved selenate in wetland sediment at Benton Lake, Montana. Results showed that selenate reduction in wetland sediment was a microbially mediated process. This process proceeded rapidly and removed more than 50% of added selenate from solution to the sediment during the first day of the experiment. The reduction potential of selenate in sediment was positively correlated to Se concentrations in sediment, but not to sediment organic C content. This process occurred at the sediment surface because the depth of diffusion of selenate was limited, resulting in most Se accumulating in the top 2 cm of the sediment. The results from this study indicate that selenate reduction in sediment dominates selenate removal from water.
This citation is from AGRICOLA.

1005. Response of a terrestrial mollusc community to an autumn prescribed burn in a rare wetland prairie of western Oregon, USA.

Severns, Paul M. *Journal of Molluscan Studies* 71(Part 2): 181-187. (2005)
NAL Call #: QL401; ISSN: 0260-1230
Descriptors: prescribed burning: applied and field techniques/ grasslands/ wetland prairie
Abstract: Conservation and management of grasslands may involve the use of prescribed fire to reinstate a historical disturbance regime recently suppressed by humans. I used traps to describe the terrestrial mollusc community in a rare wetland prairie ecosystem of western Oregon, USA over a 3-year period in an adjacent burned and unburned wetland prairie parcel beginning 1 year following an autumn prescribed fire. Species richness was lower throughout the burned area for the duration of the study period and mollusc abundance was lower in the first postburn year, but steadily increased over time, surpassing the adjacent burned area by the third postburn year. According to Multi-response Permutation Procedure, the mollusc community in the adjacent burned area differed significantly from the unburned prairie each year since the burn, suggesting that fire history may structure the wetland prairie mollusc community. Indicator species analysis identified that *Deroceras reticulatum* and *Monadenia fidelis* were indicator species for unburned wetland prairie, while *Catinella rhederi* and *Vertigo modesta* were indicator species for burned habitat at the study site. Since fire appears to decrease wetland prairie mollusc diversity and abundance, prescribed burns should be conducted in accordance with refuges, to provide a source population for colonizing molluscs and for other animals with unknown responses to fire.
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1006. Subsurface flow wetland treatment of dairy farm stormwater.

Bruce, I. D. and Puget Sound Action Team,
Olympia WA USA.

In: 2003 Georgia Basin/Puget Sound Research Conference Proceedings. (Held 3 Mar 1931-3 Apr 2003 at Vancouver, BC (Canada).) Droscher, T. W. and Fraser, D. A. (eds.); 2004.

Descriptors: wetlands/ water quality/ nutrients (mineral)/ tributaries/ ponds/ suspended particulate matter/ habitat improvement/ airports/ water pollution/ agricultural pollution/ farms/ artificial wetlands/ coliforms/ nutrients/ streams/ fisheries/ sampling/ interception/ storm seepage/ suspended solids/ monitoring/ agriculture/ dairy wastes/ storm wastewater/ Canada, British Columbia, Vancouver I., Victoria/ Canada, British Columbia, North Saanich/ habitat community studies/ prevention and control/ industrial effluents/ water & wastewater treatment

Abstract: Non-point source pollution from agriculture can cause chronic water quality impacts in small streams and downstream marine waters. In North Saanich, B.C., water quality sampling of a tributary of TENTEN Creek in February 2000 indicated excessive levels of nutrients, suspended solids and faecal coliforms present in stormwater originating from an adjacent dairy farm. The tributary from the farm crosses into lands managed by the Victoria Airport Authority (VAA). The WSIKEM-TENTEN Stewardship Project, working in partnership with VAA, Pendray Farms, Tseycum First Nation and Fisheries & Oceans Canada, developed a stormwater interception and treatment complex beginning in August 2000. A 2.1 million-litre stormwater detention pond was constructed with two piped outlets, one that fed a 150 metre long, 3-metre wide sub-surface flow constructed wetland. Monitoring of treatment efficacy in the winter of 2000-01 indicated that up to 99% of source faecal coliforms were removed, while nutrient and TSS reductions ranged from 25-95%. Subsequently a second wetland was constructed in 2001 to treat additional stormwater, and we estimate that during the first three years of operation, over 300 million litres of stormwater were treated. This paper discusses how the project was developed, its successes and limitations, and the role of stewardship partnerships in habitat and water quality restoration. Data describing wetland efficacy in treating agricultural stormwater is presented in tabular and chart formats, along with discussion of several of the water quality parameters that were investigated.

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1007. Use of radar remote sensing (RADARSAT) to map winter wetland habitat for shorebirds in an agricultural landscape.

Taft, O. W.; Haig, S. M.; and Kiilsgaard, C.

Environmental Management 33(5): 750-763. (2004)

NAL Call #: HC79.E5E5; ISSN: 0364-152X

Descriptors: wetlands/ radar/ remote sensing/ habitat/ agriculture/ wildlife/ mapping/ aquatic birds/ agricultural ecosystems/ radarsat/ shorebirds/ plovers/ sandpipers

Abstract: Many of today's agricultural landscapes once held vast amounts of wetland habitat for waterbirds and other wildlife. Successful restoration of these landscapes relies on access to accurate maps of the wetlands that remain. We used C-band (5.6-cm-wavelength), HH-polarized radar remote sensing (RADARSAT) at a 38 degree incidence angle (8-m resolution) to map the

distribution of winter shorebird (Charadriiformes) habitat on agricultural lands in the Willamette Valley of western Oregon. We acquired imagery on three dates (10 December 1999, 27 January 2000, and 15 March 2000) and simultaneously collected ground reference data to classify radar signatures and evaluate map accuracy of four habitat classes: (1) wet with less than or equal to 50% vegetation (considered optimal shorebird habitat), (2) wet with > 50% vegetation, (3) dry with less than or equal to 50% vegetation, and (4) dry with > 50% vegetation. Overall accuracy varied from 45 to 60% among the three images, but the accuracy of focal class 1 was greater, ranging from 72 to 80%. Class 4 coverage was stable and dominated maps (40% of mapped study area) for all three dates, while coverage of class 3 decreased slightly throughout the study period. Among wet classes, class 1 was most abundant (about 30% coverage) in December and January, decreasing in March to approximately 15%. Conversely, class 2 increased dramatically from January to March, likely due to transition from class 1 as vegetation grew. This approach was successful in detecting optimal habitat for shorebirds on agricultural lands. For modest classification schemes, radar remote sensing is a valuable option for wetland mapping in areas where cloud cover is persistent.
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1008. The value of agricultural wetlands as invertebrate resources for wintering shorebirds.

Taft, O. W. and Haig, S. M.

Agriculture, Ecosystems & Environment 110(3-4): 249-256. (2005)

NAL Call #: S601 .A34; ISSN: 0167-8809

Abstract: Agricultural landscapes have received little recognition for the food resources they provide to wintering waterbirds. In the Willamette Valley of Oregon, modest yet significant populations of wintering shorebirds (Charadriiformes) regularly use hundreds of dispersed wetlands on agricultural lands. Benthic invertebrates are a critical resource for the survival of overwintering shorebirds, yet the abundance of invertebrate resources in agricultural wetlands such as these has not been quantified. To evaluate the importance of agricultural wetlands to a population of wintering shorebirds, the density, biomass, and general community composition of invertebrates available to birds were quantified at a sample of Willamette Valley sites during a wet (1999-2000) and a dry winter (2000-2001). Invertebrate densities ranged among wetlands from 173 to 1925 (mean +/- S.E.: 936 +/- 106) individuals/m² in the wet winter, and from 214 to 3484 (1028 +/- 155) individuals/m² in the dry winter. Total invertebrate estimated biomass among wetlands ranged from 35 to 652 (mean +/- S.E.: 364 +/- 35) mg/m² in the wet winter, and from 85 to 1405 (437 +/- 62) mg/m² in the dry winter. These estimates for food abundance were comparable to that observed in some other important freshwater wintering regions in North America. This citation is from AGRICOLA.

1009. Variability of treatment performance in constructed wetlands.

Kuehn, E. and Moore, J. A.

Water Science and Technology 32(3): 241-250. (1995)

NAL Call #: TD420.A1P7; ISSN: 0273-1223

Descriptors: wetlands/ wastewater treatment/ pollutants/ biochemical oxygen demand/ aquatic plants/ *Schoenoplectus acutus*/ *Typha latifolia*/ pulp and paper mill effluents/ constructed wetlands

This citation is from AGRICOLA.

1010. Why pest plant control and native plant establishment failed: A restoration autopsy.

Wilson, M. V.; Ingersoll, C. A.; Wilson, M. G.; and Clark, D. L.

Natural Areas Journal 24(1): 23-31. (Feb. 2004)

NAL Call #: QH76.N37; ISSN: 0885-8608

Descriptors: environmental restoration/ pest control/ prairies/ community composition/ seeds/ restoration/ introduced species/ vegetation cover/ plant populations/ plant control/ population density/ mortality/ competition/ ecosystem management/ ecosystem disturbance/ seedlings/ indigenous species/ fallowing/ burning/ maintenance/ USA, Oregon/ USA, Oregon, Willamette Valley/ native species/ wetland prairies/ reclamation/ conservation, wildlife management and recreation/ biodiversity

Abstract: Explaining restoration failure can be as important as touting success. We used a series of studies to understand the failure of techniques commonly used to restore wetland prairies in the Willamette Valley of western Oregon. Burning, fallowing, and solarization (covering tilled plots with plastic sheeting to heat the soil) had pronounced first-year effects on several individual species, but either did not reduce overall pest plant abundance or reduced the abundance of native species as well. The 34% overall plant cover in solarized plots was the only significant difference from the 60% cover present in control plots. All first-year responses essentially disappeared by the second year. These measures had little lasting effect on pest and other exotic plants because many survived treatment and resprouted. In addition, treatments had little effect on the number of seeds in the soil, leaving a pool of immediate and potential regeneration. Specific control measures of target plants, such as hand removal and repeat maintenance after initial treatments, should prove more successful. In a second study, three mixtures of native species sown into fallowing treatment plots had low emergence rates of 1%-7%, despite high seed viability, and produced only 0%-3% cover. Native species should be selected and sown at densities high enough to lead to significant numbers of surviving seedlings, especially in the face of competition from surviving pest plants.

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Prairie Pothole Region Wetlands General Information

1011. Atmospheric inputs of mercury and organic carbon into a forested upland/bog watershed.

Kolka, R. K.; Nater, E. A.; Grigal, D. F.; and Verry, E. S. *Water, Air, and Soil Pollution* 113(1-4): 273-294. (1999)
NAL Call #: TD172 .W36; ISSN: 0049-6979

Descriptors: wetlands/ mercury/ dissolved organic carbon/ watersheds/ trees/ forests/ air pollution/ pollutant deposition/ water sampling/ filtration/ rainfall/ organic carbon/ peat bogs/ throughfall/ forest watersheds/ USA, Minnesota/ freshwater pollution/ characteristics, behavior and fate/ sources and fate of pollution/ air pollution

Abstract: Inputs of mercury (Hg) and dissolved organic carbon (DOC) in throughfall and stemflow waters were measured for an upland/bog watershed in northern Minnesota, and were compared to the deposition in a nearby opening to determine the influence of tree canopies on Hg and DOC deposition. Twice as much Hg and seven times as much DOC was deposited in the forested watershed compared to the opening. Mass balance studies that are based on wet-only deposition in openings severely underestimate atmospheric deposition of Hg in forests. Conifer canopies are more efficient filters of airborne particulates than are deciduous canopies as indicated by much higher Hg concentrations and total deposition in throughfall and stemflow waters under conifers. Significant positive relationships existed between Hg and DOC in both throughfall (36-57% of the variation) and stemflow waters (55-88% of the variation). Hg complexation by DOC appears to be related to the contact time between precipitation and carbon sources.

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1012. Bioindicators for assessing ecological integrity of prairie wetlands.

Adamus, Paul R.; Hairston, Ann J.; National Health and Environmental Effects Research Laboratory (U.S.), Western Ecology Division; and ManTech Environmental Research Services Corp.

Corvallis, OR: U.S. Environmental Protection Agency, Office of Research and Development, National Health and Environmental Effects Research Laboratory, Western Ecology Division; 209 p. (1996)

Notes: "Prepared ... through Contract 68-C4-0019 to ManTech Environmental Research Services Corp. and Contract number 5B6075NATA to Ann Hairston"--T.p. verso. Shipping list no.: 97-0045-P. "July 1996."
"EPA/600/R-96/082." Includes bibliographical references (p. 131-171). SUDOCs: EP 1.2:B 52/21.

NAL Call #: QH541.5.P7A33 1996

<http://www.epa.gov/owow/wetlands/wqual/ppaindex.html>

Descriptors: prairie ecology---United States/ wetland ecology---United States/ indicators---biology---United States/ biological diversity conservation---United States
This citation is from AGRICOLA.

1013. Chemical characteristics of prairie lakes in south-central North Dakota: Their potential for influencing use by fish and wildlife.

Swanson, George A.
Washington, D.C.: U.S. Dept. of the Interior, Fish and Wildlife Service, 1988. 44 p. Fish and Wildlife Technical Report.

NAL Call #: SH11.A37 no.18

Descriptors: limnology---North Dakota/ water chemistry
This citation is from AGRICOLA.

1014. Duck nest success in the Prairie Pothole Region.

Klett, A. T.; Shaffer, T. L.; and Johnson, D. H. *Journal of Wildlife Management* 52(3): 431-440. (1988)
NAL Call #: 410 J827; ISSN: 0022-541X

Descriptors: breeding success/ breeding/ colonies/ nests/ population dynamics/ nature conservation/ aquatic birds/ Anas/ USA, Minnesota/ USA, North Dakota/ USA, South Dakota/ aquatic birds

Abstract: The authors estimated nest success of mallard (*Anas platyrhynchos*), gadwall (*A. strepera*), blue-winged teal (*A. discors*), northern shoveler (*A. clypeata*), and northern pintail (*A. acuta*) for 5 regions in North Dakota, South Dakota, and Minnesota, for 1-3 periods between 1986 and 1984, and for 8 habitat classes. Nest success rates ranged from < 5 to 36% among regions, periods, and species. Rates were lowest in western Minnesota (MNW) and eastern North Dakota (NDE), intermediate in central North Dakota (NDC) and eastern South Dakota (SDE), and highest in central South Dakota (SDC). In regions with comparable data, no consistent trend in nest success was apparent from early to late periods. Gadwalls and blue-winged teal nested more successfully than mallards and pintails; the relative success of shovelers varied regionally.

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1015. Effects of vegetation manipulation on breeding waterfowl in prairie wetlands: A literature review.

Kantrud, H. A. Fish and Wildlife Service, U.S. Department of the Interior, 1986. Fish and Wildlife Technical Report.

Notes: Also available in USDA General Technical Report RM-194, Can Livestock Be Used as a Tool to Enhance Wildlife Habitat?, Reno, Nevada, 13 February 1990, edited by Severson, Kieth E., pp. 93-123.

NAL Call #: aSD11.A42 no. 194

<http://www.npwrc.usgs.gov/resource/wetlands/vegmanip/vegmanip.htm>

Abstract: Both dabbling and diving ducks and their broods prefer wetlands with openings in the marsh canopy. Decreased use is commonly associated with decreased habitat heterogeneity caused by tall, robust hydrophytes and other species adapted to form monotypes in the absence of disturbance. Reductions in height and density of tall, emergent hydrophytes by fire and grazing (unless very intensive) generally benefit breeding waterfowl. Such benefits are an increase in pair density, probably related to increased interspersion of cover and open water which decreases visibility among conspecific pairs, and

improvements in their invertebrate food resources that result from increased habitat heterogeneity. Research needs are great because of the drastic changes that have accrued to prairie wetlands through fire suppression, cultivation, and other factors. -from Author
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1016. Factors limiting mallard brood survival in prairie pothole landscapes.

Krapu, G. L.; Pietz, P. J.; Brandt, D. A.; and Cox, R. R. *Journal of Wildlife Management* 64(2): 553-561. (2000)
NAL Call #: 410 J827; ISSN: 0022-541X
Descriptors: survival/ prairies/ wildlife management/ mathematical models/ juveniles/ clutch/ population dynamics/ *Anas platyrhynchos*/ mallard/ prairie pothole landscapes
Abstract: In order to estimate mallard (*Anas platyrhynchos*) production from managed and unmanaged lands, waterfowl biologists need measurable predictors of brood survival. We evaluated effects of percent of seasonal basins holding water (WETSEAS), percent of upland landscape in perennial cover (PERNCOVER), rainfall (RAIN), daily minimum ambient temperature (TMIN), hatch date (HATCHDATE), brood age (BA; 0-7 or 8-30 days), age of brood females, and brood size on mallard brood survival in prairie pothole landscapes, and developed a predictive model using factors found to have significant effects. Sixteen of 56 radiomarked broods experienced total loss during 1,250 exposure days. Our final fitted model of brood survival contained only main effects of WETSEAS, HATCHDATE, and RAIN. Total brood loss during the first 30 days of exposure was 11.2 times more likely for broods hatched on areas with <17% WETSEAS than those on areas with >59% WETSEAS. Total brood loss was 5.2 times more likely during rainy conditions than during dry periods, and the hazard of total brood loss increased by 5% for each 1-day delay in hatching between 17 May and 12 August. High survival of mallard broods in landscapes where most seasonal basins contain water underscores the importance of maintaining seasonal wetlands as a major component of wetland complexes managed for mallard production. Because early hatched broods have higher survival, we also suggest that waterfowl managers focus their efforts on enhancing nest success of early laid clutches, especially in wet years.
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1017. Freshwater functions and values of prairie wetlands.

Murkin, H. R. *Great Plains Research* 8(1): 3-15. (1998)
NAL Call #: QH104.5.G73 G755; ISSN: 1052-5165
Abstract: To date, wetland conservation programs and policies have focused on wetlands primarily as wildlife habitat. In spite of the extensive efforts of wildlife interest groups, wetlands continue to be lost. Successful wetland conservation in North America will require that society, as a whole, perceives broader and more significant values of freshwater wetlands than simply their role as wildlife habitat. Identifying and quantifying the functions of wetlands to the maintenance and renewal of critical freshwater resources are important steps toward expanding the base of support for wetland conservation/restoration programs throughout the continent. This paper introduces the functions and values of prairie wetlands related to the

quantity and quality of fresh water. Subsequent papers in this issue evaluate the current state of our knowledge of these functions and values, identify priority information needs, and make specific recommendations for the use of this information to enhance wetland conservation restoration programs and policy.
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1018. Functions and values of prairie wetlands: Economic realities.

Leitch, J. A. and Fridgen, P. *Great Plains Research* 8(1): 157-168. (1998)
NAL Call #: QH104.5.G73 G755; ISSN: 1052-5165
Abstract: Land and water resources of the Prairie Pothole Region support important economic and ecologic activities. Scarce resources, such as wetlands, should be allocated among these activities such that society's well being is enhanced. Such allocation requires knowledge of the relative values of resources, something that has been largely missing in the wetland literature. This paper describes the practical realities of wetland economics, using the Prairie Pothole Region as an example. Ongoing human and economic activities in the PPR are presented as an introduction to the economy of the area. The purpose for economic valuation of wetlands - achieving the 'greatest good' - is briefly discussed. The connection between wetlands and human values is described. Five types of wetland valuation methods are discussed: market, surrogate/proxy, revealed preference, state preference, and benefits transfer. Finally, some suggestions are made to add value to all types of wetland science by enhancing the collaboration among wetland scientists.
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1019. Glaciated prairie wetland functions and values: A synthesis of the literature.

Hubbard, Daniel E. U.S. Fish and Wildlife Service, 1988. 50 p. Biological Report .
NAL Call #: QH540.U562 no.88(43)
Descriptors: wetlands/ management/ research/ United States, north central/ North America/ Great Plains

1020. The groundwater recharge function of small wetlands in the semi-arid northern prairies.

Van der Kamp, G. and Hayashi, M. *Great Plains Research* 8(1): 39-56. (1998)
Abstract: Small wetlands in the semi-arid northern prairie region are focal points for groundwater recharge. Hence the groundwater recharge function of the wetlands is an important consideration in development of wetland conservation policies. Most of the groundwater recharge from the wetlands flows to the moist margins of the wetlands and serves to maintain high evapotranspiration by the vegetation surrounding the wetlands. Only a small portion of the recharged water flows to regional aquifers, but this portion is important for sustaining groundwater resources. Wetland drainage eliminates the local flow systems, but may have little effects on regional aquifers other than a slight lowering of the groundwater levels. Further research should focus on the effects of wetland drainage on regional groundwater levels, the role of small ephemeral ponds in groundwater recharge, and the contribution of groundwater inflow to the water balance of large permanent wetlands.
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1021. Hydrologic functions of prairie wetlands.

LaBaugh, J. W.; Winter, T. C.; and Rosenberry, D. O. *Great Plains Research* 8(1): 17-37. (1998)
 NAL Call #: QH104.5.G73 G755; ISSN: 1052-5165
Abstract: Wetlands in the prairie known as potholes or sloughs represent an ever-changing mosaic of surface waters interacting with the atmosphere, groundwater, and each other in a variety of ways. Studies of groups of adjacent wetlands in different parts of the glaciated North American prairie have enabled some connections to be made between hydrologic processes, biological communities, and use of these wetlands by wetland-dependent wildlife. Understanding controls on variability in water levels, water volume, and salinity in these wetlands sets the stage for understanding controls on biological communities utilizing these wetlands. The role that natural variability in water and salinity plays in making these wetlands an important resource for waterfowl will provide an important context for those who are responsible for artificially altering the variability of water and salinity in prairie wetlands.

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1022. Hydrological, chemical, and biological characteristics of a prairie pothole wetland complex under highly variable climate conditions: The Cottonwood Lake area, east-central North Dakota.

Winter, Thomas C.
 Denver, CO: U.S. Geological Survey, 2003. U.S. Geological Survey professional paper.
 NAL Call #: 407 G29Pr no. 1675
Descriptors: groundwater flow---North Dakota---Cottonwood Lake (Stutsman County)/ wetlands---North Dakota---Cottonwood Lake (Stutsman County)/ climatic changes---North Dakota---Cottonwood Lake (Stutsman County)

This citation is from AGRICOLA.

1023. The impact of duration of drainage on the seed banks of northern prairie wetlands.

Wienhold, C. E. and Van Der Valk, A. G.
Canadian Journal of Botany 67(6): 1878-1884. (1989)
 NAL Call #: 470 C16C; ISSN: 0008-4026
Descriptors: wetlands/ environmental impact/ drainage/ population density/ prairies/ vegetation cover/ plant populations/ USA, Great Plains/ seed banks/ duration
Abstract: To determine the potential role of seed banks in the restoration of drained wetlands, the seed banks of 30 extant and 52 drained and cultivated prairie potholes were sampled in Iowa, Minnesota, and North Dakota; the potholes had been drained between 5 and 70 years ago. The midsummer vegetation of most of these potholes was also sampled. The number of species in the seed bank of a pothole declined from a mean of 12.3 in extant potholes to 7.5, 5.4, 5.0, 7.4, 3.2, and 2.1 in potholes drained up to 5, 10, 20, 30, 40, and 70 years ago, respectively. The mean total seed density of extant potholes was 3600 seeds/m². It increased to 7000 seeds/m² up to 5 years after drainage, but then declined rapidly to 1400, 1200, 600, 300, and 160 after up to 10, 20, 30, 40 and 70 years after drainage. Changes in both species richness and seed density with increasing duration of drainage varied from state to state.

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1024. Iowa's wetlands present and future with a focus on prairie potholes.

Bishop, R. A.; Joens, J.; and Zohrer, J.
Journal of the Iowa Academy of Science 105(3): 89-93. (1998)
 NAL Call #: Q11.J68; ISSN: 0896-8381
Descriptors: pothole habitat/ prairie marsh/ riparian floodplain/ uplands/ wetland restoration/ wildlife habitat
Abstract: The vast prairie marsh-pothole complex that historically covered approximately 7.6 millions acres in Iowa was reduced to less than 30,000 acres by 1980 when it was estimated that only 5,000 acres of prairie marsh and pothole habitat remained in private ownership. A bleak outlook for the future of wetlands was presented by Bishop (1981)." This outlook changed with the development of the North American Waterfowl Management Plan and the passage of two important pieces of legislation: the North American Wetlands Conservation Act and the Food Security Act of 1985. Protection of existing wetlands was afforded through the Swampbuster provision of the Food Security Act. The North American Wetlands Conservation Act and the Wetland Reserve Program offered through the Food Security Act provided needed funding for the protection and restoration of wetlands in Iowa. Since 1988, the Iowa Department of Natural Resources, the U.S. Fish and Wildlife Service, and various county conservation boards together with Pheasants Forever, Ducks Unlimited, and the Iowa Natural Heritage Foundation have purchased over 10,000 ha (25,000 ac) of wetlands and uplands in the Prairie Pothole Region of Iowa and restored over 24,240 ha (6,600 ac) of public and private wetlands. The United States Department of Agriculture, Natural Resources Conservation Service has enrolled approximately 24,240 ha (60,600 ac) of riparian floodplains and potholes into the Wetland Reserve Program and Emergency Wetland Reserve Program, affording them protection through permanent easements. Public support of wetland legislation will ensure that funding continues to be available to protect and restore Iowa's prairie wetlands.

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1025. Local and landscape-level influences on wetland bird communities of the Prairie Pothole Region of Iowa, USA.

Fairbairn, S. E. and Dinsmore, J. J.
Wetlands 21(1): 41-47. (2001)
 NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: wetlands/ landscape/ community composition/ prairies/ birds/ habitats/ wildlife management/ aquatic birds/ population structure/ habitat selection/ population density/ ecosystem management/ Aves/ USA, Iowa/ USA, Iowa/ birds
Abstract: Bird species richness and individual species densities were measured in wetland complexes in 1998. These values were then related to habitat variables within the complexes and to area of wetland habitat in the surrounding landscape. The percentage of wetland area within a complex that was covered with emergent vegetation and the total area of wetland habitat in the 3 km surrounding each complex were significant predictors of species richness. A perimeter-to-area ratio was the most frequently selected variable for inclusion in species-density models, being selected for 8 of 15 models. Five species' densities were related to the percentage of the wetland area that was covered by emergent vegetation, and 4

densities were related to the area covered by weak-stemmed wet-meadow vegetation. Densities of 5 species, as well as the overall species richness, were associated with a measure of the amount of wetland habitat within a 3-km buffer surrounding the wetland complexes. This indicates that the presence and abundance of some wetland bird species may be influenced by the amount of wetland habitat nearby. Thus, programs that encourage restoration of tracts of land that contain multiple wetland basins should be emphasized to maximize benefits to the wetland bird community.

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1026. Prairie basin wetlands of the Dakotas: A community profile.

Kantrud, Harold A.; Krapu, Gary L.; Swanson, George A.; and Allen, James A. U.S. Fish and Wildlife Service, 1989. 111 p. Biological Report.

<http://www.npwrc.usgs.gov/resource/othrdata/basinwet/basinwet.htm>

Descriptors: wetlands/ prairies

1027. Prairie wetland ecology: The contribution of the Marsh Ecology Research Program.

Murkin, Henry R.; Valk, Arnold van der; Clark, William R.; and Marsh Ecology Research Program.

Ames, Iowa: Iowa State University Press; 413 p. (2000)

Notes: 1st ed.; Includes bibliographical references (p. 395-401) and index.

NAL Call #: QH541.5.M3 P73 2000; *ISBN:* 0813827523

Descriptors: wetland ecology/ prairies

This citation is from AGRICOLA.

1028. Scale-dependent habitat use in three species of prairie wetland birds.

Naugle, D. E.; Higgins, K. F.; Nusser, S. M.; and Johnson, W. C.

Landscape Ecology 14(3): 267-276. (1999)

NAL Call #: QH541.15.L35 L36; *ISSN:* 0921-2973

Descriptors: wetlands/ habitat utilization/ nesting behavior/ foraging behavior/ habitat/ feeding behaviour/ nesting/ aquatic birds/ *Podilymbus podiceps*/ *Xanthocephalus xanthocephalus*/ *Chlidonias niger*/ USA, South Dakota/ yellow-headed blackbird/ black tern/ prairie wetlands

Abstract: We evaluated the influence of scale on habitat use for three wetland-obligate bird species with divergent life history characteristics and possible scale-dependent criteria for nesting and foraging in South Dakota, USA. A stratified, two-stage cluster sample was used to randomly select survey wetlands within strata defined by region, wetland density, and wetland surface area. We used 18-m (0.1 ha) fixed radius circular-plots to survey birds in 412 semipermanent wetlands during the summers of 1995 and 1996. Variation in habitat use by pied-billed grebes (*Podilymbus podiceps*) and yellow-headed blackbirds (*Xanthocephalus xanthocephalus*), two sedentary species that rarely exploit resources outside the vicinity of nest wetlands, was explained solely by within-patch variation. Yellow-headed blackbirds were a cosmopolitan species that commonly nested in small wetlands, whereas pied-billed grebes were an area-sensitive species that used larger wetlands regardless of landscape pattern. Area requirements for black terns (*Chlidonias niger*), a vagile species that typically forages up to 4 km away from the nest wetland, fluctuated in response to landscape structure.

Black tern area requirements were small (6.5 ha) in heterogeneous landscapes compared to those in homogeneous landscapes (15.4-32.6 ha). Low wetland density landscapes composed of small wetlands, where few nesting wetlands occurred and potential food sources were spread over large distances, were not widely used by black terns. Landscape-level measurements related to black tern occurrence extended past relationships between wetlands into the surrounding matrix. Black terns were more likely to occur in landscapes where grasslands had not been tilled for agricultural production. Our findings represent empirical evidence that characteristics of entire landscapes, rather than individual patches, must be quantified to assess habitat suitability for wide-ranging species that use resources over large areas.

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1029. Snail-periphyton interactions in a prairie lacustrine wetland.

Hann, B.; Mundy, C.; and Goldsborough, L.

Hydrobiologia 457(1-3): 167-175. (Aug. 2001)

NAL Call #: 410 H992; *ISSN:* 0018-8158

Descriptors: wetlands/ periphyton/ prairies/ nutrient concentrations/ macrophytes/ grazing/ freshwater molluscs/ interspecific relationships/ phytoplankton/ *Gyraulus circumstriatus*/ Canada, Manitoba, Delta Marsh/ disc gyro/ species interactions: general

Abstract: This study examined the effects of nutrients and macrophytes on snail grazers and periphyton in a prairie wetland food web. Snails (*Gyraulus circumstriatus*) and periphyton in large enclosures in a lacustrine wetland, Delta Marsh, MB, Canada were subjected to two experimental treatments, nutrient addition (nitrogen, phosphorus) and macrophyte exclusion (using a porous geotextile carpet) during July and August. Snail biomass and periphyton biomass (on both artificial substrata and submerged macrophytes) increased over time in all treatments, representing seasonal growth. Snail biomass was three times higher on macrophytes than on artificial substrata. In response to nutrient addition, snail biomass was significantly elevated over time on macrophytes but not on artificial substrata. Conversely, periphyton biomass was higher on artificial substrata but not on macrophytes in response to nutrient addition. Snail biomass and periphyton biomass on artificial substrata showed no response to macrophyte exclusion. Snail biomass on all substrata was inversely correlated with turbidity, whereas periphyton biomass showed no relationship with turbidity. Timing of nutrient additions to wetlands may influence whether the response occurs primarily in phytoplankton or in periphyton and macrophytes.

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1030. Status of North Dakota wetlands.

Leitch, J. A. and Baltezore, J. F.

Journal of Soil and Water Conservation 47(3): 216-219. (1992)

NAL Call #: 56.8 J822; *ISSN:* 0022-4561

Descriptors: wetlands/ environmental protection. environmental policy/ environmental law/ federal government/ state government/ case studies/ agricultural land/ private sector/ governmental programs and projects/ North Dakota/ programs/ resource conservation/

agricultural development/ state enhancement programs/ Wetland Reserve Program/ environmental easement program/ agricultural conservation program/ North Dakota Wildlife Extension Program
This citation is from AGRICOLA.

1031. A test of vegetation-related indicators of wetland quality in the Prairie Pothole Region.

Kantrud, H. A. and Newton, W. E.

Journal of Aquatic Ecosystem Health Management 5(3): 177-191. (1996); ISSN: 0925-1014

Descriptors: wetlands/ prairies/ environmental quality/ regional analysis/ vegetation/ quantitative analysis/ testing procedures/ indicators/ zones/ indicator species/ water budget/ USA, Prairie Pothole Region/ USA/ environmental quality/ indicator species/ water budget/ prairies/ regional analysis/ vegetation/ quantitative analysis/ testing procedures/ zones/ indicators

Abstract: This study was part of an effort by the U.S. Environmental Protection Agency to quantitatively assess the environmental quality or "health" of wetland resources on regional and national scales. During a two-year pilot study, we tested selected indicators of wetland quality in the U.S. portion of the prairie pothole region (PPR). We assumed that the amount of cropland versus non-cropland (mostly grassland) in the plots containing these basins was a proxy for their quality. We then tested indicators by their ability to discriminate between wetlands at the extremes of that proxy. Amounts of standing dead vegetation were greater in zones of greater water permanence. Depth of litter was greater in zones of greater water permanence and in zones of basins in poor-quality watersheds. Amounts of unvegetated bottom were greater in basins in poor-quality watersheds; lesser amounts occurred in all wetlands during a wetter year. Greater amounts of open water occurred during a wetter year and in zones of greater water permanence. When unadjusted for areas (ha) of communities, plant taxon richness was higher in wet-meadow and shallow-marsh zones in good-quality watersheds than in similar zones in poor-quality watersheds. Wet-meadow zones in good-quality watersheds had greater numbers of native perennials than those in poor-quality watersheds. This relation held when we eliminated all communities in good-quality watersheds larger than the largest communities in poor-quality watersheds from the data set. We conclude that although amounts of unvegetated bottom and plant taxon richness in wet-meadow zones were useful indicators of wetland quality during our study, the search for additional such indicators should continue. The value of these indicators may change with the notoriously unstable hydrological conditions in the PPR. Most valuable would be indicators that could be photographed or otherwise remotely sensed and would remain relatively stable under various hydrological conditions. An ideal set of indicators could detect the absence of stressors, as well as the presence of structures of functions, of known value to major groups of organisms.

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1032. Use of macroinvertebrates to identify cultivated wetlands in the Prairie Pothole Region.

Euliss, N. H. Jr; Mushet, D. M.; and Johnson, D. H.

Wetlands 21(2): 223-231. (June 2001)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: macroinvertebrates/ cultivation/ eggs/ hydrology/ taxonomy/ vegetation/ soil water/ evaluation/ macrofauna/ agricultural land/ indicator species/ aquatic animals/ identification/ agriculture/ Invertebrata/ USA, Prairie Pothole region/ wetland identification/ aquatic entomology/ habitat community studies

Abstract: We evaluated the use of macroinvertebrates as a potential tool to identify dry and intensively farmed temporary and seasonal wetlands in the Prairie Pothole Region. The techniques we designed and evaluated used the dried remains of invertebrates or their egg banks in soils as indicators of wetlands. For both the dried remains of invertebrates and their egg banks, we weighted each taxon according to its affinity for wetlands or uplands. Our study clearly demonstrated that shells, exoskeletons, head capsules, eggs, and other remains of macroinvertebrates can be used to identify wetlands, even when they are dry, intensively farmed, and difficult to identify as wetlands using standard criteria (i.e., hydrology, hydrophytic vegetation, and hydric soils). Although both dried remains and egg banks identified wetlands, the combination was more useful, especially for identifying drained or filled wetlands. We also evaluated the use of coarse taxonomic groupings to stimulate use of the technique by nonspecialists and obtained satisfactory results in most situations.

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1033. Using aquatic invertebrates to delineate seasonal and temporary wetlands in the Prairie Pothole Region of North America.

Euliss, N. H.; Mushet, D. M.; and Johnson, D. H.

Wetlands 22(2): 256-262. (June 2002)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ tillage/ pools/ indicators/ invertebrates/ prairies/ vegetation/ cropland/ seasonal variations/ indicator species/ identification/ agriculture/ man-induced effects/ temporary ponds/ Invertebrata/ North America/ tillage/ prairies/ methodology - general/ techniques/ habitat community studies

Abstract: Tillage can destroy or greatly disturb indicators of hydric soils and hydrophytic vegetation, making delineation of tilled wetlands difficult. The remains of aquatic invertebrates (e.g., shells, drought-resistant eggs, and trichopteran cases) are easily identifiable and persist in wetland substrates even when wetlands are dry. Additionally, these remains are not easily destroyed by mechanical tillage. To test the feasibility of using invertebrate remains to delineate wetlands, we used two methods to identify the wetland edge of ten seasonal and ten temporary wetlands, evenly divided between grassland and cropland landscapes. First, we identified the wetland edge using hydric soil and vegetation indicators along six evenly spaced transects in each wetland (our 'standard' delineation). We then identified the wetland edge along the same transects using aquatic invertebrate remains as our indicator. In grassland landscapes, delineations of the wetland edge made using invertebrate remains were consistently at the same location or closer to the wetland center as the standard delineations for both seasonal and temporary wetlands. In cropland landscapes, however,

many of our invertebrate delineations of seasonal and temporary wetlands were on the upland side of our standard delineations. We attribute the differences to movement of remains during tillage, increased maximum pool levels in cropland wetlands, and disturbance of hydric soils and plants. We found that the elevations of the wetland edge indicated by invertebrate remains were more consistent within a wetland than elevations determined by standard delineations. Aquatic invertebrate remains can be useful in delineating wetlands when other indicators have been destroyed or severely disturbed by tillage.

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1034. Using landscape information approaches to increase duck recruitment in the Prairie Pothole Region.

Reynolds, R. E.; Cohan, D. R.; and Johnson, M. A. *Transactions of the North American Wildlife and Natural Resources Conference*: 86-93. (1996)
NAL Call #: 412.9 N814; *ISSN*: 0078-1355.
Notes: Conference: 61. North American Wildlife and Natural Resources Conf.: Facing Realities in Resource Management, Tulsa, OK (USA), 22-27 Mar 1996
Descriptors: wetlands/ aquatic birds/ recruitment/ habitat improvement/ environment management/ predator control/ aquaculture techniques/ waterfowl/ birds/ wildlife management/ maps/ land management/ Anatidae/ North America
Abstract: Concern about decreasing numbers of some duck populations in North America was primary to the development of the North American Waterfowl Management Plan (NAWMP). Under the NAWMP, several geographical subunits, called joint venture areas, have been established to step-down the overall goals and objectives for the purpose of management action. The Prairie Pothole Joint Venture (PPJV) is a high-priority joint venture of the NAWMP. During 1991 through 1994, a planning process was conducted in the PPJV area of North Dakota, South Dakota, and northeastern Montana to develop management scenarios for meeting duck population objectives. Because predation of nests had been identified as a primary factor limiting the growth of duck populations in much of the PPJV area (Klett et al. 1988), much of the process focused on management treatments designed to reduce or limit predation on nests. Treatments included non-lethal methods, such as protection and establishment of perennial grass cover or creating nesting areas protected from predators (e.g., small islands, predator exclosures), and lethal methods, such as predator removal (Anonymous 1995). To ensure maximum benefits from each treatment, guidelines were developed for their application. A guideline common to all treatments was that each be applied to landscape units where they potentially would benefit high numbers of nesting hens. Although wetland distribution is the primary determinant of breeding duck abundance, the PPJV area is large (approximately 100,000 square miles: 260,000 km²), and wetland density, class and size vary tremendously over this area. Therefore, identifying areas where the highest duck densities occur is not a trivial task. We present a procedure to apply models developed from digital wetland data, data on duck pair/wetland relationships, and breeding duck home range characteristics to prioritize areas for nesting duck management. Using Geographic Information System (GIS) techniques, the process was applied to a two-county area

in North Dakota and a map displaying the area as four priority levels based on breeding duck density was created. We demonstrate the utility of the map by selecting example areas and prescribing specific treatments based on other landscape characteristics.

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1035. Wetland soils of the prairie potholes.

Richardson, J. L.; Arndt, J. L.; and Freeland, J. *Advances in Agronomy* 52: 121-171. (1994)
NAL Call #: 30 Ad9; *ISSN*: 0065-2113 [ADAGA7]
Descriptors: wetland soils/ prairie soils/ prairies/ soil properties/ soil sequences/ literature reviews/ Alberta/ Saskatchewan/ Manitoba/ north central states of USA
 This citation is from AGRICOLA.

1036. Wetland use, settling patterns, and recruitment in mallards.

Krapu, G. L.; Greenwood, R. J.; Dwyer, C. P.; Kraft, K. M.; and Cowardin, L. M. *Journal of Wildlife Management* 61(3): 736-746. (1997)
NAL Call #: 410 J827; *ISSN*: 0022-541X
Descriptors: wetlands/ habitat selection/ aquatic birds/ ecosystem disturbance/ ponds/ population dynamics/ ducks/ populations/ wildlife management/ waterfowl/ habitats/ habitat utilization/ recruitment/ breeding sites/ *Anas platyrhynchos*/ mallard/ USA, Minnesota/ USA, North Dakota/ breeding pairs
Abstract: The correlation between number of May ponds in the Prairie Pothole Region (PPR) of North America and size of the continental mallard (*Anas platyrhynchos*) breeding population the following spring weakened from the 1950s to the 1980s, suggesting possible changes in suitability of prairie ponds for meeting reproductive needs. We studied wetland use and preferences of radioequipped female mallards by reproductive stage (1988-90) in eastern North Dakota and westcentral Minnesota and evaluated effect of land use on pair distribution in eastern North Dakota (1987-91). May pond density varied among years and study areas, with changes in number of temporary and seasonal ponds accounting for 93% of variation in total ponds. During all reproductive stages, semipermanent basins were used most by females, but temporary and seasonal ponds were preferred during prenesting and egg production. Accounting for number of relocations, number of ponds used varied by year, by reproductive stage and with pond density during egg production. Numbers of breeding mallard pairs in stratum 46 in eastern North Dakota increased as May ponds increased from 1963 to 1985, but 33,659 fewer breeding pairs on average were present in 1971-85 than in 1963-70. Number of breeding pairs declined relative to May ponds from the 1960s to the 1980s, probably because fewer pairs settle in temporary and seasonal ponds as the percent of landscape in cropland increases. Waterfowl managers in the PPR should target efforts to increase duck production on landscapes where non-cropped temporarily and seasonally flooded wetland habitats are plentiful, thereby increasing cost effectiveness of management actions taken to increase nest success rate.

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1037. Wetlands of the Prairie Pothole Region: Invertebrate species composition, ecology, and management.

Euliss, Ned H.; Wrubleski, Dale A.; and Mushet, David M.
In: *Invertebrates in freshwater wetlands of North America: Ecology and management*/ Batzer, Darold P.; Rader, Russell B.; and Wissinger, Scott A.
New York: John Wiley & Sons, 1999; pp. 471-514.
Notes: ISBN: 0471292583
NAL Call #: QL365.4.A1158

<http://www.npwrc.usgs.gov/resource/wetlands/pothole/pothole.htm>

Descriptors: Invertebrata/ habitat management/ overview/ ecology/ wetland fauna of Prairie Pothole Region/ community structure/ Prairie Pothole Region wetlands/ semiaquatic habitat/ wetlands of Prairie Pothole Region/ species composition/ physical factors/ wetland hydroperiod influence on community/ Canada/ USA/ Prairie Pothole Region/ wetland species composition/ ecology and management
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Effects of Agricultural Conservation Practices on Wetlands

1038. Accumulation of sediment, nutrients, and cesium-137 in prairie potholes in cultivated and noncultivated watersheds.

Martin, D. B., EPA 440-5-85-001, 1985.
Notes: Conference: Perspectives on Nonpoint Source Pollution, Kansas City, MO (USA), 19-22 May 1985
Descriptors: wetlands/ sedimentation/ agricultural runoff/ pollution monitoring/ sediments/ nutrients/ watersheds/ freshwater pollution/ nonpoint pollution/ conservation/ nonpoint sources/ nutrients (mineral)/ USA/ Canada/ Cesium-137/ prairie potholes/ nonpoint sources/ nutrients (mineral)/ environmental action/ pollution characteristics and fate/ characteristics, behavior and fate/ monitoring and surveillance
Abstract: Prairie potholes are water-holding depressions of glacial origin that occur throughout 780,000 km² of prairie in the northcentral United States and southcentral Canada (Sloan, 1972). Potholes are used extensively by wildlife for water and habitat, and recently their importance in flood control and ground water recharge has been recognized. Numerous potholes have been eliminated in recent decades by drainage for agricultural purposes. Sediment is currently recognized as an important problem affecting prairie pothole wetlands. Agriculture is the predominant land use throughout the region, and erosion of farmland often results in the deposition of field soil directly onto wetlands. The impacts of sediment on wetlands are twofold. First, sediment can reduce and eventually eliminate wetland habitat by filling the pothole basin. Second, sediment may serve as an agent for the transfer of chemical contaminants for the watershed to the wetland. The purpose of this work on sedimentation in pothole wetlands is to determine the relationship between specific agricultural land use practices and sediment deposition, composition, and contaminant impacts. Cesium-137 was used as outlined by Ritchie and McHenry (1977) to determine recent sedimentation rates in the Wetlands.
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prairie wetland ecosystems/ ecology/ agrichemical effects/ significance for conservation/ semiaquatic habitat/ grassland/ prairie wetlands/ impacts and management of agrichemicals/ chemical pollution/ agrichemicals in prairie wetlands potential effects and management/ USA, north central/ conservation of prairie wetland ecosystems/ significance of agrichemicals
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1040. Agricultural pesticides threaten the ecological integrity of northern prairie wetlands.

Donald, D. B.; Syrgiannis, J.; Hunter, F.; and Weiss, G.
Science of the Total Environment 231(2-3): 173-181. (1999)
NAL Call #: RA565.S365; ISSN: 0048-9697
Descriptors: wetlands/ pesticides/ agriculture/ rainfall/ lindane/ freshwater pollution/ agrochemicals/ water pollution/ cultivated lands/ agricultural chemicals/ ecosystems/ pollution effects/ agricultural pollution/ agricultural runoff/ Canada, Saskatchewan/ triallate
Abstract: The northern Great Plains of North America has millions of small wetlands, and these are often dispersed through cultivated fields. We investigated relationship between pesticide occurrence and precipitation in selected wetlands in a 30.4 X 10⁴ km² area of the Great Plains with relatively uniform farming practices and 1,777,600 wetlands (southern Saskatchewan, Canada). By early July after pesticides have been applied to crops, the mean number of pesticides detected in wetlands ranged from 1.8 in regions with little precipitation (< 21 mm rain during the previous 15 days) to 3.2 in regions under higher rainfall (> 90 mm). The proportion of wetlands in which at least one pesticide exceeded Canadian guidelines for the protection of aquatic life increased from 0% to 60% over this same precipitation range. The maximum number of pesticides detected in a single wetland was six. Concentration of lindane in wetlands increased with increasing precipitation. Using geographic information on rainfall, wetland densities, area seeded to crops, and region specific relationships between pesticides and precipitation, we estimated the number of wetlands in Saskatchewan with elevated levels of pesticides. In early July, during 3 of the 6 years, the number of wetlands subjected to pesticide levels that exceeded guidelines for the protection of aquatic life was significant, ranging from 152,000 to 424,000 wetlands or 9-24%, respectively, of the total. Lindane and triallate exceeded the guidelines most frequently.
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1039. Agricultural chemicals and prairie pothole wetlands: Meeting the needs of the resource and the farmer - U.S. perspective.

Grue, C. E.; Tome, M. W.; Messmer, T. A.; Henry, D. B.; Swanson, G. A.; and DeWeese, L. R.
Transactions of the North American Wildlife and Natural Resources Conference 54: 43-58. (1989)
NAL Call #: 412.9 N814; ISSN: 0078-1355
Descriptors: agricultural activity/ use of chemicals in prairie wetlands/ potential effects and management/ conservation/

1041. Bird use and nesting in conventional, minimum-tillage, and organic cropland.

Lokemoen, John T. and Beiser, Julia A.
Journal of Wildlife Management 61(3): 644-655. (1997)
 NAL Call #: 410 J827; ISSN: 0022-541X
Descriptors: animals and man/ disturbance by man/ commercial activities/ reproduction/ reproductive productivity/ ecology/ population dynamics/ animal constructions/ habitat/ man made habitat/ land and freshwater zones/ nearctic region/ North America/ USA/ Aves: farming and agriculture/ fledging success/ farming system effect/ hatching success/ community structure/ seasonal changes/ mortality/ nest losses/ predators/ nest loss significance/ minimum tillage and organic farms/ nests/ density/ conventional/ minimum tillage and organic farmland/ cultivated land habitat/ farming system/ effect on community structure and reproduction/ North Dakota/ Prairie Pothole Region/ community structure and reproduction/ effect of farming system/ Aves/ birds/ chordates/ Vertebrates
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1042. Buffered wetlands in agricultural landscapes in the Prairie Pothole Region: Environmental, agronomic, and economic evaluations.

Rickerl, D. H.; Janssen, L. L.; and Woodland, R.
Journal of Soil and Water Conservation 55(2): 220-225. (2000)
 NAL Call #: 56.8 J822; ISSN: 0022-4561
Descriptors: prairies/ crop production/ cycling/ farming/ farming systems/ forage/ fodder crops/ hay/ nutrient content/ nutrients/ soil/ vegetation/ wetland soils/ vegetated strips/ economics/ United States/ South Dakota/ North America/ America/ Developed Countries/ OECD Countries/ Northern Plains States of USA/ West North Central States of USA/ North Central States of USA/ United States/ Great Plains States of USA
Abstract: A farm site with four seasonal wetlands was chosen in South Dakota, USA, to examine agronomic, environmental, and economic performance of cropped fields with buffered and non buffered wetlands. Buffers were established in blocks around two of the wetlands in 1995. In 1997 and 1998, soil/water/plants were analysed for nutrient content in the buffered and non buffered wetlands. Results showed that the wetland buffer vegetation effectively removed nutrients, thus reducing nutrient content in wetland soils and vegetation, and cycling captured nutrients through hay and forage crops. Long term budgets were developed for combinations of five wetland management scenarios and three crop farming systems. Net returns from buffered wetland fields were generally lower than net returns from maximum crop production. Net returns were greatest for the Wetland Reserve Program (WRP) or Conservation Reserve Program (CRP) scenarios, regardless of farming system. The results suggest that enrolling wetlands in WRP or CRP has both economic and environmental benefits.
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1043. Consequences of habitat loss and fragmentation for wetland amphibian assemblages.

Lehtinen, R. M.; Galatowitsch, S. M.; and Tester, J. R.
Wetlands 19(1): 1-12. (1999)
 NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: wetlands/ habitat changes/ conservation/

habitats/ amphibians/ land use/ marshes/ geographical information systems/ species extinction/ ecosystem disturbance/ habitat/ nature conservation/ Amphibia/ USA, Minnesota/ amphibians/ habitat fragmentation
Abstract: Landscape-level variables operating at multiple spatial scales likely influence wetland amphibian assemblages but have not been investigated in detail. We examined the significance of habitat loss and fragmentation, as well as selected within-wetland conditions, affecting amphibian assemblages in twenty-one glacial marshes. Wetlands were located within urban and agricultural regions of central and southwestern Minnesota, USA and were distributed across two ecoregions: tallgrass prairie and northern hardwood forest. We surveyed amphibian assemblages and used a geographic information system to quantify land-use variables at three scales: 500, 1000, and 2500 m. Ten species of amphibians were detected, the most abundant being *Rana pipiens*, *Ambystoma tigrinum*, and *Bufo americanus*. Amphibian species richness was lower with greater wetland isolation and road density at all spatial scales in both ecoregions. Amphibian species richness also had a negative relationship with the proportion of urban land-use at all spatial scales in the hardwood forest ecoregion, and species richness was greater in wetlands with fish and *Ambystoma tigrinum*. These biotic relationships are less consistent and more difficult to interpret than are land-use relationships. The data presented here suggest that decreases in landscape connectivity via fragmentation and habitat loss can affect amphibian assemblages, and reversing those landscape changes should be an important part of a regional conservation strategy.
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1044. Descriptive and experimental studies on the biotic and abiotic determinants of selected pesticide concentrations in prairie wetland water columns.

Friesen-Pankratz, Bruce
 Winnipeg, Manitoba, Canada: University of Manitoba, 2004.
Notes: Dissertation Abstracts International Part B: Science and Engineering (0419-4217) 65 (12): 6173.
Descriptors: wetlands/ pesticides/ phytoplankton/ photolysis/ sorption/ aquatic plants/ sedimentation/ dissolved organic carbon/ selenastrum capricornutum/ algae/ Canada, Manitoba, Delta Marsh
Abstract: The determinants of high use agricultural pesticide concentrations in the water columns of Prairie Pothole Region (PPR) wetlands were examined to evaluate if these ecosystems had characteristics of pesticide sinks. For an ecosystem to function as a pesticide sink it needs to receive, retain, and reduce pesticides. A survey of sixty PPR wetlands (distance between two farthest sites 1,700 km) was conducted to determine the extent to which they received high use pesticides (atrazine and lindane). Sixty-two percent of the wetlands were contaminated with either atrazine or lindane. Pesticide presence was directly related to wetland proximity to pesticide use and precipitation prior to sampling. In June-July lindane presence was positively correlated with phytoplankton concentration; however, in August lindane presence was negatively correlated with phytoplankton concentration. Laboratory and in situ (Delta Marsh, MB) experiments showed that phytoplankton can determine pesticide water column concentrations. For instance, phytoplankton can sorb lindane and remove it from the water column through sedimentation. The extent of

pesticide sorption to phytoplankton (*Selenastrum capricornutum*) was directly related to the pesticides' octanol-water partition coefficient. Sorption to phytoplankton decreased volatilization of the pesticide trifluralin. The presence of wetland water column conditions (such as phytoplankton and other particulate matter) increased degradation of atrazine, lindane, and, glyphosate. In situ experiments did not detect any atrazine or lindane photolysis. The limited amount of ultraviolet penetration, due to attenuation by aquatic macrophytes, suspended particulates, and dissolved organic carbon, prevented photolysis from being a significant pesticide reduction mechanism in the studied wetlands. PPR wetlands do possess characteristics of pesticide sinks in that they can receive, retain, and reduce pesticide concentrations. This understanding of wetlands as pesticide sinks will be useful in managing natural and constructed wetlands. Wetland managers should be aware of the high percentage of wetlands that are at risk of receiving pesticides as these may alter ecosystem dynamics. Furthermore, knowledge of the role of algae in determining pesticide concentrations could be used to manage constructed wetlands so as to maximize pesticide retention and reduction.

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1045. Distribution and environmental fate of pesticides in prairie wetlands.

Goldsborough, L. G. and Crumpton, W. G.
Great Plains Research 8(1): 73-95. (1998)
 NAL Call #: QH104.5.G73 G755; ISSN: 1052-5165
Descriptors: wetlands/ pollution effects/ environmental impact/ agricultural pollution/ pesticides/ inland water environment/ pollutant persistence/ USA/ water pollution/ distribution/ agricultural runoff/ prairies/ streams/ agrochemicals/ computer programs/ adsorption/ photolysis
Abstract: There is abundant, albeit fragmentary, evidence that prairie wetlands are being contaminated extensively by agricultural pesticides (primarily herbicides and insecticides) and other anthropogenic contaminants. Such inputs can affect fundamental ecosystem properties such as primary production which, in turn, affects habitat and resource supply for wetland fauna. We review data on the use of pesticides, off-site transport of residues from treated land, and the frequency with which these residues are subsequently detected in receiving streams and wetlands on the prairies. As the environmental distribution of a pesticide is affected by its chemical and physical properties, and the abiotic and biotic characteristics of the receiving wetland, greater insight into its ecological impacts will be obtained from considering the underlying partitioning and degradative processes that determine distribution rather than from case-by-case studies of persistence. Future research on chemical contamination of prairie wetlands should include the development and testing of dissipation and fate models under conditions typical of prairie wetlands using a process-oriented approach, emphasizing the roles of adsorption and photolysis in a shallow, high area to volume environment. Output from a computer model based on the fugacity concept (QWASFI: Quantitative Water, Air, Soil, Film Interactions) indicates the potential to predict the environmental behavior of specific chemicals in wetlands.

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1046. Duck nesting on rotational and continuous grazed pastures in North Dakota.

Murphy, Robert K.; Schindler, Darrell J.; and Crawford, Richard D.
Prairie Naturalist 36(2): 83-94. (2004)
 NAL Call #: QH540 .P7; ISSN: 0091-0376
Descriptors: visual obstruction reading: VOR, applied and field techniques/ Prairie Pothole Joint Venture [PPJV]/ continuous grazed pastures/ nest density/ nest success/ nesting habitat/ prairie habitat conservation/ rotational cattle grazing/ rotational grazed pastures
Abstract: To improve the economic viability of grazed prairie and thus conserve it as wildlife habitat, the Prairie Pothole Joint Venture (PPJV) cost-shares establishment of rotational cattle grazing on privately owned, native rangeland. During 1996 and 1997 we evaluated duck nest density, nest success, and nesting habitat on six PPJV rotational grazed pastures on the Missouri Coteau landform in central and northwestern North Dakota. Each rotational pasture was paired with a traditional, continuous grazed pasture for comparison. We located 444 nests of eight duck species. We detected no differences ($P > 0.1$) between rotational and continuous grazed pastures in apparent nest density of ducks (\bar{x} over \bar{s} \pm SD nests/ha, all species combined, 1996: 0.26 \pm 0.09 and 0.31 \pm 0.12; 1997: 0.38 \pm 0.14 and 0.25 \pm 0.12), although a grazing type \times year interaction suggested rotational pastures might be more attractive to ducks in a dry spring (1997). No differences in duck nest success were detected between rotational and continuous pastures (% Mayfield estimate, 1996: 27.2 \pm 12.6 and 15.5 \pm 11.0; 1997: 21.6 \pm 10.0 and 16.7 \pm 13.7), but varied occurrence of canid species could have obscured differences. We detected no differences in vegetation height-density indices as measured by visual obstruction readings (VORs) between rotational and continuous pastures in 1996. VORs were greater on rotational pastures, however, in the relatively dry spring of 1997. Our findings suggested that rotational grazing systems can serve as a prairie conservation tool on private rangelands without altering habitat values for nesting ducks, and in relatively dry springs might provide more attractive nesting cover for ducks than prairie under continuous grazing.

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1047. Duck nesting success on Conservation Reserve Program land in the prairie pothole region.

Kantrud, H. A.
Journal of Soil and Water Conservation 48(3): 238-242. (1993)
 NAL Call #: 56.8 J822; ISSN: 0022-4561
Descriptors: Conservation Reserve Program/ regional conservation programs/ Prairie Pothole region
Abstract: Studied duck nesting success in Waterfowl Production Areas and CRP tracts.

1048. Effect of cultivation on sediment composition and deposition in prairie pothole wetlands.

Martin, D. B. and Hartman, W. A.
Water, Air, and Soil Pollution 34(1): 45-53. (1987)
 NAL Call #: TD172 .W36; ISSN: 0049-6979
Descriptors: wetlands/ sedimentation/ sediments/ cultivation/ prairie potholes/ deposition/ watersheds/ runoff/ agriculture/ nutrients/ grasses
Abstract: Texture, major nutrient content, and deposition

rate of sediments were compared for five prairie pothole wetlands surrounded by native grassland and seven otherwise similar wetlands surrounded by row crop and small grain farmland. Specific differences in the nature of the sedimentation cycle of cultivated and noncultivated watersheds were indicated. Flux of total inorganic material into sediments averaged 80 and 43 mg cu/y in cultivated and grassland wetlands, respectively. Cultivated sediments contained significantly higher clay percentages, but lower percentages of silt and sand than grassland sediments. Deposition rates of clay at cultivated sites averaged five times that of grassland locations. Enrichment ratios (the quotient of sediment concentration divided by upland soil concentrations) suggested that sand was selectively retained in equal proportions on uplands in both types of watersheds, that silt was selectively removed (although in different proportions) from uplands in both types of watersheds, and that clay was selectively retained only on grasslands. Total N and organic matter concentrations were significantly higher in both the soils and sediments of grassland watersheds, but there were no differences in total P concentrations with respect to land use. Sediment flux rates for total N and organic matter were similar in the two land use types; however, P was transported at nearly twice the rate to cultivated wetlands. Enrichment ratios indicated that N and P were selectively removed in similar proportions from upland soils in both types of watersheds. (Author 's abstract)

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1049. Effects of agricultural activities and best management practices on water quality of seasonal prairie pothole wetlands.

Detenbeck, N. E.; Elonen, C. M.; Taylor, D. L.; Cotter, A. M.; Puglisi, F. A.; and Sanville, W. D.
Wetlands Ecology and Management 10(4): 335-354. (2002)
 NAL Call #: QH541.5.M3 W472; ISSN: 0923-4861
Descriptors: agricultural practices/ environment management/ water quality/ prairies/ ecosystem management/ restoration/ agriculture/ vegetation cover/ plant populations/ man induced effects/ water levels/ physicochemical properties/ dissolved oxygen/ nutrients (mineral)/ climate/ hydrology/ agricultural runoff/ conservation/ environmental restoration/ nutrients/ vegetation/ biogeochemistry/ water pollution sources/ nonpoint pollution sources/ United States/ prairie pothole wetlands/ biogeochemical cycle/ tillage effects/ environmental degradation/ ecosystems and energetics/ conservation, wildlife management and recreation/ environmental action/ general environmental engineering/ sources and fate of pollution

Abstract: Long-term effects of within-basin tillage can constrain condition and function of prairie wetlands even after uplands are restored. Runoff was significantly greater to replicate wetlands within tilled basins with or without vegetated buffer strips as compared to Conservation Reserve Program restoration controls with revegetated uplands (REST). However, mean water levels for native prairie reference sites were higher than for REST controls, because infiltration rates were lower for native prairie basins, which had no prior history of tillage. Nutrient dynamics changed more in response to changes in water level and vegetation structure than to increased nutrient inputs in watershed runoff. Dissolved oxygen increased between dry and wet years except in basins or zones with

dense vegetation. As sediment redox dropped, water-column phosphate declined as phosphate likely co-precipitated with iron on the sediment surface within open-water or sparsely vegetated zones. In response, N:P ratios shifted from a region indicating N limitation to P limitation. REST sites, with dense vegetation and low DO, also maintained high DOC, which maintains phosphate in solution through chelation of iron and catalysis of photoreduction. Reference sites in native prairie and restored uplands diverged over the course of the wet-dry cycle, emphasizing the importance of considering climatic variation in planning restoration efforts.

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1050. Effects of atmospheric change and agriculture on the biogeochemistry and microbial ecology of prairie wetlands.

Robarts, R. D. and Waiser, M. J.
Great Plains Research 8(1): 113-136. (1998)
 NAL Call #: QH104.5.G73 G755; ISSN: 1052-5165
Abstract: Relatively little is known about the factors which regulate in-water biogeochemical processes and food chains in prairie wetlands. Climatic warming, increased UV-radiation and agricultural activities will have interacting effects on these wetlands. We examined the effects of these processes on prairie wetland functioning and productivity with particular emphasis on production and cycling of organic carbon, especially dissolved organic carbon (DOC). Autotrophic and heterotrophic production are temperature dependent and temperature increases or decreases could affect production under more extreme climate change scenarios. DOC concentrations could decrease with increasing bacterial production and photolysis, leading to increases in UV-radiation penetration. This is pertinent to prairie wetlands because of their general shallowness. Considering the potential consequences of climatic warming, increased UV-radiation and agricultural activity on biogeochemistry and food chains, it is imperative that we obtain an understanding of the major rate processes in prairie wetlands and how these may be affected by external processes.

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1051. Effects of glyphosate herbicide on cattails, invertebrates, and waterfowl in South Dakota wetlands.

Solberg, K. L. and Higgins, K. F.
Wildlife Society Bulletin 21(3): 299-307. (1993)
 NAL Call #: SK357.A1W5; ISSN: 0091-7648
Descriptors: wetlands/ glyphosate/ Typha/ waterfowl/ population density/ nontarget organisms/ aquatic invertebrates/ adverse effects/ South Dakota
 This citation is from AGRICOLA.

1052. Effects of sediment load on emergence of aquatic invertebrates and plants from wetland soil egg and seed banks.

Gleason, R. A.; Euliss, N. H.; Hubbard, D. E.; and Duffy, W. G.
Wetlands 23(1): 26-34. (2003)
 NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: agricultural impacts/ egg banks/ hydrophytes/ prairie potholes/ resting eggs/ sedimentation/ seed banks/ siltation/ tillage/ wetland condition/ wetland degradation
Abstract: Intensive agricultural activities near prairie wetlands may result in excessive sediment loads, which

may bury seed and invertebrate egg banks that are important for maintenance and cycling of biotic communities during wet/dry cycles. We evaluated effects of sediment burial on emergence of plants and invertebrates from seed and invertebrate egg banks. Sediment-load experiments indicated that burial depths of 0.5 cm caused a 91.7% reduction in total seedling emergence and a 99.7% reduction in total invertebrate emergence. Results of our burial experiments corroborated prior research on seedling emergence. However, our study demonstrated that invertebrate emergence is also highly susceptible to the effects of burial. Our research suggests that sediment entering wetlands from agricultural erosion may also hamper successional changes throughout interannual climate cycles. Land-management strategies need to be implemented that will prevent erosion of cropland top soil from entering wetlands.

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1053. Effects of sediment load on seedling emergence from wetland seed banks.

Jurik, T. W.; Wang, Shih-Chin; and Van Der Valk, A. G. *Wetlands* 14(3): 159-165. (1994)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ sedimentation/ sediment transport/ agricultural runoff/ germination/ plant populations/ sediments/ erosion/ seedlings/ plants/ seed banks/ USA, Iowa/ seed banks/ seed burial depth/ plants/ sediment transport/ agricultural runoff/ plant populations

Abstract: The authors examined the effects of sediment depth on emergence of seedlings from wetland seed banks, with the goal of understanding potential effects on wetlands of sediment runoff from agricultural fields. Seed germination was studied in the greenhouse using seed bank samples taken from natural wetlands in central Iowa, U.S.A. Sediment loads as low as 0.25 cm significantly reduced the number of species and total number of individuals recruited from seed bank samples. Addition of sediment decreased the number of individuals appearing for most, but not all, species. The change in number of seedlings that occurred in treatments with 1 cm of sediment cover was related to seed mass, with larger-seeded species showing the least effect of burial by sediment.

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1054. Environmental fate of phorate and its metabolites in northern prairie wetlands.

Dieter, C. D.; Duffy, W. G.; and Flake, L. D. *Journal of Freshwater Ecology* 10(2): 103-110. (1995)

NAL Call #: QH541.5.F7J68; ISSN: 0270-5060

Descriptors: wetlands/ mesocosms/ pollution levels/ water/ sediments/ pesticides/ freshwater pollution/ sediment pollution/ insecticides/ pollutant persistence/ organophosphorus pesticides/ fate of pollutants/ USA, South Dakota/ pesticides (organophosphorus)/ pollutant persistence/ organophosphorus pesticides/ fate of pollutants/ pollution levels/ mesocosms/ water/ freshwater pollution/ sediment pollution

Abstract: The environmental fate of the organophosphate insecticide phorate and its metabolites, phorate sulfone and phorate sulfoxide was examined in mesocosms placed in South Dakota wetlands. Three treatment concentrations of phorate (1.2, 2.4, and 4.8 kg/ha) were applied to wetland mesocosms. Phorate, phorate sulfone, and phorate sulfoxide were present in water and sediment during the

entire study (28 days) in all treatments. Maximum phorate concentrations in water were measured one day after treatment and decreased significantly during a 28-day period. The metabolites of phorate increased significantly in the water during the study. Phorate was present in higher concentrations in sediments than either phorate sulfone or phorate sulfoxide throughout the study.

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1055. Ethyl parathion in wetlands following aerial application to sunflowers in North Dakota.

Tome, M. W.; Grue, C. E.; and De Weese, L. R. *Wildlife Society Bulletin* 19(4): 450-457. (1991)

NAL Call #: SK357.A1W5; ISSN: 0091-7648

Abstract: Reviews how spray droplet size, weather, terrain, and type of application equipment interact to determine the amount of drift from any application of pesticide. With this information, wildlife managers should be able to make decisions pertaining to insecticide applications that will minimize drift and reduce negative impacts to nontarget organisms. -from Authors

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1056. Evaluation of the effect of CRP on duck recruitment in the prairie pothole joint venture area of Fish & Wildlife Service Region 6.

Reynolds, R.

Bismark, ND: U.S. Fish and Wildlife Service, 1992. U.S. Fish & Wildlife Service Progress Report.

Descriptors: Conservation Reserve Program/ regional conservation programs/ state conservation programs/ Prairie Pothole Region/ Montana/ South Dakota/ North Dakota

Abstract: Reported the 1992 results of a pilot effort to evaluate waterfowl production in CRP grasslands compared to Waterfowl Production Areas.

1057. Impact of agricultural land-use on prairie wetland ecosystems: Experimental design and overview.

Gleason, Robert A. and Euliss, Ned H.

Proceedings of the North Dakota Academy of Science 50: 103-107. (1996)

NAL Call #: 500 N813; ISSN: 0096-9214

1058. The impact of haying Conservation Reserve Program lands on productivity of ducks nesting in the Prairie Pothole Region of North and South Dakota.

Renner, R. W.; Reynolds, R. E.; and Batt, B. D. J.

Transactions of the North American Wildlife and Natural Resource Conference 60: 221-229. (1995)

NAL Call #: 412.9 N814; ISSN: 0078-1355 [NAWTA6].

Notes: Meeting held March 24-29, 1995, Minneapolis, Minnesota

Descriptors: anatidae/ prairies/ conservation areas/ haymaking/ reproductive performance/ nature reserves/ land banks/ North Dakota/ South Dakota

Abstract: Compared nest success and duck production in hayed and non-hayed CRP fields.

This citation is from AGRICOLA.

1059. Impact of haying CRP lands on duck nesting in the Prairie Pothole Region.

Renner, R. W. and Reynolds, R. E.
 In: 60th North American Wildlife and Natural Resources Conference. (Held 24 Mar 1995-29 Mar 1995 at Minneapolis, MN (USA).)
 Bismarck, ND: Ducks Unlimited; 1995.
 Notes: Conference Sponsor: Wildlife Management Institute (Washington, DC); World Meeting Number 951-0315

1060. Impact of the Conservation Reserve Program on duck recruitment in the U.S. Prairie Pothole Region.

Reynolds, R. E.; Shaffer, T. L.; Renner, R. W.; Newton, W. E.; and Batt, B. D. J.

Journal of Wildlife Management 65(4): 765-780. (2001)
 NAL Call #: 410 J827; ISSN: 0022-541X

Descriptors: breeding success/ recruitment/ land use/ wildlife management/ Conservation Reserve Program/ habitat improvement/ breeding sites/ food availability/ hunting/ aquaculture/ Anas/ Montana/ South Dakota/ North Dakota/ Prairie Pothole Region/ dabbling ducks/ management/ culture of other aquatic animals/ United States

Abstract: The U.S. Department of Agriculture (USDA)'s Conservation Reserve Program (CRP) resulted in the conversion of about 1.9 million ha of cropland to perennial grass cover in the Prairie Pothole Region of North Dakota, South Dakota, and northeastern Montana by 1992. Many wildlife managers believed this cover would provide benefits to wildlife, including upland nesting ducks. During 1992-1995, we evaluated success of 5 duck species nesting in CRP fields and nearby Waterfowl Production Areas (WPA) throughout the region. We examined relationships between daily survival rates (DSR) of duck nests in CRP cover and landscape-level habitat and population parameters. We computed DSR of duck nests in other major cover types in our study area from data collected during 1980-1984 (pre-CRP) and 1990-1994 (CRP) periods. We then applied recruitment models to estimate duck production in our study area during peak CRP years (1992-1997) and compared these results with those that simulated the scenario in which cropland was in place of CRP cover (i.e., the CRP had not occurred). DSR were higher in all habitats combined during the CRP period compared to the pre-CRP period. Regressions of DSR in CRP cover on the percent of each study plot in perennial cover and geographic location were significant ($P < 0.01$) for 4 of 5 duck (*Anas* spp.) species. Estimated nest success and recruitment rates for the 5 species combined during 1992-1997 were 46% and 30% higher, respectively, with CRP cover on the landscape compared to a scenario where we simulated cropland in place of CRP. Our model estimated an additional 12.4 million recruits from our study area to the fall flight as a consequence of the CRP during 1992-1997. Our results document benefits to 5 duck species in the northern plains associated with a farm program that provided financial incentives to landowners for planting undisturbed grass cover as an alternative to annual crops.

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1061. Impacts of center pivot irrigation systems on birds in prairie wetlands.

Peterson, T. L. and Cooper, J. A.
Journal of Wildlife Management 51(1): 238-247. (1987)
 NAL Call #: 410 J827; ISSN: 0022-541X
Descriptors: wetlands/ center pivot irrigation/ birds/ nesting/ Minnesota
 This citation is from AGRICOLA.

1062. Influence of agriculture on aquatic invertebrate communities of temporary wetlands in the Prairie Pothole Region of North Dakota, USA.

Euliss, N. H. and Musher, D. M.
Wetlands 19(3): 578-583. (1999)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ land use/ agriculture/ prairies/ cultivated lands/ agricultural practices/ invertebrates/ environmental impact/ aquatic communities/ temporary ponds/ cladocera/ Invertebrata/ USA, North Dakota/ Prairie Pothole Region/ water fleas

Abstract: We evaluated the influence of intensive agriculture on invertebrate communities of temporary wetlands as indicated by aquatic invertebrate resting eggs, shells, and cases remaining after wetlands dried. To facilitate the comparison, we sampled 19 wetlands within cropland areas and 19 wetlands within grassland areas. We found resting eggs, shells, and cases of significantly more taxa and greater numbers of cladoceran resting eggs (ephippia), planorbis and physid snail shells, and ostracod shells in wetlands within grasslands than in croplands. We also successfully incubated greater numbers of cladocerans and ostracods from soil samples collected from grassland sites. We were unable to detect differences in the viability of cladoceran ephippia between grassland and cropland wetlands, but our sample size was small due to an absence of ephippia in most cropland wetlands sampled; 74% of the cropland wetlands were devoid of cladoceran ephippia whereas ephippia were well represented in nearly all of our grassland sites. Our results corroborate findings of other investigators that prairie pothole wetlands have been negatively impacted by human activities. Our study demonstrates that aquatic invertebrates of temporary wetlands have been negatively impacted by intensive agriculture and suggests that future studies need to assess the influence of agricultural practices on wetland-dependant wildlife.

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1063. Influence of tillage system on water quality and quantity in prairie pothole wetlands.

Elliott, J. A.; Cessna, A. J.; and Hilliard, C. R.
Canadian Water Resources Journal 26(2): 165-182. (2001)
 NAL Call #: GB707.C3; ISSN: 0701-1784

Descriptors: wetlands/ water pollution sources/ herbicides/ prairies/ tillage/ agricultural practices/ comparison studies/ potholes/ water quality/ hydrology/ water quality measurements/ fertilizers/ phosphorus/ ammonia

Abstract: Since zero tillage (ZT) requires more herbicide and fertilizer use than conventional tillage (CT) and may improve water infiltration into soil, the system may negatively impact prairie pothole wetlands. In this paper, the hydrology and water quality of pothole wetlands in zero tillage and conventional tillage systems were compared by monitoring three wetlands (ZT-1, ZT-2 and CT) from 1995 to 1997, and during a runoff-producing summer storm in

1998. Wetland water levels were recorded during snowmelt runoff and throughout the unfrozen period. Water samples from the wetlands were analyzed for total P, ortho P, NO sub(2)-NO sub(3), NH sub(3) and a suite of commonly-used herbicides. In each year of the study, similar snow accumulations generated more runoff per unit area from the ZT basins than the CT basin. Water levels were similar in the three wetlands in the spring of 1995, but by 1997 the water depths were less in the ZT wetlands than in the CT wetland. Despite greater fertilizer use in the ZT basins, we did not observe a consistent effect of tillage system on available N and P in the surface soil. Phosphorus concentrations were generally higher in the ZT than the CT wetlands during snowmelt but there was no consistent effect of tillage on NO sub(2)-NO sub(3) or NH sub(3) concentrations in the wetlands. The herbicides found in all three wetlands included those that were applied during the study and some that were not. At least one herbicide was detected in trace amounts in approximately 75% of samples from the wetlands.

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1064. Insects as indicators of land use in three ecoregions in the prairie pothole region.

Anderson, D. J. and Vondracek, B.

Wetlands 19(3): 648-664. (1999)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ grasslands/ aquatic insects/ prairies/ biological indicators/ roads/ ecology/ diversity/ relationships/ arable land/ land use/ aquatic communities/ community ecology

Abstract: Populations of insects in the prairie pothole region of North Dakota, USA, were sampled to determine whether relationships existed between community- or taxon-level indicators and 11 land-use types. Insects were sampled with light traps at 126 wetland basins in 3 ecoregions. Sampling was conducted 3 times each year during the spring and early summer of 1995 and 1996. Sites were selected based on the proportion of cropland to grassland, hayland, and Conservation Reserve Program land surrounding wetland basins at 50 and 400 m radii. Other land-use types included in the analyses were woodland, roadways, and 5 wetland types: permanent, semi-permanent, seasonal, temporary, and riverine. In both years, taxa richness, abundance, and diversity were greater for the 2nd (June) and 3rd (July) sampling periods than for the 1st period (May), and indicators were greater in the Drift Plain and Red River Valley ecoregions than in the Missouri Coteau ecoregion. Several significant associations existed between insect indicators and land-use types; however, r^2 values were generally low. Much more of the variance in insect measures was explained by temperature, seasonal, and ecoregion effects. Several associations were significant within individual ecoregions (i.e., abundance of aquatic insects, Caenidae, Scarabaeidae, and Lepidoptera and number of Ephemeroptera families). However, no indicators were found in common for all 3 ecoregions. Several significant associations with land use were identified across all sites (i.e., all ecoregions combined). A small number of the significant relationships found across all sites were related to agricultural land use, and several indicated a negative relationship with grasslands. However, several positive relationships between the chosen insect

indicators and riverine wetlands were observed across sites and in the Red River Valley ecoregion for both years and spatial scales (i.e., the abundance of Caenidae, Scarabaeidae, Ceratopogonidae, Hydropsychidae, and Hydroptilidae).

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1065. Potential impact of selected agricultural chemical contaminants on a northern prairie wetland: A microcosm evaluation.

Johnson, B. T.

Environmental Toxicology and Chemistry 5(5): 473-485. (1986)

NAL Call #: QH545.A1E58; ISSN: 0730-7268

Descriptors: wetlands/ water pollution effects/ wildlife habitats/ limnology/ agricultural chemicals/ prairies/ pesticides/ microcosms/ toxicity/ sediments/ plants/ invertebrates/ algae/ macrophytes/ growth/ productivity

Abstract: An aquatic, multicomponent microcosm simulating a northern prairie wetland was used to assess the potential effects of six extensively used agricultural pesticides. 16 3-liter aquatic microcosms were treated with three concentrations of each of the pesticides carbofuran, fonofos, phorate, atrazine, triallate. The microcosm units were incubated for 30 d in an environmental chamber, with a 16-h light:8-h dark cycle, maintained at 20 C. The laboratory protocol was designed as an initial, rapid, economical screening test to determine the effect, but not the fate, of chemical contaminants in terms of toxicity, impaired productivity and community biochemical functions. Static acute toxicity tests with *Daphnia magna* and *Chironomus riparius* suggested that carbofuran, fonofos, phorate and triallate were very toxic to aquatic invertebrates. For *D. magna* the 48-h EC50 values were 48, 15, 19 and 57 microgram(ug)/L, respectively. Invertebrates viability tests indicated rapid changes in the toxicological persistence of these pesticides after microcosm interaction. Populations of *D. magna* were established in the 10 ug/L test concentration of carbofuran, phorate, triallate and fonofos at 1, 1, 14 and 28 d, respectively. Preexposure of the wetland sediments to either triallate or fonofos did not appear to change the relative toxicological persistence of each compound in the water column. Changes in pH, alkalinity, conductivity, dissolved oxygen, total nitrogen and total phosphorus were also observed with different pesticide treatments. Atrazine significantly reduced gross primary productivity and inhibited algal and macrophytic growth. The respiratory electron transfer system, phosphatase activity, oxygen consumption and mineralization of dissolved organic carbon were not significantly impacted by any of these pesticides in hydrosols. However, the impact of atrazine, fonofos and triallate on invertebrates and plants in the microcosm - both key elements in wetland productivity - would suggest that caution be used in application of these pesticides in or near wetland habitats. (Author 's abstract)

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1066. Potential impacts of agricultural chemicals on waterfowl and other wildlife inhabiting prairie wetlands: An evaluation of research needs and approaches.

Grue, C. E.; DeWeese, L. R.; Mineau, P.; Swanson, G. A.; Foster, J. R.; Arnold, P. M.; Huckins, J. N.; Sheehan, P. J.; Marshall, W. K.; and Ludden, A. P.

Transactions of the North American Wildlife and Natural Resources Conference 51: 357-383. (1986)

NAL Call #: 412.9 N814; ISSN: 0078-1355

Descriptors: pesticide residues/ fertilizers/ pollution/ research/ toxicity/ waterfowl/ wildlife/ Midwestern United States/ Canada

This citation is from AGRICOLA.

1067. Predicting water, sediment and NO₃-N loads under scenarios of land-use and management practices in a flat watershed.

Chaplot, V.; Saleh, A.; Jaynes, D. B.; and Arnold, J. *Water, Air, and Soil Pollution* 154(1-4): 271-293. (2004)

NAL Call #: TD172 .W36; ISSN: 0049-6979

Descriptors: watersheds/ land use/ agriculture/ environment management/ nitrates/ nitrogen/ nutrient loading/ sediments/ catchment areas/ agricultural practices/ nutrients/ environmental policy/ watershed modelling/ watershed management/ land use effects on hydrology/ agricultural effects on surface waters/ sediment transport/ nitrogen in runoff/ watershed chemistry/ sediment-water interface/ hydrology/ models/ soils/ fertilizers/ nitrogen compounds/ agricultural runoff/ agricultural pollution/ river basin management/ river discharge/ sediment load/ pollution dispersion/ nutrient cycles/ sediment pollution/ wheat/ pasture/ discharges/ water springs/ topography/ tillage/ water resources/ decision making/ Triticum aestivum/ Zea mays/ Glycine max/ USA, Iowa, Walnut Creek/ maize/ soybean

Abstract: Changes in land-use or management practices may affect water outflow, sediment, nutrients and pesticides loads. Thus, there is an increasing demand for quantitative information at the watershed scale that would help decision makers or planners to take appropriate decisions. This paper evaluates by a modeling approach the impact of farming practices and land-use changes on water discharge, sediment and NO₃-N loads at the outlet of a 51.29 km² watershed of central Iowa (Walnut Creek watershed). This intensively farmed (corn-soybean rotation) watershed is characterized by a flat topography with tiles and potholes. Nine scenarios of management practices (nitrogen application rates: increase of current rate by 20, 40%, decrease of current rate by 20, 40 and 60%; no tillage) and land-use changes (from corn-soybean rotation to winter wheat and pasture) were tested over a 30 yr simulated period. The selected model (Soil and Water Assessment Tool, SWAT) was first validated using observed flow, sediment and nutrient loads from 1991 to 1998. Scenarios of N application rates did not affect water and sediment annual budgets but did so for NO₃-N loads. Lessening the N rate by 20, 40 and 60% in corn-soybean fields decreased mean NO₃-N annual loads by 22, 50 and 95%, respectively, with greatest differences during late spring. On the other hand, increasing input N by 20 and 40% enhanced NO₃-N loads by 25 and 49%, respectively. When replacing corn-soybean rotation by winter wheat, NO₃-N loads increased in early fall, immediately after harvest. Pasture installation with or without fertilization lessened flow discharge, NO₃-N

and sediment delivery by 58, 97 and 50%, respectively. No-tillage practices did not significantly affect the water resource and sediment loads. Finally, such realistic predictions of the impact of farming systems scenarios over a long period are discussed regarding environmental processes involved.

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1068. Relationships of habitat patch size to predator community and survival of duck nests.

Sovada, M. A.; Zicus, M. C.; Greenwood, R. J.; Rave, D. P.; Newton, W. E.; Woodward, R. O.; and Beiser, J. A.

Journal of Wildlife Management 64(3): 820-831. (2000)

NAL Call #: 410 J827; ISSN: 0022-541X

Descriptors: patches/ habitat/ predators/ survival/ nests/ United States, Minnesota/ United States, North Dakota/ United States, South Dakota/ community composition/ aquatic birds/ breeding success/ area/ Anatidae/ Mammalia/ ducks/ mammals/ patch size/ Prairie Pothole Region/ mammals/ environmental effects

Abstract: We studied duck nest success and predator community composition in relation to size of discrete patches of nesting cover in the Prairie Pothole Region (PPR) of the United States in 1993-95. We focused on nests in uplands that were seeded to perennial grasses and forbs and enrolled in the Conservation Reserve Program (CRP) in Minnesota, North Dakota, and South Dakota. We estimated daily survival rates (DSRs) of upland duck nests and indices of activity for red foxes (*Vulpes vulpes*), coyotes (*Canis latrans*), American badgers (*Taxidea taxus*), striped skunks (*Mephitis mephitis*), and Franklin's ground squirrels (*Spermophilus franklinii*), and related these variables to habitat patch size. The effect of patch size (small vs. large) on estimated annual mean DSR was dependent on date of nest initiation (early vs. late) and year. Examination of within-year comparisons for early and late nests suggested that DSR was generally greater in larger habitat patches. Activity indices for the 5 mammalian nest predators were influenced differently by year, location, and patch size. Activity indices of the red fox were greatest in small patches. Coyote indices were the most inconsistent, demonstrating a year x location x patch size interaction. Activity indices of the striped skunk and American badger varied only among years. Franklin's ground squirrel indices were affected by study area location, with higher indices in the southeast than the northwest. Red fox activity was weakly correlated with that of the striped skunk and coyote. Although a positive relationship between habitat patch size and nest success probably exists, we believe the experiment to fully test this hypothesis will continue to be elusive.

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1069. Response of invertebrates to glyphosate-induced habitat alterations in wetlands.

Linz, G. M.; Bleier, W. J.; Overland, J. D.; and Homan, H. J. *Wetlands* 19(1): 220-227. (1999)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ habitat availability/ herbicides/ abundance/ plant populations/ plant control/ freshwater crustaceans/ aquatic plants/ aquatic insects/ community composition/ cattails/ habitats/ invertebrates/ weed control/ Typha/ Chaoboridae/ Chironomidae/ Corixidae/ Ostracoda/ Oligochaeta/ Cladocera/ Hydracarina/ USA, North Dakota/ glyphosate/ copepods/ ostracods/ angleworms/

earthworms/ oligochaetes/ water fleas/ water boatman/ midges/ phantom midges/ Invertebrata/ Copepoda
Abstract: Wetlands in the Prairie Pothole Region of eastern North Dakota, USA are often overgrown with cattails (*Typha* spp), providing habitat for crop-depredating blackbirds and impeding use by waterfowl. One and two years post-treatment (1992 and 1993), we assessed the response of invertebrates to a catastrophic reduction in cattail coverage caused by glyphosate, a herbicide applied to about 14,000 ha of North Dakota's wetlands since 1991. Numbers of Crustacea, Hydracarina, Oligochaeta, Copepoda, Ostracoda, and Cladocera were similar between treated and reference wetlands ($P > 0.10$), while abundance of Gastropoda was greater in the treated wetlands ($P = 0.10$). Insect abundance was greater in treated wetlands ($P < 0.01$), with activity traps yielding highest numbers in July. Corixidae and Chironomidae were more abundant in treated wetlands ($P < 0.10$), whereas Chaoboridae was consistently more plentiful in the reference wetlands ($P = 0.05$). Our results suggest that populations of some aquatic invertebrates may be enhanced by a reduction in cattail coverage with glyphosate-based herbicide.
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1070. Sedimentation of Prairie Pothole Wetlands: The Need for Integrated Research by Agricultural and Wildlife Interests.

Gleason, R. A. and Euliss, N. H.
In: *Water for Agriculture and Wildlife and the Environment: Win-Win Opportunities -- Proceedings from the USCID Wetlands Seminar.* (Held 27 Jun 1996-28 Jun 1996 at Bismarck, North Dakota.) Schaack, J.; Anderson, S. S.; U.S. Committee on Irrigation and Drainage; and U.S. Bureau of Reclamation (eds.)
Denver, Colo.: U.S. Committee on Irrigation and Drainage; pp. 107-114; 1997.
NAL Call #: GB624 .U83 1996
Descriptors: Conservation Reserve Program/ regional conservation programs/ Prairie Pothole region
Abstract: Examined the influences of sedimentation on wildlife values in wetlands within the Prairie Pothole Region.

1071. Sedimentation of prairie wetlands.

Gleason, R. A. and Euliss N. H.
Great Plains Research 8(1): 97-112. (1998)
NAL Call #: QH104.5.G73 G755; *ISSN:* 1052-5165
Abstract: Many wetlands in the prairie pothole region are embedded within an agricultural landscape where they are subject to varying degrees of siltation. Cultivation of wetland catchment areas has exacerbated soil erosion; wetlands in agricultural fields receive more sediment from upland areas than wetlands in grassland landscapes and hence are subject to premature filling (i.e., they have shorter topographic lives). Associated impacts from increased turbidity, sediment deposition, and increased surface water input likely have impaired natural wetland functions. Although trapping of sediments by wetlands is often cited as a water quality benefit, sediment input from agricultural fields has potential to completely fill wetlands and shorten their effective life-span. Thus, the value placed on wetlands to trap sediments is in conflict with maximizing the effective topographic life of wetlands. Herein, we provide an overview of sedimentation, identify associated

impacts on wetlands, and suggest remedial management strategies. We also highlight the need to evaluate the impact of agricultural practices on wetland functions from an interdisciplinary approach to facilitate development of best management practices that benefit both wetland and agricultural interests.

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1072. Soil indicators of agricultural impacts on northern prairie wetlands: Cottonwood Lake Research Area, North Dakota, USA.

Freeland, J. A.; Richardson, J. L.; and Foss, L. A.
Wetlands 19(1): 56-64. (Mar. 1999)
NAL Call #: QH75.A1W47; *ISSN:* 0277-5212
Descriptors: wetlands/ soil classification/ prairies/ agricultural practices/ USA, North Dakota/ agriculture/ land use/ soil horizons/ organic matter/ cultivated lands/ environmental impact/ soils/ environmental degradation/ effects on water of human nonwater activities/ protective measures and control
Abstract: Potential damage to wetlands by land-use practices has prompted a need for relatively inexpensive, reliable indicators in monitoring ecological conditions. In this study, soil classification and the following soil tests, sodium bicarbonate-extractable P, nitrate (NO_3^-), organic matter (OM), pH, electrical conductivity (EC), and super(137)Cs distribution, were used to compare four wetlands surrounded by cultivated land or grassland. Cumulic A horizons greater than 60-cm thick were found covering the wet meadow zone of the wetland surrounded by cultivated land. No cumulic A horizons were observed in wet meadow zones adjacent to grassland. Laboratory analyses of surface (0-15 cm) soil showed that the wetland surrounded by cultivated land had P concentrations 2.5 to 6 times higher in the wet meadow and shallow marsh zones than did the other wetlands. In the wetland surrounded by cultivated land, the dominant soil separate in the wet meadow was silt, while sand was the dominant soil separate in the wet meadow zone in the other three wetlands. Phosphorus, OM, and NO_3^- concentrations in wet meadow subsoils (15-60 cm) were higher in the wetland surrounded by cultivated land than in the wetlands surrounded by grasslands. Cesium-137 activities were about 3 to 6 times greater in surface (0-15 cm) soils collected from upland grassy slopes compared to cultivated slopes. Soil morphology, super(137)Cs, P, and OM data indicate higher sedimentation and fertilization rates in wetlands next to cultivated fields.
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1073. Use of no-till winter wheat by nesting ducks in North Dakota.

Duebbert, H. F. and Kantrud, H. A.
Journal of Soil and Water Conservation 42(1): 50-53. (1987)
NAL Call #: 56.8 J822; *ISSN:* 0022-4561
Abstract: Nests of 5 duck species were found: blue-winged teal *Anas discors*, northern pintail *A. acuta*, mallard *A. platyrhynchos*, gadwall *A. strepera*, and northern shoveler *A. clypeata*. Average number of nest found was 8/100 ha in 1984 and 6/100 ha in 1985. Nest success for all species averaged 26% in 1984 and 29% in 1985. Predation by mammals was the principal cause of nest destruction. No egg or hen mortality could be attributed to pesticide use. Only 6 of 151 nests (4%) were abandoned during the 2

years. Nests of 7 other ground-nesting bird species were also found. The trend toward increased planting of no-till winter wheat in the prairie pothole region should benefit production of ducks and other ground-nesting birds. -from Authors

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1074. Water-level fluctuation in wetlands as a function of landscape condition in the prairie pothole region.

Euliss, Ned H. and Mushet, David M.

Wetlands 16(4): 587-593. (1996)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ agriculture/ freshwater ecology/ habitat/ landscape condition/ Prairie Pothole Region/ seasonality/ species composition/ surface flow mitigation/ tillage/ water level fluctuations

Abstract: We evaluated water-level fluctuation (maximum water depth - minimum water depth/catchment size) in 12 temporary, 12 seasonal, and 12 semipermanent wetlands equally distributed among landscapes dominated by tilled agricultural lands and landscapes dominated by grassland. Water levels fluctuated an average of 14.14 cm in wetlands within tilled agricultural landscapes, while water levels in wetlands within grassland landscapes fluctuated an average of only 4.27 cm. Tillage reduces the natural capacity of catchments to mitigate surface flow into wetland basins during precipitation events, resulting in greater waterlevel fluctuations in wetlands with tilled catchments. In addition, water levels in temporary and seasonal wetlands fluctuated an average of 13.74 cm and 11.82 cm, respectively, while water levels in semipermanent wetlands fluctuated only 2.77 cm. Semipermanent wetlands receive a larger proportion of their water as input from ground water than do either temporary or seasonal wetlands. This input of water from the ground has a stabilizing effect on water-levels of semipermanent wetlands. Increases in water-level fluctuation due to tillage or due to alteration of ground-water hydrology may ultimately affect the composition of a wetland's flora and fauna. In this paper, we also describe an inexpensive device for determining absolute maximum and minimum water levels in wetlands.

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1075. Water quality in a peripherally tilled prairie wetland complex, Cavalier County, North Dakota.

Goebel, D. R.; Mayer, G. G.; and Bassingthwaite, S. A. In: *Versatility of Wetlands in the Agricultural Landscape*. (Held 17 Sep 1995-20 Sep 1995 at Hyatt Regency, Tampa, Fla.)

St Joseph, Mo.: American Society of Agricultural Engineers (ASAE); pp. 549-558; 1995.

NAL Call #: QH87.3.V47 1995

Descriptors: wetlands/ land use/ surface water/ tillage/ grasslands/ spatial distribution/ arable land/ cropping systems/ denitrification/ pollution/ nitrogen/ nitrate/ groundwater

Abstract: Nitrate contamination of ground and surface waters in a peripherally tilled prairie wetland complex, Cavalier County, North Dakota, USA, was investigated. Although nitrate was not detected in surface waters, spring runoff content values ranged from <1 to >27 mg/litre. GIS analysis of shallow water showed that nitrate content was >10 mg/litre at the base of sloping tilled fields. Under

grassland soils with slow permeabilities and reduced slope, nitrate content was <1 mg/litre. Spatial distribution showed that groundwater contamination was related to land use.

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1076. Water turbidity in tilled and untilled prairie wetlands.

Dieter, C. D.

Journal of Freshwater Ecology 6(0): 185-189. (1991)

NAL Call #: QH541.5.F7J68; ISSN: 0270-5060

Descriptors: wetlands/ inland water environment/ land use/ agriculture/ sedimentation/ environmental impact/ USA, South Dakota/ turbidity

Abstract: Water turbidity was compared between 54 tilled prairie pothole wetlands, 12 partially tilled wetlands and 52 untilled wetlands in South Dakota, USA. Specific differences in sedimentation as measured by turbidity were indicated. Turbidity was significantly lighter in tilled than in partially or untilled wetlands ($P < 0.01$). Average turbidity was 24 times greater in tilled than in untilled wetlands.

There was no significant difference in turbidity between partially tilled and untilled wetlands. Turbidity measurement may be a useful tool for estimating relative sedimentation rates. Current sedimentation rates of tilled wetlands may cause them to be filled in a relatively short period of time.

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1077. Weak correspondence between macroinvertebrate assemblages and land use in prairie pothole region wetlands, USA.

Tangen, B. A.; Butler, M. G.; and Eil, M. J.

Wetlands 23(1): 104-115. (2003)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ macrofauna/ land use/ agricultural land/ aquatic communities/ aquatic insects/ community composition/ species diversity/ biotic factors/ trophic relationships/ freshwater fish/ environmental impact/ ecosystem disturbance/ agriculture/ environment management/ invertebrates/ fish/ population dynamics/ aquatic habitats/ Invertebrata/ pisces/ USA, North Dakota/ USA, Prairie Pothole Region

Abstract: To evaluate the potential development of a macroinvertebrate Index of Biotic Integrity (IBI) for Prairie Pothole Region wetlands, we sampled the aquatic macroinvertebrate and fish communities in 24 semipermanent wetlands located throughout Central North Dakota. Wetland basins were selected to encompass a range of surrounding land-use, ranging from 100% grassland to 100% cropland. We used redundancy analysis (RDA) to identify the influences of fish, and temporal and spatial variation on the macroinvertebrate community. We also used RDA to look for relationships between wetland macroinvertebrate communities and land-use. Seventeen potential invertebrate metrics were tested by graphical analyses. We identified a strong influence on the macroinvertebrate community due to the presence of fish. A number of invertebrate taxa decreased in abundance as the summer progressed, and there was noticeable variation in the invertebrate community among individual wetlands of the region. However, we detected no strong relationships between the varying degrees of agricultural land-use in the wetland catchments and the invertebrate community. Consequently, we were unable to identify any effective IBI

metrics indicative of land-use disturbance. Lack of correspondence between land-use and macroinvertebrates in this habitat is most likely due to a high degree of natural disturbance (e.g., presence of fish, temporal changes) and a low diversity community of resilient taxa in Prairie Pothole Region wetlands.

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1078. Wetlands/groundwater quality in agricultural landscapes.

Rickerl, D. H.; Kringen, D. E.; and Machacek, T. A.
Journal of the Minnesota Academy of Science 59(4): 18-24. (1995)

NAL Call #: 500 M663; ISSN: 0026-539X

Descriptors: wetlands/ groundwater/ agricultural watersheds/ water quality/ groundwater pollution/ nitrates/ phosphorus compounds/ agricultural runoff/ nutrients/ seasonal variations/ nutrients (mineral)/ USA, South Dakota/ nutrients (mineral)/ agricultural watersheds/ groundwater/ nutrients

Abstract: In the Prairie Pothole Region (PPR - SD, ND, MN, IA), wetlands classified as "semi-permanent" or "seasonal" can act as groundwater recharge sites. The nutrient filtering capacity of wetlands has been investigated for both natural and constructed wetlands linked to surface water, but there is little information available on their subsequent impact on groundwater quality. This study investigates four seasonal and two semi-permanent wetlands in the PPR of eastern South Dakota. Transitional no-till (TNT) and organic farm (ORG) management systems border the wetlands. The objective is to determine the effects of farm management system on wetland surface

water and groundwater quality. This project is part of a more comprehensive study including wildlife-habitat investigation and economic analyses. Water quality data include nitrate (NO sub(3) super(-)-N) and orthophosphate (PO sub(4) super(3-)-P) concentrations from wetland surface water, groundwater at wetland and upland sites, and run-off water from surrounding weirs. The results will be used to determine to what extent PPR wetlands act as sinks for nutrient run-off and establish baseline NO sub(3) super(-)-N and PO sub(4) super(3-)-P data for the development of PPR wetland water quality standards. The results indicate greater surface water NO sub(3) super(-)-N concentrations in semi-permanent than in seasonal wetlands. Surface water concentrations of PO sub(4) super(3-)-P, however, were greater in seasonal than semi-permanent wetlands. Groundwater sampled near the wetland perimeter had greater PO sub(4) super(3-)-P concentrations than groundwater sampled from nearby upland sites. The farming system effects were observed in weir data that indicated large concentrations of NO sub(3) super(-)-N in runoff following nitrogen (N) application in the transitional no-till system. Large NO sub(3) super(-)-N concentrations were also found in groundwater sampled from the organic semi-permanent wetland site which is cropped to alfalfa (*Medicago sativa* L.) and receive manure application. Orthophosphate concentrations were significantly greater in groundwater near the seasonal wetland in the ORG (0.68 mg L super(-1)) than the TNT (0.20 mg L super(-1)). Water quality monitoring will continue in 1995, but preliminary results suggest that both wetland classification and adjacent farming practices impact wetland and groundwater quality.

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Wetlands as Agricultural Conservation Practices

1079. Black tern colonization of a restored prairie wetland in northwestern Minnesota.

Delehanty, David J. and Svedarsky, W. Daniel
Prairie Naturalist 25(3): 213-218. (1993)

NAL Call #: QH540 .P7; ISSN: 0091-0376

Descriptors: wetlands/ birds/ behavior/ colonization/ ecosystems/ nests/ nesting/ prairies

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1080. Breeding bird communities of recently restored and natural prairie potholes.

Delphey, P. J. and Dinsmore, J. J.

Wetlands 13(3): 200-206. (1993)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ droughts/ aquatic birds/ reclamation/ community composition/ comparative studies/ environmental restoration/ Aves/ USA, Iowa/ natural wetlands/ environmental restoration/ aquatic birds/ reclamation/ comparative studies

Abstract: We compared the breeding bird communities of natural and recently restored prairie potholes in northern Iowa in 1989 and 1990. Species richness of breeding birds was higher ($P < 0.05$) at natural wetlands, although duck pair counts and species richness were not significantly different between wetland types ($P > 0.1$). Common yellowthroat (*Geothlypis trichas*), red-winged blackbird (*Agelaius phoeniceus*), marsh wren (*Cistothorus palustris*),

and swamp sparrow (*Melospiza georgiana*) were each more abundant at natural than at restored wetlands during at least one year ($P < 0.05$). Brown-headed cowbirds (*Molothrus ater*) parasitized a significantly greater proportion of red-winged blackbird nests at natural than at restored wetlands. Incomplete development of typical vegetation structure evidently depresses bird species richness at recently restored prairie potholes. Drought the year before and during the first year of our study undoubtedly affected our results. Similar studies should be conducted during periods of relatively high precipitation to complement our results.

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1081. Changes in breeding bird populations with habitat restoration in northern Iowa.

Fletcher, R. J. and Koford, R. R.

American Midland Naturalist 150(1): 83-94. (July 2003)

NAL Call #: 410 M58; ISSN: 0003-0031

Descriptors: wetlands/ terrestrial-ecology: ecology, environmental sciences/ wildlife management: conservation/ Aves/ Vertebrata/ Chordata/ Animalia/ Charadriiformes/ bird (Aves)/ *Charadrius vociferus*/ Killdeer/ Eagle Lake Wetland Complex/ Iowa/ USA, North America/ nearctic region/ Prairie Pothole Region/ geographic information system: applied and field techniques/ breeding ecology/ grasslands/ habitat fragmentation/ habitat loss/

habitat restoration/ haylands/ land conversion/ land cover types/ pastures/ population changes/ rowcrop agriculture/ species abundance

Abstract: Native tallgrass prairie and wetland habitat in the Prairie Pothole Region of the United States have declined over the past two centuries. Bird communities using these habitats have also experienced widespread declines that are often attributed to severe habitat loss and fragmentation. We estimated the change, or turnover, in bird populations in the Eagle Lake Wetland Complex, Iowa, with ongoing grassland and wetland restoration by linking geographic information system data and bird surveys in different land cover types (hayland, pasture, restored grassland, restored wetland and rowcrop agriculture) during the 1999-2001 breeding seasons. Habitat restoration efforts primarily converted rowcrop agriculture and pastures into grassland and wetland habitat. Based on land conversion, abundances of most species have likely increased in the area, including many species of management concern. Yet a few species, such as killdeer (*Charadrius vociferus*), have probably decreased in abundance. This estimation approach and these estimates provided a critical first step for evaluating restoration efforts; however, information on demographic parameters, such as nesting success, in restored areas is needed for understanding how restoration ultimately affects bird populations.

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1082. Characteristics of recently restored wetlands in the Prairie Pothole Region.

Galatowitsch, S. M. and Van Der Valk, A. G.

Wetlands 16(1): 75-83. (1996)

NAL Call #: QH75.A1W47; *ISSN:* 0277-5212

Descriptors: wetlands/ vegetation/ hydrology/ land reclamation/ hydrological regime/ aquatic plants/ plant populations/ community composition/ environment management/ ecosystem management/ reclamation/ nature conservation/ environmental restoration/ USA, Iowa/ USA, Minnesota/ USA, South Dakota

Abstract: Between 1987 and 1991, 1892 prairie potholes were restored in northern Iowa, southern Minnesota, and southeastern South Dakota by state and federal agencies, most as part of the Conservation Reserve Program. The total area covered by these restored wetlands is approximately 2714 ha. Most restorations are small (less than 4 ha) wetlands with a seasonal hydrologic regime. Wetlands with an ephemeral/temporary water regime are under-represented compared to their pre-drainage extent. Information on basin morphometry, hydrology, and vegetation-zone development was collected on 62 wetlands restored in 1988. Earthen dams are installed on most (73%) restorations in the region, increasing the full pool volume but not the mean depth of the basin. Overall, restored wetlands have basin morphometries that are comparable to those of similarly sized natural wetlands. About 60% of the basins had their predicted hydrology or held water longer than predicted. Nevertheless, about 20% of the projects that we examined were hydrologic failures and either never flooded or had significant structural problems. Most restored wetlands had developed emergent and submersed aquatic vegetation zones, but only a few had developed wet prairie and sedge meadow vegetation zones.

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1083. Decision-making for prairie wetland restorations.

Galatowitsch, S. M.; Van Der Valk, A. G.; and

Budelsky, R. A.

Great Plains Research 8(1): 137-155. (1998)

NAL Call #: QH104.5.G73 G755; *ISSN:* 1052-5165.

Notes: Special issue: Freshwater functions and values of prairie wetlands

Descriptors: wetlands/ inland water environment/ government policy/ land reclamation/ water reclamation/ environment management/ decision making/ environmental policy/ land use/ land management/ government policies/ USA

Abstract: Assessments of wetland restorations in the prairie region are not done routinely and no accepted assessment framework exists. Wetland assessment protocols in the U.S. have varied over time from those emphasizing social significance to those attempting to quantify functions of wetlands from hydrogeomorphic considerations. A conceptual framework for restoration decision-making is presented that is based on optimizing wetland restoration success at both the landscape and site scales. This framework uses societal concerns, knowledge of factors that limit ecosystem recovery, and data on losses of different types of wetlands locally and regionally to establish restoration goals and guide site selection. These goals in turn generate restoration expectations or targets. Currently, restoration expectations are usually formulated only at the basin scale. Prairie pothole wetlands, however, were historically part of wetland complexes. Consequently, restoration efforts should focus on restoring complexes not isolated wetlands. Wetland restoration decision-making thus requires that landscape-level restoration expectations be part of all prairie pothole restorations. Landscape-level expectations should also be used in the assessment of these projects. Reference wetlands or historic data from the wetland and wetland complexes to be restored are used to develop these restoration expectations.

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1084. The development of vegetative zonation patterns in restored prairie pothole wetlands.

Seabloom, E. W. and van der Valk, A. G.

Journal of Applied Ecology 40(1): 92-100. (Feb. 2003)

NAL Call #: 410 J828; *ISSN:* 0021-8901

Descriptors: prairie/ vegetation/ restoration/ zonation/ environmental restoration/ prairies/ vegetation cover/ distribution records/ aquatic plants/ interspecific relationships/ community composition/ population structure/ USA, Midwest/ prairie pothole wetlands/ water resources and supplies/ reclamation/ aquatic communities/ conservation, wildlife management and recreation/ general environmental engineering

Abstract: 1. The spatial structure of plant communities can have strong impacts on ecosystem functions and on associated animal communities. None the less, spatial structure is rarely used as a measure of restoration success. 2. The restoration of hundreds of wetlands in the prairie pothole region in the mid-western USA provided an excellent opportunity to determine whether the re-establishment of abiotic conditions is sufficient to restore structure, composition and spatial patterning of the vegetation. 3. We mapped the topography and vegetative distributions in 17 restored and nine natural wetlands. We used these data to compare the composition and spatial structure of the vegetation in both wetlands types. 4. The

composition of the plant communities differed between restored and natural wetlands; the restored wetlands lacked the well-developed sedge-meadow community found in most natural wetlands. However, the spatial heterogeneity was similar, although the zonation patterns were less well-developed in the restored wetlands. 5. Although the overall structure was similar, species distributions differed among wetland types, such that species were found more than 10 cm higher in restored wetlands than in natural wetlands. 6. Synthesis and applications. This study illustrates that restored plant community composition and spatial structure may converge on their targets at different rates. Evaluations of restoration success should consider spatial structure of communities along with compositional and functional metrics.

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1085. Diatom communities as ecological indicators of recovery in restored prairie wetlands.

Mayer, P. M. and Galatowitsch, S. M.

Wetlands 19(4): 765-774. (Dec. 1999)

NAL Call #: QH75.A1W47; *ISSN:* 0277-5212.

Notes: Conference: Temperate Wetlands Restoration Workshop, Barrie, ON (Canada), 27 Nov-1 Dec 1995

Descriptors: diatoms/ species diversity/ land management/ environmental quality/ hydrology/ drainage/ environmental restoration/ indicator species/ environment management/ community composition/ ecosystem management/ restoration/ algae (diatoms)/ land/ environmental quality standards/ Bacillariophyceae/ USA/ northern prairie wetlands/ control of water on the surface/ reclamation/ habitat community studies/ protective measures and control/ water resources and supplies

Abstract: Diatoms were employed to assess the recovery of northern prairie wetlands restored after drainage. We predicted that diatom species diversity and equitability are lower in restored wetlands than in reference wetlands and that diatom communities are similar among reference wetlands because communities should be relatively stable over time. Conversely, we predicted that diatom communities in restored and reference wetlands differ because species recovery after restoration may be incomplete or unattainable depending on environmental conditions or dispersal limits. Eight undisturbed, unrestored (reference) wetlands were compared to eight wetlands restored after drainage. Diatom communities on artificial substrates were transplanted from restored to reference wetlands and vice versa to test for environmental control and dispersal limits to community composition. Species richness was similar at restored and reference wetlands. Diversity and equitability at restored and reference sites were similar within a sampling period, but diversity and equitability decreased over the growing season in reference sites. Based on multidimensional scaling analyses, restored and reference sites could not be distinguished by species composition either early or late in the season. Transplanted diatom community assemblages became similar to those in the wetlands to which they were transferred, suggesting a strong environmental control over diatom assemblages. Diatoms, as a whole, responded rapidly to environmental conditions; yet, dispersal still may limit some species' re-establishment, while resistance to disturbance may produce little response among other diatom species. Diatoms may have limited utility as ecological indicators in prairie

wetlands because of the unique interaction between diatom life history and the cyclic hydrology of prairie wetlands and because diatom community structure is highly variable among reference wetlands.

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1086. Economic and environmental contribution of wetlands in agricultural landscapes.

Janssen, Larry

Brookings, S.D.: Economics Dept., South Dakota State University, 1995. 34 p. Economic staff paper series no. 95-3.

Notes: "May 1995." Includes bibliographical references (p. 19-21).

NAL Call #: HD1775.S8E262 no.95-3

Descriptors: Prairie Pothole Region

This citation is from AGRICOLA.

1087. Effects of moisture, temperature, and time on seed germination of five wetland carices: Implications for restoration.

Budelsky, R. A. and Galatowitsch, S. M.

Restoration Ecology 7(1): 86-97. (Mar. 1999)

NAL Call #: QH541.15.R45R515; *ISSN:* 1061-2971

Descriptors: wetlands/ environmental restoration/ seed germination/ temperature effects/ soil moisture/ North America/ seeds/ germination/ moisture content/ temperate zone/ optimization/ rehabilitation/ storage/ stratification/ nature conservation/ environment management/ *Carex*/ reclamation/ water and plants/ protective measures and control/ general environmental engineering

Abstract: Successful restoration of sedge meadow wetlands is limited by lack of information regarding reintroduction of sedge (*Carex*) propagules. While restoration from seed is common for prairie restorations, little is known about the germination characteristics of many wetland plants, including sedges. We present the results of a 2.5-year study on seed germination and viability for five species of *Carex* common to sedge meadow and prairie pothole wetlands in temperate North America. Seed storage and germination conditions were investigated to determine the optimum combination for maintaining seed viability and stimulating germination rates over time. Seeds were germinated under seven different temperature and three moisture regimes after storage for 4, 10, and 14 months under one of four different storage regimes (dry-warm, dry-cold, moist-cold, and wet-cold). The efficacy of short-term wet-cold stratification to stimulate germination of 2.5-year-old seed after long-term dry storage was also investigated. *Carex stricta*, *Carex comosa*, and *Carex lacustris* showed the greatest germination response after wet-cold or moist-cold storage, while *Carex lasiocarpa* and *Carex rostrata* showed similar rates of germination after either wet-cold or dry-warm storage. Wet-cold long-term storage was associated with a high level of viability in all five species after 2.5 years. Viability and germination rates were reduced in *Carex stricta*, *Carex comosa*, and *Carex lasiocarpa* after long-term dry-cold storage. Germination rates of seeds stored dry for 2.5 years are not improved by short-term wet-cold treatment in any species tested. *Carex* seeds should be stored under wet-cold conditions to maintain seed viability over time, thus increasing the likelihood of seeding success for sedge meadow restoration.

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1088. Effects of nutrients and water levels on emergent macrophyte biomass in a prairie marsh.

Neill, C.

Canadian Journal of Botany 68(5): 1007-1014. (May 1990)

NAL Call #: 470 C16C; ISSN: 0008-4026

Descriptors: wetlands/ emergent aquatic plants/ fertilizers/ limnology/ macrophytes/ marshes/ nutrients/ water level fluctuations/ water pollution effects/ biomass/ cattails/ marsh plants/ nitrogen/ phosphorus/ plant growth/ lakes

Abstract: Nitrogen and phosphorus fertilizers were added over two growing seasons to marshes dominated by whitetop grass (*Scolochloa festucacea*) or cattail (*Typha glauca*) in a prairie lacustrine marsh to assess nutrient limitation and the interaction of nutrient limitation with water depth. For each species, stands were selected at the deep and shallow extremes of its water depth range. Water levels were high during the first year of fertilization and low during the second year, exposing the fertilized stands to a variety of water depths. Nitrogen limited growth in whitetop and cattail marshes. Water level, by controlling whether the soil was flooded or the water table was below the soil surface, affected growth and the degree of nitrogen limitation. In whitetop marshes, nitrogen increased biomass more when the soil was flooded or when standing water was deeper and in cattail marshes, it increased biomass more under intermediate water depths (approximately 0-20 cm) than under more deeply flooded (20-40 cm) or dry conditions. Nitrogen reduced biomass in whitetop marshes the second year, apparently because growth was inhibited by fallen litter from the previous year. Nitrogen did not limit cattail marsh biomass in the driest locations during a year of low water levels. Phosphorus caused a small increase in growth of both species after 2 years. Changes of nitrogen limitation with flooding suggest that annual water level fluctuations, by creating alternating flooded and dry conditions, may influence the primary production of emergent macrophytes through effects on nitrogen cycling. (Author 's abstract)

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1089. Effects of *Phalaris arundinacea* and nitrate-N addition on the establishment of wetland plant communities.

Green, Emily K. and Galatowitsch, Susan M.

Journal of Applied Ecology 39(1): 134-144. (2002)

NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: freshwater ecology: ecology, environmental sciences/ nutrition/ agricultural drainage water/ colonization/ dominance/ reflooding/ restoration/ sedge meadow/ vegetation re-establishment/ species richness/ wetland plant community

Abstract: 1. Nutrient enrichment may adversely impact plant species richness in wetlands and enhance their susceptibility to colonization and dominance by invasive species. For North American prairie wetlands, enrichment by nitrate-N ($\text{NO}_3\text{-N}$) from agricultural runoff is thought to contribute to the increasing colonization and dominance of *Phalaris arundinacea* (reed canary grass), especially during restoration. If true, *P. arundinacea* might compromise the re-establishment of sedge meadow vegetation on sites reflooded with agricultural drainage water. 2. We tested this hypothesis using a fertilization experiment in wetlands with controlled hydrology. A community mixture comprising 11 species from native sedge meadow was seeded in mesocosms and grown under one of three $\text{NO}_3\text{-N}$ levels (0

g m^{-2} year $^{-1}$, 12 g m^{-2} year $^{-1}$, 48 g m^{-2} year $^{-1}$) with or without *P. arundinacea*. Above- and below-ground biomass were measured after two growing seasons to assess the response of vegetation to $\text{NO}_3\text{-N}$ and *P. arundinacea* treatments. 3. The total shoot biomass of the native community was suppressed in the presence of *P. arundinacea* at all $\text{NO}_3\text{-N}$ levels, but shoot suppression was significantly greater at the highest $\text{NO}_3\text{-N}$ dose level (48 g m^{-2}). Shoot growth of the native community was reduced by nearly one-half under these conditions. 4. The total root biomass of the community was also suppressed by *P. arundinacea* when no $\text{NO}_3\text{-N}$ was added. 5. As $\text{NO}_3\text{-N}$ increased, the relative abundance (shoot biomass) of native graminoids declined while native forbs increased in communities with and without *Phalaris*. The most common graminoid, *Glyceria grandis*, was suppressed by *P. arundinacea* at all levels, with suppression enhanced at the 48 g m^{-2} $\text{NO}_3\text{-N}$ level. Three other species were suppressed at the highest $\text{NO}_3\text{-N}$ level, in the presence of *Phalaris*. The two most common forbs, *Asclepias incarnata* and *Sium suave*, exhibited a continual increase in growth with $\text{NO}_3\text{-N}$ additions along with overall suppression by *P. arundinacea*. 6. Community diversity and evenness declined with increasing $\text{NO}_3\text{-N}$ levels, whether or not *P. arundinacea* was present. 7. Our results demonstrate that if *P. arundinacea* is present, the restored sedge meadow community will not achieve levels of abundance that are possible when this species is absent, regardless of $\text{NO}_3\text{-N}$ enrichment conditions. 8. At the same time, the increased suppression by *P. arundinacea* at the 48 g m^{-2} $\text{NO}_3\text{-N}$ dose level supports the hypothesis that the dominance of this species over the native sedge meadow community is enhanced by $\text{NO}_3\text{-N}$ inputs at levels that are common in agricultural landscapes. 9. Our results carry two implications for achieving biodiversity conservation in agricultural landscapes. First, reducing nitrate loads to wetland reserves is essential for minimizing declines in community diversity. Secondly, the use of *P. arundinacea* for soil conservation and other agri-environmental purposes should be curtailed because of the likelihood of off-site impacts to wetland biodiversity.

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1090. Feasibility of restoring previously drained wetlands to reduce flood damage.

Shultz, S. D. and Leitch, J. A.

Journal of Soil and Water Conservation 58(1): 21-29. (2003)

NAL Call #: 56.8 J822; ISSN: 0022-4561

Descriptors: wetlands/ land restoration/ floods/ watershed management/ watersheds/ cost benefit analysis/ economic feasibility

This citation is from AGRICOLA.

1091. Floral and faunal colonization of restored wetlands in west-central Minnesota and northeastern South Dakota.

Sewell, R. S. and Higgins, K. F.

In: Proceedings of the Fourteenth Annual Conference on Wetlands Restoration and Creation/ Webb, F. J. Plant City, FL: Hillsborough Community Coll, 1991; pp. 108-133.

Notes: Conference: 18. Annu. Conf. on Wetlands Restoration and Creation, Plant City, FL (USA), 16-17 May 1991

Descriptors: wetlands/ biological surveys/ community composition/ land reclamation/ aquatic animals/ freshwater fish/ aquatic plants/ aquatic birds/ USA, Minnesota/ USA, South Dakota

Abstract: The objective of this study was to determine trends in species abundance and richness of waterfowl, aquatic macroinvertebrates, fishes and hydrophytes in restored wetlands of differing ages since restoration. One hundred fifty-six restored seasonal and semi-permanent basins of 12 different ages were surveyed in 3 counties of northeast South Dakota and 6 counties of west-central Minnesota, USA. A large diversity of flora and fauna colonized wetlands as early as one year after restoration. Twelve species of waterfowl were observed in all age classes of the restored basins. Thirty-one taxa of macroinvertebrates occurred in restored basins, 12 of which were in age class 1 basins. Four fish species inhabited restored basins of all ages. An average of over 16 taxa of aquatic hydrophytes had coverage values of greater than or equal to 5% of the total wetland area in restored basins. This study demonstrated that wetland managers can expect extensive floral and faunal colonization of prairie wetlands even in the first year after restoration.

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1092. Implications of marsh size and isolation for marsh bird management.

Brown, M. and Dinsmore, J. J.

Journal of Wildlife Management 50(3): 392-397. (1986)

NAL Call #: 410 J827; *ISSN:* 0022-541X

Descriptors: wetlands/ marshes/ species richness/ wildlife management/ nature conservation/ species diversity/ habitat selection/ Aves/ USA, Iowa/ species richness/ wildlife management

Abstract: The number of breeding bird species in 30 Iowa prairie marshes ranged from 2 to 17/marsh during 1983 and 1984. All marshes were similar in physical characteristics, except for size and isolation from other marshes. A 2-variable regression model containing size and isolation accounted for 75% of the variation in species richness. Ten of 25 species did not occur in marshes < 5 ha. Species richness often was greater in wetland complexes than in larger isolated marshes. Marsh size and isolation are important management considerations.

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1093. Influence of wetland age on bird use of restored wetlands in Iowa.

Vanrees-Siewert, K. L. and Dinsmore, J. J.

Wetlands 16(4): 577-582. (1996)

NAL Call #: QH75.A1W47; *ISSN:* 0277-5212

Descriptors: wetlands/ habitat improvement/ reclamation/ aquatic birds/ breeding sites/ evaluation/ species diversity/ habitat/ environmental restoration/ habitat utilization/ environmental quality/ birds/ habitats/ waterfowl/ USA, Iowa/ evaluation/ breeding sites/ Aves

Abstract: A goal of wetland restoration is to provide habitat for breeding populations of waterfowl and other bird species. To meet this goal, it is important to determine how birds respond to restored wetlands and which factors influence their use of restored wetlands. We examined the relationship between bird species richness and years since restoration at restored prairie wetlands in Iowa. We detected 42 bird species in restored wetlands, 15 of which were breeding species. The mean number of breeding bird

species was significantly greater in older restored wetlands (4.3 species in 1-year-old wetlands, 7.2 species in 4-year-old wetlands, $P = 0.005$). The mean number of all bird species, waterfowl species, and breeding waterfowl species did not change with wetland age. Total and breeding bird species richness increased with percent cover of emergent vegetation. Waterfowl species richness and breeding waterfowl species richness were influenced more by wetland area than vegetation characteristics, whereas total species richness and breeding bird species richness were influenced more by vegetation characteristics. If the goal of restoration is simply to provide a breeding site for waterfowl, our data suggest that this can be done in a few years. However, we favor longterm restorations. Such restorations are more likely to have a more diverse bird community that more closely resembles those found in natural wetlands.

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1094. Invertebrate egg banks of restored, natural, and drained wetlands in the Prairie Pothole Region of the United States.

Gleason, R. A.; Euliss, N. H.; Hubbard, D. E.; and Duffy, W. G.

Wetlands 24(3): 562-572. (2004)

NAL Call #: QH75.A1W47; *ISSN:* 0277-5212

Descriptors: wetlands/ prairies/ abundance/ drainage/ eggs/ succession/ recruitment/ man-induced effects/ anthropogenic factors/ embryonic development/ habitat improvement/ aquatic insects/ seasonal variations/ restoration/ water levels/ dispersion/ statistical analysis/ community composition/ population dynamics/ species diversity/ invertebrates/ banks/ history/ cultivation/ maintenance/ seeds/ indicators/ drawdown/ habitats/ Invertebrata/ USA/ USA, Prairie Pothole Region/ Canada, Saskatchewan, Prairie Pothole Region

Abstract: Analogous to 'seed banks,' 'egg banks' are important for seasonal succession and maintenance of invertebrate species diversity throughout wet and dry cycles in the prairie pothole region. Further, recruitment of invertebrates from relic egg banks in the sediments and dispersal of eggs into wetlands is believed to be important for reestablishment of invertebrates in recently restored wetlands. Although tens-of-thousands of wetlands have been restored in the prairie pothole region of the United States, studies have not been conducted to evaluate the recovery of invertebrate egg banks in restored wetlands. We used taxon richness and abundance as indicators of potential egg bank recovery and compared these parameters in restored wetlands to those of non-drained and drained wetlands with a history of cultivation and also to reference wetlands with no history of cultivation. We found few significant differences among wetland categories within three physiographic regions (Glaciated Plains, Missouri Coteau, and Prairie Coteau). Most statistical comparisons indicated that restored wetlands had invertebrate egg banks similar to reference, non-drained, and drained wetlands. The one exception was drained seasonal wetlands in the Glaciated Plains, which had significantly lower taxon richness and invertebrate abundance than the other wetland categories. Trends did suggest that invertebrate egg bank taxon richness and abundance are increasing in restored seasonal wetlands relative to their drained analogues, whereas a similar trend was not observed for restored semi-permanent wetlands.

Although recovery was not related to years since restoration, comparisons of restored wetlands with reference wetlands suggest that recovery potential may be inversely related to the extent of wetland drainage and intensive agriculture that varies spatially in the prairie pothole region. Our research suggests that periodic drawdowns of semi-permanent restored wetlands may be needed to promote production and development of invertebrate egg banks. Inoculation of restored wetlands may also be needed in areas where extensive wetland drainage has resulted in fewer wetland habitats to provide sources of passively dispersed eggs to newly restored wetlands.

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1095. Mallard recruitment in the agricultural environment of North Dakota.

Cowardin, L. M.; Gilmer, D. S.; and Shaiffer, C. W. *Wildlife Monographs* 92: 1-37. (1985)

NAL Call #: 410 W64; ISSN: 0084-0173

Descriptors: *Anas platyrhynchos* (Anatidae)/ wildlife management/ population recruitment implications/ agricultural land/ nesting site/ agricultural habitat usage/ breeding season/ nest initiation curves/ reproductive productivity/ population dynamics/ recruitment/ habitat preference/ nesting/ agricultural environment/ semiaquatic habitat/ wetland/ grassland/ cultivated land habitat/ agricultural population recruitment and management/ North Dakota/ population recruitment/ management implications/ agricultural habitat

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1096. A method to prioritize and monitor wetland restoration for water-quality improvement.

Almendinger, J. E.

Wetlands Ecology and Management 6(4): 241-251. (1999)

NAL Call #: QH541.5.M3 W472; ISSN: 0923-4861

Descriptors: wetlands/ environmental restoration/ water quality/ runoff/ reclamation/ habitat improvement/ nature conservation/ site selection/ water quality control/ hydraulics/ benefits/ land management/ agriculture/ phosphorus/ nitrogen/ environment management/ USA/ USA, Minnesota R.

Abstract: Wetland restoration can improve water quality by reducing concentrations of sediment, total phosphorus, and nitrate in runoff. Managers need a simple method to choose among many possible restoration sites, particularly in large agricultural basins covering thousands of square kilometers. The purpose of this paper is to outline a method for prioritizing and monitoring wetland restoration sites in light of the factors that affect water-quality improvement by wetlands. These factors are categorized as loading factors, path factors, and process factors. The method for prioritizing wetland restoration sites depends primarily on assessing the potential effectiveness of the wetland for improving water quality. Three types of effectiveness are considered: problem effectiveness (is the site in an area with known water-quality problems?), function effectiveness (is the site likely to improve water quality more or less than other sites?), and information effectiveness (does the site fit within an overall research plan to gain information on how wetlands improve water quality?). The variables of hydraulic residence time, hydraulic flux, and wetland area, volume, and average depth are combined into a single variable termed epsilon and used as a proxy for estimating

the relative function effectiveness of potential restoration sites. Monitoring restoration sites is targeted at establishing a minimum data set that can be collected consistently at different sites over time, and that can be used for inter-site comparison with simple statistical techniques. The Minnesota River Basin is used as an example throughout to demonstrate the types of data that are available to plan wetland restoration. While this paper focuses on the water-quality benefits, wetland restoration should be a multi-disciplinary effort to integrate other benefits of restoration, such as improvement of wildlife habitat and flood abatement.

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1097. Natural revegetation during restoration of wetlands in the southern Prairie Pothole Region of North America.

Galatowitsch, S. M. and van der Valk, A. G.

In: *Restoration of Temperate Wetlands/ Wheeler, Bryan D.; Shaw, Susan C.; Fojt, Wanda J.; and Robertson, R. Allan.* New York: John Wiley & Sons, 1995; pp. 129-142

NAL Call #: QH541.5.M3R47 1995

Descriptors: wetlands/ ecological restoration/ land restoration

1098. Nitrogen transformation and fate in prairie wetlands.

Crumpton, W. G. and Goldsborough, L. G.

Great Plains Research 8(1): 57-72. (1998)

NAL Call #: QH104.5.G73 G755; ISSN: 1052-5165

Abstract: Agricultural applications of fertilizers and pesticides have increased dramatically in the prairie pothole region since the middle 1960s, and agrochemical contamination of surface and groundwater has become a serious environmental concern. There is growing interest in the potential of prairie wetlands as sinks for excess nutrients in this agricultural landscape. As much as 50% of the fertilizer nitrogen applied to cultivated crops may be lost as nitrate in agricultural drainage water, and prairie wetlands may be especially effective as nitrate sinks. The effectiveness of prairie wetlands as sinks for nonpoint source nitrogen loads is likely to depend on the magnitude of nitrate loads and the capacity of the wetlands to remove nitrate by dissimilatory processes. Performance forecast models are needed to evaluate the effectiveness of prairie wetlands as nitrogen sinks from a watershed scale framework. This will be made significantly more difficult by the spatial and temporal complexity of prairie pothole wetlands and by their hydrologic diversity. Future research should focus on identifying the principal factors controlling nitrogen transformation in prairie wetlands and on developing general predictive tools for modeling nitrogen fate in these systems.

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1099. Nutrient retention in a northern prairie marsh (Frank Lake, Alberta) receiving municipal and agro-industrial wastewater.

White, J. S. and Bayley, S. E.

Water, Air, and Soil Pollution 126(1-2): 63-81. (Feb. 2001)

NAL Call #: TD172 .W36; ISSN: 0049-6979

Descriptors: wetlands/ marshes/ nutrient concentrations/ industrial effluents/ wastewater discharges/ ammonia/ nitrates/ phosphorus/ water quality control/ nutrients/ wastewater/ flow discharge/ ponds/ industrial wastewater/

industrial wastes/ domestic wastes/ nutrients (mineral)/ agricultural pollution/ biodegradation/ eutrophication/ seasonal variations/ ice cover/ temperature effects/ industrial waste waters/ Canada, Alberta, Frank L./ prairie marshes/ freshwater pollution/ wastewater treatment processes/ characteristics, behavior and fate/ sewage
Abstract: Agro-industrial wastewater and municipal sewage were used to restore Frank Lake, a 1246 ha northern prairie marsh in southern Alberta, Canada, to provide waterfowl habitat and improve water quality. Mean annual inflow wastewater nutrient concentrations were 17 mg L super(-1) NH sub(3)-N, 30 mg L super(-1) NO sub(3)-N and 11 mg L super(-1) SRP. Mean flows greater than 5000 m super(3) day super(-1) loaded the marsh with 23 000 kg of P annually. Summer NH sub(3)-N, NO sub(3)-N and total phosphorus (TP) surface water concentrations were decreased by 76, 87 and 64%, respectively, as waters flowed through the first basin of the marsh. Winter treatment was less successful, with surface water NH sub(3)-N, NO sub(3)-N and TP reductions of 46, -26 (export) and 26%, respectively. Short-circuiting of water flow through the marsh and cold seasonal conditions with ice cover caused spatial and temporal variation in marsh treatment. Continued high loadings to the marsh may lead to sediment saturation, eutrophication or phosphorus export from the marsh.
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1100. Plant and animal community responses to restored Iowa wetlands.

LaGrange, Theodore G. and James J. Dinsmore
Prairie Naturalist 21(1): 39-48. (1989)
NAL Call #: QH540 .P7; ISSN: 0091-0376
Descriptors: wetlands/ communities/ ecosystems/ habitat management/ habitat surveys/ management/ plants/ wildlife/ administracion/ Iowa
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1101. Restoring prairie wetlands: An ecological approach.

Galatowitsch, Susan M.; Valk, Arnoud van der; and Institute for Wetland and Waterfowl Research.
Ames, Iowa: Iowa State University Press; 246 p. (1994)
Notes: 1st ed.; "A special publication of Ducks Unlimited's Institute for Wetland and Waterfowl Research." Includes bibliographical references and index.
NAL Call #: QH75.G35 1994; ISBN: 0813824990
Descriptors: wetland conservation/ wetland conservation---Prairie Pothole Region/ restoration ecology/ restoration ecology---Prairie Pothole Region/ wetland ecology/ wetland ecology---Prairie Pothole Region
This citation is from AGRICOLA.

1102. The role of water depth and soil temperature in determining initial composition of prairie wetland coenoclines.

Seabloom, E. W.; Van Der Valk, A. G.; and Moloney, K. A.
Plant Ecology 138(2): 203-216. (Oct. 1998)
NAL Call #: QK900.P63; ISSN: 1385-0237
Descriptors: wetlands/ prairies/ soil temperature/ water levels/ seed banks/ recruitment/ USA, Iowa/ water depth/ seedlings/ principal component analysis/ tolerance/ elevation/ correlation analysis/ seeds/ germination/ soils/ temperature effects/ community composition/ aquatic

plants/ USA, Iowa/ species richness/ water and plants/ habitat community studies
Abstract: In this study, we examined the effects of water depth and temperature on seedling recruitment from a prairie wetland seed bank. We collected seed-bank samples from natural and restored prairie pothole wetlands in northwestern Iowa and combined them into a single sample. We examined seedling recruitment from this seed-bank sample in an experimental study using a factorial design of 4 temperature treatments (5 degree night and 15 degree day to 20 degree night and 30 degree day) and 3 water-depth treatments (0, 2, and 7 cm). Principal Components Analysis showed that both water depth and temperature had significant effects on the composition of the seedling community as measured by changes in relative stem density and biomass. Water depth had its strongest effects on stem density while temperature had its strongest effects on biomass. For the 22 most common species, stem density varied with water depth for 95% of the species and with temperature for 50% of the species. Most species with water depth responses had lower stem counts as water depth increased, and for the majority of species with temperature responses stem density increased with temperature. Total, annual, and perennial species richness was negatively correlated with water depth. Total and annual species richness was positively correlated to temperature, while perennial species richness was unresponsive to temperature. In addition, species found at low elevations as adults emerged at higher rates in the deep water treatments while species that occurred at higher elevations as adults had their highest emergence rates in the low water treatments. Our results suggest that differences in environmental conditions along coenoclines can affect the initial distribution of species emerging from the soil seed bank. Water depth sorted seedlings according to their adult water-depth tolerances, and temperature determined the proportion of annuals in the seedling community.
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1103. A synoptic assessment for prioritizing wetland restoration efforts to optimize flood attenuation.

McAllister, L. S.; Peniston, B. E.; Leibowitz, S. G.; Abbruzzese, B.; and Hyman, J. B.
Wetlands 20(1): 70-83. (Mar. 2000)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: wetlands/ rehabilitation/ indicators/ optimization/ synoptic analysis/ prairies/ assessments/ mapping/ priorities/ flood control/ potholes/ flood plains/ regional planning/ environment management/ environmental restoration/ flooding/ USA, north central/ renovation/ maps and mapping/ USA, Prairie Pothole Region/ streamflow and runoff/ conservation/ protective measures and control/ reclamation/ environmental action/ water resources and supplies
Abstract: The placement of wetland restoration projects in a landscape to optimize the functional performance of wetlands on a regional scale is often overlooked. To address this problem, the U.S. Environmental Protection Agency's Landscape Function Project developed the synoptic approach to assign restoration priority to landscape subunits according to selected functional criteria. The approach provides a flexible, ecologically-based framework for allocating limited restoration-resources and preserving valued wetland functions on a landscape scale.

We conducted a synoptic assessment of the Prairie Pothole Region of the north-central U.S. to demonstrate application of the method for our assessment criterion - the marginal decrease in total downstream flood volume per restoration dollar. A criterion is often not directly measurable but can be represented by an index composed of measurements on related variables. In a synoptic assessment, these measured variables, referred to as indicators, are limited to variables for which data are existing, accessible, and uniformly available for the entire region. We developed a conceptual model to guide the development of an index of the assessment criterion. We then ranked landscape subunits based on index values and mapped the ranks to show relative priority for restoration among landscape subunits. We conducted a series of analyses to justify selection of indicators and some of our assumptions. The approach offers multiple options for processing and displaying information for use by wetland managers.
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1104. A test of two annual cover crops for controlling *Phalaris arundinacea* invasion in restored sedge meadow wetlands.

Perry, Laura G. and Galatowitsch, Susan M.
Restoration Ecology 11(3): 297-307. (2003)
NAL Call #: QH541.15.R45R515; ISSN: 1061-2971
Descriptors: annual cover crop value/ invasive species control/ restoration ecology/ sedge meadow wetlands restoration
Abstract: Rapid establishment by aggressive plants such as *Phalaris arundinacea* (reed canarygrass) often interferes with sedge meadow establishment in restored prairie pothole wetlands in the mid-continental United States. Introducing a cover crop during community establishment might suppress *P. arundinacea* invasion in restored prairie potholes by reducing resource availability. We evaluated two potential cover crops, *Echinochloa crusgalli* (barnyardgrass) and *Polygonum lapathifolium* (nodding smartweed), for suppressing *P. arundinacea* invasion in an experimental wetland using replacement series competition experiments. Further, we assessed the effects of *E. crusgalli* and *P. lapathifolium* on sedge meadow establishment by sowing *Carex hystericina*, a common wetland sedge, as a third species at a constant density in the replacement experiments. *Echinochloa crusgalli*, compared with no cover crop, reduced *P. arundinacea* biomass by more than 1,000 g/m² (65%) after two growing seasons. *Polygonum lapathifolium* did not affect *P. arundinacea* biomass. Dense *E. crusgalli* canopies in the first year and thick *E. crusgalli* thatch in the second year substantially reduced light availability for *P. arundinacea* establishment. *Echinochloa crusgalli* also reduced *C. hystericina* biomass by more than 1,800 g/m² (99%) after two growing seasons. *Carex hystericina* biomass was similar in plots sown with *E. crusgalli* to *P. arundinacea* monocultures. Neither *E. crusgalli* nor *P. lapathifolium* is likely to improve sedge meadow restoration success. These trends were not sensitive to initial sowing density or elevation above water level. Without methods to suppress *P. arundinacea* invasions, sedge meadow restorations may often fail. Thorough site preparation to remove *P. arundinacea* propagule sources before restoration is essential.
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1105. Vegetation and environmental conditions in recently restored wetlands in the Prairie Pothole Region of the USA.

Galatowitsch, S. M. and Van Der Valk, A. G.
Vegetatio 126(1-4): 89-99. (1996)
NAL Call #: 450 V52; ISSN: 0042-3106.
Notes: Conference: 6. International Congress of Ecology, Manchester (UK), Aug 1994
Descriptors: wetlands/ plant populations/ ecosystem management/ soils/ community composition/ dispersion/ environmental conditions/ surface water/ flooding/ vegetation patterns/ environmental restoration/ environmental quality/ vegetation/ water level fluctuations/ USA, Prairie Pothole Region
Abstract: How closely the vegetation of restored wetlands resembles that of comparable natural wetlands is a function of the probability of propagules of wetland species reaching reflooded wetlands and how similar environmental conditions in the restored wetland are those in the natural wetlands. Three years after reflooding, we examined the vegetation composition, water level fluctuations, soil organic carbon content, and soil bulk density as well as surface water pH, alkalinity, conductivity, and calcium and magnesium concentrations of 10 restored and 10 natural wetlands. In the restored wetlands, more species of submersed aquatics colonized than were found in natural wetlands, and they rapidly spread to form extensive beds that were larger than those found in natural wetlands. Emergent and wet meadow species in restored wetlands, however, were found in only sparse stands as were a variety of annuals. The vegetation of natural wetlands was predominantly large stands of emergent species. Fluctuations in water storage volume and basin surface area were similar for both restored and natural wetlands. The surface water in restored wetlands had higher pH and lower alkalinity, conductivity, and calcium and magnesium concentrations than that in natural wetlands. Soils of restored wetlands have a lower organic carbon content and higher bulk density than do those of natural wetlands. Our results suggest that for submersed aquatics, dispersal of propagules to restored wetlands is rapid and environmental conditions in restored wetlands are very suitable for their establishment. For other guilds of wetland species, e.g., sedges and other wet meadow species, dispersal to restored wetlands is likely much slower and may pose a serious problem for the re-establishment of these species in restored wetlands. Even if dispersal is not limiting, low surface organic carbon and high bulk density may prevent the establishment of these species in restored wetlands.
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1106. Walnut Creek Watershed Monitoring Project, Iowa: Monitoring water quality in response to prairie restoration.

Schilling, K. E. and Thompson, C. A.
Journal of the American Water Resources Association 36(5): 1101-1114. (Oct. 2000)
NAL Call #: GB651.W315; ISSN: 1093-474X
Descriptors: wetlands/ habitat improvement/ water quality control/ environmental protection/ agricultural runoff/ eutrophication/ pesticides/ pollution monitoring/ USA, Iowa/ watershed management/ prairies/ agriculture/ land use/ land management/ herbicides/ water quality/ nitrates/ streamflow/ water management/ land/ water quality (natural waters)/ nitrate/ pesticides/ stream flow/ water quality

measurements/ watersheds/ nitrogen/ environmental restoration/ atrazine/ USA, Iowa, Walnut Creek/ USA, Iowa, Walnut Creek/ USA, Iowa/ conservation, wildlife management and recreation/ effects on water of human nonwater activities/ water quality/ freshwater pollution

Abstract: Land use and surface water data for nitrogen and pesticides (1995 to 1997) are reported for the Walnut Creek Watershed Monitoring Project, Jasper County Iowa. The Walnut Creek project was established in 1995 as a nonpoint source monitoring program in relation to watershed habitat restoration and agricultural management changes implemented at the Neal Smith National Wildlife Refuge by the U.S. Fish and Wildlife Service. The monitoring project utilizes a paired-watershed approach (Walnut and Squaw creeks) as well as upstream/downstream comparisons on Walnut for analysis and tracking of trends. From 1992 to 1997, 13.4 percent of the watershed was converted from row crop to native prairie in the Walnut Creek watershed. Including another 6 percent of watershed farmed on a cash-rent basis, land use changes have been implemented on 19.4 percent of the watershed by the USFWS. Nitrogen and pesticide applications were reduced an estimated 18 percent and 28 percent in the watershed from land use changes. Atrazine was detected most often in surface water with frequencies of detection ranging from 76-86 percent. No significant differences were noted in atrazine concentrations between Walnut and Squaw Creek. Nitrate-N concentrations measured in both watersheds were similar; both basins showed a similar pattern of detection and an overall reduction in nitrate-N concentrations from upstream to downstream monitoring sites. Water quality improvements are suggested by nitrate-N and chloride ratios less than one in the Walnut Creek watershed and low nitrate-N concentrations measured in the subbasin of Walnut Creek containing the greatest amount of land use changes. Atrazine and nitrate-N concentrations from the lower portion of the Walnut Creek watershed (including the prairie restoration area) may be decreasing in relation to the upstream untreated component of the watershed. The frequencies of pesticide detections and mean nitrate-N concentrations appear related to the percentage of row crop in the basins and subbasins. Although some results are encouraging, definitive water quality improvements have not been observed during the first three years of monitoring. Possible reasons include: (1) more time is needed to adequately detect changes; (2) the size of the watershed is too large to detect improvements; (3) land use changes are not located in the area of the watershed where they would have greatest effect; or (4) water quality improvements have occurred but have been missed by the project monitoring design. Longer-term monitoring will allow better evaluation of the impact of restoration activities on water quality.

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Wetlands in Multiple CEAP Wetlands Assessment Regions

General Information

1107. Analysis of wetland trends and management alternatives for Georgia.

Woolf, S. W. and Kundell, J. E.

Atlanta: Environmental Resources Center, Georgia Institute of Technology; Report No. Erc 01-85, 1985. 154 p.

Descriptors: wetlands/ coastal marshes/ Georgia/ land use/ salt marshes/ alternative planning/ drainage/ erosion/ estuaries/ flood control/ forest management/ marshes/ soils/ urban runoff/ vegetation/ water management/ waterfowl

Abstract: Georgia is experiencing 'Sunbelt' population growth and expansions in agricultural and forestry production resulting in increased pressure to convert wetlands to other uses. An analysis was undertaken of data generated by the Fish & Wildlife Service's National Wetland Inventory, Georgia Department of Natural Resource's Landsat Land use study, and Soil Conservation Service's National Resources Inventory. Wetland acreage, distribution, types, and trends were identified for Georgia. A review of case law and statutory law was conducted and wetland management activities of federal, state, and local governments were determined. Alternative management strategies were identified for Georgia.

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1108. Bayous of the northern Gulf of Mexico: Distribution and trophic ecology of invertebrates.

Gaston, Gary R.

In: Invertebrates in freshwater wetlands of North America: Ecology and management/ Batzer, Darold P.; Rader,

Russell B.; and Wissinger, Scott A.

New York: John Wiley & Sons, 1999; pp. 919-947.

Notes: ISBN: 0471292583

NAL Call #: QL365.4.A1158

Descriptors: Invertebrata/ ecology/ functional ecology of bayous streams/ trophic structure/ population density/ bayous streams/ brackish habitat/ USA/ Gulf of Mexico, north coast/ bayous streams functional ecology

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1109. Changes in piping plover nesting habitat availability at Great Plains alkaline wetlands, 1938-1997.

Root, Brian G. and Ryan, Mark R.

Wetlands 24(4): 766-776. (2004)

NAL Call #: QH75.A1W47; *ISSN:* 0277-5212

Descriptors: alkaline wetland/ fire frequency/ flooding impact/ ground water hydrology/ livestock grazing intensity/ long term recovery/ nesting habitat availability/ surface water level/ total beach habitat/ vegetation encroachment

Abstract: Alkaline wetland beaches provide crucial habitat for breeding piping plovers (*Charadrius melodus*) in the northern Great Plains of the United States and Canada. Vegetation encroachment has been identified as a potential threat that decreases alkaline beach habitat availability, but the long-term status of these breeding habitats has not been evaluated. We measured vegetation changes at two North Dakota alkaline wetland complexes from 1938 to 1997. Total beach habitat, including lower beaches that were impacted by flooding, varied substantially among years based on changes in surface-water levels. Quantities

of upper-beach habitats, which were not affected by inundation, were negatively correlated with precipitation amounts during the previous five-year periods. We measured declines in upper-beach habitat averaging 0.89 ha/yr and 0.20ha/yr at our two wetland complexes from 1938 to 1997, suggesting that long-term changes in factors other than precipitation (e.g., ground-water hydrology, livestock grazing intensity, or fire frequency) may be negatively affecting beach availability. Vegetation reduction may be critical to long-term recovery of threatened piping plovers in the Great Plains.

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1110. Characteristics of wetland habitats and waterfowl populations in Oklahoma.

Heitmeyer, Mickey E. / Oklahoma State University, 1980.

Notes: Thesis (M.S.)

NAL Call #: QH87.3.H45 1980

Descriptors: wetlands, Oklahoma/ waterfowl, Oklahoma

This citation is from AGRICOLA.

1111. Climate change, hurricanes and tropical storms, and rising sea level in coastal wetlands.

Michener, W. K.; Blood, E. R.; Bildstein, K. L.;

Brinson, M. M.; and Gardner, L. R.

Ecological Applications 7(3): 770-801. (1997)

NAL Call #: QH540.E23; *ISSN:* 1051-0761

Descriptors: climate change/ coastal wetlands in southeastern United States/ colonial waterbirds and hurricanes/ comparative studies, conceptual models of hurricanes/ moisture-continuum model/ sea level rise/ space-for-time substitution/ tropical storms

Abstract: Global climate change is expected to affect temperature and precipitation patterns, oceanic and atmospheric circulation, rate of rising sea level, and the frequency, intensity, timing, and distribution of hurricanes and tropical storms. The magnitude of these projected physical changes and their subsequent impacts on coastal wetlands will vary regionally. Coastal wetlands in the southeastern United States have naturally evolved under a regime of rising sea level and specific patterns of hurricane frequency, intensity, and timing. A review of known ecological effects of tropical storms and hurricanes indicates that storm timing, frequency, and intensity can alter coastal wetland hydrology, geomorphology, biotic structure, energetics, and nutrient cycling. Research conducted to examine the impacts of Hurricane Hugo on colonial waterbirds highlights the importance of longterm studies for identifying complex interactions that may otherwise be dismissed as stochastic processes. Rising sea level and even modest changes in the frequency, intensity, timing, and distribution of tropical storms and hurricanes are expected to have substantial impacts on coastal wetland patterns and processes. Persistence of coastal wetlands will be determined by the interactions of climate and anthropogenic effects, especially how humans respond to rising sea level and how further human encroachment on coastal wetlands affects resource exploitation, pollution, and water use. Long-term changes in the frequency, intensity, timing, and distribution of hurricanes and tropical storms will likely affect biotic

functions (e.g., community structure, natural selection, extinction rates, and biodiversity) as well as underlying processes such as nutrient cycling and primary and secondary productivity. Reliable predictions of global-change impacts on coastal wetlands will require better understanding of the linkages among terrestrial, aquatic, wetland, atmospheric, oceanic, and human components. Developing this comprehensive understanding of the ecological ramifications of global change will necessitate close coordination among scientists from multiple disciplines and a balanced mixture of appropriate scientific approaches. For example, insights may be gained through the careful design and implementation of broad-scale comparative studies that incorporate salient patterns and processes, including treatment of anthropogenic influences. Well-designed, broad-scale comparative studies could serve as the scientific framework for developing relevant and focused long-term ecological research, monitoring programs, experiments, and modeling studies. Two conceptual models of broad-scale comparative research for assessing ecological responses to climate change are presented: utilizing space-for-time substitution coupled with long-term studies to assess impacts of rising sea level and disturbance on coastal wetlands, and utilizing the moisture-continuum model for assessing the effects of global change and associated shifts in moisture regimes on wetland ecosystems. Increased understanding of climate change will require concerted scientific efforts aimed at facilitating interdisciplinary research, enhancing data and information management, and developing new funding strategies.
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1112. Colonization of restored wetlands by amphibians in Minnesota.

Lehtinen, Richard M. and Galatowitsch, Susan M.
American Midland Naturalist 145(2): 388-396. (2001)
NAL Call #: 410 M58; ISSN: 0003-0031
Descriptors: aquatic vegetation cover/ colonization/ habitat suitability/ restored wetlands/ water chemistry
Abstract: Twelve wetlands (7 recently restored; 5 reference) in central and southern Minnesota were monitored during the 1998 breeding season to assess colonization of recently restored wetlands by amphibians, compare the amphibian fauna to that of reference wetlands and identify important factors influencing the probability of colonization. Eight amphibian species rapidly colonized recently restored wetlands and established breeding populations. Reference wetlands were inhabited by twelve species, including four not found in restored wetlands (*Ambystoma laterale*, *Notophthalmus viridescens*, *Pseudacris crucifer* and *Rana clamitans*). Most local habitat variables, such as water chemistry or aquatic vegetation cover, were not influential in determining species richness patterns in recently restored wetlands. Size and spatial isolation of restored wetlands, however, were important predictors of species richness. Habitat suitability also influenced the probability of colonization for some species. The results of this study indicate that restored wetlands are valuable habitat for at least a subset of the amphibian fauna of this region and that wetland size, isolation and habitat suitability all influence colonization success.
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1113. A comparison of the watershed hydrology of coastal forested wetlands and the mountainous uplands in the Southern US.

Sun, G.; McNulty, S. G.; Amatya, D. M.; Skaggs, R. W.; Swift, L. W.; Shepard, J. P.; and Riekerk, H.
Journal of Hydrology 263(1-4): 92-104. (2002)
NAL Call #: 292.8 J82; ISSN: 0022-1694
http://www.srs.fs.usda.gov/pubs/ja/ja_sun002.pdf
Descriptors: USA, Southeast/ catchment areas/ watersheds/ hydrology/ streamflow comparison/ studies/ forests/ climatology/ topography/ regional analysis/ stream flow/ comparative studies/ forest hydrology/ wetlands development/ hydrologic data/ long-term changes/ seasonal variations/ runoff/ storms/ climate/ USA, Southeast
Abstract: Hydrology plays a critical role in wetland development and ecosystem structure and functions. Hydrologic responses to forest management and climate change are diverse in the Southern United States due to topographic and climatic differences. This paper presents a comparison study on long-term hydrologic characteristics (long-term seasonal runoff patterns, water balances, storm flow patterns) of three watersheds in the southern US. These three watersheds represent three types of forest ecosystems commonly found in the lower Atlantic coastal plain and the Appalachian upland mountains. Compared to the warm, flat, and shallow groundwater dominated pine flatwoods on the coast, the inland upland watershed was found to have significantly higher water yield, Precipitation/Hamon's potential evapotranspiration ratio (1.9 for upland vs 1.4 and 0.9 for wetlands), and runoff/precipitation ratio (0.53 plus or minus 0.092 for upland vs 0.30 plus or minus 0.079 and 0.13 plus or minus 0.094 for wetlands). Streamflow from flatwoods watersheds generally are discontinuous most of the years while the upland watershed showed continuous flows in most years. Stormflow peaks in a cypress-pine flatwoods system were smaller than that in the upland watershed for most cases, but exceptions occurred under extreme wet conditions. Our study concludes that climate is the most important factor in determining the watershed water balances in the southern US. Topography effects streamflow patterns and stormflow peaks and volume, and is the key to wetland development in the southern US.
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1114. Conserving Southeastern coastal wetlands.

Southworth, A. D.
Audubon Wildlife Report 1989/1990: 223-257. (1989)
NAL Call #: QL84.2.A8; ISSN: 0885-6044
Abstract: Introduces the problems of general wetland loss in the USA, emphasising the status of Southeastern coastal wetlands. Acreage statistics are included, with a summary of wetland losses, the causes of such loss, and the impact on fish and wildlife. Federal regulatory programmes are described, including the Clean Water Act. State regulatory programmes include wetland regulations in North Carolina, Florida, Louisiana and Texas. Non-regulatory programmes like Coastal Zone Management Acts, Coastal Barrier Resources Acts, acquisition programmes and State planning programmes are considered, as are restoration and management efforts. -S.J.Yates
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1115. Constructed wetlands for wastewater treatment: Municipal, industrial and agricultural.

In: Proceedings from the First International Conference on Constructed Wetlands for Wastewater Treatment . (Held 13 Jun 1988-17 Jun 1988 at Chattanooga, Tennessee.) Hammer, Donald A. (eds.)

Chelsea, Michigan: Lewis Publishers; 831 p.; 1989.

NAL Call #: TD756.5.C66

Descriptors: wetlands/ land disposal/ conferences/ wastewater treatment/ artificial wetlands/ biological wastewater treatment/ water pollution control/ macrophytes/ municipal wastewater/ industrial wastewater/ agricultural wastewater/ tennessee/ wastewater treatment processes/ ultimate disposal of wastes/ lakes

Abstract: Widespread use of constructed wetlands may provide a relatively simple and inexpensive solution for controlling many water pollution problems facing small communities, industries, and agricultural operations. Adoption of this technology has been inhibited by a lack of guidelines and instructions supported by adequate information on important system components and basic wetlands ecology. The goal of the present volume is to provide information to improve acceptance and increase application of constructed wetlands for water quality improvements. The book represents the proceedings of the First International Conference on Constructed Wetlands for Wastewater Treatment, held at Chattanooga, Tennessee, on 13-17 June 1988. Besides wetlands treatment of municipal wastewater, which has been the subject of other conferences, this volume includes applications with acid mine drainage, urban runoff, agricultural wastes, and industrial effluents. Topics include: general principles (hydrology, chemistry, physics, ecology, and microbiology); case histories (pilot and full-scale plants); design, construction, and operation; and recent results from field and laboratory (dynamics of inorganic and organic materials in wetlands, efficiencies of substrates, vegetation, water levels, and microbial populations, management of domestic and municipal wastewaters, nonpoint source pollutants (urban runoff and agricultural wastes), applications to industrial and landfill wastewaters, and control of acid mine drainage including coal pile and ash pond seepage).

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1116. Creation and restoration of coastal plain wetlands in Florida.

Lewis, R. R.

In: Wetland Creation and Restoration: The Status of the Science.

Covelo, Calif.: Island Press, 1990; pp. 73-101.

Notes: ISBN: 1559630450

NAL Call #: QH541.5.M3W462

Descriptors: artificial wetlands/ Florida/ tidal marshes/ water resources management/ wetland restoration/ drainage engineering/ environmental impact/ habitat restoration/ mangrove swamps/ plant populations/ planting management/ tidal effects/ vegetation establishment/ water resources development

Abstract: Despite hundreds of mangrove and tidal marsh restoration and creation efforts in Florida over the last fifteen years, current efforts are largely more art than science. Adequate monitoring and reporting are rare, and no institutional memory exists to improve the review and monitoring process. An overview of the Floridian region is

given, followed by discussions of the extent to which creation/restoration has occurred, the design of creation/restoration projects, monitoring, and information gaps and research needs. Appendices include recommended reading, a list of project profiles, and a permit review checklist for Florida coastal wetlands. Based on a critical review of actual projects and the sparse literature, five factors appear most important to successful wetland establishment; these are: (1) correct elevations for the target plant species; (2) adequate drainage provided by gradual slopes and sufficient tidal connections; (3) appropriate site selection to avoid wave damage; (4) appropriate plant materials; and (5) protection from human impacts.

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1117. Creation and restoration of forested wetland vegetation in the southeastern USA.

Clewell, A. F. and Lea, R.

In: Wetland Creation and Restoration: The Status of the Science/ Kusler, J. A. and Kentual, M. E.

Island Press: Washington, D.C., 1990; pp. 195-232

NAL Call #: QH541.5.M3W462

Descriptors: conservation/ ecology: environmental sciences/ estuarine ecology: ecology, environmental sciences/ forestry/ pest assessment control and management/ soil science/ wildlife management: conservation/ animal marsh vs. forest replacement/ hydrology substrate/ soil fertility wetland type/ ecological function/ herbivore control/ weed control/ mine reclamation/ water management/ revegetation/ biomonitoring/ Kentucky/ South Carolina/ Florida/ Louisiana/ Arkansas/ Virginia/ North Carolina/ Tennessee/ Georgia

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1118. Development of Ohio's GIS-based wetlands inventory.

Yi, Gi-Chul; Risley, D.; Koneff, M.; and Davis, C.

Journal of Soil and Water Conservation 49(1): 23-28. (1994)

NAL Call #: 56.8 J822; ISSN: 0022-4561

Descriptors: wetlands/ mapping/ inventories/ environmental protection/ classification/ geographic information systems/ USA, Ohio/ GIS/ geographic information systems/ inventories/ classification/ conservation, wildlife management and recreation/ environmental action/ network design

Abstract: Of Ohio's original 26.4 million acres, more than five million are classified as hydric soils or having hydric inclusions, a condition indicative of wetlands. Today, about 800,000 acres, less than 20 percent of the historical wetlands, remain unaltered. Ohio's legacy of wetland degradation reflects the national trend with respect to inland wetland losses attributable to agricultural, residential, and commercial development as well as other uses. Today, the state's remaining wetlands are threatened by such activities as land development, draining, land-filling, conversion to agriculture, and highway construction. The threats to wetlands are varied and complex. While pressures to convert wetlands mount, there is a growing public awareness of the value of wetlands. State-of-the-art mapping systems, Geographic Information Systems (GIS), were used in the creation of the Ohio Wetland Inventory. GISs are computer hardware and software configurations specifically designed to manipulate, interpret, and manage

large spatially referenced data bases. These systems can be successfully applied to the integration of natural, cultural, social, and economic information and utilized as interactive spatial data processing systems.
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1119. Ecological relationships between landscape change and plant guilds in depressional wetlands.

Lopez, Ricardo D.; Davis, Craig B.; and Fennessy, M. Siobhan

Landscape Ecology 17(2): 43-56. (2002)

NAL Call #: QH541.15.L35 L36; ISSN: 0921-2973

Descriptors: ecology: environmental sciences/ freshwater ecology: ecology, environmental sciences/ nested quadrat sampling/ field method, sampling method/ depressional wetlands/ ecological relationships: landscape change, plant guilds/ land cover type: cropland, forest, grassland, open water, urban land

Abstract: We used plant guilds to measure the relationships between wetland plant community characteristics and landscape change around 31 depressional wetlands in central Ohio, USA. Characteristics of certain plant guilds within each wetland site are correlated with changes in: (a) area of urban land cover, forest, grassland, agriculture, and open-water in the local vicinity of the wetland; (b) inter-wetland distance; and (c) wetland size (area). Taxa richness is negatively correlated with inter-wetland distance for all plant guilds, except submersed herbaceous plants. Taxa richness of the submersed herbaceous plant guild (usually less than 20% of the total number of plant species at a wetland) is positively correlated with the area of open-water in the local landscape and with the area of the wetland site itself. Significant positive correlations also exist between the area of open-water in the vicinity of the wetland and the proportion of submersed herbaceous plant taxa at the site, the number of native submersed herbaceous plant species, the submersed herbaceous plant perennial-to-annual ratio, and the number of avian-dispersed submersed herbaceous plant species at a site. The results suggest that (a) the dominance of submersed herbaceous plant species at a site is related to dispersal constraints between wetlands, and (b) the relatively slower physiological response of woody plants to local landscape change may result in their contribution to greater 'ecological inertia' in the plant community as a whole. For these reasons, relationships between the plant community and land cover change may not always be observed unless analyzed at the level of plant-guild.

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1120. Ecosystem dynamics of protists and bacteria in a lotic wetland ecosystem.

Johnson, M. D.

Tuscaloosa, AL: University of Alabama at Tualoosa, 1995.

Descriptors: wetlands/ abundance/ bacteria/ biomass/ ciliates/ ecosystem dynamics/ organic carbon/ protists/ seasonal changes/ ecology/ bacteria/ fungi/ viruses/ North America/ United States/ Insertae/ Sedis/ Ophrydium versatile

Abstract: Despite their importance, little information is available on the ecology of protists and bacteria in freshwater wetland ecosystems. Microbial communities were compared monthly at eight sites in a lotic wetland within the coastal plain region of the southeastern United

States, from upstream, through an alder swamp, reed marsh, and water lily pond, to a downstream site. Protist abundances and biomass, and bacterial abundances, biomass, and productivity were all generally greater in the wetland habitats compared to up stream and downstream sites, especially in summer. Among wetland habitats, planktonic microbial populations were most productive in the reed marsh and among submerged aquatic plants, and lowest in the alder swamp. The planktonic microbial communities were primarily heterotrophic. Dissolved organic carbon (DOC) derived from aquatic plant community production during summer in the wetland pond stimulated planktonic bacterial production, which served as a primary food source for protozoa. The wetland habitats affected the lotic system as a whole by substantially increasing the amount of microbial biomass transported downstream. In the wetland pond, DOC concentrations, bacterial abundance and productivity, and protist abundance were more than an order of magnitude higher during warm months than cool months. Out-of-phase oscillations between microbial populations suggested protist grazing pressure strongly affected bacterial abundance during the warm months. Experiments using natural microbial communities showed similar uptake rates of macrophyte leachate by both grazed and un grazed bacteria. However, in the plankton, grazing of bacteria by nanoflagellates resulted in greatly increased rates of carbon mineralization to carbon dioxide (CO₂) rather than making this carbon available to other trophic levels. Ophrydium versatile, a mixotrophic, colonial ciliate was studied to determine seasonal changes in its distribution, primary productivity, and rates of bacterivory. Summer rates of primary production and bacterial consumption were higher than any other season on the basis of colony surface area. However, high bacterial productivity and limited ciliate distribution diminished their importance to the pond ecosystem in summer. During the winter, these ciliates functioned primarily as bacterivores, and low planktonic bacterial productivity combined with a wide distribution of large ciliate colonies made O. versatile capable of clearing up to one-third of the water column of bacterial production daily.

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1121. Environmental characteristics of Oklahoma wetlands.

Heitmeyer, Mickey E. and Vohs, Paul A.

Stillwater, Okla.: Oklahoma State University; Series: Environment series 5; 141 p. (1981)

NAL Call #: QH541.5.M3H4

Descriptors: wetlands Oklahoma/ wetland ecology Oklahoma

This citation is from AGRICOLA.

1122. Evaluating regional differences in macroinvertebrate communities from forested depressional wetlands across eastern and central North America.

Batzer, Darold P.; Dietz Brantley, Susan E.; Taylor, Barbara E.; and DeBiase, Adrienne E.

Journal of the North American Benthological Society 24(2): 403-414. (June 2005)

NAL Call #: QL141.F7; ISSN: 0887-3593

Descriptors: Macroinvertebrata/ community structure/ forested depressional wetland habitats/ semiaquatic

habitat/ forested depressional wetlands/ community structures/ North America, central and eastern/ forested depressional wetland habitat community structures/ regional differences

Abstract: Forested depressional wetlands are an important seasonal wetland type across eastern and central North America. Macroinvertebrates are crucial ecosystem components of most forested depressional wetlands, but community compositions can vary widely across the region. We evaluated variation in macroinvertebrate faunas across eastern and central North America using 5 published taxa lists from forested depressional wetlands in Michigan, Ontario, Wisconsin, Florida, and Georgia. We supplemented those data with quantitative community descriptions generated from 17 forested depressional wetlands in South Carolina and 74 of these wetlands in Minnesota. Cluster analysis of presence/absence data from these 7 locations indicated that distinct macroinvertebrate communities existed in northern and southern areas. Taxa characteristic of northern forested depressional wetlands included Sphaeriidae, Lumbriculidae, Lymnaeidae, Physidae, Limnephilidae, Chirocephalidae, and Hirudinea (Glossophoniidae and/or Erpobellidae) and taxa characteristic of southern sites included Asellidae, Crangonyctidae, Noteridae, and Cambaridae. Quantitative sampling in South Carolina and Minnesota indicated that regionally characteristic taxa included some of the most abundant organisms, with Sphaeriidae being the 2nd most abundant macroinvertebrate in Minnesota wetlands and Asellidae being the 2nd most abundant macroinvertebrate in South Carolina wetlands. Mollusks, in general, were restricted to forested depressional wetlands of northern latitudes, a pattern that may reflect a lack of Ca needed for shell formation in acidic southern sites. Differences in community composition probably translate into region-specific differences in the ecological functions performed by macroinvertebrates in forested depressional wetlands.
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1123. Forested wetland area and distribution: A detailed look at the South.

Cubbage, F. W. and Flather, C. H.
Journal of Forestry 91(5): 35-39. (1993)
NAL Call #: 99.8 F768; ISSN: 0022-1201
Descriptors: wetlands/ watershed management/ forestry/ protection/ federal jurisdiction/ regulations/ distribution/ environmental protection/ classification systems/ ecosystem management/ environment management/ geographical distribution/ USA, Southeast/ watershed management/ forestry/ federal jurisdiction/ regulations/ watershed protection/ conservation, wildlife management and recreation
Abstract: Debate over the classification, protection, and management of forested wetlands has intensified in recent years. Federal agencies have classified US wetlands in various manners, leading to frequent protests by groups favoring more or less stringent criteria. In addition, wetland issues have faced an evolving scope of federal water pollution laws applying to wetland regulation; a unified federal wetland delineation manual whose implementation was opposed by the executive branch and some members of Congress; and introduction of bills to redefine wetlands. Despite continuing debate, there is still no single definition of wetlands, and very little information is available on their actual area and distribution in the United States, especially

forested wetlands. In fact, published estimates of forest wetland acreage have varied widely, increasing confusion about the implications of permit requirements of management restrictions. More reliable data on forested wetland extent and trends can clarify our knowledge and contribute to future discussions. Accordingly, this article summarizes the latest data on the acreage and regional distribution of forested wetlands in the United States. Since almost two-thirds are in the South, it also examines the distribution of forest wetland types among southern subregions.
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1124. Forested wetlands of the Southeast: Review of major characteristics and role in maintaining water quality.

Winger, P. V. Fish and Wildlife Service, U.S. Department of the Interior, 1986. Resource Publication.
Abstract: The productive and ecologically diverse forested wetlands occupying the floodplains of major rivers in the US Southeast are produced and maintained by fluvial processes and periodic flooding. The shift between aerobic and anaerobic conditions in the floodplain soil in response to flooding facilitates assimilation of nutrients and organic matter, hastens degradation of persistent pesticides, and decreases the bioavailability of heavy metals. -Author
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1125. Forested wetlands of the southern United States. Hook, Donal D. and Lea, Russ (eds.) Proceedings of the symposium. (Held 12 Jul 1988-14 Jul 1988 at Orlando, Fla.) Asheville, N.C.: United States Dept. of Agriculture Forest Service; 168 p.; 1989.
NAL Call #: aSD433.A53 no.50
http://www.srs.fs.usda.gov/pubs/gtr/gtr_se050.pdf
Descriptors: forest management--United States--congresses/ wetlands--United States--congresses/ wetland conservation--United States--congresses/ wetland ecology--United States--congresses
This citation is from AGRICOLA.

1126. Functional assessment of five wetlands constructed to mitigate wetland loss in Ohio, USA.

Wilson, R. F. and Mitsch, W. J.
Wetlands 16(4): 436-451. (1996)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: wetlands/ habitat improvement/ man-induced effects/ nature conservation/ evaluation/ hydrology/ marshes/ environmental restoration/ USA, Ohio/ evaluation/ depression wetlands/ environmental restoration/ habitat improvement/ man-induced effects/ nature conservation
Abstract: Five replacement wetlands in Ohio, USA, were investigated to determine their ecological and legal success. Hydrology, soils, vegetation, wildlife, and water quality of each wetland determined their functional success. The progress of the wetlands was also compared to their legal requirements. Four of the five wetlands (80%) were in compliance with legal requirements and the same four wetlands demonstrated medium to high ecosystem success. For the four wetlands, a replacement ratio of 1.4:1 was achieved for area, and depressional wetlands were generally replaced with depressional wetlands.
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1127. The geological history of the marshes of coastal Louisiana.

Leblanc, R. J.

In: Marsh Management in Coastal Louisiana: Effects and Issues. (Held 7 Jun 1988-10 Jun 1988 at Baton Rouge, LA.) Duffy, W. G. and Clark, D. (eds.): Fish and Wildlife Service, U.S. Department of the Interior; pp. 1-27; 1989. NAL Call #: QH540.U562 no.89(22)

Abstract: Part I of this paper consists of a brief description of the deltaic plain complex. Part II is concerned with the description of the coastal bays, sounds, transgressive barrier islands and offshore shoals which are related to the delta complex. Part III discusses 51 significant papers on the delta complex which have been written during the past 58 years. Part IV is a brief summary of the origin and development of the coastal region of southeast Louisiana based upon the research outlined above. -from Author © 2006 Elsevier B.V. All rights reserved.

1128. The hydrogeomorphic approach to functional assessment of riparian wetlands: Evaluating impacts and mitigation on river floodplains in the USA.

Hauer, F. Richard and Smith, R. Daniel
Freshwater Biology 40(3): 517-530. (1998)

Descriptors: conservation/ freshwater ecology: ecology, environmental sciences/ hydrogeomorphic classification/ assessment method/ bottomland hardwood forest/ compensatory mitigation/ functional assessment/ human impact/ riparian wetlands/ river floodplains

Abstract: 1. The 'hydrogeomorphic' approach to functional assessment of wetlands (HGM) was developed as a synthetic mechanism for compensatory mitigation of wetlands lost or damaged by human activities. The HGM approach is based on: (a) classification of wetlands by geomorphic origin and hydrographic regime (b) assessment models that associate variables as indicators of function, and (c) comparison to reference wetlands that represent the range of conditions that may be expected in a particular region. In this paper, we apply HGM to riparian wetlands of alluvial rivers. 2. In the HGM classification, riverine wetlands are characterized by formative fluvial processes that occur mainly on flood plains. The dominant water sources are overbank flooding from the channel or subsurface hyporheic flows. Examples of riverine wetlands in the U.S.A. are: bottomland hardwood forests that typify the low gradient, fine texture substratum of the south-eastern coastal plain and the alluvial flood plains that typify the high gradient, coarse texture substratum of western montane rivers. 3. Assessment (logic) models for each of fourteen alluvial wetland functions are described. Each model is a composite of two to seven wetland variables that are independently scored in relation to a reference data set developed for alluvial rivers in the western U.S.A. Scores are summarized by a 'functional capacity index' (FCI), which is multiplied by the area of the project site to produce a dimensionless 'functional capacity unit' (FCU). When HGM is properly used, compensatory mitigation is based on the FCUs lost that must be returned to the riverine landscape under statutory authority. 4. The HGM approach also provides a framework for long-term monitoring of mitigation success or failure and, if failing, a focus on topical remediation. 5. We conclude that HGM is a robust and easy method for protecting riparian wetlands, which are critically important components of alluvial river landscapes.

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1129. Hydrologic model for design and constructed wetlands.

Arnold, J. G.; Allen, P. M.; and Morgan, D. S.
Wetlands 21(2): 167-178. (2001)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: flow discharge/ model studies/ hydrology/ watersheds/ topography/ soil water plant relationships/ climatic changes/ land use/ artificial wetlands/ mathematical models/ water budget/ stream flow/ design/ soils/ topographic features/ Texas/ Trinity River/ United States

Abstract: The Trinity River Mitigation Bank was proposed to develop and use a mature, contiguous, diverse riparian corridor along the West Fork of the Trinity River near Dallas, Texas, USA. In the proposed wetland design, water would be diverted from Walker Creek as necessary to maintain wetland function. Therefore, assessment of the magnitude and continuity of the flow from Walker Creek was paramount to successful wetland operation. The Soil and Water Assessment (SWAT) model was used to assess whether the sustained flow (storm flow and base flow) from the Walker Creek Basin could maintain the proposed bottomland wetland ecosystem. For this study, SWAT was modified to allow ponded water within the prescribed wetland to interact with the soil profile and the shallow aquifer. The water budget was prepared for the wetland based on a three-step process. First, data required to run the model on Walker Creek, including soils, topographic, land-use, and daily weather data were assembled. Next, data required to validate the model were obtained. Since stream flow was not available at the proposed site, flow from a nearby watershed with similar soils, land use and topography were used. In the final step, the model was run for 14 years and compared to the measured water balance at the nearby watershed. The model results indicate that the wetland should be at or above 85 percent capacity over 60 percent of the time. The wetland did not dry up during the entire simulated time period (14 years) and reached 40 percent capacity less than one percent of the time during the simulation period. The advantages of the continuous simulation approach used in this study include (1) validation of wetland function (hydroperiod, soil water storage, plant water uptake) over a range of climatic conditions and (2) the ability to assess the long-term impact of land-use and management changes.

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1130. Hydrology, vegetation, and soils of riverine and tidal floodplain forests of the lower Suwannee River, Florida, and potential impacts of flow reductions.

Light, Helen M.; Darst, Melanie R.; and Lewis, Lori J.
Denver, CO: U.S. Geological Survey, 2002. 124 p. U.S. Geological Survey professional paper.

NAL Call #: 407 G29Pr no. 1656A

Descriptors: hydrology, forest---Suwannee River Watershed (Ga. and Fla.)/ streamflow---Suwannee River Watershed (Ga. and Fla.)/ hydrology, forest---Florida/ streamflow---Florida/ Suwannee River Watershed (Ga. and Fla.)

This citation is from AGRICOLA.

1131. Implications of environmental change for energy flow through natural systems: Freshwater wetlands and coastal zones.

Chasar, L. C.

Tallahassee, FL: Florida State University of Tallahassee, 2002.

Descriptors: carbon/ coastal zones/ energy flow/ environmental changes/ Florida Bay/ freshwater wetlands/ northern Minnesota/ coastal environments/ ecology

Abstract: Freshwater wetlands and coastal zones are complex ecosystems threatened by direct (e.g., encroachment, water/waste management) and indirect (e.g., climate change) human disturbances. My research evaluates a northern peatland and a subtropical estuary using natural abundance isotopes to trace the origin, transport and transformation of energy through these systems. This information is used in establishing current levels of functioning, comparing present to past status, and constructing models of potential responses to continually changing environmental conditions. Peat-accumulating wetlands are often characterized by their ability to store carbon. In a northern Minnesota peatland, radiocarbon and stable carbon isotope ratios of peat and of porewater dissolved organic carbon (DOC), dissolved inorganic carbon (DIC) and methane (CH₄) illustrated both temporal and spatial trends in below-ground carbon cycling:

seasonality in porewater profiles of $\delta^{13}C$ -DIC and $\delta^{13}C$ -CH₄ (representative of rate and pathway of microbial respiration) was greater in fens than bogs; radiocarbon content of peat and DOC, DIC and CH₄ indicated that recently-fixed organic matter is utilized as substrate for microbial respiration throughout the peatland, and that modern carbon is more labile in fens and non-forested Sphagnum lawns (poor fens) than bogs. Sensitivity of carbon dynamics to local vegetation and hydrology will be a dominant factor controlling the carbon storage capacity of large northern peatlands in the face of predicted climate change. In contrast, coastal ecosystems are often characterized by the types of primary production driving the system and by the dynamics of higher trophic levels. Florida Bay has been heavily impacted by the development of south Florida, and changing conditions in the bay have engendered fears that the fisheries in this system are shifting from dependence on benthic production (seagrasses) to water-column production (phytoplankton). A multiple stable isotope analysis ($\delta^{13}C$, $\delta^{15}N$ and $\delta^{34}S$) of the bay's biota illustrates a strong dependence on benthic production such as seagrass, seagrass detritus, benthic algae and sedimentary organic matter. Long-term fish preservation experiments indicate that this multiple stable isotope approach is feasible for museum specimens (i.e. specimens that have been fixed in formalin and preserved in formalin or ethanol), allowing evaluation of trophic dynamics of current and historic populations relative to changing environmental conditions (e.g. temperature, salinity, turbidity, and seagrass distribution).

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1132. Introduction to nonpoint source pollution in the United States and prospects for wetland use.

Baker, L. A.

Ecological Engineering 1(1-2): 1-26. (1992)

NAL Call #: TD1.E26; ISSN: 0925-8574.

Notes: Conference: US EPA Workshop on the Role of Created and Natural Wetlands in Controlling Nonpoint

Source Pollution, Arlington, VA (USA), 10-11 Jun 1991

Descriptors: wetlands/ reviews/ pollution sources/ pollution effects/ pollution clean-up/ water pollution/ pollution control/ wastewater treatment/ literature reviews/ agricultural pollution/ USA/ nonpoint/ nonpoint source pollution/ United States/ literature reviews/ agricultural pollution/ pollution sources/ reviews/ pollution clean-up/ pollution studies/ freshwater pollution/ characteristics, behavior and fate
Abstract: Nonpoint source (NPS) pollution is the major cause of impairment of US surface waters. The dominant source of NPS pollution is agricultural activity, and "traditional" pollutants --nutrients, sediments, and pathogens-- are the main detrimental constituents. Erosion from cropland has been declining and is expected to decline further in the 1990s, but it is unclear how this will translate into changes in sediment yields in streams. Pollution by nitrogen is of particular concern in eutrophication of estuaries, as a contaminant of groundwater and as an acidifying agent in atmospheric deposition. Nitrogen fertilizer and emissions of nitrous oxides are major contributors to the problem. The outlook on pesticides is mixed: bans on organochlorine pesticides in the 1970s have resulted in decreasing concentrations in fish tissue; however, herbicides are now a problem for some surface and groundwater sources of drinking water, especially in the Upper Midwest. Metals in NPS pollution are primarily a concern in mining areas and in urban runoff.
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1133. Macroinvertebrate responses to wetland restoration in northern New York.

Brown, S. C.; Smith, K.; and Batzer, D.

Environmental Entomology 26(5): 1016-1024. (Oct. 1997)
NAL Call #: QL461.E532; ISSN: 0046-225X

Descriptors: wetlands/ environmental restoration/ USA, New York/ macrofauna/ man-induced effects/ environmental impact/ environment management/ habitat improvement/ colonization/ community composition/ aquatic insects/ Insecta/ soil transplantation/ aquatic entomology/ reclamation/ mechanical and natural changes/ habitat community studies

Abstract: Wetlands are being restored throughout the United States in an effort to replace habitat functions lost following drainage. We studied the macroinvertebrate communities that developed in wetlands restored by the U.S. Fish and Wildlife Service and compared them to those occurring at natural wetlands in the same area. During the 3 yr of the study, most taxa found at the natural sites could also be found in similar numbers at the restored sites. Insects with aerial dispersal capability rapidly colonized the restored habitats, but some less mobile forms (noninsects and some hemipterans) either colonized more slowly or not at all. We analyzed the effects of experimental techniques for site preparation that were applied before restoration of hydrology to determine if they influenced macroinvertebrate recolonization. Transplantation of remnant wetland soil, which resulted in faster and more prolific plant growth, significantly increased overall macroinvertebrate numbers, and significantly increased the abundance of 10 specific taxonomic groups. The use of this technique, along with possible inoculation of some less mobile taxa, could improve efforts to reestablish natural macroinvertebrate communities to newly restored wetland habitats.

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1134. Marsh impoundments for the management of wildlife and plants in Louisiana.

Chabreck, R. H. and Junkin, G. M.

In: *Marsh Management in Coastal Louisiana: Effects and Issues*. (Held 7 Jun 1988-10 Jun 1988 at Baton Rouge, LA.) Duffy, W. G. and Clark, D. (eds.): Fish and Wildlife Service, U.S. Department of the Interior; pp. 112-119; 1989. *NAL Call #*: QH540.U562 no.89(22)

Abstract: Marsh impoundments are widely used in coastal regions for improving wildlife habitats, aquaculture, water storage for agricultural irrigation and industrial uses, flooding of marshes for mosquito control, and maintenance of favorable water depths for navigation. Impoundments used to improve wildlife habitat can be categorized into 4 types by water depth and salinity regimes: permanently flooded with freshwater, manipulated freshwater, permanently flooded with brackish water, and manipulated brackish water. In certain areas, eg SE Louisiana, impoundment use is limited because of the fluid nature of the subsoil. -from Authors

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1135. Nekton use of salt marshes of the Southeast region of the United States.

Rozas, Lawrence P.

In: *Coastal Zone: Proceedings of the Symposium on Coastal and Ocean Management*. (Held 19 Jul 1993-23 Jul 1993 at New Orleans, La.); Vol. 1.

New York: American Society of Civil Engineers; pp. 528-537; 1993.

NAL Call #: HT391.S935 1993; *ISBN*: 087262918X

Abstract: Published studies of nekton in salt marshes of the Southeast Region of the U.S. were reviewed to identify fish and decapod crustaceans associated with marsh-surface habitats, to describe preferred microhabitats, and to compare habitat use between the Gulf of Mexico and Atlantic coasts. Nekton assemblages are dominated by estuarine resident species such as daggerblade grass shrimp *Palaemonetes pugio*, sheepshead minnow *Cyprinodon variegatus*, and several other cyprinodonts. Other numerically dominant cyprinodont *variegatus*, and several other cyprinodonts. Other numerically dominant cyprinodonts are: gulf killifish *Fundulus grandis* and diamond killifish *Adinia xenica* on the Gulf coast and mummichog *F. heteroclitus*, spotfin killifish *F. luciae*, and striped killifish *F. majalis* on the Atlantic coast. Most resident species can use interior marshes that are remote from subtidal habitats. The majority of estuarine transients, including many fishery species (e.g., spotted seatrout *Cynoscion nebulosus* and brown shrimp *Penaeus aztecus*), select marsh edge, that part of the marsh surface immediately adjacent to subtidal habitats. Marsh submergence time also influences habitat selection. Nekton assemblages using the marsh surface along the Atlantic and Gulf coasts differ not only in terms of species composition, but also by nekton densities. Densities on Gulf coast marshes are at least an order of magnitude greater than those reported from Atlantic coast marshes. Differences in habitat utilization may be due to dissimilarities in marsh geomorphology, tidal regimes, or rates of relative sea level rise along the two coasts.

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1136. Nitrate removal for Platte Valley, Nebraska synthetic groundwater using a constructed wetland model.

Robins, J. P.; Rock, J.; Hayes, D. F.; and Laquer, F. C.

Environmental Technology 21(6): 653-659. (2000)

NAL Call #: TD1.E59; *ISSN*: 0959-3330

Descriptors: groundwater/ carbon/ cellulose/ denitrification/ nitrate/ organic matter/ oxygen/ retention/ starch/ water quality/ removal/ nitrogen/ models/ artificial wetlands

Abstract: The purposes of this study were (i) to show that nitrate removal by denitrification from Platte Valley, Nebraska, USA, synthetic groundwater was possible utilizing a model, laboratory-scale, constructed wetland (MW) and (ii) to evaluate the influence of MW on water quality when the hydraulic retention time (HRT) was varied. Denitrification was successfully achieved using a starch and cellulose mixture as the carbon source, instead of carbon from plant growth, and a 30 mg nitrate-N litre⁻¹ synthetic feed concentration. For 1, 3, and 7 day HRTs, the MW achieved nitrate-N plus nitrite-N (nitrate/nitrite-N) removals of 82%, 98%, and 88%, respectively. The effluent nitrate/nitrite-N levels were not significantly different, based on their 95% confidence intervals. For all HRTs, average effluent organic-N concentrations were less than 2.0 mg litre⁻¹ and average effluent ammonia-N values were less than 0.5 mg litre⁻¹. For 356 mg litre⁻¹ chemical oxygen demand (COD) addition to the MW, the MW achieved COD removals of 84%, 89%, and 98% for the 1, 3, and 7 day HRTs, respectively. Volatile fatty acid effluent levels were below the detection limit. Residual organic matter in the treated water may make further treatment necessary.

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1137. Nitrogen retention and release in Atlantic white cedar wetlands.

Zhu, Wei Xing and Ehrenfeld, Joan G

Journal of Environmental Quality 29(2): 612-620. (2000)

NAL Call #: QH540.J6; *ISSN*: 0047-2425

Descriptors: freshwater ecology: ecology, environmental sciences/ pollution assessment control and management/ soil science/ laboratory incubations/ laboratory techniques/ Atlantic white cedar wetlands/ groundwater: nitrogen enriched/ hollows/ hummocks/ nitrification rates/ nitrogen saturated sediments/ pulsed stormwater inputs/ runoff: nitrogen enriched/ soil total Kjeldahl nitrogen [soil TKN]/ suburban watersheds/ undisturbed watersheds/ water quality degradation/ wetland peats

Abstract: The fate of N inputs to freshwater wetlands from enriched runoff, ground water, or atmospheric deposition reflects a variety of processes that determine the net retention of N or its release to downstream ecosystems. The history of N enrichment may affect the relative importance of different pathways. We compared the ability of sediments from Atlantic cedar wetlands in suburban and undisturbed watersheds to remove added inorganic N in laboratory incubations. Three pulses of NH₄NO₃, at 50 mg N L⁻¹ concentration, were added at consecutive 2-wk intervals as an analog of pulsed stormwater inputs. After each incubation, soils were leached with CaCl₂ and inorganic N concentrations in the leachate were analyzed. The peats retained added N during the first incubation, but after the second and third, all soils released more N than had been added. Nitrate concentrations were always lower than ammonium concentrations. Soils from hollows and most hummocks retained added nitrate throughout the

study, but all soils released ammonium. Soil extractable ammonium increased four to 10 times after the 6-wk incubation, while extractable dissolved organic N (DON) decreased. There also was a net decrease of soil total Kjeldahl N (TKN). The patterns of retention and release of nitrate and ammonium were correlated positively with the N mineralization and nitrification rates of the soils. Our results suggest that wetland peats in suburban drainages may have limited ability to retain frequent, pulsed N inputs from runoff and high intrinsic N mineralization in N-saturated sediments can become a cause of water quality degradation.

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1138. Nutrient interactions, plant productivity, soil accretion, and policy implications of wetland enhancements in coastal Louisiana.

Brantley, Christopher G. / Louisiana State University, 2005.
[http://etd.lsu.edu/docs/available/etd-10242005-143348/unrestricted/\(Brantley\)dissert.pdf](http://etd.lsu.edu/docs/available/etd-10242005-143348/unrestricted/(Brantley)dissert.pdf)

1139. Population biology and management of rare plants in depression wetlands of the southeastern coastal plain, USA.

Edwards, A. L. and Weakley, A. S.
Natural Areas Journal 21(1): 12-35. (Jan. 2001)
Descriptors: wetlands/ rare species/ plants/ population studies/ management/ conservation/ environmental degradation/ USA/ aquatic plants/ check lists/ distribution records/ population structure/ species diversity/ dominant species/ population genetics/ degradation/ marshes/ salt marshes/ nature conservation/ ecosystem management/ coastal zone/ bays/ coastal plains/ USA, Southeast/ USA, South Carolina, Carolina Bay/ coastal plains/ conservation/ water and plants/ conservation, wildlife management and recreation

Abstract: One of the greatest challenges for conservation biologists is how to minimize biodiversity losses in the face of staggering habitat destruction. In the southeastern United States, a majority of the depression wetlands (Carolina bays, limesinks, and other landscape depressions) have been altered or destroyed. These wetlands harbor a large proportion of the region's rare species. Surprisingly, there is no single resource from which the patterns of rarity, life history characteristics, and vegetation alliances for species can be obtained. We extracted information from natural heritage program lists, floristic manuals, and primary literature to synthesize information on rare plants in isolated, seasonally ponded depression wetlands in the southeastern coastal plain. Out of 197 species of concern listed in six states, 69 were threatened to varying degrees, occurring in a few to approximately 100 populations (G1-G3G4 species), and 128 were relatively secure with 100 or more populations but were rare in a portion of their geographical ranges. Rare species in depression wetlands were predominately perennial and clonal (120 species), which reflects the prevalence of that life form throughout southeastern wetlands. The perennial and clonal growth form can influence population demographic and genetic structure, and should influence the management of rare plants in depression wetlands. To preserve rare species, it is important to know where they occur and what aspects of their habitats and biology most limit their persistence.

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1140. Quantification of the water budget and nutrient loading in a small peatland.

Drexler, J. Z.; Bedford, B. L.; DeGaetano, A. T.; and Siegel, D. I.

Journal of the American Water Resources Association 35(4): 753-769. (Aug. 1999)

NAL Call #: GB651.W315; *ISSN:* 1093-474X

Descriptors: wetlands/ peat bogs/ nutrients/ evapotranspiration/ groundwater/ hydrology/ hydrologic budget/ agriculture/ peat/ water budget/ eutrophication/ nutrients (mineral)/ chemical processes/ habitat community studies/ physics and chemistry

Abstract: Few water budgets exist for specific types of wetlands such as peatlands, even though such information provides the basis from which to investigate linkages between wetlands and upland ecosystems. In this study, we first determined the water budget and then estimated nutrient loading from an upland farm field into a 1.5 ha, kettle-block peatland. The wetland contains highly anisotropic peat and has no distinct, active layer of groundwater flow. We estimated the depth of the active layer using Fick's law of diffusion and quantified groundwater flow using a chemical mass balance model. Evapotranspiration was determined using MORECS, a semi-physical model based on the Penman-Monteith approach. Precipitation and surface outflow were measured using physical means. Groundwater provided the major inflow, 84 percent (44,418 m super(3)) in 1993 and 88 percent (68,311 m super(3)) in 1994. Surface outflow represented 54 percent (28,763 m super(3)) of total outflows in 1993 and 48 percent (37,078 m super(3)) in 1994. A comparison of several published water budgets for wetlands and lakes showed that error estimates for hydrologic components in this study are well within the range of error estimates calculated in other studies. Groundwater inflow estimates and nutrient concentrations of three springs were used to estimate agricultural nutrient loading to the site. During the study period, nutrient loading into the peatland via groundwater discharge averaged 24.74 kg K ha super(-1), 1.83 kg total inorganic P ha super(-1), and 21.81 kg NO sub(3)-N ha super(-1).

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1141. Restoration and creation of palustrine wetlands associated with riverine systems of the glaciated northeast.

Lowry, D. J.
 In: *Wetland Creation and Restoration: The Status of the Science.*

Covelo, Calif.: Island Press, 1990; pp. 267-280.

Notes: ISBN: 1559630450

NAL Call #: QH541.5.M3W462

Descriptors: artificial wetlands/ glaciation/ habitat restoration/ water resources management/ wetland restoration/ environmental policy/ environmental quality/ monitoring/ research priorities/ water resources development

Abstract: Published information on freshwater wetland creation in the glaciated northeastern United States is largely limited. Though there is more experience in constructing wetlands than the literature base would indicate, there has been no compilation of the experience obtained from most of the wetland creation projects in the region and there appears to be a general lack of detailed monitoring which would provide data necessary for

assessment of results. Long-term, comprehensive studies evaluating the functions of created freshwater wetlands in the region are not presently being conducted. There is, therefore, a need to document the ability of such areas to provide a range of ecological and hydrological functions, rather than just serving as sites where wetland plants grow and that waterfowl visit. In evaluating future projects involving wetland creation as mitigation for wetland loss in the region, the following critical points should be emphasized: (1) the project proposal should provide an assessment of the wetland functions; (2) goals should be developed based on the most significant functions; (3) the hydrologic setting and water budget of the created area must be understood; (4) present capabilities to create other wetland types (swamps, fens, bogs) is in question; (5) every attempt should be made to replace lost wetland in the same hydrogeologic unit and reach of the riverine system associated with the original wetland; (6) an understanding of the area where the wetland is proposed to be created is needed; (7) detailed consideration of a number of logistical constraints (hydrologic controls, machinery needs, availability of plant stock and soils, sediment and erosion control, wildlife predation, and barriers to human intrusion) is always necessary; and (8) monitoring requirements should depend on the functions determined to be of most significance at the assessment stage.

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1142. A review of basin morphology and pool hydrology of isolated ponded wetlands: Implications for seasonal forest pools of the northeastern United States.

Brooks, Robert T.

Wetlands Ecology and Management 13: 335-348.

NAL Call #: QH541.5.M3 W472; ISSN: 0923-4861

<http://www.treesearch.fs.fed.us/pubs/21526>

Descriptors: amphibians/ aquatic invertebrates/ hydrology/ hydroperiod/ seasonal forest pools/ woodland vernal pools
Abstract: Seasonal forest pools (SFPs) are geographically- and hydrologically- isolated ponded wetlands, in that they are topographically isolated from other surface waters. SFPs occur commonly throughout the temperate forests of the eastern United States and adjacent Canada. SFPs are ephemeral in occurrence, typically drying annually. The regular drying of SFPs excludes fish from these habitats, and as a result, they are the preferred breeding habitat of some amphibians, notably ambystomid ('mole') salamanders and wood frogs (*Rana sylvatica* Le Conte). The pools also support a rich and diverse invertebrate fauna. The duration of the wet phase, or hydroperiod of SFPs, has been repeatedly shown to be the dominant influence on the composition and fitness of the faunal community of the pools. Despite the importance of SFP hydrology, it is a poorly studied subject. This paper reviews the limited state-of-knowledge of seasonal forest pool hydrology and associated basin morphology. The review discusses findings from studies of other isolated ponded wetlands that could be applicable to our understanding of the hydrology of SFPs.

This citation is from Treeseearch.

1143. A review of early literature on forested wetlands in the United States.

Lugo, A. E. (1984)

Descriptors: wetlands/ reviews/ forests/ ecology/ literature reviews/ USA/ literature/ forested/ literature reviews/ reviews/ habitat community studies

Abstract: A review of the literature dealing with freshwater-forested wetlands reveals three phases prior to 1970: early descriptions, formal descriptive accounts, and ecological descriptions. Each of these phases is reviewed with the objective of presenting the points of view of early students of forested wetlands and focusing on the generalizations that emerged from those studies. Specific topics of discussion are species composition and diversity, vegetation structure and physiognomy, response to flooding, succession, site factors and wetland classification, wildlife, and uses and values.

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1144. Riverine floodplain forests of the southeastern United States: Invertebrates in an aquatic-terrestrial ecotone.

Smock, Leonard A.

In: Invertebrates in freshwater wetlands of North America:

Ecology and management/ Batzer, Darold P.; Rader,

Russell B.; and Wissinger, Scott A.

New York: John Wiley & Sons, 1999; pp. 137-165.

Notes: ISBN: 0471292583

NAL Call #: QL365.4.A1158

Descriptors: Macroinvertebrata/ life cycle/ riverine flood plain forest fauna life history adaptations/ biomass/ productivity/ community structure/ population density/ riverine flood plain forest community characteristics review/ distribution within habitat/ semiaquatic habitat/ flood plain forests community characteristics review/ flood plain habitat/ forest and woodland/ forested freshwater wetland community characteristics review/ flooding/ hydrologic cycle effect on riverine flood plain forest community/ USA, Southeast

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1145. The role of canopy gaps in maintaining vascular plant diversity at a forested wetland in New York State.

Anderson, Kimberly L. and Leopold, Donald J.

Journal of the Torrey Botanical Society 129(3):

238-250. (2002)

NAL Call #: QK1.J687; ISSN: 1095-5674

Descriptors: biodiversity/ ecology: environmental sciences/ groundwater ecology: ecology, environmental sciences/ canopy gaps/ forested wetland: habitat/ microsite heterogeneity

Abstract: We studied species diversity and composition of herbaceous layer vascular plant communities under closed canopies and within gaps in a central New York conifer swamp. Our study site, Nelson Swamp, has high documented species richness and supports a large number of state-protected species. Understory cover and species richness at both the quadrat and gap scale were compared among closed canopy areas and gaps in three size classes. To assess differences in the understory environment among the three size classes, we compared light, hydrology, and microtopography. We also tested for correlations between gap species richness and light, wetness, and microsite heterogeneity to determine which aspects of the gap environment might influence vascular

plant diversity therein. There was higher quadrat- and gap-level species richness in gaps than in closed canopy areas. Small gaps did not appear to offer a physical environment substantially different from non-gaps, as no differences in their understory communities were apparent. Mid-sized and large gaps had higher species richness, substrate heterogeneity, and water table fluctuation than small gaps. Based on the correlations, the individual factors influencing species richness at the gap scale were depth to water, water level fluctuation, and microtopographic variability, indicating the importance of hydrology over light as a species control. Although gaps and non-gaps shared many of the same species, there were distinct subsets of species that were more important in either type of community. Based on these subsets, closed canopy areas and large gaps can be viewed as two ends of a continuum corresponding to light and hydrology gradients. Out of all the species encountered, 10 percent were found exclusively in gaps, and none were found only under closed canopy. Thus, these gaps are not only sites of higher overall plant growth, but also areas that allow rare species to persist.

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1146. Shorebird use of coastal wetland and barrier island habitat in the Gulf of Mexico.

Withers, Kim

Scientific World Journal 2: 514-536. (2002);

ISSN: 1532-2246

Descriptors: Aves/ habitat management/ implications of coastal wetland and barrier island use by shorebirds/ overview/ migration/ coastal habitat use/ population dynamics/ abundance patterns/ coastal wetland and barrier island habitats/ distribution within habitat/ habitat utilization/ semiaquatic habitat/ coastal wetlands/ habitat use/ overview and conservation implications/ shorebirds/ Mexico and USA/ Mexico/ USA/ Gulf of Mexico/ shorebird abundance and habitat use/ coastal wetlands and barrier islands/ conservation implications

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1147. Soils of Louisiana's coastal marsh.

Murphy, K.

In: *Marsh Management in Coastal Louisiana: Effects and Issues.* (Held 7 Jun 1988-10 Jun 1988 at Baton Rouge, LA.) Duffy, W. G. and Clark, D. (eds.): Fish and Wildlife Service, U.S. Department of the Interior; pp. 58-66; 1989.

NAL Call #: QH540.U562 no.89(22)

Abstract: The vast and unique coastal area of Louisiana was formed through thousands of years of geological change which included sea-level changes, subsidence, and sediment deposition. The 1.3 million ha area of coastal marsh is a very delicate ecosystem composed of two slightly different areas: the Deltaic marsh of southeast Louisiana and the Chenier marsh located along the southwest coastline of the State. All of Louisiana's coastal marsh soils have the common characteristics of wetness, flooding, low elevation, and low relief. -from Author

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1148. Southern forested wetlands: Ecology and management.

Messina, M. G. and Conner, William H.

Boca Raton, Fla.: Lewis Publishers; 616 p. (1998)

Notes: Includes bibliographical references (p. 493-582) and index.

NAL Call #: SD410.9.S68 1998; ISBN: 1566702283

Descriptors: wetland forestry/ forested wetlands---management/ wetlands---management/ wetland ecology/ forest ecology

This citation is from AGRICOLA.

1149. Submerge, salt-water intrusion, and managed Gulf Coast marshes.

Nyman, J. A.; Chabreck, R. H.; DeLaune, R. D.; and Patrick, W. H.

In: *Coastal Zone: Proceedings of the Symposium on Coastal and Ocean Management.* (Held 19 Jul 1993-23 Jul 1993 at New Orleans, La.); Vol. 2.

New York: American Society of Civil Engineers; pp. 1690-1704; 1993.

NAL Call #: HT391.S935 1993; ISBN: 087262918X

Abstract: Many coastal marshes are managed to improve wildlife habitat. Simultaneous salt-water intrusion and rapid submergence in Louisiana place additional demands on marsh managers and may become common worldwide because of the greenhouse effect. Current management practices often counter salt-water intrusion but not submergence, which is offset by soil formation. The purpose of this paper is to help Gulf Coast marsh managers understand how marsh management may influence soil formation by providing an overview of the relevant physical, chemical, and biological processes. Organic matter accumulation controls soil formation in Louisiana marshes, thus vigorous plant growth should promote soil formation. Soil aeration controls many factors that limit plant growth. An indication of soil aeration is Eh, which is greater in drained soils than in waterlogged soils. Eh also depends partly on soil organic matter qualities. Eh is greater in *Spartina Patens* soil than in *Panicum hemitomon* or *Spartina alterniflora* soil even when hydrological conditions are the same.

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1150. Subsidence in coastal Louisiana: Causes, rates, and effects on wetlands.

Boesch, D. F.; Levin, D.; Nummedal, D.; and Bowles, K.

U.S. Fish and Wildlife Service; FWS/OBS-83/26, 1983. 42 p.

Descriptors: wetlands/ geomorphology/ habitat changes/ land/ water level/ sedimentation/ mapping/ man/ marshes/ North America/ United States/ Louisiana/ coastal region

Abstract: Purpose of this review is to summarize the known causes of subsidence or land loss in coastal Louisiana, to examine the available data on subsidence rates, and to review the effects of subsidence on wetlands.

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1151. Temporarily flooded wetlands of Missouri: Invertebrate ecology and management.

Magee, Patrick A.; Reid, Frederic A.; and Fredrickson, Leigh H.

In: *Invertebrates in freshwater wetlands of North America: Ecology and management/* Batzer, Darold P.; Rader, Russell B.; and Wissinger, Scott A.

New York: John Wiley & Sons, 1999; pp. 691-710.

Notes: ISBN: 0471292583

NAL Call #: QL365.4.A1158

Descriptors: Invertebrata/ habitat management/ ecology/ temporarily flooded wetlands/ semiaquatic habitat/ flooding/ Missouri/ temporarily flooded wetlands ecology and management

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1152. Vegetative marsh management in Louisiana: Long-range recommendations.

Good, B.

In: Marsh Management in Coastal Louisiana: Effects and Issues. (Held 7 Jun 1988-10 Jun 1988 at Baton Rouge, LA.) Duffy, W. G. and Clark, D. (eds.): Fish and Wildlife Service, U.S. Department of the Interior; pp. 222-234; 1989. NAL Call #: QH540.U562 no.89(22)

Abstract: The major objectives of vegetative marsh management are to prevent the conversion of marsh to open water and to control the erosion at marsh-water interfaces. In many cases soil stabilization can be accomplished most cost-effectively with vegetative marsh management. Succession acceleration can reduce erosion if an environment changes faster than natural plant succession can recolonize the area. A proposed procedure for selecting an optimal project design incorporates site evaluation data, the likelihood of project success, potential benefits, and project costs. A state-wide prioritization scheme is suggested that would locate vegetation projects in those areas with the highest rates of wetland loss. -from Author

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1153. Wetland mitigation along the Pacific coast of the United States.

Griswold, T.; Zedler, J.; and Josselyn, M.

In: Wetland Creation and Restoration: The Status of the Science.

Covelo, Calif.: Island Press, 1990; pp. 3-36.

Notes: ISBN: 1559630450

NAL Call #: QH541.5.M3W462

Descriptors: artificial wetlands/ coastal zone management/ habitat restoration/ water resources management/ wetland restoration/ coastal lagoons/ coastal marshes/ databases/ estuarine environment/ hydrologic properties/ monitoring/ vegetation establishment/ water resources development/ watershed management/ wildlife habitats

Abstract: Mitigation to compensate for coastal wetland losses has taken place under federal and state permit policies for over 15 years. As a result, a substantial

database has developed in the scientific and governmental literature on which to base recommendations for improvement in mitigation practice. Hydrologic characteristics of a mitigation site are especially important as they structure the possible wetland habitats that can be created. Within the Pacific coastal zone, four general hydrological types occur: wetlands associated with small rivers or lagoons, wetlands associated with major estuaries and coastal embayments, wetlands associated with rivers, and non-tidal wetlands. Within each of these broad categories, watershed management and specific opportunities and constraints must be considered prior to approving mitigation proposals. Elements that need to be included within mitigation proposals are a description of existing conditions, a description of proposed hydrological conditions, means by which mitigation site constraints are to be ameliorated, planting procedures, determination of appropriate buffers, enforceable construction procedures, and monitoring programs. Outside of site-specific review, resource agencies must assess the long-term implications of individual permit approvals. Reappraisal should be based on detailed analysis contained within accessible database files. Such appraisal can provide important information on regional trends and means by which mitigation can be redirected to better serve fish and wildlife needs. (Author 's abstract)

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1154. Wetlands in the northern Great Plains: A guide to values and management.

Berry, Charles R.; Buechler, Dennis G.; Wentz, W. Alan; South Dakota State University. Cooperative Extension Service; and U.S. Prairie Pothole Joint Venture Washington, D.C.?: U.S. Fish and Wildlife Service; 13 p. (1993)

Notes: Caption title. "Published by a cooperative agreement between the U.S. Fish and Wildlife Service (U.S. Prairie Pothole Joint Venture) and the Agricultural Extension Service, South Dakota State University, Brookings, S.D. Funding was provided by the U.S. Fish and Wildlife Service, the Federal Highway Administration, and the U.S. Army Corps of Engineers"--P. 13. "Update of Wetland values and management ... 1981"--P. 13.

NAL Call #: QH541.5.M3B47 1993

Descriptors: wetland ecology---Great Plains/ wetlands---Great Plains

This citation is from AGRICOLA.

Effects of Agricultural Conservation Practices on Wetlands

1155. Bioassessment of silvicultural impacts in streams and wetlands of the Eastern United States.

Hutchens, J. J.; Batzer, D. P.; and Reese, E.
Water, Air, and Soil Pollution 4(1): 37-53. (2004)
NAL Call #: TD172 .W36; ISSN: 1567-7230.
Notes: Water, Air, and Soil Pollution: Focus
Descriptors: wetlands/ streams/ bioindicators/ environment management/ forestry/ nature conservation/ environmental policy/ logging/ conservation/ USA, East/ environmental action/ water resources and supplies/ water quality control/ general environmental engineering
Abstract: Bioassessment is a useful tool to determine the impact of logging practices on the biological integrity of streams and wetlands. Measuring biota directly has an intuitive appeal for impact assessment, and biota can be superior indicators to physical or chemical characteristics because they can reflect cumulative impacts over time. Logging can affect stream and wetland biota by increasing sedimentation rates, altering hydrologic, thermal, and chemical regimes, and changing the base of food webs. Biotic impacts of logging on streams compared to wetlands probably differ, and in this paper we review some of those differences. In streams, invertebrates, fishes, amphibians, algae, and macrophytes have been used as indicators of logging impacts. In wetlands, bioassessment is just beginning to be used, and plants and birds are the most promising indicator taxa. Various best management practices (BMPs) have been developed to reduce the impacts of logging on stream and wetland biota, and we review quantitative studies that have evaluated the efficacy of some of these techniques in streams and wetlands in the eastern United States. Remarkably few studies that address the overall efficacy of BMPs in limiting biotic changes in streams and wetlands after BMP implementation have been published in scientific journals, although some work exists in reports or is unpublished. We review these works, and compile conclusions about BMP efficacy for biota from this body of research.
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1156. A case study of changing land use practices in the Northern Great Plains, USA: An uncertain future for waterbird conservation.

Higgins, K. F.; Naugle, D. E.; and Forman, K. J.
Waterbirds 25(2 [supplement]): 42-50. (2002)
NAL Call #: QL671; ISSN: 1524-4695.
Notes: Managing Wetlands for Waterbirds: Integrated Approaches
Descriptors: wetlands/ land use/ habitat changes/ agricultural practices/ conservation/ wildlife management/ aquatic birds/ habitat/ breeding sites/ agriculture/ nature conservation/ ecosystem management/ environmental protection/ Aves/ United States, Great Plains/ birds/ mixed grass prairies/ conservation, wildlife management and recreation/ reproduction and development
Abstract: Wetland and grassland habitats of the northern Great Plains are a primary breeding ground for waterbirds in North America. Native mixed grass prairies that were historically used for cattle grazing have met with changing social and economic pressures that put the remaining 40% of this resource at high risk of tillage. In this paper, we describe the current state of our waning rural societies, characterize impacts of land use change on waterbird

habitats, and discuss conservation actions to benefit waterbirds. Recent population statistics indicate that a record number of farmers facing low commodity prices are selling their farms and moving to urban centers for employment. Other farmers are shifting from diversified agriculture to monoculture grain farming to take advantage of farm programs that provide incentives to bring marginal land into production. Additional data indicate that concurrent changes in crop types have decreased quality of farmland wildlife habitat while bigger and faster farm equipment and genetically modified crops continue to make farming marginal land less risky. Legislators and administrators should be advised that waterbird habitat loss continues to expand westward. The last chance to sustain the unique grassland-wetland character of the northern Great Plains is to accelerate grassland conservation with short- and long-term stewardship programs and incentives to family ranchers. This philosophy is of vital importance because it also protects wetland habitats that otherwise are vulnerable to drainage when native prairie is converted to cropland. Lastly, and perhaps most importantly, this would conserve our prairie heritage for future generations while preserving the private property rights of landowners.
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1157. Changes in species diversity in peatlands drained for forestry.

Vasander, Harri; Laiho, Rajja; and Laine, Jukka
In: Northern forested wetlands: Ecology and management/ Trettin, Carl C.; Jurgensen, Martin F.; Grigal, David F.; and Gale, Margaret R.
Boca Raton, Fla.: CRC Press, Inc., 1997; pp. 109-119.
Notes: ISBN: 1566701775. Meeting Information: Papers presented at the International Symposium on the Ecology and Management of Northern Forested Wetland, Traverse City, Michigan, USA; Cochrane, Ontario, Canada; August 24-31, 1994
Descriptors: biodiversity/ forestry/ freshwater ecology: ecology, environmental sciences/ northern forested wetland/ peatland drainage/ species diversity/ book chapter/ meeting paper
© The Thomson Corporation

1158. Cumulative impact assessment in bottomland hardwood forests.

Gosselink J. G. and Lee L. C.
Wetlands 9(Special Issue): 83-174. (1989)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: conservation/ ecology: environmental sciences/ forestry/ freshwater ecology: ecology, environmental sciences/ soil science/ wetland forest function/ conservation/ biogeography/ streams/ lakes/ nutrient loading rates/ south central, southeastern USA
Abstract: Bottomland hardwood forest ecosystems of the south central and southeastern United States include extensive areas of palustrine forested wetlands. They are valuable to humans because they support a high density and diversity of flora and fauna, help protect the quality of water and habitat in adjacent streams, and serve as flood water storage areas. These ecosystems, however, have been rapidly transformed or modified over the past 40 years. About 20 million ha remain out of an historical area of over 100 million ha. Most of this area is now in row crop

production, although hydrologic modification by flood control projects is also an important impact. The cumulative impact of incremental forest loss has been deleterious to ecosystem processes upon which society depends. It has caused increased flooding, turbid and eutrophic streams and lakes, and loss of plant and animal species including top carnivores, such as large mammals and raptors, and birds adopted to forest interiors. Regulation of cumulative impacts raises issues that are not addressed by traditional site-specific permit evaluation. For example, because the spatial scale of cumulative impacts is large relative to most individual permit request sites, ecological complexity is dramatically increased, spatial and conceptual boundaries are unclear, and ecological processes that depend on large landscape patterns are difficult to conserve. From a policy standpoint, the issue is plagued by a lack of objective, scientific data; fragmented jurisdiction; a need to set goals within which individual permits can be evaluated; the need to maintain regional flexibility; and the imperative to develop a way of maintaining and updating records. Many of the scientific and technical questions of resource conservation, appropriate to cumulative impact management, have been addressed previously in the context of island biogeography as applied to nature reserves. The extensive literature on this subject is summarized in this report. In this report we describe a method for cumulative impact assessment and management in bottomland and hardwood wetlands that uses the landscape approach of island biogeography. Goals for this approach are two-fold. The first is to conserve bottomland forest functions, such as water-dependent terrestrial and wetland-dependent aquatic organisms, subsidized production, water quality, and flood water desynchronization. The second is to conserve landscape pattern-i.e., large blocks of bottomland/upland forest, appropriately interspersed with smaller tracts, continuity among forest patches, contiguity between bottomland forest and stream, and between bottomland and upland forest. Generally, the bottomland hardwood functions are preserved by conserving landscape integrity. In order to assess the cumulative impact status of an area it is necessary to select an appropriate scale of analysis, characterize the "health" of the landscape unit, and consider the assessment unit in the context of the whole region. From a consideration of ecological, socio-political, and mapping scales, we recommend an assessment unit of about 1 million ha. We also describe eight fairly simple indices of forest system integrity that, when taken together, characterize the assessment unit. Three of these involve structural features of the landscape: forest loss, forest contiguity, and forest pattern. The other five indices are functional indices that integrate over the entire landscape: change in discharge rating curves, change in water residence time, stream nutrient concentration trends, nutrient loading rates, and native biotic diversity. Finally we summarize briefly a suggested procedure for cumulative impact management that involves boundary determination, cumulative impact assessment, goal-setting and planning, and permit evaluation in the context of the cumulative impact management plan.

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1159. Determination of the environmental impact of several substitute chemicals in agriculturally affected wetlands.

Meyers, S. P.; Gambrell, R. P.; Day, J. W.; and Environmental Research Laboratory (Gulf Breeze, Fla., EPA-600/4-82-052; Washington, D.C.: U.S. Environmental Protection Agency, 1982. xiii, 136 p.

Notes: NTIS Order No.: PB82-242017;

Grant EPA-R-804976

Descriptors: wetlands/ sediments/ simulation/ environmental impact/ parathion/ pesticides/ pollution detection/ agricultural runoff/ chemical pollutants/ agriculture/ chemical pollutants/ Kepone/ Guthion/ parathion/ land pollution/ insecticides/ methods and instruments

Abstract: Procedures have been developed for processing of anaerobic wetland sediments for pesticide recovery along with formulation of simulation models of anaerobic/aerobic soil and sediment environments to study pesticide degradation. Redox conditions of soils and sediment-water systems have a significant effect on in situ persistence of synthetic organic pesticides. Chemical and microbiological characteristics of wetland sediments have equally important consequences on mobility and degradation of toxic compounds. The total invertebrate community of selected backswamp regions has been examined as affected by Guthion and other pesticides. A system of continuous-flow and static microcosm systems have been developed for quantitative analyses of the effect of selected toxic substances, including Guthion, methyl parathion, and Kepone. Decomposition of ecologically-significant substrates such as chitin is variously affected by different toxic substances as shown in microcosm investigations.

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1160. Effects of forest management on surface water quality in wetland forests.

Shepard, J. P.

Wetlands 14(1): 18-26. (1994)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ water quality/ forest industry/ fertilizers/ harvesting/ literature reviews/ environmental impact/ nutrients (mineral)/ sediments/ resource management/ logging/ environmental effects/ forest management/ literature review/ USA/ forest management/ literature review/ forest industry/ harvesting/ nutrients (mineral)/ logging/ environmental effects/ literature reviews/ environmental impact/ resource management

Abstract: A literature review on the effects of silvicultural practices on water quality in wetland forests was conducted. The review summarized results from nine wetland forests in five states (AL, FL, MI, NC, and SC). Silvicultural practices assessed were timber harvesting (including thinning and clearcutting), site preparation, bedding, planting, drainage, and fertilization. Many of the studies reviewed observed increased concentrations of suspended sediment and nutrients following silvicultural operations when compared with undisturbed controls. Water quality criteria were rarely exceeded by silvicultural operations, however, and effects on water quality were transient. Water quality parameters returned to undisturbed levels within a period ranging from months to several years.

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1161. Effects of silvicultural activity on ecological processes in floodplain forests of the southern United States: A review of existing reports.

Lockaby, B. G.; Stanturf, J. A.; and Messina, M. G. *Forest Ecology and Management* 90(2-3): 93-100. (1997)
NAL Call #: SD1.F73; ISSN: 0378-1127

Descriptors: functions/ harvests/ wetland forests
Abstract: Activities associated with timber harvesting have occurred within floodplain forests in the southern United States for nearly two hundred years. However, it is only in the last ten years that any information has become available about the effects of harvesting on the ecological functions of this valuable resource. Hydrology is the driving influence behind all ecological processes in floodplains, and timber harvesting alone usually has little long-term effect on hydroperiod. However, logging roads, built in association with harvest sites, can sometimes alter hydroperiod to the extent that vegetation productivity is raised or lowered. There is no evidence that harvesting followed by natural regeneration represents a threat to ground or surface water quality on flood plain sites, as long as 'best management practices' are followed. Harvested floodplains may increase or have little effect on decomposition rates of surface organic matter. The nature of the effect seems to be controlled by site wetness. Data from recently harvested sites (i.e. within the last ten years) suggest that vegetation productivity is maintained at levels similar to those observed prior to harvests. During the early stages of stand development, tree species composition is heavily influenced by harvest method. Similarly, amphibian populations (monitored as bioindicators of ecosystem recovery) seem to rebound rapidly following harvests, although species composition may be different from that of unharvested stands.

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1162. Effects of timber management on the hydrology of wetland forests in the southern United States.

Sun, G.; McNulty, S. G.; Shepard, J. P.; Amatya, D. M.; Riekerk, H.; Comerford, N. B.; Skaggs, W.; and Swift, L. *Forest Ecology and Management* 143(1-3): 227-236. (2001)
NAL Call #: SD1.F73; ISSN: 0378-1127

<http://www.srs.fs.usda.gov/pubs/2756>

Descriptors: wetlands/ hydrology/ streams/ forest management/ USA, Southeast/ forest industry/ environmental impact/ rivers/ flood plains/ USA/ forests/ forest hydrology/ runoff/ USA, South
Abstract: The objectives of this paper are to review the hydrologic impacts of various common forest management practices that include harvesting, site preparation, and drainage. Field hydrological data collected during the past 5-10 years from ten forested wetland sites across the southern US are synthesized using various methods including hydrologic simulation models and Geographic Information Systems. Wetland systems evaluated include red river bottoms, black river bottoms, pocosins, wet mineral flats, cypress domes, and pine flatwoods. Hydrologic variables used in this assessment include water table level, drainage, and storm flow on different spatial and temporal scales. Wetland ecosystems have higher water storage capacity and higher evapotranspiration than uplands. Hydrologic impacts of forest management are variable, but generally minor, especially when forest best management practices are adopted. A conceptually generalized model is developed to illustrate the relative

magnitude of hydrologic effects of forest management on different types of wetlands in the southern US. This model suggests that in addition to soils, wetland types, and management practice options, climate is an important factor in controlling wetland hydrology and the magnitude of disturbance impacts. Bottomland wetlands, partial harvesting, and warm climate usually offer conditions that result in low hydrologic impact.

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1163. Evaluation of management practices and farming systems on Missouri wetland wildlife areas: A survey of agricultural cropping systems and wetland management practices on selected Missouri Department of Conservation wildlife areas.

Graber, D. A. Missouri Dept. of Conservation, 1987. 20 p. Annual Report .

Descriptors: wetlands/ evaluation/ surveys/ cultivated farmland/ farms/ food crops/ habitat management/ questionnaire/ fertilization, soil and water/ water resources management/ plant control/ vegetation/ floods
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1164. Evaluation of management practices and farming systems on Missouri wetland wildlife areas: Determining the nutritional value of selected moist soil seeds and wetland agricultural crops.

Graber, D. A. Missouri Dept. of Conservation, 1989. 13 p.
Descriptors: wetlands/ amino acids/ bioenergetics/ cultivated farmland/ evaluation/ farms/ floods/ food crops/ goose, Canada/ metabolism/ nutrients/ nutrition/ overwintering/ proteins/ seeds/ wildlife management areas/ Panicum spp./ Polygonum amphibium/ smartweed/ Sorghum vulgare/ North America/ United States/ Missouri
Abstract: Objectives were to determine: (1) by means of proximate analysis, amino acid assay and gross energy assay, the nutrient content of rowcrops and moist-soil plants (largeseed smartweed, milo, corn, wild millet, nodding smartweed, rice cutgrass, nodding foxtail, beggarticks, and soybean) regularly consumed by wintering Canada Geese in Missouri; (2) the true metabolizable energy of these rowcrops and plants for Canada geese; and (3) to what extent the gross energy of Canada goose foods varies when exposed to non-flooded and flooded conditions for 30, 60, 90 and 15 days between September 1987 and March 1988.

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1165. Forestry best management practices for wetlands in Minnesota.

Phillips, Michael J.
In: Northern Forested Wetlands: Ecology and Management/ Trettin, Carl C.
Boca Raton, Fla.: CRC Lewis, 1997; pp. 403-409
NAL Call #: SD410.9.N67 1997
<http://www.srs.fs.usda.gov/pubs/680>

Abstract: Wetlands are a common landscape feature in Minnesota in spite of significant losses of wetlands to agriculture and development. Prior to European settlement, Minnesota contained 7.5 million ha of wetlands, including both wet, mineral and peat soils. These wetlands covered approximately 35 percent of the state. The current extent of wetlands for Minnesota is approximately 3 million ha, which represents a 60 percent loss of the original wetland acreage (Minnesota Department of Natural Resources,

Protected Water Inventory Data Base, 1984). The majority of the remaining wetlands are found in the forested regions of Minnesota, predominantly located on county, state, and federal lands in northern Minnesota. This citation is from Treesearch.

1166. Impacts of irrigation drainwater on wetlands.

Deason, J. P.

In: *Wetlands: Concerns and Successes - Proceedings of a Symposium*. (Held 17 Sep 1989-22 Sep 1989 at Tampa, Florida.)

Bethesda, Maryland: American Water Resources Association; pp. 127-138; 1989.

NAL Call #: TC401.A5 no.89-3

Descriptors: wetlands/ agricultural runoff/ drainage water/ environmental effects/ irrigation effects/ selenium/ water pollution effects/ water pollution sources/ Arizona/ California/ geochemistry/ irrigation/ Montana/ Nevada/ Texas/ Utah/ Wyoming

Abstract: Over the past four years, the U.S. Department of the Interior has been engaged in a program to identify, evaluate and respond to irrigation-induced contamination problems in the western states. To date 20 areas in 13 states have been selected for investigation.

Reconnaissance-level studies focusing on identification of irrigation-induced contamination problems have been completed at nine locations in Arizona, California, Montana, Nevada, Texas, Utah, and Wyoming. Results reveal significant adverse impacts on a number of wetland areas receiving irrigation drainage water. Several observations about the nature of irrigation-induced contamination problems can be made: (1) it appears that selenium is the constituent of concern most commonly found at elevated concentrations in wetland ecological systems receiving irrigation drainage water; (2) concentrations of analytes were found to vary widely on a spatial basis in all environmental media sampled; (3) closed watersheds are an important physical characteristic of locations that may tend to exhibit symptoms of irrigation-induced contamination; and (4) other hydrologic and geochemical characteristics can also serve as indicators of potential problems with irrigation drainage.

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1167. Impacts of stressors on the emergence and growth of wetland plant species in Pennsylvania, USA.

Mahaney, W. M.; Wardrop, D. H.; and Brooks, R. P.

Wetlands 24(3): 538-549. (2004)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ sedimentation/ plant communities/ urbanization/ nitrogen/ greenhouses/ organic matter/ slope/ flood plains/ community composition/ geomorphology/ soils/ environmental impact/ hydrology/ aquatic plants/ prediction/ ecological distribution/ ecosystem disturbance/ growth/ eutrophication/ plant growth/ headwaters/ plant populations/ slopes/ enrichment/ moisture/ agriculture/ species composition/ USA, Pennsylvania

Abstract: Agriculture and urbanization in the upland landscape often generate stressors, such as sedimentation and eutrophication, that may negatively impact wetland plant communities. Individual plant species responses to stressors are also likely influenced by the hydrologic and geomorphologic characteristics of different wetland hydrogeomorphic (HGM) subclasses. The goal of this study was to determine to what extent the two stressors listed

above influence the growth and development of wetland plant species and how these responses vary across HGM subclasses. The impacts of the two stressors on wetland plant species emergence and growth were examined in a 2 x 2 factorial greenhouse experiment, using soil moisture and organic matter content to simulate three HGM subclasses. Both stressors elicited significant responses in species establishment and growth, but overall trends in stressor responses differed by wetland type. For instance, sedimentation reduced the emergence of four species in simulated riparian depressions but only affected one species in simulated slope wetlands and none in simulated headwater floodplains. Sedimentation had little impact on any species establishment or growth in headwater floodplains. Approximately half of the species showed an increase in at least one growth variable in response to nitrogen enrichment. Additionally, the conditions used to simulate HGM subclasses appeared to impact a species performance and sensitivity to stressors. Therefore, further investigation of the impacts of HGM subclass conditions on species performance is needed. We expected differences in species responses to be related to their natural distribution across pristine and impacted wetlands; however, no obvious relationships were found. Our results suggest that it will be difficult to make generalizations about species responses to stressors because responses varied by stressor type, stressor interactions, and HGM subclass. Therefore, perhaps the next step in formulating broad generalizations and predictions about wetland plant community composition will require a shift from species-based approaches to a trait-based approach for examining how species composition may change in response to future disturbances.

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1168. Irrigated agriculture and freshwater wetlands: A struggle for coexistence in the western United States.

Lemly, A. D.

Wetlands Ecology and Management 3(1): 3-15. (1994)

NAL Call #: QH541.5.M3 W472; ISSN: 0923-4861

<http://www.srs.fs.usda.gov/pubs/1123>

Descriptors: wetlands/ fresh water/ irrigation/ agriculture/ environmental effects/ salinity/ water use/ environmental impact/ drainage/ water demand/ ecological effects/ USA, West/ drainage/ water demand/ ecological effects/ USA, Western/ fresh water/ environmental impact/ environmental effects/ water use

Abstract: This paper is a review of the major environmental problems associated with irrigated agriculture in the western United States. Freshwater wetlands are being contaminated by subsurface agricultural irrigation drainage in many locations. Historic freshwater inflows have been diverted for agricultural use, and remaining freshwater supplies are not sufficient to maintain these important natural areas once they are degraded by irrigation drainage. Migratory birds have been poisoned by drainwater contaminants on at least six national wildlife refuges; waterfowl populations are threatened in the Pacific and Central flyways. Revised water allocation policies and regulatory actions are probably necessary to correct existing damage and prevent future problems. The benefits of maintaining healthy wetlands should be used as a rationale for negotiating increases in freshwater supplies. Cost analyses that show the importance of wetlands in dollar values are critical to the success of these

negotiations. The next few years will provide unique opportunities for wetland managers to use cost analyses to make changes in water allocation policies. Federally subsidized water has supported and expanded agriculture at the expense of native wetlands for over 100 years in the western United States. This trend must be reversed if these wetlands and their fish and wildlife populations are to survive. (DBO)
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1169. Linking surface- and ground-water levels to riparian grassland species along the Platte River in Central Nebraska, USA.

Henzey, R. J.; Pfeiffer, K.; and Keough, J. R.
Wetlands 24(3): 665-687. (2004)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ rivers/ water levels/ grasslands/ statistical analysis/ meadows/ prairies/ grazing/ aquatic plants/ riparian environments/ riparian vegetation/ river basin management/ community composition/ ground water/ water table/ water management/ environmental impact/ water level/ statistics/ environmental gradient/ model studies/ elevation/ standing waters/ plant populations/ USA, Kansas, Platte R./ USA, Nebraska, Platte R./ temperate grasslands/ environmental effects/ dynamics of lakes and rivers/ streamflow and runoff

Abstract: Nearly all the techniques used to quantify how plants are linked to environmental gradients produce results in general terms, such as low to high elevation, xeric to mesic, and low to high concentration. While ecologists comprehend these imprecise scales, managers responsible for making decisions affecting these gradients need more precise information. For our study, we preserved the measurement scale and units of a dominant environmental gradient by using non-linear models to fit plant frequency to a water-level gradient ranging from shallow ground water to standing water along the Platte River in central Nebraska, USA. Non-linear models, unlike polynomials, have coefficients that can be interpreted with a biological meaning such as population peak, optimum gradient position, and ecological amplitude. Sixty-three riparian grassland species had sufficient information to link their plant frequency to the water-level gradient. From among 10 water-level summary statistics evaluated for a subset of 22 species, the best plant-frequency response curves were obtained by using the growing season 10% cumulative frequency water level, followed closely by the growing season 7-day moving average high water level and two other high water-level statistics. This suggests that for Platte River riparian grasslands, high water levels are more influential than mean, median, or low water levels. Land-management practices (i.e., grazing, haying, and extended rest) affected six species by a change in frequency or a shift in position along the water-level gradient. Four general plant communities composed of species responding individually to the water-level gradient and other factors were identified for Platte River riparian grasslands: emergent, sedge meadow, mesic prairie, and dry ridge. Plant response curves are the first step toward predicting how plants responding to riparian-grassland water levels might also respond to river management.

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1170. Nitrogen and phosphorus dynamics and the fate of agricultural runoff.

Neely, R. K. and Baker, J. L.

In: Northern Prairie Wetlands/ Van der Valk, A.
Ames, Iowa: Iowa State University Press, 1989; pp. 92-131.

Notes: ISBN: 0813800374

Descriptors: wetlands/ cycling/ nitrogen/ soil/ agricultural chemicals/ phosphorus/ pollutants/ land types/ prairies
Abstract: Prairie wetlands are often contaminated by agricultural pollutants. Pesticides and NH₄-N are predominantly present in surface runoff, PO₄-P is transported mainly by sediment, and NO₃-N is lost mainly with subsurface drainage. Contaminants can be transferred to or retained in the soil, groundwater, atmosphere or biomass of microbes, plants and animals. Nitrogen is removed more effectively than phosphorus from marsh surface waters, and NO₃-N to a greater extent than NH₄-N. The most important removal processes seem to be denitrification for NO₃-N, sedimentation and precipitation for PO₄-P, and assimilation of inorganic nitrogen and phosphorus by emergent vegetation and microorganisms. Excessive nitrogen and phosphorus in wetlands increase nutrient accumulation in living plants, but accelerate nutrient release from decaying plants.

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1171. Nitrogen management strategies to reduce nitrate leaching in tile-drained Midwestern soils.

Dinnes, D. L.; Karlen, D. L.; Jaynes, D. B.; Kaspar, T. C.; Hatfield, J. L.; Colvin, T. S.; and Cambardella, C. A.

Agronomy Journal 94(1): 153-171. (2002)

NAL Call #: 4 AM34P; ISSN: 0002-1962

Descriptors: wetlands/ soil fertility/ nitrogen/ soil management/ leaching/ tile drainage/ groundwater/ groundwater contamination/ water pollution/ surface water/ water quality/ tillage/ crops/ soil organic matter/ hydrology/ air temperature/ precipitation/ monitoring/ crop rotation/ cover crops/ conservation tillage/ nitrification inhibitors/ biofiltration/ application rate/ literature reviews/ United States

Abstract: Balancing the amount of N needed for optimum plant growth while minimizing the NO₃ that is transported to ground and surface waters remains a major challenge for everyone attempting to understand and improve agricultural nutrient use efficiency. Our objectives for this review are to examine how changes in agricultural management practices during the past century have affected N in midwestern soils and to identify the types of research and management practices needed to reduce the potential for nonpoint NO₃ leakage into water resources. Inherent soil characteristics and management practices contributing to nonpoint NO₃ loss from midwestern soils, the impact of NO₃ loading on surface water quality, improved N management strategies, and research needs are discussed. Artificial drainage systems can have a significant impact on water quality because they behave like shallow, direct conduits to surface waters. Nonpoint loss of NO₃ from fields to water resources, however, is not caused by any single factor. Rather, it is caused by a combination of factors, including tillage, drainage, crop selection, soil organic matter levels, hydrology, and temperature and precipitation patterns. Strategies for reducing NO₃ loss through drainage include improved timing of N application at appropriate rates, using soil tests and plant monitoring, diversifying crop rotations, using

cover crops, reducing tillage, optimizing N application techniques, and using nitrification inhibitors. Nitrate can also be removed from water by establishing wetlands or biofilters. Research that is focused on understanding methods to minimize NO₃ contamination of water resources should also be used to educate the public about the complexity of the problem and the need for multiple management strategies to solve the problem across agricultural landscapes.

This citation is from AGRICOLA.

1172. Organochlorine pesticides and polychlorinated biphenyls in sediment and fish from wetlands in the north central United States.

Martin, D. B. and W. A. Hartman

Journal of the Association of Official Analytical Chemists 68(4): 12-17. (1985)

NAL Call #: 381 As7; ISSN: 0004-5756.

Notes: Other number: FR 31(3)

Descriptors: biomagnification/ polychlorinated biphenyls/ organochlorines/ pollution/ animals/ chromatography, gas/ fishes [metabolism]/ insecticides [analysis]/ polychlorinated biphenyls [analysis]/ soil pollutants [analysis]/ water pollutants [analysis]/ water pollutants, chemical [analysis]/ North America/ United States, north central

Abstract: Sediment samples collected in 1980-1982 from riverine and pothole wetlands at 17 locations in the north central United States were analyzed for organochlorine pesticides, certain of their metabolites, and polychlorinated biphenyls (PCBs). Concentrations were above minimum detection levels (5 ng/g of organochlorines and 20 ng/g of PCBs) in less than 4% of the samples taken. Fish samples taken at 9 of these 17 locations, and analyzed for the same compounds, showed a higher frequency of detectable contaminants. The most common compound found in fish was DDE, which was found in 51% of the samples at levels up to 512 ng/g. alpha-BHC was present at concentrations of 5 to 27 ng/g in 36% of the fish samples, and DDD was found at levels of 5 to 60 ng/g in 14%. Four other compounds, DDT, dieldrin, PCB, and trans-nonachlor, were detected in fish at relatively low concentrations in less than 10% of the samples. This survey, thus, indicated little contamination by organochlorine pesticides or PCBs in the wetland habitats of this region.

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1173. A review of wildlife changes in southern bottomland hardwoods due to forest management practices.

Wigley, T. Bently and Roberts, Thomas H.

Wetlands 14(1): 41-48. (1994)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: southern USA/ wildlife abundance/ wildlife diversity

Abstract: One function of bottomland hardwood forests is provision of wildlife diversity and abundance. In this paper, we discuss the temporal and spatial changes in wildlife diversity and abundance often associated with forest management practices in bottomland hardwoods. Forest management activities alter forest composition, structure, and spatial heterogeneity, thereby changing the composition, abundance, and diversity of wildlife communities. Special habitat features such as snags, den trees, and dead and down woody material also may be

impacted by forestry practices. More research is needed to fully understand landscape-level impacts of forest management.

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1174. Sedimentation associated with forest road surfacing in a bottomland hardwood ecosystem.

Rummer, Bob; Stokes, Bryce; and Lockaby, Graeme

Forest Ecology and Management 90(2-3): 195-200. (1997)

NAL Call #: SD1.F73; ISSN: 0378-1127

Descriptors: bottomland hardwood system/ ecology/ forest road surfacing/ forestry/ miscellaneous method/ sedimentation/ water quality

Abstract: Access systems are a necessary element of resource production in bottomland hardwood sites. However, road building may have a detrimental effect on hydrologic function of the site. This report describes initial results of a study designed to examine the effect of different road surfacing treatments on water quality. Four surfacing treatments installed on two test roads included native soil, native soil with vegetative stabilization, 6 cm of gravel, and 15 cm of gravel over geotextile. During the first flooding season periodic sampling measured floodwater suspended sediments and location of erosion and sediment deposition within the road prism. Initial results suggest that sediment movement was confined to the road right-of-way, with no statistically significant sedimentation effects detected beyond the clearing limits of the road. The study is continuing for another field season.

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1175. Small mammal response to farming as practiced on the Franklin Island Wildlife Area.

Clawson, R. L. and Smith, J. W. Missouri Dept. of Conservation; MO W-013-R-39/Job 1/Study No. 69, 1985. 21 p.

Descriptors: wetlands/ cotton-rat/ food crops/ mammals/ mice, deer/ mice, harvest/ mice, white-footed/ mouse, house/ rodents/ species diversity/ state wildlife management areas/ tillage/ voles/ Triticum spp./ North America/ United States/ Missouri/ Howard County

Abstract: Objective was to determine small mammal populations in corn, soybean, and wheat fields on a Missouri Department of Conservation wetland area.

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1176. Sources and impacts of irrigation drainwater contaminants in arid wetlands.

Lemly, A. D.; Finger, S. E.; and Nelson, M. K.

Environmental Toxicology and Chemistry 12(12): 2265-2279. (1993)

NAL Call #: QH545.A1E58; ISSN: 0730-7268

Descriptors: wetlands/ arid environments/ contaminants/ agriculture/ irrigation/ drainage/ reviews/ agricultural wastes/ agricultural runoff/ water supply/ ecological effects/ environmental effects/ toxicity/ pollutants/ regulations/ Western/ environmental impact/ sources and fate of pollution/ freshwater pollution/ United States/ Northwest/ Central Valley/ High Plains

Abstract: Arid wetlands are being contaminated by subsurface agricultural irrigation drainage throughout the western United States. Historic freshwater inflows have been diverted for agricultural and municipal use, and remaining freshwater supplies are not sufficient to maintain the integrity of these important natural areas once they are

degraded by irrigation drainwater. Waterfowl populations are threatened in the Pacific and Central Flyways; migratory birds have been poisoned by drainwater contaminants on at least six national wildlife refuges. Subsurface irrigation drainage is the most widespread and biologically important source of contaminants to wetlands in arid regions of the country. The case history of poisoning at Kesterson National Wildlife Refuge in California and studies at other locations by the U.S. Department of the Interior provide detailed information on the toxicity of drainwater contaminants to fish and wildlife. Biogeochemical conditions favorable for the production of toxic drainage are found throughout the western states. Two actions seem necessary to prevent further drainage-related degradation of arid wetlands. First is a reduction in the amount of contaminants reaching these wetlands, possibly involving regulatory intervention through the National Pollutant Discharge Elimination System permit process. Second, a better balance must be achieved in the way fresh water is allocated between agriculture and wildlife. Federally subsidized water has supported agriculture at the expense of wetlands for nearly 100 years in the western United States. This trend must be reversed if arid wetlands and their fish and wildlife populations are to survive.

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1177. Speciation of soluble selenium in agricultural drainage waters and aqueous soil-sediment extracts using hydride generation atomic absorption spectrometry.

Zhang, Y.; Moore, J. N.; and Frankenberger, W. T.

Environmental Science and Technology 33(10): 1652-1656. (1999)

NAL Call #: TD420.A1E5; ISSN: 0013-936X

Descriptors: wetlands/ chemical speciation/ selenium/ drainage water/ agricultural runoff/ sediment pollution/ spectroscopic techniques/ analytical methods/ speciation/ spectroscopy/ drainage/ ponds/ water sampling/ atomic absorption spectroscopy/ agriculture/ oxidation

Abstract: There are few methods to effectively measure organic selenium [Se(-II)] in natural water and soil-sediment extracts. A method has been developed to determine organic Se(-II) in soil-sediment extracts and agricultural drainage water by using persulfate to oxidize organic Se(-II) and using manganese oxide as an indicator for oxidation completion. This method was used to determine Se speciation in eleven soil-sediments and four agricultural drainage water samples collected from the western United States. Results showed that organic Se(-II) can be quantitatively oxidized to selenite without changing the selenate concentration in the soil-sediment extract and agricultural drainage water and then quantified by hydride generation atomic absorption spectrometry. Recoveries of spiked organic Se(-II) and selenite were 96-105% in the soil-sediment extracts and 96-103% in the agricultural drainage water. Concentrations of soluble Se in the soil-sediment extracts were 0.0534-2.45 $\mu\text{g/g}$, of which organic Se(-II) accounted for 4.5-59.1%. Selenate is the dominant form of Se in agricultural drainage water, accounting for about 90% of the total Se. In contrast, organic Se(-II) was an important form of Se in the wetlands. These results showed that wetland sediments are more active in reducing selenate compared to evaporation pond sediments.

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1178. Timber harvesting considerations for site protection in southeastern forested wetlands.

Aust, W. M.

Technical Publication R8 20: 5-12. (Dec. 1994)

NAL Call #: aSD11.U5962; ISSN: 0749-5536

Descriptors: wetlands/ forests/ logging/ natural resource management/ environmental impact/ forest management/ hydrology/ water quality/ productivity/ history/ trafficability/ soil properties/ natural regeneration/ economic analysis/ equipment/ disturbed soils/ literature reviews

This citation is from AGRICOLA.

1179. A VSA-based strategy for placing conservation buffers in agricultural watersheds.

Qiu, Zeyuan

Environmental Management 32(3): 299-311. (2003)

NAL Call #: HC79.E5E5; ISSN: 0364-152X

Descriptors: agriculture/ freshwater ecology: ecology, environmental sciences/ pollution assessment control and management/ terrestrial ecology: ecology, environmental sciences/ benefit cost analysis/ applied and field techniques/ VSA conservation buffer scenario/ agricultural land conservation buffer interactions/ agricultural landscapes/ agricultural nonpoint source pollution/ agricultural watersheds/ available funding/ conservation buffers/ aesthetics improvement potential/ agricultural nonpoint source pollution reduction potential/ flood control improvement potential/ landscape biodiversity improvement potential/ location/ recreation potential improvement/ size/ terrestrial wild life habitat improvement potential/ cost effectiveness/ edge of field buffer scenario/ effectiveness/ environmental objectives/ field scale example/ hydrological processes/ landscape planning/ natural characteristics: hydrology, land use, cover, soils, topography/ riparian wetlands/ runoff generation/ streamside areas/ variable source area [VSA]: hydrology, identification, runoff generation contribution/ variable source area based strategy/ water quality

Abstract: Conservation buffers have the potential to reduce agricultural nonpoint source pollution and improve terrestrial wild-life habitat, landscape biodiversity, flood control, recreation, and aesthetics. Conservation buffers, streamside areas and riparian wetlands are being used or have been proposed to control agricultural nonpoint source pollution. This paper proposes an innovative strategy for placing conservation buffers based on the variable source area (VSA) hydrology. VSAs are small, variable but predictable portion of a watershed that regularly contributes to runoff generation. The VSA-based strategy involves the following three steps: first, identifying VSAs in landscapes based on natural characteristics such as hydrology, land use/cover, topography and soils; second, targeting areas within VSAs for conservation buffers; third, refining the size and location of conservation buffers based on other factors such as weather, environmental objectives, available funding and other best management practices. Building conservation buffers in VSAs allows agricultural runoff to more uniformly enter buffers and stay there longer, which increases the buffer's capacity to remove sediments and nutrients. A field-scale example is presented to demonstrate the effectiveness and cost-effectiveness of the within-VSA conservation buffer scenario relative to a typical edge-of-field buffer scenario. The results enhance the understanding of hydrological processes and interactions between agricultural lands and conservation buffers in

agricultural landscapes, and provide practical guidance for land resource managers and conservationists who use conservation buffers to improve water quality and amenity values of agricultural landscape.
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Wetlands as Agricultural Conservation Practices

1180. Breeding season bird use of recently restored versus natural wetlands in New York.

Brown, S. C. and Smith, C. R.

Journal of Wildlife Management 62(4): 1480-1491. (1998)
NAL Call #: 410 J827; ISSN: 0022-541X

Descriptors: environmental restoration/ habitat utilization/ breeding/ aquatic birds/ ecosystem management/ nature conservation/ breeding sites/ habitat selection/ plant populations/ ecological succession/ nesting/ Aves/ USA, New York/ birds/ restored wetlands

Abstract: Restoration of drained wetlands may contribute significantly to conservation of habitats for wetland birds, and state and federal agencies throughout the country rely on restoration and creation of wetlands to mitigate habitat losses to development. However, it is unclear if restored systems replace the habitat functions of natural wetlands, and few direct comparisons of multiple sites have been made. Three years after restoration, we compared the relative abundance and density of birds using 18 restored wetlands and 8 natural wetlands located in northern New York. Birds were classified as wetland dependent, wetland associated, or nonwetland. Abundances of species and of individuals in all 3 groups did not differ ($P > 0.05$) between restored and natural wetlands in any year. Densities of species in all 3 groups were consistently but not significantly lower at restored sites. Densities of individuals in the wetland-associated category and nonwetland category were significantly lower at restored sites for the first 2 years following restoration. Bird communities were significantly less similar between restored and natural sites than among restored sites. However, many of these differences may not persist following natural successional development of the restored sites. The long-term persistence of appropriate plant communities will determine whether or not restored sites provide bird habitat comparable to natural wetlands. The restoration program successfully increased the amount of bird habitat available in the region. However, hectare-for-hectare, the restored wetland sites did not replace the habitat functions of natural wetlands during the time period of this study.

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1181. Core terrestrial habitat for conservation of local populations of salamanders and wood frogs in agricultural landscapes.

Porej, D.; Micacchion, M.; and Hetherington, T. E.

Biological Conservation 120(3): 399-409. (2004)
NAL Call #: S900.B5; ISSN: 0006-3207

Descriptors: wetlands/ akaike information criterion/ fish/ glaciated plateau/ habitat preservation/ marbled salamanders/ predation/ red spotted newts/ smallmouth salamanders/ spotted salamanders/ tiger salamanders/ till plains/ wood frogs/ amphibia/ conservation/ North America/ United States/ Ohio/ *Notophthalmus viridescens* viridescens/ *Rana sylvatica*/ *Ambystoma tigrinum*/

Ambystoma maculatum/ *Ambystoma jeffersonianum*

Abstract: Pond-breeding amphibians require aquatic and terrestrial habitats to complete their lifecycles, and preservation of both habitats is necessary for maintaining local populations. Current wetland regulations focus primarily on aquatic habitats, and criteria to define critical upland habitats and regulations to protect them are often ambiguous or lacking. We examined the association between the presence of seven pond-breeding amphibian species and the landscape composition surrounding 54 wetlands located within the Till Plains and the Glaciated Plateau ecoregions of Ohio, USA. We quantified landscape composition within 200 m of the wetland ("core terrestrial zone") and the area extending from 200 m to 1 km from the wetland ("broader landscape context zone"). We constructed binary logistic regression models for each species, and evaluated them using Akaike Information Criterion. Presence of spotted salamanders (*Ambystoma maculatum*), Jefferson's salamander complex (*A. jeffersonianum*) and smallmouth salamanders (*A. texanum*) was positively associated with the amount of forest within the core zone. Presence of wood frogs (*Rana sylvatica*) was positively associated with the amount of forest within the core zone and the amount of forest within the broader landscape context zone. Presence of tiger salamanders (*A. tigrinum tigrinum*) was negatively associated with the cumulative length of paved roads within 1 km of the site, and presence of red-spotted newts (*Notophthalmus v. viridescens*) was negatively associated with the average linear distance to the five nearest wetlands. Overall salamander diversity was positively associated with the amount of forest within the core zone, and negatively associated with the presence of predatory fish and cumulative length of paved roads within 1 km of the site. Our results confirm the strong association between the structure of surrounding upland areas and amphibian diversity at breeding ponds, and stress the importance of preserving core terrestrial habitat around wetlands for maintaining amphibian diversity.

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1182. Creation and restoration of forested wetland vegetation in the southeastern United States.

Lea, R. and Clewell, A. F.

In: *Wetland Creation and Restoration: The Status of the Science.*

Covelo, Calif.: Island Press, 1990; pp. 195-231.

Notes: ISBN: 1559630450

NAL Call #: QH541.5.M3W462

Descriptors: artificial wetlands/ forest ecosystems/ swamps/ vegetation establishment/ water resources management/ wetland restoration/ hardwood/ oak trees/ plant populations/ planting management/ soil-water-plant relationships/ trees/ vegetation regrowth/ water resources development

Abstract: A wide variety of forest establishment techniques have been employed, some with initial success, but most are too new for critical evaluation. Most of these projects pertain to bottomland hardwood and cypress replacement. The two most significant trends in project activity have been the direct seeding of oaks on abandoned croplands and the replacement of all trees and sometimes the undergrowth at reclaimed surface mines. Project success depends largely on judicious planning and careful execution. The most critical factor for all projects is to achieve adequate hydrological conditions. Other important factors may include substrate stability, availability of adequate soil rooting volume and fertility, and the control of herbivores and competitive weeds. Success criteria for evaluating extant projects throughout the southeast need to place emphasis on the presence of preferred species and on the attainment of a threshold density of trees that are at least two meters tall. At that point, release from regulatory liability should be seriously considered. Several critical information gaps have been identified: (1) the silvicultural literature warrants further investigation of wetland tree establishment; (2) the conditions conducive to effective natural regeneration need to be elucidated; (3) techniques for undergrowth establishment should be developed; (4) baseline ecological and floristic studies need expansion for certain plant communities and regions; (5) research is needed to determine if successful forest replacement will provide the functional services of the original ecosystem; and (6) the time is ripe for a coordinated southeastern regional monitoring effort. (Author 's abstract)
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1183. Creation and restoration of riparian habitat in southwestern arid and semi-arid regions.

Johnson, R. R.; Mills, G. S.; and Carothers, S. W.
In: Wetland Creation and Restoration: The Status of the Science.

Covelo, Calif.: Island Press, 1990; pp. 351-366.

Notes: ISBN: 1559630450

NAL Call #: QH541.5.M3W462

Descriptors: artificial wetlands/ habitat restoration/ riparian land/ water resources management/ wetland restoration/ arid lands/ planting management/ research priorities/ riparian vegetation/ riparian waters/ soil-water-plant relationships/ vegetation establishment/ water resources development

Abstract: Though the literature on characteristics, values, and functions of riparian habitats in the arid and semiarid southwestern region of the United States is fairly extensive, few papers that pertain to its creation or restoration are available. Because these projects are so recent, evaluations of successes and failures are based on short-term results; long-term survival and growth rates are as yet unknown. In most cases, creation and restoration projects have involved the planting of vegetation and not the creation of conditions suitable for the natural regeneration of riparian habitats. Important considerations for riparian creation or restoration projects in the Southwest include: depth to water table; soil salinity and texture; amount and frequency of irrigation; effects of rising and dropping water tables on planted trees; protection from vandalism, off-road vehicles, and livestock; monitoring of growth rates as well as survival; and project design flexible enough to allow for major modifications. Because the creation and restoration of riparian habitats in the Southwest is new and mostly

experimental, more information is needed for virtually every aspect of revegetation. Two major questions that need to be answered are whether planted trees survive for more than a few years and reach expected sizes, and what ranges of planting parameters are most cost-effective. Specific information needs include the identification of: the most suitable watering regimes; suitable soil conditions for various tree species; long-term survival and growth rates; and effects of variable water levels on planted trees.

(Author 's abstract)

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1184. Creation, restoration, and enhancement of marshes of the northcentral Gulf Coast.

Chabreck, R. H.

In: Wetland Creation and Restoration: The Status of the Science.

Covelo, Calif. Island Press, 1990; pp. 125-142.

Notes: ISBN: 1559630450

NAL Call #: QH541.5.M3W462

Descriptors: artificial wetlands/ coastal marshes/ Louisiana/ water resources management/ wetland restoration/ Alabama/ diversion/ drainage engineering/ dredging/ environmental engineering/ levees/ marsh management/ Mississippi/ planting management/ salt marshes/ sedimentation/ Texas/ tidal marshes/ vegetation establishment/ water resources development/ weirs

Abstract: Coastal marshes of the northcentral Gulf Coast comprise almost 50% of the coastal marshes of the United States, excluding Alaska. Over 80% of the marshes in this region occur in Louisiana because of the influence of the Mississippi River. Salt, brackish, intermediate, and fresh marshes are well-represented within the region. Marshes have been created from dredged material deposited in shallow waters and by controlled diversion of river flow to direct sedimentation to specific sites. Plantings are seldom made on dredged material in Louisiana because of the large area to be planted and the fact that natural colonization is rapid. In fresher marshes, dredged material is left as levees after canals are dug that connect to salt water sources. Levees reduce salt water contamination and drainage of the marsh. Dredge material is usually planted in Texas, Mississippi, and Alabama to stabilize the material and hasten marsh development. In tidal marshes, construction of weirs is the most widely used enhancement practice. Impoundments provide a mechanism for controlling water depth and salinity and regulating plant growth. But impoundments can only be constructed in marshes that will support a continuous levee system. Freshwater diversion from the Mississippi River has been used on a small scale for marsh restoration and enhancement but could be used to improve vast areas of the rapidly deteriorating marshes of southeastern Louisiana. Precise information is needed on subsidence rates of individual localities for planning marsh creation and restoration projects. Methods for maximizing subdelta development and determining best use of dredged material are needed. (Author 's abstract)

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1185. Design and implementation of functional wetland mitigation: Case studies in Ohio and South Carolina.

McCuskey, S. A.; Conger, A. W.; and Hillestad, H. O. *Water, Air, and Soil Pollution* 77(3-4): 513-532. (1994)
Abstract: Wetland development offers the opportunity to replace and enhance ecological functions lost through permitted wetland impacts. Components necessary for the restoration and creation of wetlands are presented and examples of wetland construction are described to illustrate the application of wetland design. Land contours, top soil, hydrology and vegetation were manipulated to develop wooded wetlands at sites in Ohio and South Carolina. In Ohio, approximately 30 ha of former crop land/sod farm were modified to bring water from the adjacent creek onto the site and hold it to saturate soils for wetland development. A 2.8 ha ponding area and channels were constructed, berms were built to slow the exit of stormwater runoff, and trees were planted in spring 1994. The mitigation site lies adjacent to a park and high school, thereby also providing community benefits and wetland education opportunities. In South Carolina, 9.5 ha of an abandoned soil borrow pit were converted into wooded wetlands, hydrologically connected to an adjacent swamp. Native plants were removed from the 4 ha of isolated wetlands to be impacted, and were augmented with nursery stock to create the mitigation wetland. Monitoring of vegetation, hydrology and wildlife usage of the constructed system continues to document wetland development and success.

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1186. Designing constructed wetlands to remove phosphorus from barnyard run-off: Seasonal variability in loads and treatment.

Hill, C. M.; Duxbury, J. M.; Geohring, L. D.; and Peck, T. *Advances in Ecological Sciences* 11: 181-196. (2003)
NAL Call #: QH540.I67; *ISSN:* 1369-8273.

Notes: Special issue: Constructed wetlands for wastewater treatment in cold climates; Issue editors: Mander, U. and Janssen, P.

Descriptors: wetlands/ agricultural runoff/ farm wastes/ phosphorus removal/ costs/ dairy wastes/ wastewater treatment/ runoff (agricultural)/ dairy industry waste waters/ wastewater treatment processes/ industrial effluents/ water & wastewater treatment

Abstract: While constructed wetlands can be a cost-effective method for reducing the export of P from agricultural ecosystems, removal rates vary depending on the substrate, the climate, and the load of nutrients. The objectives of this research were to evaluate substrates that could improve soluble P removal in treatment wetlands, and to compare their efficacy both seasonally and under varying loading regimes. To compare four substrates for removing soluble P from dairy barnyard run-off, eight 55 m super(2) subsurface wetland cells were built on an 800-head dairy farm in Newark, NY, USA. The four media were (1) a fine loamy, mixed, mesic Glossic Hapludalf, (2) crushed limestone, (3) Norlite (lightweight coarse aggregates of fired shale), and (4) wollastonite (calcium metasilicate) mining tailings. Influent P concentrations in the growing season dropped to 2.9 mg/L, while concentrations in the dormant season rose gradually to a peak of 28.5 mg/L. Over 1.5 years, soil removed the most soluble P (53%), followed by Norlite (34%), wollastonite tailings (13%), and limestone (4%). No significant difference was found in percent

removal of soluble P across seasons, an indication that neither higher loads nor freezing conditions curtail removal of phosphorus from this wastestream. These results help demonstrate that subsurface flow wetlands are appropriate components of stormwater management systems on farms in cold temperate climates. Treatment rates are sustainable in winter even at very high P loads.

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1187. Forested wetlands.

Calhoun, Aram J.

In: *Maintaining biodiversity in forest ecosystems/* Hunter, Malcolm L. Cambridge, UK: Cambridge University Press, 1999; pp. 300-331.

Notes: ISBN: 0521631041

Descriptors: biodiversity/ ecology: environmental sciences/ ecosystem management/ management method/ forested wetlands/ hydroperiod/ book chapter

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1188. A guide to bottomland hardwood restoration.

Allen, J. A.; Keeland, B. D.; Stanturf, J. A.; Clewell, A. F.; and Kennedy, H. E.

Asheville, North Carolina: U.S. Geological Survey, Biological Resources Division//U.S. Department of Agriculture, Forest Service, Southern Research Station; USGS/BRD/ITR-2000-0011132 pp. General Technical Report SRS-40.

Notes: Information and Technology Report

NAL Call #: aSD143 .G46 no. 40

http://www.nwrc.usgs.gov/wdb/pub/diglib/bottomland_hardwood.htm

Descriptors: wetlands/ afforestation/ bottomland forests/ choice of species/ direct sowing/ forests/ nature conservation/ planning/ revegetation/ seedlings/ silviculture/ site preparation/ southeastern states of USA/ forests and forest trees/ biology and ecology/ silviculture and forest management/ biological resources/ plants

Abstract: During the last century, a large amount of the original bottomland hardwood forest area in the USA has been lost, with losses greatest in the Lower Mississippi Alluvial Valley and East Texas. With a holistic approach in mind, this manual describes methods to restore bottomland hardwoods in the lower Midwest, including the Lower Mississippi Alluvial Valley and the southeastern USA. Bottomland hardwoods in this guide include not only the hardwood species that predominate in most forested floodplains of the area but also the softwood species such as baldcypress that often co-occur. General restoration planning considerations are discussed as well as more specific elements of bottomland hardwood restoration such as species selection, site preparation, direct sowing, planting of seedlings, and alternative options for revegetation. We recognize that most projects will probably fall more within the realm of reforestation or afforestation rather than a restoration, as some site preparation and the planting of seeds or trees may be the only actions taken. Practical information needed to restore an area is provided in the guide, and it is left up to the restorationist to decide how complete the restoration will be. Postplanting and monitoring considerations are also addressed. Restoration and management of existing forests are included because of the extensive areas of degraded natural forests in need of rehabilitation.

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1189. Habitat use by mallards during spring migration through Central Iowa USA.

Lagrange, T. G. and Dinsmore, J. J.

Journal of Wildlife Management 53(4): 1076-1081. (1989)

NAL Call #: 410 J827; ISSN: 0022-541X

Descriptors: Anas platyrhynchos/ high energy seed/ food/ nighttime cover/ sheetwater wetland

Abstract: We studied the use of 455 seasonally flooded farmed basins (sheetwater wetlands) and 16 small emergent wetlands by migratory mallards (*Anas platyrhynchos*) in central Iowa during spring 1983-84. During daytime, sheetwater wetlands provided 19,530 mallard use days compared with 103 on the few remaining emergent wetlands. Mallards used larger (> 2 ha) versus smaller sheetwater wetlands, moist-soil or corn-vegetated wetlands more than emergent wetlands or soybean-vegetated wetlands, untilled wetlands more than conservation-tiller or plowed sheetwater wetlands, and sheetwater wetlands located farther from disturbance. Mallards used sheetwater wetlands during all daylight hours, but flew 13 km to roost on larger emergent wetlands. A diversity of habitats appears necessary for spring migratory mallards: sheetwater wetlands provide food and high-energy seeds and emergent wetlands provide nighttime cover.

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1190. A handbook of constructed wetlands: A guide to creating wetlands for agricultural wastewater, domestic wastewater, coal mine drainage, stormwater in the Mid-Atlantic Region.

Davis, Luise; United States. Natural Resources Conservation Service; United States. Environmental Protection Agency. Region III; and Pennsylvania. Dept. of Environmental Resources.

Washington, D.C.: U.S. Department of Agriculture. (1995)

Notes: "This document was prepared by Luise Davis"--P. [2] of cover; Contents note: v.1. General considerations -- v.2. Domestic wastewater -- v.3. Agricultural wastewater -- v.4. Coal mine drainage -- v.5. Stormwater.

NAL Call #: TD756.5.D39 1995; ISBN: 0160529999 (v.1); 0160530008 (v.2); 0160530016 (v.3); 0160530024 (v.4); 0160530032 (v.5)

Descriptors: constructed wetlands--Middle Atlantic States--handbooks, manuals, etc/ sewage purification--handbooks, manuals, etc/ agricultural pollution--handbooks, manuals, etc/ coal mine waste--handbooks, manuals, etc/ storm sewers--handbooks, manuals, etc
This citation is from AGRICOLA.

1191. The importance of local and regional factors in predicting effective conservation: Planning strategies for wetland bird communities in agricultural and urban landscapes.

Whited, Diane; Galatowitsch, Susan; Tester, John R.;

Schik, Karen; Lehtinen, Rick; and Husveth, Jason

Landscape and Urban Planning 49(1-2): 49-65. (2000)

NAL Call #: QH75.A1L32; ISSN: 0169-2046

Descriptors: wildlife management: conservation/ agricultural landscapes/ conservation effectiveness: local factors, regional factors/ urban landscapes/ wetland communities

Abstract: Wetland assessment techniques have generally focused on rapid evaluations of local and site impacts; however, wetland biodiversity is often influenced both by

adjacent and regional land use. Forty wetlands were studied in the Red River Valley (RRV), Southwest Prairie (SWP), and the Northern Hardwood Forest (NHF) ecoregions of Minnesota, USA, to assess the strength of association between local and landscape condition and avian community composition. We examined the relationship between bird assemblages and local and landscape factors (connectedness, isolation, road density, and site impacts). Landscape variables were calculated for three spatial scales at 500 m (79 ha), 1000 m (314 ha), and 2500 m (1963 ha). Connectedness and road density are important measures for predicting bird assemblages in both agricultural ecoregions (SWP and RRV). Connectedness and its relationship with wetland bird assemblages were most pronounced at the larger scale (2500 m), where the largest remnant patches can be discerned. In contrast, road effects on bird assemblages were most pronounced at the smallest scale (500 m). Wetland isolation corresponded to bird community patterns as well, but only in one ecoregion (SWP). In the urbanizing ecoregion (NHF), species richness was considerably lower than elsewhere but community patterns did not correspond to landscape variables. The focus of wetland conservation planning needs to shift from the site scale to the landscape scale to ensure that connection with the regional wetland pattern is accounted for, therefore, affording the best opportunity to successfully maintain wetland avian diversity.

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1192. Managing agricultural wetlands for waterbirds in the coastal regions of Louisiana, USA.

Huner, J. V.; Jeske, C. W.; and Norling, W.

Waterbirds 25(Special Publication 2): 66-78.

NAL Call #: QL671; ISSN: 1524-4695

Descriptors: agricultural wetlands/ artificial freshwater habitat/ coastal wetlands/ crawfish management/ crawfish ponds/ freshwater habitat/ gulf coastal plain/ land conservation programs/ migration/ riparian habitat

Abstract: Rice and/or crawfish are cultivated in over 225,000 ha of shallow earthen impoundments within 160 km of the Gulf of Mexico along the coast of Louisiana. The region includes both the Gulf Coastal Plain and Prairie and the Lower Mississippi River Valley. Annual loss of 4,475 ha of coastal wetlands in Louisiana due to subsidence, erosion, and rising sea level has significantly reduced desirable freshwater habitat in the region. The suite of resident, migrant, breeding, and wintering waterbirds depending on this region includes grebes, pelicans, cormorants, anhingas, wading birds, waterfowl, coots, rails, gallinules, shorebirds, gulls, terns, and kingfishers. These taxa utilize the artificial freshwater wetland habitat provided by the agricultural wetlands. Numerous other birds utilize riparian areas associated with these artificial wetlands. Crawfish ponds are especially valuable cool season habitat for predaceous waterbirds because they provide shallow water systems rich in invertebrate and small vertebrate prey during the period from mid-autumn through mid-spring when most rice fields are drained. Because most crawfish ponds are not drained until late spring or early summer, predictable, food-rich, shallow water waterbird habitat is available throughout the region when rice fields are being cultivated for rice production. Incorporation of crawfish management into government-sponsored land conservation programs should encourage land owners to sustain standing water habitat outside of program mandated

fill/drain requirements. Farmers could adjust the times when their impoundments are filled or drained to maximize benefits to many species, especially migrating shorebirds.
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1193. Reciprocating constructed wetlands for treating industrial, municipal and agricultural wastewater.

Behrends, L.; Houke, L.; Bailey, E.; Jansen, P.; and Brown, D.
Water Science and Technology 44(11-12): 399-405. (2001)
NAL Call #: TD420.A1P7; ISSN: 0273-1223
Descriptors: bioprocess engineering/ freshwater ecology: ecology, environmental sciences/ pollution assessment control and management/ waste management: sanitation/ agricultural wastewater treatment/ industrial wastewater treatment/ municipal wastewater treatment/ wastewater treatment method/ aerobic zones/ anaerobic zones/ biochemical oxygen demand/ contiguous cells/ denitrification/ fixed film biological reactor/ high strength animal wastewater/ hydraulic retention time/ mixed wastewater streams/ municipal/ domestic wastewater/ nitrification/ paired subsurface flow constructed wetlands/ reciprocating constructed wetlands/ reciprocation cycle time/ reciprocation depth/ reciprocation frequency/ redox potential: control/ substrate composition/ substrate size/ Tennessee Valley Authority [TVA]/ U.S. Environmental Protection Agency [U.S. EPA]

Abstract: Scientists at the Tennessee Valley Authority (TVA), and in collaboration with the U.S. Environmental Protection Agency (EPA), are continuing to develop and refine an innovative wastewater treatment system referred to as reciprocating subsurface-flow constructed wetlands. Reciprocation relates to patented improvements in the design and operation of paired subsurface-flow constructed wetlands, such that contiguous cells are filled and drained on a frequent and recurrent basis. This operating technique turns the entire wetland system into a fixed-film biological reactor, in which it is possible to control redox potential in alternating aerobic and anaerobic zones. Reciprocating systems enable manipulation of wastewater treatment functions by controlling such parameters as hydraulic retention time, frequency of reciprocation, reciprocation cycle time, depth of reciprocation, and size and composition of substrate. These improved wetland technologies have been used for treating municipal/domestic wastewater, high strength animal wastewater, and mixed wastewater streams containing acids, recalcitrant compounds, solvents, antifreeze compounds, heavy metals, explosives, and fertilizer nutrients. Results from selected treatability studies and field demonstrations will be summarized with respect to conceptual design and treatment efficacy.

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1194. Regional analysis of the creation and restoration of kettle and pothole wetlands.

Hollands, G. G.
In: *Wetland Creation and Restoration: The Status of the Science*.
Covelo, Calif.: Island Press, 1990; pp. 281-298.
Notes: ISBN: 1559630450
NAL Call #: QH541.5.M3W462
Descriptors: artificial wetlands/ environmental engineering/ glaciation/ hydrologic budget/ water resources management/ continental basins/ permeability/ potholes/ soil properties/ streams/ surface-groundwater relations/

water resources development/ watershed management
Abstract: Kettles are topographic basins created by a variety of glacial processes and occur randomly throughout glaciated regions. They are associated with both permeable and impermeable deposits. Kettle wetlands can have complex hydrologic types: those having no inlet or outlet streams, and those associated with surface water streams. Complex relationships of surface water, groundwater, water chemistry, and other hydrologic elements combine to create water balances. This has been documented in the Prairie Potholes region of the United States where site specific hydrologic research has been conducted. Creating kettle wetlands is similar to other types of freshwater wetland creation, except where unique vegetation and hydrology are involved and replication may be a complex, technical effort. Identification of limiting factors is critical to wetland creation. Typical factors important to kettle wetlands are: surface water hydrology, groundwater hydrology, stratigraphy, soils, and water chemistry. Depending upon the goals of the project, other limiting factors may include: nuisance animals, long-term maintenance/monitoring, lack of funds, and disposals of excavated soil. The primary concern in creating kettle wetlands is the establishment of the proper hydrology. This normally requires mid-course corrections in design during construction to establish proper post-construction hydrology. Critical needs include studies on microstratigraphy, geochemical processes, the properties of organic soil, and the details of hydrology.
(Author's abstract)

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1195. The use of macrophyte-based systems for phosphorus removal: An overview of 25 years of research and operational results in Florida.

Debusk, T. A.; Dierberg, F. E.; and Reddy, K. R.
Water Science and Technology 44(11-12): 39-46. (2001)
NAL Call #: TD420.A1P7; ISSN: 0273-1223.
Notes: Conference: 7th International Conference on Wetland Systems for Water Pollution Control 2000, Lake Buena Vista, FL [USA], 11-16 Nov 2000; Issue editors: Kadlec, R. H. and Reddy, K. R.; ISBN: 1843394073
Descriptors: wetlands/ United States, Florida/ water pollution control/ performance evaluation/ phosphorus removal/ macrophytes/ case studies/ reviews/ case study/ agricultural runoff/ wastewater treatment/ historical account/ United States, Florida/ water quality control/ water treatment/ freshwater pollution/ water pollution: monitoring, control & remediation/ wastewater treatment processes
Abstract: Phosphorus (P) removal from wastewaters and surface runoff using macrophyte-based systems (MBS) has been a topic of great interest in Florida for over 25 years. During this period, P removal by both treatment wetlands and floating aquatic macrophyte systems has been evaluated from both a research and operational standpoint. Several factors have contributed to the increased focus on the use of MBS for P removal. First, there exist no conventional technologies that can cost-effectively achieve the low outflow P concentrations required to protect the integrity of Florida's relatively pristine surface waters. Second, because MBSs typically provide some water storage, they can accommodate the wide ranges of flows typical for runoff sources such as agricultural drainage waters. Finally, many regions in Florida have sufficient area for deployment of the relatively land-intensive MBS technologies. The first P removal work in Florida was

initiated in the mid-1970s, and involved pilot-scale research on domestic wastewater treatment by natural wetlands. Parallel studies were performed with managed (periodically harvested) floating plant systems (i.e., *Eichhornia crassipes*) for tertiary treatment. Since that time, the range of operational systems that have been deployed include emergent macrophyte-based and forested wetlands, managed floating plant systems, and submerged macrophyte-based systems. Waters treated by MBS include domestic effluents, agricultural runoff and eutrophic lake waters. Phosphorus removal targets for MBS in Florida have been as low as 10 µg/L. In this paper, we summarize research and operational results for MBS in Florida over the past 25 years.

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1196. Vegetation similarity and avifaunal food value of restored and natural marshes in northern New York.

Brown, Stephen C.

Restoration Ecology 7(1): 56-68. (1999)

NAL Call #: QH541.15.R45R515; ISSN: 1061-2971

Descriptors: natural restored marsh comparisons: avifaunal food value, vegetation/ restoration ecology

Abstract: Measuring the success of wetland restoration efforts requires an assessment of the wetland plant community as it changes following restoration. But analyses of restored wetlands often include plant community data from only one time period. We studied the development of plant communities at 13 restored marshes in northern New York for 4 years, including 1 year prior to restoration and 3 years afterwards. Restored wetlands ranged in size from 0.23 to 1.70 ha. Four reference wetlands of similar basin morphology, soil type, and size (0.29-0.48 ha) that occurred naturally in the same area were studied as comparisons. Dike construction to restore hydrology disturbed the existing vegetation in some parts of the restored sites, and vegetation was monitored in both disturbed and undisturbed areas. Undisturbed areas within the restored sites, which were dominated by upland field grasses before restoration, developed wetland plant communities with lower wetland index values but comparable numbers of wetland plant species than the reference wetlands, and they lagged behind the reference sites in terms of total wetland plant cover. There were significantly more plant species valuable as food sources for wetland birds, and a significantly higher percent cover of these species, at the undisturbed areas of the restored sites than at the reference wetlands. Areas of the restored sites that were disturbed by dike construction, however, often developed dense, monospecific cattail stands. In general, the plant communities at restored sites became increasingly similar to those at the reference wetlands over time, but higher numbers of herbaceous plants developed at the restored sites, including food plants for waterfowl, rails, and songbirds. Differences in shrub cover will probably lessen as natural recolonization increases shrub cover at the restored sites. Natural recolonization appears to be an effective technique for restoring wetlands on abandoned agricultural fields with established plant cover, but it is less successful in areas where soil has been exposed by construction activity.

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1197. Wetland conservation and Ducks Unlimited: Real world approaches to multispecies management.

Tori, Gildo M.; Mcleod, Scott; Mcknight, Keith; Moorman, Thomas; and Reid, Frederic A.

Waterbirds 25(Special Publication 2): 115-121. (2002)

NAL Call #: QL671; ISSN: 1524-4695

Descriptors: biodiversity/ freshwater ecology: ecology, environmental sciences/ terrestrial ecology: ecology, environmental sciences/ wildlife management: conservation/ multispecies management/ applied and field techniques/ Ducks Unlimited/ biodiversity/ coastal wetlands/ development: agricultural, industrial, urban/ habitat degradation/ habitat loss/ hydrological modification/ integrated habitat based landscape management/ land conversion/ palustrine wetlands/ riverine wetlands/ sustainable ecosystems/ wetland conservation/ wetland management/ wetland restoration/ wetland associated uplands/ wildlife diversity

Abstract: Conversion and loss of coastal, riverine, and palustrine wetlands to agricultural, urban, and industrial developments have had significant impacts on waterbirds. Degradation of wetlands and associated upland habitats, and associated impacts on several duck and rail species are well documented. Wetland restoration and management are essential for wildlife diversity because of the magnitude of wetland destruction and hydrological modification that has occurred in most of the United States. Half of threatened and endangered species rely upon wetlands for some portion of their life cycle, underscoring the importance of wetlands to all wildlife. Ducks Unlimited, during its 65-year history of conservation programs, has restored, protected, and enhanced nearly 4.05 million hectares of wetlands and associated uplands in North America. Despite the accomplishments of Ducks Unlimited and its private, state, provincial and federal partners, the perception remains that our efforts benefit only waterfowl. However, wildlife inventories on Ducks Unlimited projects indicate benefits to more than 900 species. Herein, we promote an integrated, habitat-based landscape approach to wetland restoration and management, rather than individual species management, to achieve biodiversity and sustainable ecosystem objectives. We discuss the development of wetland restoration and management strategies for quality wetland complexes needed for waterbirds during their annual life cycles. Further, we underscore the importance of wetland management by our state, federal and private land partners to manage wetland complexes to provide high quality habitat for a wide array of wetland wildlife.

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U.S. Wetlands Outside of CEAP Wetlands Assessment Regions General Information

1198. Avian use of revegetated riparian zones.

Anderson, Bertin W. and Ohmart, Robert D.
In: California Riparian Systems: Ecology, Conservation,
and Productive Management/ Warner, Richard E. and
Hendrix, Kathleen M.
Berkeley: University of California Press, 1984; pp. 626-631
NAL Call #: QH105.C2C36
Descriptors: birds/ communities/ ecosystems/
riparian habitat
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1199. Effects of stressors on invasive and halophytic plants of New England salt marshes: A framework for predicting response to tidal restoration.

Konisky, R. A. and Burdick, D. M.
Wetlands 24(2): 434-447. (June 2004)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: wetlands/ plant communities/ salt marshes/
environmental restoration/ flooding/ competition/
Halophytes/ hydrology/ interspecific relationships/ tidal
models/ habitat improvement/ dispersion/ transplants/
environmental impact/ aquatic plants/ salinity effects/
marshes/ salinity tolerance/ plant growth/ biological
production/ introduced species/ restoration/ plant
populations/ stress/ *Spartina*/ salinity/ tolerance/ floods/
biomass/ habitats/ hydrological regime/ tides/ survival/
cattails/ field tests/ strength/ *Juncus*/ *Phragmites australis*/
Spartina patens/ *Typha angustifolia*/ *Lythrum salicaria*/
Spartina alterniflora/ *Juncus gerardii*/ USA, New England/
habitat community studies/ TSD distribution, water masses
and circulation/ ecology/ community studies/ conservation,
wildlife management and recreation/ estuaries
Abstract: Salt marsh restoration practices based on the
reintroduction of tides to hydrologically-altered wetlands
may be hindered by a lack of specific knowledge regarding
plant community response to environmental change. Since
saltmarsh plant communities are controlled by physical
stress tolerance and competition, we conducted a field
experiment that measured effects of saltwater flooding and
competitive interactions on plants as a guide for predicting
habitat response to tidal restoration. Six plant species of
New England salt marshes were studied: halophytes
Spartina alterniflora, *Spartina patens*, and *Juncus gerardii*
and brackish invasive species *Phragmites australis*, *Typha*
angustifolia, and *Lythrum salicaria*. Plant shoots were
transplanted across a gradient of three flooding and three
salinity regimes and arranged into pair-wise competitive
combinations. After one growing season, saltwater flooding
was found to decrease transplant survival, biomass
production, and/or relative growth for all species. Reduction
in halophyte growth was largely due to increased flood
duration; brackish species were most reduced by increased
salinity. Interspecific competition also influenced species
growth, although the short duration of the study may have
weakened these effects. Transplants paired with *S.*
alterniflora had reduced growth, but combinations with
Juncus produced increased growth. Standardized factors of
stress tolerance and relative competitive strength were
derived for the six study species as a framework for

understanding community-level changes in marshes. As an
aid to resource managers, experimental results can be
used to predict plant community response to existing and
potential alterations in saltmarsh tidal hydrology.
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1200. An evaluation of vernal pool creation projects in New England: Project documentation from 1991-2000.

Lichko, L. E. and Calhoun, A. J.
Environmental Management 32(1): 141-151. (2003)
NAL Call #: HC79.E5E5; ISSN: 0364-152X
Descriptors: conservation/ freshwater ecology/ protected
species/ vernal-pool-dependent species/ New England,
USA/ vernal pool creation/ compensatory mitigation/
conjecture/ federal regulatory action/ key vernal pool
functions/ long term landscape functions/ pool design
specifications/ project monitoring: inconsistencies, reliability
gaps/ record-keeping inadequacies/ reference wetlands/
standardization/ vernal pool creation projects/ vernal pools:
forestry practice impacts, loss to development, size
Abstract: Vernal pools are vulnerable to loss through
development and agricultural and forestry practices owing
to their isolation from open water bodies and their small
size. Some vernal pool-dependent species are already
listed in New England as Endangered, Threatened, or
Species of Special Concern. Vernal pool creation is
becoming more common in compensatory mitigation as
open water ponds, in general, may be easier to create than
wooded wetlands. However, research on vernal pool
creation is limited. A recent National Research Council
study (2001) cites vernal pools as "challenging to recreate."
We reviewed documentation on 15 vernal pool creation
projects in New England that were required by federal
regulatory action. Our purpose was to determine whether
vernal pool creation for compensatory mitigation in New
England replaced key vernal pool functions by assessing
project goals and documentation (including mitigation
plans, pool design criteria, monitoring protocols, and
performance standards). Our results indicate that creation
attempts often fail to replicate lost pool functions. Pool
design specifications are often based on conjecture rather
than on reference wetlands or created pools that function
successfully. Project monitoring lacks consistency and
reliability, and record keeping by regulatory agencies is
inadequate. Strengthening of protection of isolated
wetlands in general, and standardization across all aspects
of vernal pool creation, is needed to ensure success and to
promote conservation of the long-term landscape functions
of vernal pools.
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1201. The hydrology of Alaskan wetlands, USA: A review.

Ford, J. and Bedford, B. L.
Arctic and Alpine Research 19(3): 209-229. (1987)
NAL Call #: GB395.A73; ISSN: 0004-0851
Descriptors: wetlands/ hydrology/ water budget/ stream
flow rate/ literature reviews/ extreme values/ USA, Alaska/
nearshore dynamics

Abstract: Alaska's wetland resources are vast and the literature dealing directly with any given aspect of Alaskan wetland hydrology is sparse. This review focuses on hydrological function and pays particular attention to (1) hydrologic inputs to and outputs from wetlands, and (2) the influence of wetlands on peak flow regulation. The influence of several characteristic high-latitude phenomena (permafrost, glaciers, and seasonal stream icings) on the overall water balance and the volume, areal distribution, rate, and timing of water release are discussed.
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1202. Importance of small wetlands for the persistence of local populations of wetland-associated animals.

Gibbs, James P.

Wetlands 13(1): 25-31. (1993)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: conservation/ isolation/ metapopulation/ population dynamics

Abstract: I simulated loss of small, legally unprotected freshwater wetlands in a 600 km² area of Maine, USA to examine how loss of small wetlands altered the geometry of the wetland mosaic and thereby might affect the dynamics of metapopulations of wetland-associated organisms. Loss of small wetlands resulted in total wetland area declining by 19% (from 2032 to 1655 ha), total wetland number declining by 62% (from 354 to 136 wetlands), and average inter-wetland distance increasing by 67% (from 0.6 to 1.0 km). Also, average upland-wetland proximity decreased by 50% (0.5 to 1.0 km), such that just 54% of the landscape was within the maximum migration distance (1000 m) of terrestrial-dwelling and aquatic-breeding amphibians after loss of small wetlands, versus 90% before loss. A spatially-structured demographic model revealed that local populations of turtles, small birds, and small mammals, stable under conditions of no wetland loss, faced a significant risk of extinction (P < 5%) after loss of small wetlands. No change in metapopulation extinction risk was evident for salamanders or frogs, largely because high rates of population increase buffered these taxa against local extinction. These results suggest that small wetlands play a greater role in the metapopulation dynamics of certain tax or wetland animals than the most area comprised by small wetlands might imply.

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1203. Macroinvertebrate response to marsh management strategies in Utah.

Huener, J. D. and Kadlec, J. A.

Wetlands 12(2): 72-78. (1992)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wildlife management/ marshes/ water levels/ macrofauna/ ecosystem management/ population density/ Invertebrata/ USA, Utah/ wildlife management/ macrofauna

Abstract: The authors examined the response of aquatic macroinvertebrates to three marsh management strategies. The three management practices compared were conventional full pool management, full pool management with carp (*Cyprinus carpio*) control, and contour furrowing (also with carp control). Significant differences in standing crops (both numbers and biomass) of invertebrates were observed among the three management strategies. The contour furrowed area had the highest standing crops of water column invertebrates, followed by the carp-controlled full pool area, while the conventionally managed area had

the lowest standing crops. In the benthos, the two full pool areas (with and without carp) had higher standing crops than the contour furrowed area. Significant differences were noted in seasonal abundance, with all management practices having lowest densities of invertebrates in April and May. Implications for management include indications of the negative impacts of carp and winter drawdowns on invertebrates in managed marshes.

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1204. Relationship of breeding bird density and diversity to habitat variables in forested wetlands.

Swift, B. L.; Larson, J. S.; and DeGraaf, R. M.

Wilson Bulletin 96(1): 48-59. (1984)

NAL Call #: 413.8; ISSN: 0043-5643

Descriptors: Aves/ community structure/ breeding/ forest wetland habitat relationships/ semiaquatic habitat/ forested wetland/ forest/ wetland/ breeding community structure relationships/ Massachusetts/ Connecticut Valley/ breeding community structure relative to forest wetland variables

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1205. Relationships among wetland and indicators in Hawaiian rain forest.

Wakeley, James S.; Sprecher, Steven W.; and Lichvar, Robert W.

Wetlands 16(2): 173-184. (1996)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: ecology: environmental sciences/ methods and techniques/ soil science/ field method/ habitat/ hydric soil/ hydrophytic vegetation/ rain forest/ terrestrial ecology/ undulating flow pattern/ wetland/ wetland identification/ wetland indicators

Abstract: We applied established methods for wetland identification in lowland and montane wet forests (rain forests) on the island of Hawaii to determine whether rain forests exhibited wetland indicators specified in delineation manuals and to examine relationships among indicators of hydrophytic vegetation, hydric soils, and wetland hydrology. Morphological characteristics and ferrous iron tests indicated pockets of hydric organic soils within areas mapped as Folist. Hydrophytic vegetation decisions based on prevalence values agreed with hydric soil determinations more often than did decisions based on dominant plant species. None of the rain forest types we studied exhibited wetland indicators throughout, but some sites contained scattered small wetlands occupying microtopographic lows created by cracks, folds, and undulating flow patterns in the lava bedrock. Further work is needed to identify reliable wetland indicators that can be used during drier portions of the year and to distinguish hydric from nonhydric organic rain forest soils.

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1206. A review of vertebrate community composition in seasonal forest pools of the northeastern United States.

Paton, Peter W. C.

Wetlands Ecology and Management 13(3): 235-246. (2005)

NAL Call #: QH541.5.M3 W472; ISSN: 0923-4861

Descriptors: terrestrial ecology: ecology, environmental sciences/ community composition/ breeding habitat/ seasonally flooded wetland/ seasonal forest pool

Abstract: Seasonally-flooded wetlands occur throughout the world and provide important foraging, resting, and

breeding habitat for a broad array of organisms. This review summarizes our current understanding of vertebrate community composition at seasonal forest pools in the northeastern United States. These wetlands typically have hydroperiods that range from temporarily flooded to intermittently exposed, which reduces densities of many potential predators (e.g., fish). Current research has shown that pool hydroperiod, canopy closure, vegetation structure within pools, presence of potential predators, and landscape structure surrounding pools are the key factors determining vertebrate diversity at seasonal forest pools. Of 25 species of amphibians in the region, frogs (10 of 12 species) are more likely to breed in seasonal forest pools than salamanders (6 of 13 species). Seven of 10 amphibian species that breed in seasonal forest pools are state-listed as threatened or endangered. Among 27 species of reptiles, 3 of 15 species of snakes, and 6 of 12 species of turtles utilize seasonal pools during at least one stage of their annual cycle. Seasonal forest pools are important foraging and basking habitat for three species of turtles listed as threatened or endangered. Compared to other vertebrate taxa, most species of mammals are habitat generalists, with 50 of 63 mammal species potentially foraging at seasonal pools during part of their annual cycle. Chiroptera (bats; all 9 species) are believed to actively forage at seasonal pools and some Insectivora, particularly *Sorex palustris* Richardson and *S. fumeus* (Miller) and *Condylura cristata* (L.), are detected regularly at seasonal pools. Breeding birds are less likely to utilize seasonal pools than other vertebrate taxa, although 92 of 233 species might forage or breed near seasonal pools. Several species of Anatidae, Rallidae, and some Passeriformes use seasonally flooded pools. All vertebrates that use seasonal forest pools use other habitats during some stage in their life cycle; thus gaining a clear understanding of their habitat requirements is critical to their long-term persistence.
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1207. Stream/aquifer interactions at Great Sand Dunes National Monument, Colorado: Influences on interdunal wetland disappearance.

Wurster, Frederic C.; Cooper, David J.; and Sanford, William E.
Journal of Hydrology (Amsterdam) 271(1-4): 77-100. (2003)
NAL Call #: 292.8 J82; ISSN: 0022-1694
Descriptors: climatology: environmental sciences/ freshwater ecology: ecology, environmental sciences/ groundwater ecology: ecology, environmental sciences/ ground water level measurement/ ground water modeling/ mathematical and computer techniques/ natural stable isotope analysis/ applied and field techniques/ sand creek channel incision/ buried seed banks/ climatic fluctuations/ dune movement/ ground water pumping: agriculture related, regional water table lowering/ hydrologic data/ intermittent sand creek flows/ local hydrologic process changes/ long term wet dry cycles/ pressure waves: ground water level influence/ regional stream flow records/ seepage/ severe drought/ soil stratigraphy/ stream/ stream/ aquifer interactions: interdunal wetland disappearance influence/ sub creek ground water mound: seasonal development, seasonal dispersion/ unconfined aquifer/ wetland area
Abstract: Between 1937 and 1995 a complex of more than 100 interdunal wetlands disappeared from Great Sand Dunes National Monument, Colorado. We investigated

three hypotheses that could explain wetland disappearance: (1) dune movement during a severe drought in the 1950s buried the wetlands, (2) agriculture related ground water pumping lowered the regional water table, and (3) changes in local hydrologic processes led to wetland loss. We used regional stream flow records, ground water level measurements, natural stable isotope analyses, soil stratigraphy, buried seed banks, and ground water modeling to address these hypotheses. Hydrologic data and stable isotope analyses illustrated the interaction between Sand Creek, a nearby stream, and the unconfined aquifer in the area where wetlands occurred. When the intermittent Sand Creek flows, seepage through its bed creates a large ground water mound under the creek. The seasonal development and dispersion of this mound propagates pressure waves through the aquifer that influence ground water levels up to 2 km from Sand Creek. Our data suggest the primary factors contributing to wetland disappearance were recent climatic fluctuations and incision of the Sand Creek channel. Below average stream flow between 1950 and 1980 reduced the duration of Sand Creek flow across the dune complex, minimizing ground water mound development. Consequently, the water table in the unconfined aquifer dropped approx 1.0 m and interdunal wetlands dried up. Twentieth Century incision of Sand Creek's channel reduced ground water mound height approx 2.5 m, decreasing seasonal water table fluctuations at interdunal wetlands and contributing to the overall water table decline. Long-term wet and dry cycles affect the water table elevation more than channel incision, leading us to conclude that many interdunal wetlands are ephemeral features. Wetland area is maximized during consecutive years of above average Sand Creek discharge and minimized as the water table drops during dry periods.
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1208. Weather-related effects on woodland vernal pool hydrology and hydroperiod.

Brooks, Robert T.
Wetlands 24(1): 104-114. (2004)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
<http://www.treesearch.fs.fed.us/pubs/6982>
Descriptors: hydrology/ hydroperiod/ potential evapotranspiration/ precipitation/ vernal pools/ woodland vernal pools
Abstract: Woodland vernal pools occur commonly throughout northeastern North America. These pools provide preferred breeding habitat for mole salamanders (*Ambystoma* spp.) and wood frogs (*Rana sylvatica*) and support an abundant and diverse macroinvertebrate fauna. Vernal pool hydrology, and especially hydro-period or duration of the wet phase, affects the composition and productivity of pool fauna. The hydrology of ephemeral wetlands is dominated by local weather conditions. In this paper, I report a ten-year record of the relationships between precipitation and evapotranspiration and water-level change and hydroperiod in four typical southern New England vernal pools. Long-term average precipitation is evenly distributed throughout the year in the Northeast; potential evapotranspiration peaks in the summer months and exceeds precipitation from mid-June through mid-September. This period of water deficit causes the period of maximum vernal pool drying. Vernal pool hydroperiods were shorter and pools dried earlier in those years with

larger cumulative water deficits, especially when early spring ground-water resources were below long-term means and late winter snowpack was reduced or absent. Weekly water-level change in vernal pools was significantly related to precipitation and potential evapotranspiration, with precipitation having 2-5 times greater effect than evapotranspiration. Under climate-change predictions of more episodic precipitation and increased evapotranspiration, vernal pools would dry earlier in the year and remain dry longer. These changes would

adversely affect the successful reproduction of pool-breeding amphibians and isolate the remaining productive pools.

This citation is from Treeseearch.

1209. Wetland features that influence occupancy by endangered Hawaiian duck on the island of Hawaii.

Uyehara, Kimberly J.

Annandale-on-Hudson, New York: Bard College, 2005.

Descriptors: wetlands/ ducks/ wildlife habitat/ ecology

Effects of Agricultural Conservation Practices on Wetlands

1210. Contaminant loading in drainage and fresh water used for wetland management at Stillwater National Wildlife Refuge.

Kilbride, K. M.; Paveglio, F. L.; Altstatt, A. L.; Henry, W. G.; and Janik, C. A.

Archives of Environmental Contamination and Toxicology 35(2): 236-248. (Aug. 1998)

NAL Call #: TD172.A7; *ISSN:* 0090-4341

Descriptors: wetlands/ agricultural pollution/ drainage water/ ecosystem management/ arid environments/ agricultural runoff/ heavy metals/ detritus/ dissolved chemicals/ pesticides/ USA, West/ drains/ water pollution/ pollution load/ contamination/ water management/ land management/ freshwater pollution/ drainage/ trace elements/ aquatic organisms/ biota/ irrigation/ national parks/ USA, Nevada, Stillwater National Wildlife Refuge/ USA, Nevada, Stillwater Natl. Wildl. Refuge/ characteristics, behavior and fate/ sources and fate of pollution/ freshwater pollution

Abstract: Throughout the western United States, studies have identified various detrimental effects of contaminants to aquatic biota from the use of agricultural drainage water for management of arid wetlands. However, little is known about the relative contributions of contaminant loading from pollutants dissolved in water compared with those carried by drifting material (e.g., detritus) associated with drainage water. Consequently, we determined loading rates for contaminants dissolved in water and those incorporated by drifting material for drainage (Diagonal Drain) as well as fresh (S-Line Canal) water used for wetland management at Stillwater National Wildlife Refuge (SNWR), Nevada during the early, middle, and late periods of the irrigation season (June through mid-November) in 1993. We found loading rates for trace elements throughout the irrigation season were almost entirely (> 98%) associated with contaminants dissolved in the water rather than incorporated by drift. Although drift contributed little to the total loading for trace elements to SNWR wetlands, contaminant concentrations were much greater in drift compared with those dissolved in water. Loading rates for dissolved As, B, Hg, and total dissolved solids (TDS) differed among periods for the Diagonal Drain. Along the Diagonal Drain, loading rates for dissolved As, B, Hg, Mo, unionized ammonia (NH sub(3)-N), TDS, and Zn differed among its three sampling sites. B was the only trace element with differences in loading rates for drift among periods from the Diagonal Drain. In contrast, loading rates for As, B, Cr, Cu, Hg, Se, and Zn in drift differed among periods for the S-Line Canal. Along Diagonal Drain, loading rates in drift for B (middle and late periods), Cr, Cu, and Zn

differed among sites. Hg (x greater than or equal to 12.0 ng/L) and NH sub(3)-N (x greater than or equal to 0.985 mg/L) dissolved in water as well as B (x greater than or equal to 97.4 mu g/g DW) and Hg (x greater than or equal to 0.461 mu g/g DW) in drift from the Diagonal Drain and S-Line Canal exceeded screening levels (SLs) for protection of aquatic biota throughout the irrigation season. Dissolved As (x greater than or equal to 0.0426 mg/L) in water from the Diagonal Drain during all periods exceeded the SL for protection of aquatic biota. Dissolved B (x = 1.03 mg/L) in water from the Diagonal Drain during the early period exceeded the SL for protection of aquatic biota.

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1211. Detailed study of irrigation drainage in and near wildlife management areas, west-central Nevada, 1987-90.

Hoffman, R. J.

Denver, Colo.: U.S. Geol. Survey, Earth Science Information Center, 1994. USGS Water-Resources Investigations Report.

NAL Call #: GB701.W375 no.92-4024C

Descriptors: wetlands/ wildlife habitats/ water quality/ irrigation effects/ public health/ contamination/ toxicity/ heavy metals/ agricultural hydrology/ aquatic life/ bioaccumulation/ water pollution effects/ USA, Nevada/ Stillwater Wildlife Management Area

Abstract: This report presents a summary of the detailed scientific study of Stillwater Wildlife Management Area and other nearby wetlands in west-central Nevada during 1987-90. The work was funded by the National Irrigation Water Quality Program of the U.S. Department of the Interior with the overall objectives of determining (1) the extent, magnitude, and effects of selected water-quality constituents associated with irrigation drainage on fish, wildlife, and human health, and (2) the sources and exposure pathways that cause contamination where adverse effects are documented. Much of the information in this report was summarized from two previously published interpretive reports that were completed to fulfill study objectives. Where applicable, data for the study area from other published sources also were utilized. The results of these studies indicate that the aquatic biota in natural wetlands of the Carson Desert are adversely affected by hydrological and geochemical sources and processes in the Newlands Irrigation Project area. Reactions between water and naturally occurring minerals in the shallow alluvial aquifer increase concentrations of potentially toxic constituents in ground water that eventually enters the wetlands. Once in the wetlands, these constituents are

further concentrated by evaporation and transpiration. Water from some agricultural drains that enter Stillwater WMA was acutely toxic to aquatic organisms. The drains in the agricultural areas, which eventually discharge to the wetlands, were also implicated as sites of uptake of selenium and mercury by aquatic organisms.

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1212. Detailed study of irrigation drainage in and near wildlife management areas, west-central Nevada, 1987-90 - Part B: Effect on biota in Stillwater and Fernley wildlife management areas, and other nearby wetlands.

Hallock, R. J. and Hallock, L. L.

Denver, Colo.: U.S. Geological Survey; Water Resources Investigation Report: 92-4024B, 1993.

Descriptors: wetlands/ water pollution effects/ toxicity/ selenium/ dissolved solids/ water quality/ waterfowl/ water control/ wildlife/ irrigation/ drainage/ pollution effects/ USA, Nevada, Stillwater/ irrigation drainage/ pollution effects/ water pollution effects/ dissolved solids/ waterfowl/ water control

Abstract: A water-quality reconnaissance study during 1986-87 found high concentrations of several potentially toxic elements in water, bottom sediment, and biota in and near Stillwater Wildlife Management Area (WMA). This study prompted the U.S. Department of the Interior to initiate a more detailed study to determine the hydrogeochemical processes that control water quality in the Stillwater WMA, and other nearby wetlands, and the resulting effects on biota, especially migratory birds. Present wetland size is about 10% of historical size; the dissolved-solids load in the water in these now-isolated wetlands has increased only moderately, but the dissolved-solids concentration has increased more than seven-fold. Wetland vegetation has diminished and species composition in flow water has shifted to predominant salt-tolerant species in many areas. Decreased vegetative cover for nesting is implicated in declining waterfowl production. Decreases in numbers or virtual absence of several wildlife species are attributed to degraded water quality. Results of toxicity tests indicate that water in some drains and wetland areas is acutely toxic to some fish and invertebrates. Toxicity is attributed to the combined presence of arsenic, boron, lithium, and molybdenum. Biological pathways are involved in the transport of mercury and selenium from agricultural drains to wetlands. Hatch success of both artificially incubated and field-reared duck eggs was greater than/= 90 percent; no teratogenesis was observed. Mercury in muscle tissue of waterfowl harvested from Carson Lake in October 1987 exceeded the human health criterion six-fold.

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1213. Detailed study of selenium and selected elements in water, bottom sediment, and biota associated with irrigation drainage in the middle Green River basin, Utah, 1988-90.

Stephens, D. W.; Waddell, B.; Peltz, A.; and Miller, J. B. Denver, Colo.: U.S. Geological Survey; Water-Resources Investigations Report 92-4084, 1992. 164 p.

Descriptors: wetlands/ bioaccumulation/ drainage water/ selenium/ water pollution effects/ water pollution sources/ ducks/ irrigation/ water birds/ waterfowl/ wildlife habitats

Abstract: Studies completed at Stewart Lake Waterfowl Management Area, lower Ashley Creek, Ouray National

Wildlife Refuge, and Pariette Wetlands, Utah identified several areas where selenium was adversely affecting water quality and creating a hazard to wildlife. The source of contamination at Stewart Lake is drainwater and shallow groundwater from soils derived from Mancos Shale. Median concentrations of selenium in all drainwater discharged to Stewart Lake exceeded the State standard of 5 microg/L established for wildlife protection. Selenium concentrations in all biological tissues sampled at Stewart Lake Waterfowl Management Area were large compared to concentrations in biota from most other sites in the middle Green River basin. Selenium concentrations in Ashley Creek upstream of the City of Vernal generally were less than 1 microg/L but 12 miles downstream averaged 73 microg/L. The source of the contamination was believed to be from inflows of shallow groundwater and surface water originating as seepage from a sewage-lagoon system that flows through Mancos Shale and mobilizes selenium. Waterfowl from the area contained selenium concentrations as large as 27.2 microg/g in muscle tissue, and an eared grebe egg contained 71 microg/g. Selenium contamination of ponds at Ouray National Wildlife Refuge was limited to a small area on the western part of the refuge and was apparently due to seepage of shallow groundwater into waterfowl ponds. Geometric mean concentrations of selenium in plants, invertebrates, bird eggs, and fish from the North and South Roadside Ponds were larger than concentrations known to cause reproductive failure in mallards. (USGS)

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1214. Effects of agricultural runoff on vegetation composition of a priority conservation wetland, Vermont, USA.

Gustafson, S. and Wang, D.

Journal of Environmental Quality 31(1): 350-357. (2002)

Descriptors: wetlands/ agriculture/ composition/ conservation/ runoff/ vegetation/ watersheds/ subwatersheds/ environmental engineering/ water pollution/ conservation of natural resources/ ecosystem/ eutrophication/ plants

Abstract: This study examined the effects of agricultural runoff on the vegetation structure of Franklin Bog, a priority conservation area located in a rapidly developing region of northwestern Vermont. Forested and agricultural runoff from the mixed land use watershed created differential vegetation patterns in the wetland, including weedy species introductions. Concentrations of nitrogen and phosphorus were measured in the stream runoff from four forested subwatersheds and two agricultural subwatersheds. Nutrient concentrations were significantly higher for agricultural vs. forested runoff for all measured parameters. Nitrate and total phosphorus concentrations in agricultural runoff ranged from 0.62 to 1.35 mg L⁻¹ and 0.07 to 0.37 mg L⁻¹, respectively. Forested runoff values were less than 0.37 mg L⁻¹ nitrate and 0.09 mg L⁻¹ total phosphorus. Significantly higher proportions of weedy species occurred at impacted vs. reference sites (46 ± 5% vs. 23 ± 4%). Furthermore, significantly higher total percent vegetated cover occurred at impacted vs. reference sites (116 ± 11% vs. 77 ± 9%) suggesting nutrient induced plant growth. Of the nine frequently occurring species categorized as bog species, only one was found within impacted sites while all nine were found at the reference sites. This suggests that the wetland's distinctive native flora is being replaced by widespread, vigorous species enhanced by agricultural

nonpoint pollution in the watershed of Franklin Bog. Protection of wetlands requires attention to conservation measures throughout the entire watershed.
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1215. Physical, chemical, and biological data for detailed study of irrigation drainage in the middle Green River basin, Utah, 1988-89, with selected data for 1982-87.

Peltz, L. A. and Waddell, B.
Denver, Colo.: U.S. Geological Survey; Open-File Report 91-530, 1991. 213 p.
Descriptors: wetlands/ water quality/ water pollution sources/ nonpoint pollution sources/ Utah/ selenium/ irrigation/ drainage water/ sediments/ plants/ waterfowl/ fish/ invertebrates/ water measurement/ data collections/ irrigation
Abstract: Physical, chemical, and biological data were collected in the middle Green River basin, eastern Utah, between 1988 and 1989, as part of a detailed study of the effects of irrigation drainage on wetlands areas. Data-collection efforts were concentrated in the Stewart Lake Waterfowl Management Area near Jensen, and Ouray National Wildlife Refuge near Ouray. Data also were collected from Ashley Creek near Vernal, Pelican Lake near Ouray, and in Pariette Wetlands near Myton. A limited quantity of data collected during earlier studies (1982-87), funded by the U.S. Fish and Wildlife Service, also is included. This report contains data needed to assess the effects of selenium and other potentially toxic contaminants on streams and wetlands. Data consist of concentrations of trace elements and common elements in samples of water, sediments, plants, waterfowl, birds, fish, and invertebrates. Other data presented in the report are groundwater levels, surface water discharges, radiochemical constituents in water, analyses of organochlorine compounds in biota, and morphometric measurements of biota. (USGS)
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1216. Protection of habitat for rare wetland fauna during timber harvesting in Massachusetts (USA).

Kittredge, D. B.
Natural Areas Journal 16(4): 310-317. (1996)
Descriptors: wetlands/ conservation/ rare species/ environmental protection/ trees/ harvesting/ nature conservation/ aquatic organisms/ ecosystem disturbance/ environmental impact/ forestry/ environmental effects/ forest industry/ USA, Massachusetts/ harvesting/ forest industry/ trees/ forestry/ rare species/ nature conservation/ aquatic organisms/ ecosystem disturbance/ environmental impact/ environmental effects
Abstract: The practice of harvesting timber is commonly thought of as conflicting with the protection of rare species habitat. In Massachusetts, over 5 years and more than 3,300 harvesting operations, rare wetland faunal habitat was involved 5.3% of the time (175 occurrences). The Massachusetts Natural Heritage and Endangered Species Program reviewed all proposed harvesting that involved habitat for rare wetland species and determined that operations would cause "no impact" in 58.9% of the cases, "possible impact" in 40% of the cases, and "definite impact" in 1.1% of the cases. Rare fauna whose habitat was most frequently involved were wood turtle (*Clemmys insculpta*), spotted turtle (*Clemmys guttata*), and spring salamander (*Gyrinophilus porphyriticus*). The Natural Heritage and

Endangered Species Program recommended mitigating measures such as timing of the harvest, buffers around water bodies, improved stream crossing techniques, and other practices. In most circumstances, these were incorporated into the forest cutting plan and were made a requirement of the operation. When they were not required, the regulating agency had determined that the recommendations did not apply to the specific circumstances on the ground. In general, habitat of rare wetland faunal species is not impacted by timber harvesting in Massachusetts, and likewise, harvesting is not seriously impacted by habitat protection. Regulation of harvesting, an atlas of rare species habitats, and good communication result in protection of habitat that is compatible with harvesting.
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1217. Role of wetlands and developed land use on dissolved organic nitrogen concentrations and DON/TDN in northeastern U.S. rivers and streams.

Pellerin, B. A.; Wollheim, W. M.; Hopkinson, C. S.; McDowell, W. H.; Williams, M. R.; Voeroesmary, C. J.; and Daley, M. L.
Limnology and Oceanography 49(4): 910-918. (2004)
NAL Call #: GC1 .L5; ISSN: 0024-3590
Descriptors: watersheds/ resource management/ dissolved organic nitrogen/ drainage water/ anthropogenic factors/ agriculture/ man-induced effects/ rivers/ streams/ organic matter/ nitrogen/ human factors/ drainage/ urban areas/ land use/ limnology/ dissolved organic matter in river water/ nitrogen in watersheds/ nitrogen in wetlands/ USA, Massachusetts
Abstract: Previous studies have shown that watersheds with significant human development (i.e., urban and agricultural land use) generally have higher concentrations and fluxes of dissolved inorganic nitrogen (DIN) in comparison to less-developed or forested watersheds. However, the impact of watershed development on dissolved organic nitrogen (DON) concentrations in drainage waters has received little attention. We present data from 39 watersheds in Massachusetts (Ipswich River watershed) encompassing a gradient of developed land use (0%-92% urban plus agriculture) and wetland abundance (0%-32%) to assess controls on mean annual DON concentrations and DON/total dissolved nitrogen (TDN) in drainage waters. In addition, we compiled published data from 119 northeastern U.S. watersheds to evaluate broader-scale relationships between DON, developed land use, and wetlands. The percentage of developed land is a poor predictor of DON concentrations in the Ipswich watersheds ($r^2 = 0.09$) and the compiled dataset ($r^2 = 0.27$). In contrast, wetland percentage explains 56% of the variability in DON concentrations in the Ipswich watersheds, and 60% when all literature data are included. Excluding watersheds with direct wastewater inputs to surface waters improves the regional relationship significantly ($r^2 = 0.79$). The DON:TDN ratio is best explained by a multiple regression of wetland percentage and developed land use percentage for both the Ipswich watersheds ($r^2 = 0.73$) and the compiled dataset ($r^2 = 0.50$). Watersheds with abundant wetlands may therefore have high DON concentrations and DON:TDN ratios despite elevated anthropogenic nitrogen inputs associated with human development.
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1218. The transformation of Sonoran desert wetlands following the historic decrease of burning.

Davis, O. K.; Minckley, T.; Moutoux, T.; Jull, T.; and Kalin, B.

Journal of Arid Environments 50(3): 393-412. (2002)

NAL Call #: QH541.5.D4J6; ISSN: 0140-1963

Descriptors: wetlands/ historical ecology/ fires/ sediments/ vegetation changes/ vegetation/ history/ deserts/ fungi/ plant populations/ USA, Arizona/ Mexico

Abstract: The analysis of sediments from six wetlands (cienegas) in the Sonoran Desert of Arizona, U.S.A., and Sonora, Mexico, document a marked expansion of wetland taxa--particularly woody plants--about 200 years ago at the beginning of the historic period, following a decrease in charcoal percentages and increased percentages of the dung fungus *Sporormiella*. The presence of charred seeds and fruits of wetland plants in prehistoric sediment establishes burning of the cienega itself. The charcoal decline ca. 250 years ago precedes the first occurrence of

the pollen exotic plants at several sites, the change of cienega sediment from silt to peat, and the increase of percentages of the decay fungus *Tetraploa*. We conclude that prior to the historic period, burning was frequent enough to exclude most woody plants (*Celtis*, *Cephalanthus*, *Populus*, *Fraxinus*, *Salix*) from the wetlands and suppress the abundance of bulrush (*Scirpus*). The cienegas were probably burned seasonally as a management tool to harvest animals and promote agriculture. Prehistoric agricultural utilization of the cienegas is demonstrated by the presence of corn (*Zea*) and pre-Columbian weeds. This study also records post-settlement (ca. 200 years ago) change of upland vegetation; i.e. an increase in the abundance of *Juniperus*, *Quercus*, *Larrea*, and *Prosopis* pollen. Historic fire suppression may have permitted the expansion of these non-wetland woody species. Copyright 2002 Elsevier Science Ltd.

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Wetlands as Agricultural Conservation Practices

1219. Analysis of sediment retention in western riverine wetlands: The Yampa River watershed, Colorado, USA.

Arp, Christopher D. and Cooper, David J.

Environmental Management 33(3): 318-330. (2004)

NAL Call #: HC79.E5E5; ISSN: 0364-152X

Descriptors: freshwater ecology: ecology, environmental sciences/ hydrogeomorphic approach/ applied and field techniques/ wetland resource management

Abstract: We quantified annual sediment deposition, bank erosion, and sediment budgets in nine riverine wetlands that represented a watershed continuum for 1 year in the unregulated Yampa River drainage basin in Colorado. One site was studied for 2 years to compare responses to peak flow variability. Annual mean sediment deposition ranged from 0.01 kg/m along a first-order subalpine stream to 21.8 kg/m at a sixth-order alluvial forest. Annual mean riverbank erosion ranged from 3 kg/m-of-bank at the first-order site to 1000 kg/m at the 6th-order site. Total sediment budgets were nearly balanced at six sites, while net export from bank erosion occurred at three sites. Both total sediment deposition ($R^2 = 0.86$, $p < 0.01$) and bank erosion ($R^2 = 0.77$, $p < 0.01$) were strongly related to bankfull height, and channel sinuosity and valley confinement helped to explain additional variability among sites. The texture and organic fraction of eroded and deposited sediment were relatively similar in most sites and varied among sites by watershed position. Our results indicate that bank erosion generally balances sediment deposition in riverine wetlands, and we found no distinct zones of sediment retention versus export on a watershed continuum. Zones of apparent disequilibrium can occur in unregulated rivers due to factors such as incised channels, beaver activity, and cattle grazing. A primary function of many western riverine wetlands is sediment exchange, not retention, which may operate by transforming materials and compounds in temporary sediment pools on floodplains. These results are considered in the context of the Hydrogeomorphic approach being implemented by the U.S. government for wetland resource management.

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1220. Assessment of hydraulic restoration of San Pablo Marsh, California.

Grismer, Mark E.; Kollar, J.; and Syder, J.

Environmental Monitoring and Assessment 98(1-3):

69-92. (2004)

NAL Call #: TD194; ISSN: 0167-6369

Descriptors: biodiversity/ conservation/ terrestrial ecology: ecology, environmental sciences/ aerial survey/ applied and field techniques/ channel survey/ applied and field techniques/ ground truthing/ applied and field techniques/ agricultural development/ biodiversity/ drainage channel/ hydraulics/ inter tidal marsh/ ocean environment/ restoration strategy/ salt marsh hydrodynamics/ sediment accretion process/ terrestrial environment/ tidal circulation/ tidal level/ water quality

Abstract: Inter-tidal marshes are dynamic diverse ecosystems at the transition zone between terrestrial and ocean environments. Geomorphologically, inter-tidal salt marshes are vegetated landforms at elevations slightly greater than mean tidal levels that have distributed channels formed under ebb (drainage) tidal flows that widen and deepen in the seaward direction. The drainage channels enable tidal flows to circulate sediments and nutrients through the marsh system during normal tidal events, while depositing sediments during storm or seismic events. This dynamic system encourages considerable biodiversity while simultaneously providing water quality enhancement features that service marsh terrestrial life and marine life in the estuary. Reservoir creation limiting sediment transport, anticipated large increases in sea levels as well as agricultural and urban development have resulted in significant loss of inter-tidal marshes and subsequent adverse impacts on waterfowl, infauna and fisheries. The complex and continuously changing marsh channel hydraulics and sedimentary processes have severely constrained quantitative modeling of these marsh systems such that restoration/creation efforts remain something of an empirical science and further assessments are needed. The purpose of this paper is to outline current understanding of salt marsh hydrodynamics, sediment accretion processes and subsequent response of marsh

vegetation to set the stage for assessment of a marsh restoration effort along San Pablo Bay near San Francisco, California. Several kilometers of drainage channels were constructed in a 624 ha disturbed salt marsh to restore tidal circulation and vegetation so as to enhance habitat for threatened species (e.g. clapper rail, harvest mouse, delta smelt and potentially anadromous fish species). Two distinct drainage channel systems ('east' and 'west') were installed having similar channel dimensions common to salt marshes in the region, but having design bankfull tidal prism volumes differing by a factor of two. Following channel excavation, main channel tidal flows and sediment loads as well as marsh sediment accretion rates were monitored to assess the relative success of the excavation in restoring tidal circulation and vegetation (*Salicornia* spp.) to the marsh. Annual aerial surveys corroborated with ground-truthing indicated that marsh vegetation rapidly expanded, from 40 to 85% coverage several years following excavation. The 'east' channel intake was nearly completely silted in within three years. However, channel surveys and flow measurements indicated that the 'east' channel system tidal prism was only about 1200 m³, more than an order of magnitude less than that of the stable 'west' channel system. Marsh sediment accretion rates were on the order of 7-8 mm yr⁻¹, a rate common to the Pacific coast region that exceeds estimated sea level rise rates of approx 2 mm yr⁻¹. East channel network siltation resulted in storm and spring tidal flood ponding such that marsh vegetation coverage decreased to 51% of the marsh area and related habitat expansion decreased. These results are considered in terms of the primary inter-tidal marsh factors affecting possible restoration/creation strategies.

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1221. Bird use of restoration and reference marshes within the Barn Island Wildlife Management Area, Stonington, Connecticut, USA.

Brawley, A. H.; Warren, R. S.; and Askins, R. A. *Environmental Management* 22(4): 625-633. (1998)
NAL Call #: HC79.E5E5; ISSN: 0364-152X

Descriptors: ecosystem management/ environment management/ salt marshes/ impoundments/ species diversity/ population density/ aquatic birds/ USA, Connecticut/ tidal marshes/ birds/ habitats/ estuaries/ vegetation/ artificial wetlands/ environmental restoration/ habitat utilization/ Aves/ USA, Connecticut, Stonington, Barn Island Wildlife Management Area/ restoration/ birds/ habitat community studies/ mechanical and natural changes/ estuaries/ reclamation

Abstract: Tidal marshes have been actively restored in Connecticut for nearly 20 years, but evaluations of these projects are typically based solely on observations of vegetation change. A formerly impounded valley marsh at the Barn Island Wildlife Management Area is a notable exception; previous research at this site has also included assessments of primary productivity, macroinvertebrates, and use by fishes. To determine the effects of marsh restoration on higher trophic levels, we monitored bird use at five sites within the Barn Island complex, including both restoration and reference marshes. Use by summer bird populations within fixed plots was monitored over two years at all sites. Our principal focus was Impoundment One, a previously impounded valley marsh reopened to full tidal exchange in 1982. This restoration site supported a greater

abundance of wetland birds than our other sites, indicating that it is at least equivalent to reference marshes within the same system for this ecological function. Moreover, the species richness of birds and their frequency of occurrence at Impoundment One was greater than at 11 other estuarine marshes in southeastern Connecticut surveyed in a related investigation. A second marsh, under restoration for approximately ten years, appears to be developing in a similar fashion. These results complement previous studies on vegetation, macroinvertebrates, and fish use in this system to show that, over time, the reintroduction of tidal flooding can effectively restore important ecological functions to previously impounded tidal marshes.

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1222. Fish assemblage composition in constructed and natural tidal marshes of San Diego Bay: Relative influence of channel morphology and restoration history.

Williams, G. D. and Zedler, J. B.

Estuaries 22(3A): 702-716. (Sept. 1999)

NAL Call #: GC96.E79; ISSN: 0160-8347

Descriptors: wetlands/ tides/ environmental restoration/ habitat utilization/ USA, California/ USA, California, San Diego Bay/ tidal marshes/ morphology/ rehabilitation/ channel morphology/ species composition/ aquatic habitats/ population density/ killifish/ multivariate analysis/ monitoring/ biological sampling/ physical properties/ environment management/ river engineering/ ecosystem disturbance/ environmental impact/ community composition/ fluvial morphology/ environmental factors/ Pisces/ *Fundulus parvipinnis*/ California killifish/ reclamation/ water quality control/ mechanical and natural changes/ multi-disciplinary studies/ environmental effects/ erosion and sedimentation

Abstract: This study evaluated the use by fish of restored tidal wetlands and identified links between fish species composition and habitat characteristics. We compared the attributes of natural and constructed channel habitats in Sweetwater Marsh National Wildlife Refuge, San Diego Bay, California, by using fish monitoring data to explore the relationships between channel environmental characteristics and fish species composition. Fishes were sampled annually for 8 yr (1989-1996) at eight sampling sites, four in constructed marshes and four in natural marshes, using beach seines and blocking nets. We also measured channel habitat characteristics, including channel hydrology (stream order), width and maximum depth, bank slope, water quality (DO, temperature, salinity), and sediment composition. Fish colonization was rapid in constructed channels, and there was no obvious relationship between channel age and species richness or density. Total richness and total density did not differ significantly between constructed and natural channels, although California killifish (*Fundulus parvipinnis*) were found in significantly higher densities in constructed channels. Multivariate analyses showed fish assemblage composition was related to channel habitat characteristics, suggesting a channel's physical properties were more important in determining fish use than its restoration status. This relationship highlights the importance of designing restoration projects with natural hydrologic features and choosing proper assessment criteria in order to avoid misleading interpretations of constructed channel success. We recommend that future projects be designed to mimic

natural marsh hydrogeomorphology and diversity more closely, the assessment process utilize better estimates of fish habitat function (e.g., individual and community-based species trends, residence time, feeding, growth) and reference site choice, and experimental research be further incorporated into the restoration process.

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1223. Hydrologic restoration of a fen in Rocky Mountain National Park, Colorado, USA.

Cooper, D. J.; MacDonald, L. H.; Wenger, S. K.; and Woods, S. W.

Wetlands 18(3): 335-345. (Sept. 1998)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: wetlands/ marshes/ hydrology/ environment management/ soil mechanics/ ground water/ water levels/ rainfall/ USA, Colorado, Rocky Mountain National Park, Big meadows/ rehabilitation/ fens/ national parks/ water table fluctuations/ anaerobic conditions/ precipitation/ mountains/ hydrological regime/ ditches/ laminar flow/ environmental restoration/ USA, Colorado, Rocky Mountain National Park/ USA, Colorado, Rocky Mountain Natl. Park, Big meadows/ ditch blocking/ conservation, wildlife management and recreation/ environmental action

Abstract: Big Meadows, a 63-ha fen in Rocky Mountain National Park (RMNP), was ditched for agricultural purposes in the early part of this century. Although use of the ditch ceased after the establishment of RMNP in 1915, it continued to intercept sheet flows in the central and southern portions of the fen, causing the ground-water level to decrease and aerobic soil conditions to develop in the mid- to late-summer of most years. In 1990, the ditch was blocked in an attempt to restore the hydrologic regime in the central and southern portions of the fen. Water-level data from three years prior to restoration and four years after restoration show that blocking the ditch successfully restored surface sheet flow, high late-summer water-table levels, and anaerobic soil conditions in much of the central and southern portions of the fen. Conditions in these areas are now similar to those in the northern portion of the fen. The long-term data from this site also indicate that summer rainfall has a greater influence on the magnitude of late-summer drying than the size of the winter snowpack. In a post-restoration year with extremely low rainfall in July and August, water levels throughout the fen decreased to levels similar to those observed throughout most of the pre-restoration period. The study suggests that this and other fens in the southern Rocky Mountains are extremely sensitive to summer precipitation and the hydrologic changes created by even small ditches or water diversions.

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1224. Rapid salinity mapping by electromagnetic induction for determining riparian restoration potential.

Sheets, K. R.; Taylor, J. P.; and Hendrickx, J. M. H.

Restoration Ecology 2(4): 242-246. (1994)

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Descriptors: wetlands/ mapping/ riparian environments/ environmental restoration/ flood plains/ ecosystem management/ nature conservation/ sediments/ conservation/ electromagnetic radiation/ sampling/ salinity/ soils/ sediment properties/ riparian waters/ saline soils/ environmental restoration/ salinity/ soils/ sediment properties/ riparian waters/ saline soils/ soil sampling/ riparian environments/ ecosystem management/ nature

conservation/ electromagnetic radiation/ sampling/ reclamation/ methods and instruments/ protective measures and control/ evaluation, processing and publication/ freshwater pollution/ freshwater

Abstract: The feasibility of measuring soil salinity with electromagnetic induction (EM) for determining riparian restoration potential was investigated on a 28-hectare plot at the Bosque del Apache National Wildlife Refuge in central New Mexico. The plot was cleared of exotic *Tamarix chinensis* (saltcedar), surveyed and gridded into 1370.2 hectare sections. Soil samples and EM measurements were taken at each section. We compared laboratory-determined EC sub(e) values from the soil samples with EC sub(a) values calculated from the EM measurements using a model developed by Rhoades et al. (1990). Direct comparison of EC sub(e) values determined from the two methods yields a low correlation due to sample-size differences but the calculated EC sub(a) was able to accurately predict whether the measured EC sub(e) would lie above or below some threshold value. An assessment of general site suitability for riparian restoration with electromagnetic induction has proven to be a rapid, accurate, and cost-effective alternative to intensive soil sampling.

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1225. Seasonal performance of a wetland constructed to process dairy milkhouse wastewater in Connecticut.

Newman, J. M.; Clausen, J. C.; and Neafsey, J. A.

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Descriptors: agricultural pollution/ wastewater treatment/ pollution control/ USA, Connecticut/ artificial wetlands/ construction/ dairy wastes/ nonpoint pollution sources/ water pollution/ biochemical oxygen demand/ seasonal variations/ dairies/ fecal coliforms/ nutrients/ denitrification/ building and construction/ dairy industry waste waters/ pollution (nonpoint sources)/ pollution (water)/ oxygen demand (biochemical)/ seasonal variations/ dairy milkhouse wastewaters/ performance assessment/ characteristics, behavior and fate/ wastewater treatment processes/ sewage & wastewater treatment/ water treatment

Abstract: Constructed wetlands are gaining increased attention for treatment of nonpoint sources of water pollution. Although constructed wetlands have been utilized for wastewater treatment in warm climates, their performance in cold climates has been questioned. A surface-flow wetland, designed to treat 2.65 m super(3) d super(-1) of milkhouse wastewater, was constructed on the University of Connecticut's Storrs campus in 1994. The purpose of the project was to determine the efficiency of the system in reducing nitrogen, phosphorus, five-day biochemical oxygen demand (BOD sub(5)), total suspended solids (TSS), and fecal coliform bacteria (FC). The wetland was designed to process an estimated BOD sub(5) loading rate of 7.3 g m super(-2) d super(-1), which was less than half of the average actual loading rate. The overall percentage of mass retention was 94, 85, 68, 60 and 53% for TSS, BOD sub(5), total phosphorus, nitrate-nitrite and total Kjeldahl-nitrogen, respectively. Although the wetland became a net source of ammonia nitrogen (NH sub(3)-N) following plant die back in fall 1994, NH sub(3)-N outflow concentrations have gradually declined over time.

Wetlands in Agricultural Landscapes

Mass retention was significantly greater ($P < 0.05$) during the summer than during the winter for all variables except FC. Denitrification rates measured using the acetylene block method have shown denitrification to be a minor removal mechanism ($<1\%$) for nitrogen in this wetland. The mass balance indicated that settling and increased storage was the largest removal mechanism. The treatment of wastewater in this wetland did not meet design outflow concentration criteria, most likely due to BOD sub(5) overloading.

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