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/m super(2). It increased to 7000 seeds/m super(2) 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, Arnoud 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.A1I58
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 km super(2) 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 contaminat impacts. Cesium-137 was used as outlined by Ritchie and McHenry (1977) to determine recent sedimentation rates in the Wetlands.
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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/ 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 10 super(4) km super(2) 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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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/ fledgeing 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 posses 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 ((x)over bar> +/- SD nests/ha, all species combined, 1996: 0.26 +/- 0.09 and 0.31 +/- 0.12; 1997: 0.38 +/- 0.14 and 0.25 +/- 0.12), although a grazing type x 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 +/- 12.6 and 15.5 +/- 11.0; 1997: 21.6 +/- 10.0 and 16.7 +/- 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 retianed 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 Mushet, 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), planorbid 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, rsuperscript 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 asses 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, treflan and 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 hydrosoils. 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 NO sub(3)-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 NO sub(3)-N loads at the outlet of a 51.29 km super(2) 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 NO sub(3)-N loads. Lessening the N rate by 20, 40 and 60% in corn-soybean fields decreased mean NO sub(3)-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 NO sub(3)-N loads by 25 and 49%, respectively. When replacing corn-soybean rotation by winter wheat, NO sub(3)-N loads increased in early fall, immediately after harvest. Pasture installation with or without fertilization lessened flow discharge, NO sub(3)-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 sugject 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 sub(3) super(-)), 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 sub(3) super(-) 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 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 Ell, 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 (NO3-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 NO3-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 NO3-N and P. arundinacea treatments. 3. The total shoot biomass of the native community was suppressed in the presence of P. arundinacea at all NO3-N levels, but shoot suppression was significantly greater at the highest NO3-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 NO3-N was added. 5. As NO3-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 NO3-N level. Three other species were suppressed at the highest NO3-N level, in the presence of Phalaris. The two most common forbs, Asclepias incarnata and Sium suave, exhibited a continual increase in growth with NO3-N additions along with overall suppression by P. arundinacea. 6. Community diversity and evenness declined with increasing NO3-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 NO3-N enrichment conditions. 8. At the same time, the increased suppression by P. arundinacea at the 48 g m-2 NO3-N dose level supports the hypothesis that the dominance of this species over the native sedge meadow community is enhanced by NO3-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 inhibited 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. Alhough 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
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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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