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HERBICIDES AND MILITARY OPERATIONS

VOLUME II

Prepared by

Engineer Strategic Studies Group
Office, Chief of Engineers
Department of the Army

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CONTENTS

SUMMARY

VOLUME II

This is Volume II of a three-volume study on the utility of herbicides to military operations. This UNCLASSIFIED volume contains Annexes A, C, and G and Appendixes B-3 and B-4. Annex A is the study procedure. Annex C is the survey forms and a compilation of the responses. Appendixes B-3 and B-4 describe the vegetation types and military situations in the Republic of Vietnam.

Volume I is the main paper; it discusses the military uses of herbicides in general. The study findings and conclusions are explained in Volume I.

Volume III is classified SECRET and contains detailed information on the herbicide program in the Republic of Vietnam, earlier studies of military effects of herbicides, the quantitative analysis, and the use of herbicides in other conflicts.

ANNEX A

STUDY PROCEDURE

ANNEX A

STUDY PROCEDURE

1. Purpose. The purpose of this annex is to describe the procedure which has been used in the conduct of this study.

2. Scope. As a counterpart to the National Academy of Sciences study of ecological and physiological effects of the herbicide program in the Republic of Vietnam (RVN), this study determines the military utility of herbicides. A case study of the herbicide program in RVN is included to determine the utility of herbicides in support of military operations conducted there. Military war gaming procedures are used to develop an estimate of the utility of herbicides in other conflicts.

3. Terms of Reference.

a. Impact of the problem. Policies shaping the future role of herbicides in military operations are being examined and careful

consideration should be given to the role of these techniques in supporting the military. Such consideration requires that the utility of herbicides be stated in a form useful to policy deliberations. The future use of herbicides impacts on all the military services, and the study includes the kinds of operations conducted by each of the services.

b. Objectives.

(1) Evaluate the military utility of herbicides in the Republic of Vietnam.

(2) Evaluate the potential military utility of herbicides in other possible areas (theaters of operations) around the world.

c. Scope. The study consists of the following:

(1) A theoretical analysis of the impact of vegetation on the military operations conducted by the services and on the enemy activities.

(2) An evaluation of the herbicide program in RVN.

d. Methodology. During the course of the study, the world environment was examined to select regions where vegetation influences the land mass. Conventional linear and nonlinear conflicts are considered in the theoretical analysis. The utility of herbicides in RVN provides a check on the results of the theoretical analysis.

4. Theoretical Analysis. The effect of herbicides is included in the planning procedures used to determine requirements for possible future military conflicts. By comparing the new requirements to those

of previous war games planned without herbicides, a measure of the utility of herbicides is developed.

a. ATLAS. The ATLAS war game, a highly aggregated theater level model, is used in the Portfolio of General Purpose Force Requirements (SPECTRUM). The ATLAS war game is used in this study to represent the effect of herbicides in conventional linear conflict. Results with herbicides in the ATLAS war game are compared with the SPECTRUM results. SPECTRUM uses the force density theory to analyze nonlinear conflict. This analysis also uses the force density theory. (Results are in Annex B.)

b. DYNTACS. An attempt was made to analyze the effects of herbicides by using the DYNTACS war gaming model. DYNTACS is a high resolution model including line of sight, stochastic representation of vegetation, and reinforced battalion size forces. (Discussion in Main Paper.) (24)[1/]

5. Case Study in RVN. The relationship between the military operations and the herbicide program in RVN is investigated. Data from RVN were collected and processed as a case study of the use of herbicides in military operations. The case study includes:

a. Military results. The contribution of the herbicide program to military operations in RVN is investigated. An analysis of the

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1/ The reference numbers in this study are shown at the end of the appropriate sentence or paragraph and are keyed to the bibliography at Annex G, this volume.

frequency of incidents (friendly initiated, enemy initiated, and fatalities) is made for the area affected by herbicides. The analysis includes a period before the spray and another period after the spray effect. Incidents in areas not treated are included in control areas. (See Annex E.)

b. Military personnel who were responsible for the conduct of military operations in RVN were asked to indicate the utility of herbicides in their activities. Questionnaires to US Army battalion commanders or higher and advisors, US Navy personnel conducting riverine operations and advising RVN forces, US Air Force personnel on flying missions, and US Marine Corps ground and air personnel and advisors provided qualitative estimates of herbicide utility. (See Annex C.)

c. Synopsis. The study includes a synopsis of the past reviews, evaluations, and studies of the herbicide program in RVN. (See Annex D.)

6. Conduct of the Study.

a. A team from the Engineer Strategic Studies Group (ESSG), Office, Chief of Engineers conducted the study. The team included a project director, senior analyst (forester), two analysts, and one associate analyst. Headquarters, USAF provided an additional part-time study team member.

b. Plan. A study plan was prepared and briefed to the DOD Steering Group on 5 May 1971. The scope of the study plan has remained unchanged throughout the data collection and analysis processes.

c. Data collection. In addition to obtaining information from the Defense Documentation Center and other agencies in CONUS, the study team traveled to CINCPAC and to MACV to collect and organize information. The National Military Command System Support Center provided the Herbicide File and the basic file of incidents in RVN.

d. Analysis. Data were organized and the analysis performed by ESSG during the period August to December 1971.

e. Report. Draft copies of the report Herbicides and Military Operations were provided to the study sponsor for his use and comment. The final published report was distributed in February 1972.

APPENDIX B-3

VEGETATION OF SOUTHEAST ASIA

APPENDIX B-3

VEGETATION OF SOUTHEAST ASIA

1. Vegetation in the Republic of Vietnam. The RVN is part of a tropical land mass and has vegetation typical of tropical regions. Foliage throughout the country may be grouped into six categories: rain (moist, dense) forest; deciduous dipterocarp forest (monsoon forest); mangrove forest; pine forest; savanna and grassland; cultivated vegetation. Each of these categories, with the exception of cultivated and some savanna or grassland areas, provides ready concealment to men on the ground. Much of the forested area within the normal limits of these broad types has been altered by man over the years. This is especially true in the rain forest areas where very little virgin vegetation remains. What really exists in many of these categories is various stages of secondary growth. However, the main factors in determining composition of vegetation within these categories is the annual rainfall and its distribution throughout the year, the type of soil, and the elevation. The rainfall pattern (in relation to fastest growing season), the vegetation composition, and the number of canopies are important in

herbicide applications. These factors help to determine the proper herbicide agent and the number of applications that will be required.

2. Vegetation Types.

a. Rain (moist, dense) forest. The rain forest occupies most of the upland area up to an elevation of 2,300 feet in areas where the annual precipitation is over 80 inches and somewhat evenly distributed throughout the year. However, the area is usually subject to a short seasonal dry period. These forests are made up of broadleaf evergreen species. A few areas support vegetation that takes the form of semi-evergreen forest where the dry season is longer and there is a mixture of species (22, 35, 57).

(1) Virgin forests are those that exist in their natural or near natural state. These forests remain only in the more remote areas. They usually attain an average height of 80 to 100 feet and contain a multiple canopy with two or three upper layers. The top layer of the canopy is usually discontinuous, with the crown of the lower layers completely concealing the ground underneath. The forest floor often is relatively open while its other areas are a tangled mixture of vines and shrubs (22, 35, 57).

(2) Secondary rain forest. Secondary forests occupy the largest part of the forested areas where the environmental characteristics are those of a rain forest. These secondary forests are not as tall as

the original forests, and the canopy is a dense somewhat even layer of crowns. The low ground cover underneath the main canopy, or the ground cover in the beginning stages of secondary growth (regrowth) is a thick mass of bamboo, various vines and other tropical plants which restrict movement and visibility. Secondary rain forests are more easily defoliated than mature or virgin forests, because the crown structure is usually more uniform and the spray can penetrate to the ground cover more easily.

b. Deciduous (dipterocarp, monsoon) forest. This type of forest is found primarily at the higher elevations in areas where the rainfall is somewhat less than the rain forest and where there is a prolonged dry season, on the plateau areas of Pleiku, Phubon, Darlac and Quang Duc provinces. These forests are usually composed of more widely spaced trees and therefore relatively open both from the standpoint of crown density and ground cover density. Grass is the usual ground cover. However, there are many areas of dense thickets, with bamboo as the ground cover. During the dry season trees within the deciduous forest drop their leaves. Trees in these forests are small to medium in height. Because dipterocarp forests are relatively open, have a single canopy, and drop their leaves naturally for a period each year, they do not present as great a problem for military operations. After clearing a deciduous forest, the first secondary growth is various herbs followed by

bamboo and bananas and followed in time by the regular dipterocarpus species (22, 35, 57).

c. Mangrove forest. Mangrove forests occupy the marsh lowlands along the coastal areas of the Mekong Delta. The largest individual areas containing mangrove forests are in the Rung Sat, southeast of Saigon, and the Ca Mau Peninsula located in the southwesternmost part of Vietnam. Mangrove species help to hold and consolidate alluvial material. Therefore, mangrove forests gradually advance further into the sea as the rivers deposit more material. These forests grow in a tidal area and are adapted to growing in salt and fresh water. Mangrove forests are composed of about 20 dominant trees and shrubs. The forest canopy is usually uniform in height, continuous, and up to 80 to 100 feet tall on the Ca Mau Peninsula, but somewhat shorter in the Rung Sat. These forests are very difficult to travel through on foot or by land transportation because of a combination of thick brush, tree trunks often with stilt roots, a wet to inundated soil condition, and many winding streams and canals (22, 35, 57).

d. Pine forest (coniferous evergreen forest). The distribution of pine (needleleaf) forests in Vietnam is limited in comparison with broadleaf forests. Pine forests are concentrated in Tugen-Duc province. At elevations above 800 to 1,000 meters the pine grows in mixtures with broadleaf dipterocarp trees. Pine forests are also found in local areas

of Kontum province and other scattered upland points. These forests are usually relatively open, but this varies with age, soil, and disturbance by man over the years. Ground cover is composed of grasses and ferns and may range from dense to sparse and from 1 to 2 meters high (22, 35, 57).

e. Savanna and grassland. Savanna consists of a very open distribution of trees or shrubs with a ground cover of grasses from 1 to 3 meters high. They usually are situated in areas previously occupied by a deciduous dipterocarp forest. This type is formed as a result of slash and burn operations, annual burns or soil conditions which will not readily sustain forest growth. Savanna type vegetation is most prevalent in the plateau areas of MR II and MR III. Grassland areas are similar to savannas except that trees are scarce or absent. They may be found in conjunction with savanna, in swamps, steppes, mountain grassland, and abandoned rice fields (22, 35, 57).

f. Cultivated vegetation. Cultivated land in Vietnam is concentrated in the Mekong Delta and sizeable dispersed areas adjacent to the coast northward to the DMZ. Other small to medium size cultivated areas are randomly distributed inland, some of which are relatively permanent along stream valleys, while others are slash and burn operations which are periodically abandoned. The primary crop in Vietnam is rice and accounts for over 90 percent of the cultivated land in Vietnam.

APPENDIX B-4

PHOTOGRAPHS OF THE HERBICIDE EFFECT IN TYPE SITUATIONS IN VIETNAM

APPENDIX B-4

PHOTOGRAPHS OF THE HERBICIDE EFFECT IN TYPE SITUATIONS IN VIETNAM

1. Purpose. The purpose of this appendix is to show the effect of herbicides on different types of targets in RVN. Some of the photographs were taken after the herbicides program had ended, and there is some evidence of regrowth and regeneration.

2. Scope. Herbicides were used in Vietnam to deny the enemy those military advantages which dense foliage lends to the following military activities: ambush and harassment along transportation routes (land and water), infiltration, enemy base areas, and surprise attack on friendly bases. Herbicides were also used to destroy crops grown in the enemy area. This appendix uses photographs taken by the ESSG study team in June 1971 and other photographs of the effects of herbicides in RVN. See Figure B-4-1 for general location of photo areas.

3. Ambush Along Transportation Routes. Since the beginning of the conflict in Vietnam, the enemy very effectively used the dense forests

PHOTO AREA LOCATION MAP

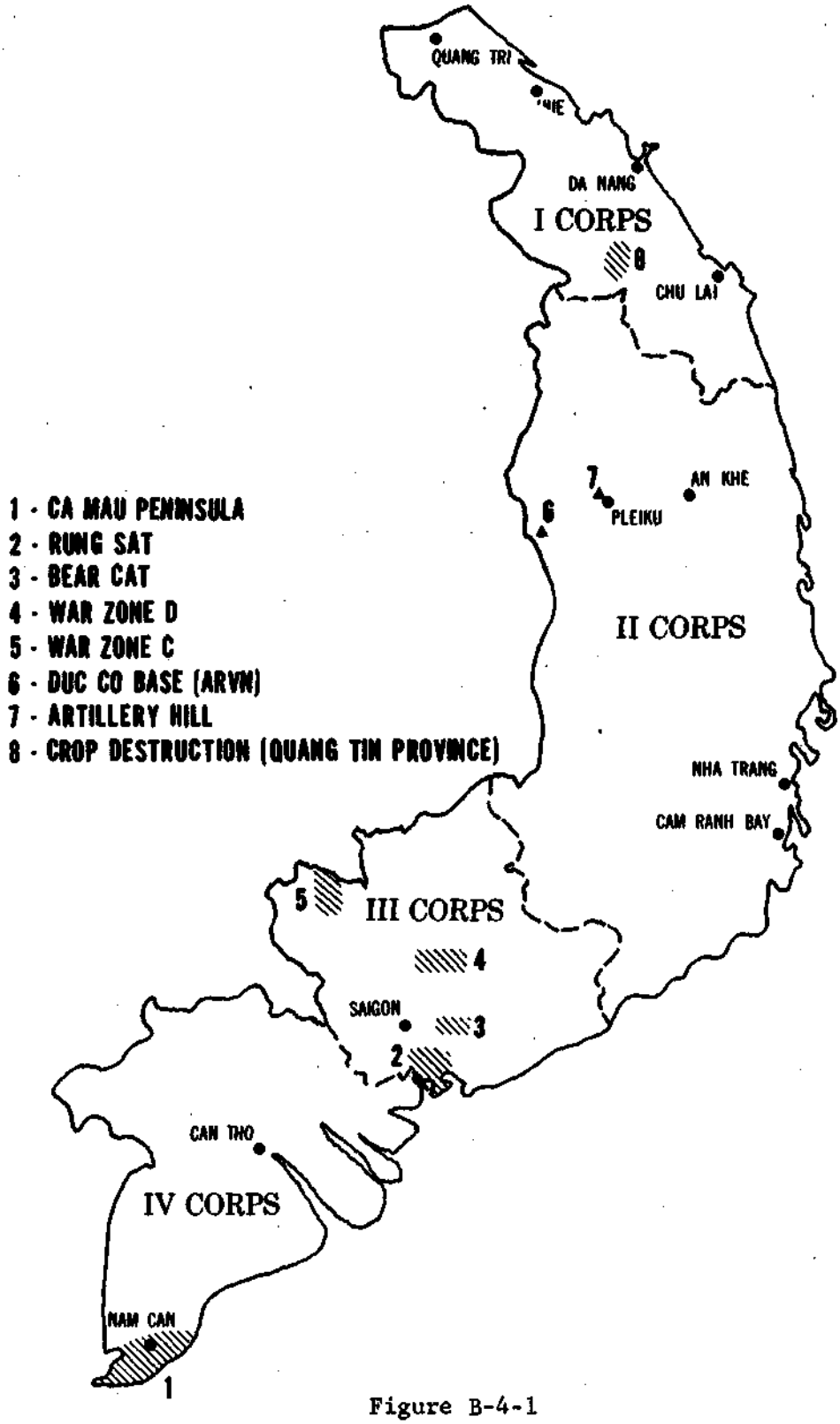

Figure B-4-1

along many of the key marine and land transportation routes as cover for ambush. There were many areas in Vietnam where the vegetation areas adjacent to the transportation routes were large and dense enough to provide points of attack and safe havens where aerial reconnaissance was ineffective. The Viet Cong also harassed local civilian transport of goods by charging taxes to allow passage of goods over many transportation routes where they controlled the adjacent forests.

a. Rung Sat Special Zone. The main shipping route to Saigon for oceangoing vessels and a vital link in the US supply system to RVN was subject to interdiction from the earliest days of the conflict. The dense canopy formed by the mangrove forests, like those in Figure B-4-2, provided a unique hideout. There were a few alternate routes for large ships in the Rung Sat, but they did not provide enough flexibility to avoid enemy attacks. The water there is affected by the tides, and much of the land surface is inundated at high tide. Although traveling on foot in this area is difficult because of mud and the intricate system of large to small streams and canals, these channels provide good transportation for the enemy by small boat. Defoliation of this area began in the middle 1960's, and most of the mangrove forests adjacent to shipping routes were defoliated by the late 1960's (see Figure B-4-3). The mangrove forest was so susceptible to agent Orange that in addition to defoliating the mangrove, it also killed the trees. In June 1971, the ESSG study team observed that entire trees (including crown, trunk

Figure B-4-2. MANGROVE FOREST IN THE RUNG SAT, VIETNAM. JUNE 1971.

Figure B-4-3. DEFOLIATED MANGROVE FOREST ALONG THE SHIPPING ROUTES IN THE RUNG SAT, VIETNAM. JUNE 1971.

and stump-root system) were missing in many areas (see Figure B-4-4). This probably was the result of being uprooted during high water (after some root deterioration) and then floating out to sea. In some areas, local woodcutters were hired to remove dead snags that remained after defoliation. Some salvage cuttings were conducted independently by the local population. This defoliation operation was so complete that it eliminated enemy attacks on shipping in the Rung Sat area. Even though there are a few areas with mangrove regeneration (see Figure B-4-5) and grasses (6 to 9 inches high), the regrowth process is very slow and the military advantage is maintained for several years. The vertical visibility of the ground is improved by 99 to 100 percent. The horizontal visibility is limited only by topography (generally flat to rolling), unsprayed foliage, or an occasional area where dead mangrove stems remain standing (limited obstruction) (see Figure B-4-5).

b. Ca Mau Peninsula. A strip along both banks of the Cua Lon River was defoliated (see Figures B-4-6 and B-4-7). Even though the amount and height of regeneration and the number of trees that survived the defoliation is much greater than in the Rung Sat, the vertical visibility remains good. The horizontal visibility is restricted at many locations by a narrow strip of regeneration (new vegetation) along the Cua Lon River and some tributary streams. The photograph in Figure B-4-8 was taken from an RVN patrol boat in June 1971. This regeneration

Figure B-4-4. DEFOLIATED MANGROVE FOREST ALONG THE SHIPPING ROUTES IN RUNG SAT, VIETNAM. NOTE THAT THE TREE TRUNKS ARE ALSO REMOVED. JUNE 1971.

Figure B-4-5. REGROWTH IN A DEFOLIATED MANGROVE AREA IN THE RUNG SAT, VIETNAM. JUNE 1971.

Figure B-4-6. DEFOLIATED STRIP (MANGROVE FOREST) ALONG THE CUA LON RIVER ON THE CA MAU PENINSULA, VIETNAM NEAR NAM CAN (VIEW FROM A HELICOPTER). JUNE 1971.

Figure B-4-7. DEFOLIATED STRIP ALONG THE CUA LON RIVER, SOUTH BANK, JUST WEST OF NAM CAN (VIEW FROM A VIETNAMESE PATROL BOAT). JUNE 1971.

within the earliest sprayed areas reveals, to some degree, what the area adjacent to the river would look like from a boat traveling along the river before defoliation. Without defoliation, a patrol boat and other river traffic are prime targets for the enemy. In contrast, the enemy can operate from concealed positions, making exact location and target hits difficult because of the dense forest.

c. Land transportation routes. Forest areas adjacent to several highways were defoliated (no photo examples readily available) with the same general advantages in avoiding ambush as in riverine areas.

4. Infiltration. Infiltration of men and supplies into Vietnam has been a menacing problem since the beginning of US support in Vietnam. This problem is compounded by the extensive border area with Cambodia and Laos where the enemy has traveled almost at will. These sanctuaries for men and supplies, a springboard for infiltration into Vietnam, were virtually unmolested until the Cambodian operation. Also, there was considerable infiltration through the DMZ and at various points along the extensive coastline. The predominant points of entry into Vietnam, whether by land or water were in forested areas where vertical visibility is poor and where probes (on foot or motorized patrol) into these sparsely populated hideouts were subject to ambush. The infiltration usually ended at a base area where supplies and equipment are stored and the forest cover was excellent for both men and supplies. From these base camp areas, the enemy conducted raids and operations into surrounding

areas. Normal methods of detection by air and ground did not stem the infiltration, as positive identification of targets and results of aerial or artillery attack were difficult to evaluate because of dense cover and inaccessibility. As a result, herbicides were used to defoliate many infiltration routes. The study team observed areas in the Ca Mau Peninsula, War Zone D, and the Rung Sat where defoliation was used to help prevent infiltration.

a. Ca Mau Peninsula. Ca Mau is an excellent example of defoliation to disrupt infiltration. Alternate strips of defoliated and nondefoliated vegetation across the peninsula allow excellent visibility within the defoliated areas. This area had been a temporary staging area for infiltration into the Mekong Delta and for attacks on local shipping and patrol craft along the peninsula's many streams and canals. Figures B-4-9 and B-4-10 clearly reveal the utility of defoliation in disrupting infiltration. Figure B-4-11 illustrates the improved aerial observation that results from defoliation. Contrasting the exposed ground and absence of foliage in the defoliated area with the bush coverage and easy concealment in the untouched area shows how improved observation would help control such an area. Some regeneration is also visible in Figure B-4-11. The photographs in Figures B-4-12, B-4-13, and B-4-14 were acquired from COMNAVFORV. They were taken in the Ca Mau Peninsula area in early 1971 and demonstrate the concealment afforded by heavy

Figure B-4-8. REGROWTH ALONG THE CUA LON RIVER, SOUTH BANK, WEST OF NAM CAN AT 8°44'30" N. 104°58'45" E. JUNE 1971.

Figure B-4-9. DEFOLIATED STRIP IN MANGROVE FOREST ON THE CA MAU PENINSULA, LOOKING NORTH AT 8°35'00" N. 104°46'30" E. JUNE 1971.

Figure B-4-10. DEFOLIATED AND NONDEFOLIATED STRIPS IN MANGROVE FOREST ON THE CA MAU PENINSULA AT 8°34'00" N. 104°50'40" E. JUNE 1967.

Figure B-4-11. DEFOLIATED AREA WITH SOME REGENERATION IN MANGROVE FOREST ON THE CA MAU PENINSULA AT 8°41'00" N. 105°07'40" E.

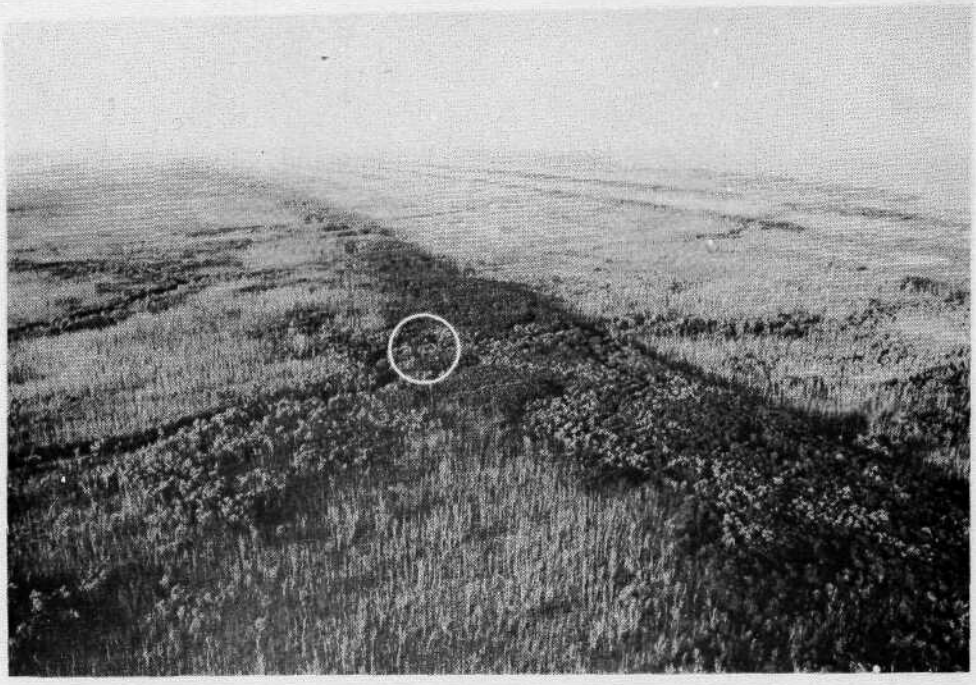

Figure B-4-12. OCEANGOING SHIP (100-TON) CONCEALED (CIRCLED) IN A NONDEFOLIATED STRIP IN MANGROVE FOREST ON CA MAU PENINSULA, EARLY 1971.

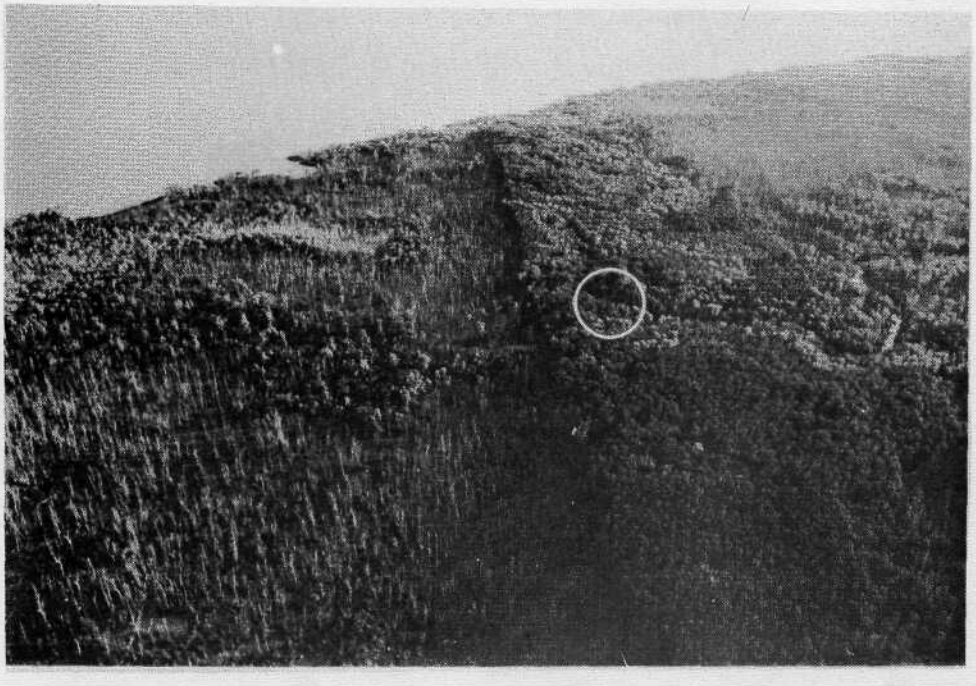

Figure B-4-13. OCEANGOING SHIP (100-TON) CONCEALED (CIRCLED) WITHIN NONDEFOLIATED STRIP IN MANGROVE FOREST ON CA MAU PENINSULA, INFILTRATION ROUTE, EARLY 1971.

foliage in the mangrove forest. In these photographs, the enemy has taken advantage of a strip that was not defoliated. The area is laced with small streams and canals connected to the open sea. Enemy infiltration and resupply used these small waterways to land forces and supplies. Defoliation in strips through the area exposed many of the waterways to ready observation, thereby limiting enemy use. However, the natural or unchanged strips were used to continue the infiltration and resupply activity. As the close-up photo shows, the enemy positioned a 100-ton oceangoing ship at the circle in the first photo (Figure B-4-12). By securing trees from the stream banks over the ship, the ship's position remained undetected for several weeks to several months. The ship was last sighted on the open seas 6 months before it was spotted in this location. When sighted in this location, the ship had been abandoned for some time due to mechanical difficulties. This ship was unusually large in comparison with the sampans and junks common to the waterways of the Delta. However, its size indicates the importance the enemy attaches to this base and operation. Forces to detect, control, and eliminate enemy operations in areas of this kind are severely handicapped by limited visibility. Herbicides aid military operations by permitting easy observation into formerly heavily forested jungle areas. As a result of improved observation, other weapons and weapon systems can be effectively directed against the enemy to restrict his operation in such areas.

Figure B-4-14. CLOSE-UP VIEW OF 100-TON OCEANGOING SHIP IN CONCEALED POSITION AFTER BEING LOCATED, EARLY 1971.

b. War Zone D. War Zone D was defoliated primarily because the area was being used as an enemy base camp. However, Figure B-4-15 demonstrates how effectively roads and trails are exposed when foliage is removed. Roads and trails in this photo were originally concealed by a multiple canopy forest.

c. Rung Sat. The mangrove forests of the Rung Sat were used as a base for operations against marine shipping routes to Saigon and for some infiltration from the sea to other parts of the RVN. The defoliation was so effective and extensive (see Figures B-4-2, B-4-3, and B-4-4) that infiltration was eliminated.

5. Enemy Base Camps. The enemy infiltration terminated in large base camps within RVN; some of these camps were located deep in the heart of the country. Other camps were located near the Cambodian border and the previously referred to enemy sanctuaries a relatively short distance from Saigon and the hub of RVN influence. These camps were the source of activities such as raids and harassment of friendly forces, terror attacks on local inhabitants, and attempted infiltration into cities (e.g., the Tet offensive of 1968). When a given operation was completed or aborted, the enemy forces withdrew into these base camp areas for refitting. Defoliation was found helpful in exposing and disrupting the enemy base camp operation.

a. War Zone D. This area is typical of the enemy base camp areas in which penetration of the foliage (multiple canopy) by aerial reconnaissance seemed ineffective in locating and destroying the enemy and disrupting his operation. Figures B-4-15 and B-4-16 are examples of areas where the visibility was improved by defoliation. Much of the area was sprayed repeatedly, as it usually required two to three sprays to reach all levels of a multiple canopy forest; repeat sprays were required because of regrowth. Many of the trees in the upper canopy are dead as a result of repeat spraying.

b. Rung Sat and Ca Mau mangrove forest. When enemy base camp operations were located within mangrove forests, one application of agent Orange herbicide usually defoliated the area almost completely

Figure B-4-15. DEFOLIATED MULTIPLE CANOPY FOREST IN WAR ZONE D. NOTE THE EXPOSED ROADS AND TRAILS. JUNE 1971.

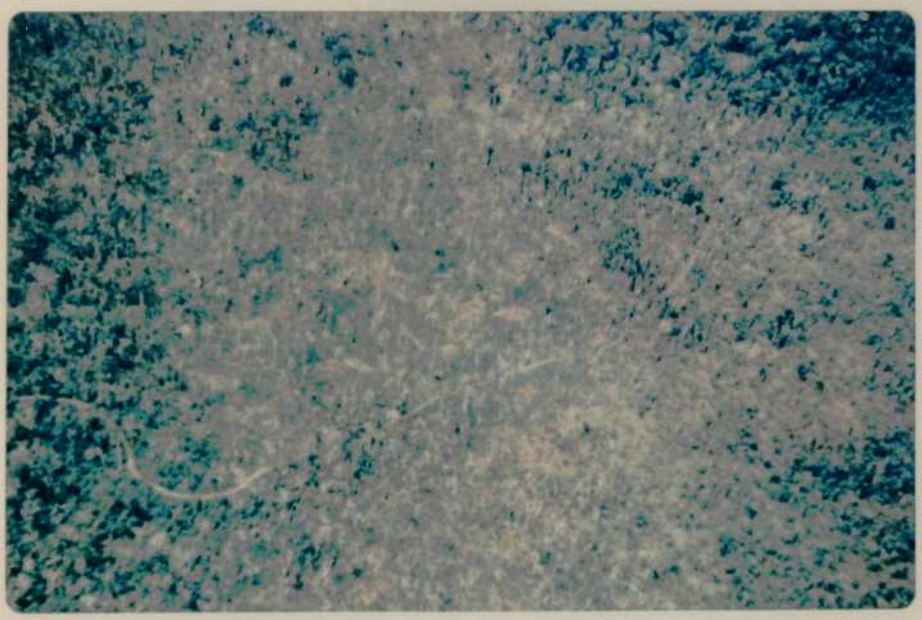

Figure B-4-16. DEFOLIATED MULTIPLE CANOPY FOREST IN WAR ZONE D. NOTE DEAD SNAGS, JUNE 1970.

(especially in the Rung Sat) and exposed the enemy hideout. Study team members saw abandoned enemy fortifications (one- or two-man) and hideout sites from a helicopter at tree height in the Rung Sat. Figure B-4-4 shows a typical mangrove forest. Also, the previous examples in the Rung Sat and Ca Mau Peninsula show the extent to which bases in the mangrove were exposed.

c. Bear Cat and War Zone C. The photograph in Figure B-4-17 shows structures and trails uncovered in the Bear Cat area. Figure B-4-18 (Bear Cat) illustrates the fact that horizontal visibility often remains obstructed by tree or shrub trunks and branches after most of the leaves have dropped. The photograph in Figure B-4-19 is of a defoliated area in War Zone C.

6. Perimeter Security at Fixed Bases and Other Installations. There is an obvious need for a sizeable perimeter clear of all vegetation high enough to conceal the movements of crawling men. Under cover of darkness, the enemy can hide in the tall grass or brush even when flares are released. The enemy has actually penetrated perimeter fences and barbed wire barriers before being detected. Without herbicides, control of grass and weeds in the barbed wire barriers is very difficult. A large area around the Nam Can Naval Facility (Base) was defoliated, and local wood cutters were hired to remove some of the remaining dead trees which obstructed observation and weapons fire.

Figure B-4-17. STRUCTURE AND TRAILS UNCOVERED BY DEFOLIATION IN BEAR CAT AREA, VIETNAM.

Figure B-4-18. HORIZONTAL VISIBILITY REMAINS SOMEWHAT OBSTRUCTED BY THE TRUNKS AND BRANCHES OF TREES AND SHRUBS AFTER SIGNIFICANT DEFOLIATION. BEAR CAT, VIETNAM.

Figure B-4-20 shows the utility of clearing the perimeter of vegetation. Attacks on the base and anchored boats were negligible after defoliation. Repeat sprays were not necessary in the Nam Can (Ca Mau Peninsula) area because of the mangrove forest's susceptibility to herbicides. However, in areas where bamboo or tall grass surrounded a base, it was necessary to respray every 2 or 3 months to keep the vegetation low. In June 1971, the study group saw the results (Figure B-4-21) of hand sprayings with agent Blue to remove grass from the perimeter fences around Artillery Hill at Pleiku. Duc Co Base (RVN) located southwest of Pleiku was sprayed by helicopter with agent Blue; 550 gallons were used on the perimeter area 1½ months before the study teams took the photographs in Figure B-4-22. The brown color of dead grass has almost disappeared, and the new grass is very short. In most locations the topography, hazardous conditions, mine fields, and limited work force and equipment precluded other means of keeping the perimeter areas cleared.

7. Crop Destruction. Herbicides were used in Vietnam to destroy crops grown for enemy use. Most crop destruction targets were located in areas where the population was very sparse and the surrounding area was under enemy influence. Also, most targets were located in the western parts of military regions I and II. Rice was the main target for destruction, and agent Blue was the chief herbicide used. The crop destruction program was very successful from the standpoint of

Figure B-4-19. DEFOLIATED VEGETATION IN WAR ZONE C, VIETNAM.

Figure B-4-20. DEFOLIATED STRIP AROUND THE PERIMETER OF NAM CAN NAVAL FACILITY ON THE CUA LON RIVER, JUNE 1971.

Figure B-4-21. PERIMETER OF ARTILLERY HILL AT PLEIKU, DEFOLIATED AREAS ARE ALONG FENCES AND WERE HAND SPRAYED WITH AGENT BLUE. PHOTOGRAPH TAKEN IN JUNE 1971.

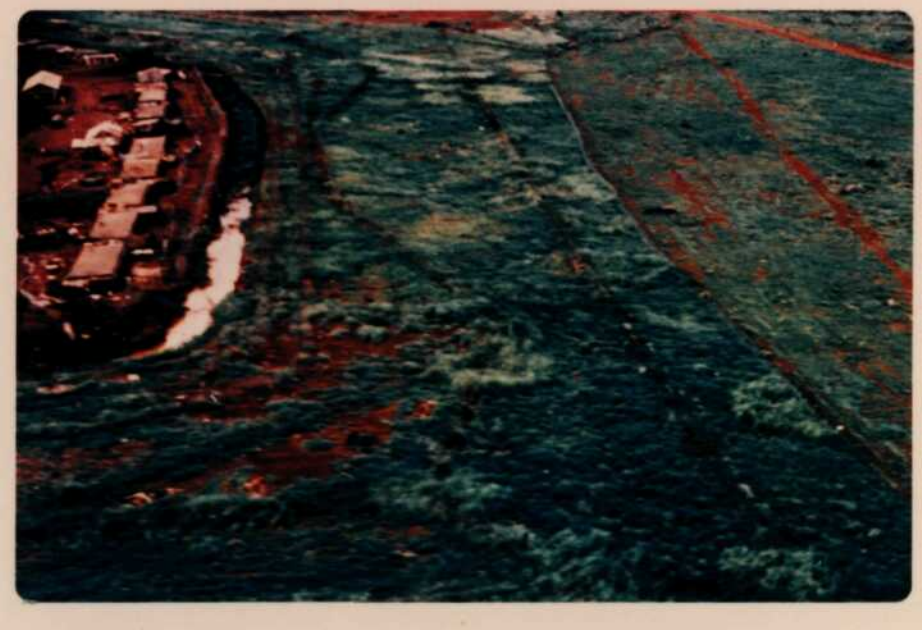

Figure B-4-22. PERIMETER AREA OF DUC CO FIRE BASE, LOCATED SOUTHWEST OF PLEIKU, WAS SPRAYED WITH 10 DRUMS (550 GALLONS) OF AGENT BLUE 1½ MONTHS BEFORE PHOTO WAS TAKEN, JUNE 1971.

killing crops, and the effect is permanent on the crop that is sprayed. However, a new crop can be planted at the next planting time, as no residual remains in the soil to retard new crop growth. When the herbicide is applied at lighter rates than required for complete plant kill, the yield of rice often may be reduced to little or nothing anyway. A study team member observed (by helicopter) several areas in Quang Tin Province, MR-I where the rice crop had been killed by spraying with Blue in 1970 (confirmed by personnel who flew over the area when the crops were brown). New crops were growing in these areas in June 1971 (see Figures B-4-23 and B-4-24); this helps confirm the lack of any residual in the soil that retards subsequent plant growth.

8. Conclusions. The effects of herbicides in RVN indicate that herbicides contribute to military operations. When herbicides were used in mangrove forests where the enemy was infiltrating and resupplying his forces, excellent visibility resulted. Because observation was so improved, the enemy was forced to stop or greatly reduce his operations in these areas. Herbicides used along lines of communications (water, road, and rail) reduced the enemy cover and improved friendly firepower control, thereby forcing the enemy to sharply reduce his ambush activity. When herbicides were used in extensive rain forests against enemy infiltration and bases the results were less impressive; there, herbicides were complimentary to many systems used to identify

Figure B-4-23. AREA IN WHICH RICE CROPS WERE SPRAYED AND DESTROYED IN 1970. NEW CROPS ARE GROWING IN JUNE 1971 AS SHOWN IN THIS PHOTO. LOCATED IN QUANG TIN PROVINCE MR I.

Figure B-4-24. AREA IN WHICH RICE CROPS WERE SPRAYED AND DESTROYED IN 1970. NEW CROPS ARE GROWING IN JUNE 1971 AS SHOWN IN THIS PHOTO. LOCATED IN QUANG TIN PROVINCE MR I.

enemy activities. In many instances, herbicides caused the enemy to relocate his activity. Herbicides did not eliminate the enemy, but they sometimes caused relocation or elimination of his activity at a location. The crop destruction program was effective from the standpoint of physical results. Herbicides contributed to the conduct of military operations in RVN. Their use was advantageous to friendly forces and forced the enemy to abandon his activity in many areas.

ANNEX C

SURVEY OF OPINIONS ON HERBICIDE EFFECTS

ANNEX C

SURVEY OF OPINIONS ON HERBICIDE EFFECTS

1. General. This annex presents the results of a qualitative appraisal of the effects of herbicides used in Southeast Asia. The appraisal is made on the basis of opinions expressed by military personnel who used herbicides in their operations in Southeast Asia. Questionnaires

were distributed to five groups: Army and Marine commanders and advisors at battalion and higher levels, Navy personnel, Air Force and Marine Corps air personnel, Army chemical officers, and Air Force personnel who participated in the herbicide spray operation (Ranch Hand). Responses are analyzed to establish a consensus for each of these groups. Within the groups, a further analysis examines the time of experience, area of operations, level of command or activity, and the type herbicide targets. The analysis also identifies target types and the effectiveness of herbicides against each.

2. Results. Appendixes C-1 through C-5 present the questionnaires and comments from the respondents. The following paragraphs summarize the results.

a. Effect on vegetation.

(1) The period from application to maximum defoliation was from 3 to 8 weeks--depending on agent, season, and weather. Herbicides applied to food crops were effective in 1 or 2 days.

(2) The improvement in visibility provided by defoliation generally lasted 4 to 6 months.

(3) The effects of defoliants were in accord with planning factors.

(4) Effects of defoliation missions generally met the expectations of tactical commanders.

(5) For clearing foliage, herbicides are more effective than napalm or HE bombs, about equal to slash and burn, and less effective than Rome Plow.

b. Military effects.

(1) All services agreed that defoliation assisted their mission performance. There was general agreement that missions would have been possible but more difficult without defoliation. Defoliation impeded only those few missions which required concealment for friendly forces operating in enemy areas.

(2) Defoliation assisted direct observation greatly, both on the ground and from the air. Estimates of improvement in vertical visibility varied widely, but averaged 40-60 percent. Observation by night vision devices and by radar was improved to a lesser degree.

(3) Defoliation of the areas surrounding fixed bases greatly assisted in their defense.

(4) Friendly casualties from ambush were reduced significantly by defoliating along friendly LOC. Friendly casualties from other causes and in other areas of application were reduced slightly.

(5) Enemy casualties from unit and support weapons were increased slightly by defoliation. The enemy avoided heavier casualties by avoiding defoliated areas.

(6) Defoliation decreased significantly the number of small arms and heavy weapons attacks on friendly vessels, and it decreased

slightly the accuracy of weapons used in those attacks. The number of attacks by naval mines was not affected. The effectiveness of defensive or retaliatory fire was increased significantly.

(7) Crop denial helped to achieve RVN political and military objectives. It made the enemy change his pattern of operations and about half the time made him change his area of operations. Where herbicides were used for crop denial, the distinction between crops grown for use by the enemy and crops grown by noncombatants not supporting the enemy was usually reliable.

c. Future need. Respondents estimated the need for herbicides in future conflicts as follows:

	Yes	Perhaps	No	
Army Chemical Officers	28	5	0	
Army and Marine Commanders and Advisors	238	83	20	
Air Force and Marine Air	145	116	38	
Navy	107	35	9	
Total Respondents	518	239	67	= 824
	63%	29%	08%	

3. Conclusions.

a. Defoliation helped all services to perform their missions. While the missions would have been possible without defoliation, they would have been more difficult.

b. Defoliation reduced friendly casualties.

c. The enemy was forced to avoid defoliated areas or to accept increased casualties.

d. Crop denial helped to achieve RVN political and military objectives.

e. There is a forseeable need for herbicides in future conflicts and a capability should be maintained.

APPENDIX C-1

COMMANDERS AND ADVISORS

APPENDIX C-1

COMMANDERS AND ADVISORS

1. Purpose. This appendix analyzes the replies of Army and Marine Corps personnel who served in RVN as commanders at battalion and higher levels or as advisors in the period 1965 through 1970.

2. Scope. The questions cover the effects of defoliation and crop denial herbicides on both friendly and enemy forces. Respondents are also asked to rate the effectiveness of herbicides in comparison to other methods of clearing vegetation and to give their opinions on the need for herbicides in the future. Replies are analyzed by area, by level of command, and by time period. The questionnaire and cover letter are appended as Tab A.

3. Respondents.

a. Names of Army personnel were extracted from Army Activities Report Southeast Asia (prior to 1969 titled Army Buildup Progress Report). Social Security account numbers were obtained from the Army Register, which also classified individuals as active, retired, or deceased. Addresses of Active Army personnel were obtained from the Army Locator. Four hundred Army responses were received. The Marine Corps made their own selection of individuals to receive the questionnaire and handled the distribution and collection.

b. Figure C-1-1 lists the number of respondents who reported that they observed the effects of herbicides in the areas of application examined. These areas are not mutually exclusive, and a single individual may have indicated experience in any or all. This distribution represents the replies of 393 individual respondents.

RESPONDENTS OBSERVING EFFECTS OF HERBICIDES

Area	Respondents
On extensive wooded areas of VC shelter	291
On enemy infiltration routes	263
Along friendly roads	236
Along friendly waterways	136
On friendly defense perimeter	233
On food crops	145

Figure C-1-1

c. Only positive answers are tabulated. "Don't Know" answers are not included in the analysis.

4. Replies to Questions.

a. Use of defoliants on wooded areas of VC shelter.

(1) Question 5a(1). Where defoliants were used on wooded areas of VC shelter, friendly cross-country movement was:

5	33	57	139	38
Seriously Impeded	Impeded Somewhat	Unaffected	Assisted Somewhat	Greatly Assisted

The average of replies indicates some small degree of improvement. This response is consistent for all areas, time periods, and command levels.

(2) Question 5a(2). Where defoliants were used on wooded areas of VC shelter, friendly casualties from enemy ambush were:

65	120	67	2	0
Significantly Reduced	Slightly Reduced	Unaffected	Increased Slightly	Increased Significantly

The average of replies indicates a slight reduction in the number of ambush casualties.

(3) Question 5a(3). Where defoliants were used on wooded areas of VC shelter, friendly casualties from road mines were:

21	62	144	1	2
Significantly Reduced	Slightly Reduced	Unaffected	Increased Slightly	Increased Significantly

Most respondents indicated that defoliation had no effect on friendly casualties from road mines. The average of replies shows a very slight reduction. The replies are consistent for all areas, time periods, and command levels.

(4) Question 5a(4). Where defoliants were used on wooded areas of VC shelter, friendly casualties from booby traps were:

23	102	114	5	0
Significantly Reduced	Slightly Reduced	Unaffected	Increased Slightly	Increased Significantly

Nearly equal numbers indicated reduction of casualties and no effect. The average is a slight reduction which holds for all areas, time periods, and command levels.

(5) Question 5a(5). Where defoliants were used on wooded areas of VC shelter, enemy casualties from unit weapons were:

7	20	54	134	23
Significantly Reduced	Slightly Reduced	Unaffected	Increased Slightly	Increased Significantly

The preponderant reply was slight increase in enemy casualties. The reductions indicated in some replies probably result from enemy evacuation of defoliated areas.

(6) Question 5a(6). Where defoliants were used on wooded areas of VC shelter, the number of enemy targets engaged by artillery was:

4	6	68	130	34
Significantly Reduced	Slightly Reduced	Unaffected	Increased Slightly	Increased Significantly

The preponderant reply is a slight increase and is representative of all command levels, areas, and time periods. The reductions indicated in some replies probably result from enemy evacuation of defoliated areas.

(7) Question 5a(7). Where defoliants were used on wooded areas of VC shelter, enemy casualties from air support were:

2	4	51	146	39
Significantly Reduced	Slightly Reduced	Unaffected	Increased Slightly	Increased Significantly

The preponderant reply is a slight increase in enemy casualties. This is representative of all areas and time periods.

(8) Question 5a(8). Where defoliants were used on wooded areas of VC shelter, ground observation by conventional means was:

2	6	20	166	82
Seriously Impeded	Impeded Somewhat	Unaffected	Assisted Somewhat	Greatly Assisted

An increase in horizontal visibility is indicated for all areas, time periods, and command levels.

(9) Question 5a(9). Where defoliants were used on wooded areas of VC shelter, aerial observation by conventional means was:

1	2	6	103	165
Seriously Impeded	Impeded Somewhat	Unaffected	Assisted Somewhat	Greatly Assisted

There was general agreement that defoliants assisted aerial observation by conventional means, and the preponderant reply indicated that they assisted greatly. The lower enthusiasm was indicated in the I Corps area; but, favorable results were shown for all areas, time periods, and command levels.

(10) Question 5a(10). Where defoliants were used on wooded areas of VC shelter, aerial observation by night vision devices was:

0	1	42	111	36
Seriously Impeded	Impeded Somewhat	Unaffected	Assisted Somewhat	Greatly Assisted

The preponderant reply, "assisted somewhat," is consistent for all areas, time periods, and for the levels of command from which replies were received.

(11) Question 5a(11). Where defoliants were used on wooded areas of VC shelter, aerial observation by radar was:

0	0	60	49	12
Seriously Impeded	Impeded Somewhat	Unaffected	Assisted Somewhat	Greatly Assisted

Approximately equal numbers of respondents indicated no effect and assistance. The average shows a slight assistance to aerial observation by radar.

b. Use of defoliants on enemy infiltration routes.

(1) Question 5b(1). Where defoliants were used on enemy infiltration routes, enemy movement was:

33	157	43	12	2
Seriously Impeded	Impeded Somewhat	Unaffected	Assisted Somewhat	Greatly Assisted

The consensus for all areas, command levels, and time periods is that enemy movement was impeded somewhat.

(2) Question 5b(2). Where defoliants were used on enemy infiltration routes, friendly casualties from booby traps were:

16	90	108	0	0
Significantly Reduced	Slightly Reduced	Unaffected	Increased Slightly	Increased Significantly

The effect, if any, was favorable but very slight.

(3) Question 5b(3). Where defoliants were used on enemy infiltration routes, enemy casualties from unit weapons were:

5	11	61	116	26
Significantly Reduced	Slightly Reduced	Unaffected	Increased Slightly	Increased Significantly

The preponderant reply shows a slight increase in enemy casualties from unit weapons. This was representative of all levels of command for all areas and time periods.

(4) Question 5b(4), Where defoliants were used on enemy infiltration routes, the number of enemy targets engaged by artillery was:

2	7	61	124	32
Significantly Reduced	Slightly Reduced	Unaffected	Increased Slightly	Increased Significantly

The preponderant reply indicates a slight increase. This was representative of all command levels for all areas and time periods.

(5) Question 5b(5). Where defoliants were used on enemy infiltration routes, enemy casualties from air support were:

2	2	48	125	48
Significantly Reduced	Slightly Reduced	Unaffected	Increased Slightly	Increased Significantly

The preponderant reply indicates a slight increase in enemy casualties. This was true for all command levels and for all areas and time periods.

(6) Question 5b(6). Where defoliants were used on enemy infiltration routes, ground observation by conventional means was:

1	2	25	155	64
Seriously Impeded	Impeded Somewhat	Unaffected	Assisted Somewhat	Greatly Assisted

Respondents indicated that defoliation assisted ground observation by a ratio of 8:1 over those indicating no effect or an unfavorable effect. The preponderant reply "assisted somewhat" is representative of all command levels, areas, and time periods.

(7) Question 5b(7). Where defoliants were used on enemy infiltration routes, ground observation by night vision devices was:

1	2	39	119	35
Seriously Impeded	Impeded Somewhat	Unaffected	Assisted Somewhat	Greatly Assisted

The preponderant reply shows observation assisted somewhat. This is representative of all command levels reporting, all areas, and all time periods.

(8) Question 5b(8). Where defoliants were used on enemy infiltration routes, ground surveillance by radar was:

0	1	72	77	20
Seriously Impeded	Impeded Somewhat	Unaffected	Assisted Somewhat	Greatly Assisted

Some assistance to ground surveillance by radar is indicated. There were no replies from division commanders for the 1965-66 period. Most respondents indicated no effect for the 1965-66 period.

(9) Question 5b(9). Where defoliants were used on enemy infiltration routes, aerial observation by conventional means was:

0	1	7	112	129
Seriously Impeded	Impeded Somewhat	Unaffected	Assisted Somewhat	Greatly Assisted

Almost all replies indicate assistance, with a preponderance indicating that defoliation assisted observation greatly. The greatest enthusiasm seems to come from the lower levels of command. Overall response was consistent for all areas and time periods.

(10) Question 5b(10). Where defoliants were used on enemy infiltration routes, aerial observation by night vision devices was:

0	1	39	95	36
Seriously Impeded	Impeded Somewhat	Unaffected	Assisted Somewhat	Greatly Assisted

The preponderant reply indicates that defoliation assisted aerial observation by night vision devices, with nearly equal numbers reporting that observation was unaffected and that it was assisted greatly. Replies were not received for the 1965-66 period from division commanders. Responses were consistent for all areas and time periods.

(11) Question 5b(11). Where defoliants were used on enemy infiltration routes, aerial observation by radar was:

0	0	51	51	9
Seriously Impeded	Impeded Somewhat	Unaffected	Assisted Somewhat	Greatly Assisted

Almost as many respondents reported no effect as reported assistance. The average reply indicates some assistance for all areas and time periods. Division commanders did not reply for 1965-66.

c. Use of defoliants along friendly roads.

(1) Question 5c(1). Where defoliants were used along friendly roads, friendly movement on roads was:

3	2	27	90	107
Seriously Impeded	Impeded Somewhat	Unaffected	Assisted Somewhat	Greatly Assisted

Most respondents indicated that friendly travel was assisted, with the preponderance indicating that it was greatly assisted. No replies were received from division commanders in I Corps area.

(2) Question 5c(2). Where defoliants were used along friendly roads, friendly casualties from enemy ambush were:

100	92	24	2	1
Significantly Reduced	Slightly Reduced	Unaffected	Increased Slightly	Increased Significantly

Most respondents indicated a reduction in friendly casualties, nearly equally divided between significant and slight. No replies were received from division commanders in I Corps area nor for the 1965-66 period.

(3) Question 5c(3). Where defoliants were used along friendly roads, friendly casualties from road mines were:

3	90	88	2	1
Significantly Reduced	Slightly Reduced	Unaffected	Increased Slightly	Increased Significantly

The preponderant reply is a slight reduction. Division commanders did not reply for I Corps area nor for 1965-66. The average reply was a slight reduction for all areas and periods.

(4) Question 5c(4). Where defoliants were used along friendly roads, friendly casualties from booby traps were:

22	97	83	2	0
Significantly Reduced	Slightly Reduced	Unaffected	Increased Slightly	Increased Significantly

The preponderance indicates slight reduction. No replies were received from division commanders in I Corps area nor for 1965-66. The average reply showed casualties slightly reduced in all areas and time periods.

(5) Question 5c(5). Where defoliants were used along friendly roads, enemy casualties from unit weapons were:

10	9	49	109	24
Significantly Reduced	Slightly Reduced	Unaffected	Increased Slightly	Increased Significantly

The preponderant reply shows a slight increase. Division commanders did not reply for I Corps nor for 1965-66. The average reply "increased slightly," was representative of all areas and time periods.

(6) Question 5c(6). Where defoliants were used along friendly roads, ground observation by conventional means was:

0	0	8	108	108
Seriously Impeded	Impeded Somewhat	Unaffected	Assisted Somewhat	Greatly Assisted

Improved observation is a nearly unanimous response, with replies differing only in degree. Division commanders did not reply for I Corps area nor for 1965-66. The greatest assistance was reported by division commanders and by advisors. Overall, the average reply "assisted somewhat" was representative of all areas and time periods.

d. Use of defoliants along friendly waterways.

(1) Question 5d(1). Where defoliants were used along friendly waterways, friendly casualties from enemy ambush were:

41	60	21	1	0
Significantly Reduced	Slightly Reduced	Unaffected	Increased Slightly	Increased Significantly

The preponderant reply is a slight reduction in casualties. Division commanders did not reply for I Corps area nor for 1965-66. The average reply "slightly reduced" is representative of all areas and time periods.

(2) Question 5d(2). Where defoliants were used along friendly waterways, friendly casualties from booby traps were:

15	47	54	0	0
Significantly Reduced	Slightly Reduced	Unaffected	Increased Slightly	Increased Significantly

About as many respondents reported reduction in booby trap casualties as reported that the number was unaffected. No division commanders replied for I Corps area nor for 1965-66. The average reply is a slight reduction.

(3) Question 5d(3). Where defoliants were used along friendly waterways, enemy casualties from unit weapons were:

6	5	31	61	12
Significantly Reduced	Slightly Reduced	Unaffected	Increased Slightly	Increased Significantly

The preponderant reply is a slight increase. No division commanders replied for I Corps area or 1965-66. The reply "increased slightly" is representative of all areas and time periods.

(4) Question 5d(4). Where defoliants were used along friendly waterways, ground observation by conventional means was:

0	0	8	71	53
Significantly Impeded	Impeded Somewhat	Unaffected	Assisted Somewhat	Greatly Assisted

Respondents indicated almost unanimously that observation was assisted, with the preponderance "assisted somewhat." Division commanders did

not reply for I Corps area nor for 1965-66. "Assisted somewhat" is the average reply for all command levels, areas, and time periods.

e. Use of defoliants on friendly defense perimeter.

(1) Question 5e(1). Where defoliants were used on a friendly defense perimeter, defense of that perimeter was:

0	5	2	79	147
Seriously Impeded	Impeded Somewhat	Unaffected	Assisted Somewhat	Greatly Assisted

Replies indicate almost unanimously that defense was assisted, and 2:1 that it was greatly assisted. The average reply for all command levels and all areas and time periods is "greatly assisted."

(2) Question 5e(2). Where defoliants were used on a friendly defense perimeter, friendly casualties from booby traps were:

31	52	115	1	0
Significantly Reduced	Slightly Reduced	Unaffected	Increased Slightly	Increased Significantly

The preponderant reply indicated booby trap casualties unaffected. This is representative of all command levels, areas, and time periods.

(3) Question 5e(3). Where defoliants were used on a friendly defense perimeter, enemy casualties from unit weapons were:

2	4	32	113	51
Significantly Reduced	Slightly Reduced	Unaffected	Increased Slightly	Increased Significantly

The preponderant reply is a slight increase. Division commanders reported significant increase. For other levels of command and all areas and periods, the average reply was "increased slightly."

(4) Question 5e(4). Where defoliants were used on a friendly defense perimeter, ground observation by conventional means was:

1	0	1	75	156
Seriously Impeded	Impeded Somewhat	Unaffected	Assisted Somewhat	Greatly Assisted

Respondents indicate almost unanimously that observation was assisted, with replies "greatly assisted" more than double those "assisted somewhat." For all areas and periods, the average reply was "greatly assisted."

(5) Question 5e(5). Where defoliants were used on a friendly defense perimeter, ground observation by night vision devices was:

0	0	9	84	128
Seriously Impeded	Impeded Somewhat	Unaffected	Assisted Somewhat	Greatly Assisted

The preponderant reply indicates observation greatly assisted. For all areas and periods, the average reply is "greatly assisted."

(6) Question 5e(6). Where defoliants were used on a friendly defense perimeter, ground observation by radar was:

0	0	31	79	66
Seriously Impeded	Impeded Somewhat	Uanffected	Assisted Somewhat	Greatly Assisted

The preponderant reply is "assisted somewhat." For all areas and periods, this is the average response.

f. Use of herbicides on food crops.

(1) Question 5f(1). Where herbicides were used on food crops in my area of operations, evidence used in designating crops for destruction included;

Response		Number of Respondents
a.	Cultivation of areas apparently larger than required to feed the civilian population.	39
b.	Cultivation of areas remote from known civilian settlements.	127
c.	Method or pattern of cultivation.	36
d.	Proximity to known or suspected enemy supply route.	105
e.	Hostile acts attributed to local population.	15
f.	Failure to report hostile efforts such as ambushes, mines, booby traps.	7
g.	Provision of guides, porters, or other non-food assistance to enemy forces.	23

Response	Number of Respondents
h. Cultivation in VC or NVA controlled areas.	118
i. Resistance to resettlement.	7
j. Non-cooperation with RVN government.	11

(2) Question 5f(2). Where herbicides were used on food crops, the distinction between crops grown for use by the enemy and crops grown by noncombatants who were not supporting the enemy was:

21	53	63	5	3	14
Completely Reliable	Usually Reliable	Fairly Reliable	Not Usually Reliable	Unreliable	Of Unknown Reliability

The preponderant reply is "usually reliable." For all areas and periods, the average reply of "usually reliable" is representative.

(3) Question 5f(3). Where herbicides were used on food crops, destruction of crops made the enemy change his pattern of operations.

Yes 44 No 22

The preponderance is 2:1 for the affirmative.

(4) Question 5f(4). Where herbicides were used on food crops, destruction of crops made the enemy change his area of operations.

Yes 41 No 47

There seems to be no agreement on this question. There is no pattern indicating differences in areas, time periods, or command levels.

(5) Question 5f(5), Considering both military and political effects, how did crop destruction affect RVN objectives?

7	13	16	71	22
Significantly Impeded	Impeded Somewhat	Unaffected	Assisted Somewhat	Greatly Assisted

While there is disagreement, the number reporting that crop destruction assisted is almost five times the number reporting that it impeded. The reply "assisted somewhat" is representative of all areas, command levels, and periods.

g. Question 6. Effect of defoliation on number of enemy prisoners captured.

0	1	148	89	10
Significantly Reduced	Slightly Reduced	Unaffected	Increased Slightly	Increased Significantly

Most respondents report the number of prisoners captured unaffected; those reporting any effect report an increase. Division commanders report a slight increase. Otherwise the reply "unaffected" is representative.

h. Question 7. Reaction of local residents to defoliation.

2	21	140	71	14
Enthusiastic Approval	Approval	Indifference	Disapproval	Hostility

The preponderant reply is "indifference." The average reply of advisors is a low level of disapproval. Otherwise the average reply "indifference" is representative.

i. Question 8. Compared to other means of clearing foliage listed below, herbicides were:

	Significantly More Effective	Somewhat More Effective	Equally Effective	Slightly Less Effective	Significantly Less Effective
Napalm Bomb	119	85	24	25	32
Slash and Burn	64	46	27	39	48
Rome Plow	31	16	11	27	207
HE Bomb	131	65	14	35	42

For clearing foliage, herbicides are ranked significantly more effective than napalm bomb and HE bomb, significantly less effective than Rome Plow, and about equal to slash and burn.

j. Question 9. Change in area under cultivation.

68	70	88	38	16
Increased Significantly	Increased Slightly	No Change	Decreased Slightly	Decreased Significantly

The average reply falls between a slight increase and no change. Although the number of responses shows considerable difference of opinion, there appears to be no correlation of replies with a particular command level, period, or area.

k. Question 10. Change in ratio of cultivated area to population.

46	80	93	37	11
Increased Significantly	Increased Slightly	No Change	Decreased Slightly	Decreased Significantly

Battalion commanders 1965-66 reported no change. Otherwise, the average reply which falls between a slight increase and no change is representative.

1. Question 11. Change in percent of population which supported RVN.

74	113	48	14	3
Increased Significantly	Increased Slightly	No Change	Decreased Slightly	Decreased Significantly

The preponderant reply is a slight increase. Four division commanders 1969-70 reported significant increase. Otherwise, the average reply "increased slightly" is representative.

m. Question 12. Means of crop denial other than herbicides used.

Means	Respondents
Bombing	55
Burning	102
Other (principally manual destruction)	87
None	93

n. Question 13. Need for herbicides in other future contingency operations.

Yes	238	Perhaps	83	No	20

TAB A
TO
APPENDIX C-1

COVER LETTER AND QUESTIONNAIRE FOR COMMANDERS AND ADVISORS

DEPARTMENT OF THE ARMY
OFFICE OF THE DEPUTY CHIEF OF STAFF FOR MILITARY OPERATIONS
WASHINGTON, D.C. 20310

Dear Sir:

The use of herbicides in Vietnam was authorized by President Kennedy as early as 1961. During the period 1965 to 1970, chemical herbicides were used as a form of combat support to defoliate vegetated areas which were used by the VC as base areas or which provided cover for VC attacks against friendly forces or population centers. They were also used to destroy enemy crops. Their use in Vietnam is the first large scale experience with herbicides in military operations, and their contribution is now being evaluated.

At the direction of the Department of Defense (DDR&E), the Engineer Strategic Studies Group (ESSG) is conducting a study to identify the utility of herbicides in the conduct of military operations. An important part of this study is an analysis of the experience of commanders and advisors who participated in military operations in Vietnam while herbicides were being used. To give the study the benefit of your experience, please complete the inclosed questionnaire and return it in the envelope provided.

Please respond at your earliest convenience before 22 September 1971.

Sincerely yours,

JOHN R. D. CLELAND
Brigadier General, GS
Senior Army Representative
Herbicide Study Steering Group

HERBICIDES AND MILITARY OPERATIONS

RESPONDENT CREDIT DATA

Name _____

Present Rank _____

Present Organization _____

The identification on this sheet will be used only to credit you on the roster of respondents as having complied with the request to furnish information. Your response will be credited and this sheet will be removed and destroyed before your answers are examined. The information you furnish will be aggregated in a computer record and the questionnaire sheets will then be destroyed, making it impossible to match any item with the individual source.

HERBICIDES AND MILITARY OPERATIONS
QUESTIONNAIRE FOR COMMANDERS AND ADVISERS

1. Organization(s) at time of experience with herbicide effects:

_____

2. Assignment(s) at time of experience with herbicide effects:

_____

3. Period covered by experience:

From _____ (month) _____ (year)

To _____ (month) _____ (year)

4. Region(s), zone(s), and province(s) in which effects of herbicides were observed or otherwise known to you:

_____

5. Have you observed the effects of herbicides as applied: (check as many as may apply)

____ a. On extensive wooded areas of VC shelter.

____ b. On enemy infiltration routes.

____ c. Along friendly roads.

____ d. Along friendly waterways.

____ e. On friendly defense perimeter.

____ f. On food crops.

____ g. Other (expand on page 11)

If you checked none of the above, please return the questionnaire without answering any of the questions which follow. If you checked one or more of the above, fill in the appropriate rating schedule in the following pages and then complete the overview information on page 12. When you fill in any rating scale, you should base your judgment on your own experience. If you can't estimate what the effect was, skip the question.

RATING SCHEDULE FOR USE OF HERBICIDES

5a. Where defoliants were used ON WOODED AREAS OF VC SHELTER in my area of operations:

(1) Friendly cross-country movement was:

Seriously Impeded	Impeded Somewhat	Unaffected	Assisted Somewhat	Greatly Assisted

(2) Friendly casualties from enemy ambush were:

Significantly Reduced	Slightly Reduced	Unaffected	Increased Slightly	Increased Significantly

(3) Friendly casualties from road mines were:

Significantly Reduced	Slightly Reduced	Unaffected	Increased Slightly	Increased Significantly

(4) Friendly casualties from booby traps were:

Significantly Reduced	Slightly Reduced	Unaffected	Increased Slightly	Increased Significantly

(5) Enemy casualties from unit weapons were:

Significantly Reduced	Slightly Reduced	Unaffected	Increased Slightly	Increased Significantly

(6) The number of enemy targets engaged by artillery was:

Significantly Reduced	Slightly Reduced	Unaffected	Increased Slightly	Increased Significantly

5a. Where defoliants were used ON WOODED AREAS OF VC SHELTER in my area of operations:--CONTINUED

(7) Enemy casualties from air support were:

Significantly Reduced	Slightly Reduced	Unaffected	Increased Slightly	Increased Significantly

(8) Ground observation by conventional means was:

Seriously Impeded	Impeded Somewhat	Unaffected	Assisted Somewhat	Greatly Assisted

(9) Aerial observation by conventional means was:

Seriously Impeded	Impeded Somewhat	Unaffected	Assisted Somewhat	Greatly Assisted

(10) Aerial observation by night vision devices was:

Seriously Impeded	Impeded Somewhat	Unaffected	Assisted Somewhat	Greatly Assisted

(11) Aerial observation by radar was:

Seriously Impeded	Impeded Somewhat	Unaffected	Assisted Somewhat	Greatly Assisted

RATING SCHEDULE FOR USE OF HERBICIDES

5b. Where defoliants were used ON ENEMY INFILTRATION ROUTES in my area of operations:

(1) Enemy movement was:

Seriously Impeded	Impeded Somewhat	Unaffected	Assisted Somewhat	Greatly Assisted

(2) Friendly casualties from booby traps were:

Significantly Reduced	Slightly Reduced	Unaffected	Increased Slightly	Increased Significantly

(3) Enemy casualties from unit weapons were:

Significantly Reduced	Slightly Reduced	Unaffected	Increased Slightly	Increased Significantly

(4) The number of enemy targets engaged by artillery was:

Significantly Reduced	Slightly Reduced	Unaffected	Increased Slightly	Increased Significantly

(5) Enemy casualties from air support were:

Significantly Reduced	Slightly Reduced	Unaffected	Increased Slightly	Increased Significantly

(6) Ground observation by conventional means was:

Seriously Impeded	Impeded Somewhat	Unaffected	Assisted Somewhat	Greatly Assisted

5b. Where defoliants were used ON ENEMY INFILTRATION ROUTES in my area of operations:--CONTINUED

(7) Ground observation by night vision devices was:

Seriously Impeded	Impeded Somewhat	Unaffected	Assisted Somewhat	Greatly Assisted

(8) Ground surveillance by radar was:

Seriously Impeded	Impeded Somewhat	Unaffected	Assisted Somewhat	Greatly Assisted

(9) Aerial observation by conventional means was:

Seriously Impeded	Impeded Somewhat	Unaffected	Assisted Somewhat	Greatly Assisted

(10) Aerial observation by night vision devices was:

Seriously Impeded	Impeded Somewhat	Unaffected	Assisted Somewhat	Greatly Assisted

(11) Aerial observation by radar was:

Seriously Impeded	Impeded Somewhat	Unaffected	Assisted Somewhat	Greatly Assisted

RATING SCHEDULE FOR USE OF HERBICIDES

5c. Where defoliants were used ALONG FRIENDLY ROADS in my area of operations:

(1) Friendly movement on roads was:

Seriously Impeded	Impeded Somewhat	Unaffected	Assisted Somewhat	Greatly Assisted

(2) Friendly casualties from enemy ambush were:

Significantly Reduced	Slightly Reduced	Unaffected	Increased Slightly	Increased Significantly

(3) Friendly casualties from road mines were:

Significantly Reduced	Slightly Reduced	Unaffected	Increased Slightly	Increased Significantly

(4) Friendly casualties from booby traps were:

Significantly Reduced	Slightly Reduced	Unaffected	Increased Slightly	Increased Significantly

(5) Enemy casualties by unit weapons were:

Significantly Reduced	Slightly Reduced	Unaffected	Increased Slightly	Increased Significantly

(6) Ground observation by conventional means was:

Seriously Impeded	Impeded Somewhat	Unaffected	Assisted Somewhat	Greatly Assisted

RATING SCHEDULE FOR USE OF HERBICIDES

5d. Where defoliants were used ALONG FRIENDLY WATERWAYS in my area of operations:

(1) Friendly casualties from enemy ambush were:

Significantly Reduced	Slightly Reduced	Unaffected	Increased Slightly	Increased Significantly

(2) Friendly casualties from booby traps were:

Significantly Reduced	Slightly Reduced	Unaffected	Increased Slightly	Increased Significantly

(3) Enemy casualties from unit weapons were:

Significantly Reduced	Slightly Reduced	Unaffected	Increased Slightly	Increased Significantly

(4) Ground observation by conventional means was:

Significantly Impeded	Impeded Somewhat	Unaffected	Assisted Somewhat	Greatly Assisted

RATING SCHEDULE FOR USE OF HERBICIDES

5e. Where defoliants were used ON A FRIENDLY DEFENSE PERIMETER in my area of operations:

(1) Defense of that perimeter was:

Seriously Impeded	Impeded Somewhat	Unaffected	Assisted Somewhat	Greatly Assisted

(2) Friendly casualties from booby traps were:

Significantly Reduced	Slightly Reduced	Unaffected	Increased Slightly	Increased Significantly

(3) Enemy casualties from unit weapons were:

Significantly Reduced	Slightly Reduced	Unaffected	Increased Slightly	Increased Significantly

(4) Ground observation by conventional means was:

Seriously Impeded	Impeded Somewhat	Unaffected	Assisted Somewhat	Greatly Assisted

(5) Ground observation by night vision devices was:

Seriously Impeded	Impeded Somewhat	Unaffected	Assisted Somewhat	Greatly Assisted

(6) Ground observation by radar was:

Seriously Impeded	Impeded Somewhat	Unaffected	Assisted Somewhat	Greatly Assisted

RATING SCHEDULE FOR USE OF HERBICIDES

5f. Where herbicides were used ON FOOD CROPS in my area of operations:

(1) Evidence used in designating crops for destruction included: (check as many as apply)

___ a. Cultivation of areas apparently larger than required to feed the civilian population.

___ b. Cultivation of areas remote from known civilian settlements.

___ c. Method or pattern of cultivation.

___ d. Proximity to known or suspected enemy supply route.

___ e. Hostile acts attributed to local population.

___ f. Failure to report hostile efforts such as ambushes, mines, booby traps.

___ g. Provision of guides, porters, or other non-food assistance to enemy forces.

___ h. Cultivation in VC or NVA controlled areas.

___ i. Resistance to resettlement.

___ j. Non-cooperation with RVN government.

___ k. None.

___ l. Other (specify)

(2) The distinction between crops grown for use by the enemy and crops grown by non-combatants who were not supporting the enemy was:

Completely Reliable	Usually Reliable	Fairly Reliable	Not Usually Reliable	Unreliable	Of Unknown Reliability

5f. Where herbicides were used ON FOOD CROPS in my area of operations: CONTINUED

(3) Destruction of crops made the enemy change his pattern of operations.

( ) Yes ( ) No ( ) Don't Know

( ) Question not applicable to my area.

(4) Destruction of crops made the enemy change his area of operations.

( ) Yes ( ) No ( ) Don't Know

( ) Question not applicable to my area.

(5) Considering both military and political effects, how did crop destruction affect RVN objectives?

Significantly Impeded	Impeded Somewhat	Unaffected	Assisted Somewhat	Greatly Assisted

RATING SCHEDULE FOR USE OF HERBICIDES

5g. AREA OF HERBICIDE APPLICATION. Describe below, areas of application not listed in question 5 on page 1. Include the purpose and the military effectiveness.

OVERVIEW ON USE OF HERBICIDES (Continued from page 1)

6. As a result of the defoliation program, the number of enemy prisoners captured was:

Significantly Reduced	Slightly Reduced	Unaffected	Increased Slightly	Increased Significantly

7. With regard to the defoliation program, local residents indicated:

Enthusiastic Approval	Approval	Indifference	Disapproval	Hostility

8. Compared to other means of clearing foliage listed below, herbicides were:

	Significantly More Effective	Somewhat More Effective	Equally Effective	Slightly Less Effective	Significantly Less Effective	Don't Know
Napalm Bomb						
Slash & Burn						
Rome Plow						
HE Bomb						
Other (Specify)						

9. During your tour, how did the area under cultivation in your province/area change, for whatever reason?

Increased Significantly	Increased Slightly	No Change	Decreased Slightly	Decreased Significantly

10. How did the ratio of cultivated areas to civilian population change, for whatever reason?

Increased Significantly	Increased Slightly	No Change	Decreased Slightly	Decreased Significantly

11. What changes occurred in the percentage of population which supported the RVN?

Increased Significantly	Increased Slightly	No Change	Decreased Slightly	Decreased Significantly

12. What means of crop denial other than chemical herbicides were used in your province/area? (check as many as apply)

___ a. Bombing
___ b. Burning
___ c. Other (Specify)
___ d. None

13. Considering the contributions of herbicides to accomplishment of your mission in RVN, do you see a need for these agents in other future contingency operations?

( ) Yes ( ) No ( ) Perhaps

14. Expand, as you feel appropriate, on any previous questions or answers.

APPENDIX C-2

NAVAL FORCES

APPENDIX C-2

NAVAL FORCES

1. Purpose. This appendix analyzes the replies of Navy personnel who participated in inland operations in RVN between 1965 and 1970.

2. Scope. The questions asked concern the influence of defoliation on the number and accuracy of attacks on vessels by small arms, heavy weapons, and mines; on the effectiveness of retaliatory fire; and on mission performance. Respondents also were asked their opinions on the need for herbicides in the future. The questionnaire and cover letter are appended as Tab A.

3. Respondents.

a. Personnel to receive the questionnaire were selected by the Navy to give a sampling of appropriate missions and periods of service. Of 230 replies received, 150 indicated experience with herbicides.

b. The areas of operation designated by more than 10 respondents are listed in Figure C-2-1.

c. Missions designated by more than 10 respondents are listed in Figure C-2-2.

d. Each question is analyzed both by mission and by area. Each area or mission with 10 or more respondents, as listed in paragraphs b and c above, is reported separately. All other areas or missions are combined under the designation "Other." The number of

individual replies is also shown. Since some individuals served in more than one area or on more than one mission, the number of individual replies is not necessarily the area or mission total.

AREAS OF OPERATION

Area	No. of Respondents
IV Corps	59
Rung Sat	53
Mekong Delta	43
Mekong	36
I Corps	23
III Corps	21
Van Co Dong	14
Bassac	11

Figure C-2-1

RESPONDENTS' MISSION AREAS

Mission	No. of Respondents
Interdiction	54
River Patrol	41
Intelligence	17
Air Support	15
Construction	11
Assault	11
Support Riverine Forces	11

Figure C-2-2

4. Replies to Questions.

a. Effects of defoliation on the number of attacks by small arms fire (Question 7) are shown respectively by area and mission in Figures C-2-3 and C-2-4. Although some few individuals reported an increase in the number of small arms attacks on vessels as a result of defoliation, the weight of opinion in every area examined and for every mission examined favored a decrease in the number of attacks. The median reply indicates a significant decrease.

ANALYSIS BY AREA--QUESTION 7

	Replies				
Area	Inc Signif	Inc Slightly	Remained the Same	Dec Slightly	Dec Signif
IV Corps	1	0	3	15	15
Rung Sat	2	0	4	13	19
Mekong Delta	0	0	1	9	13
Mekong	0	0	2	6	11
I Corps	0	0	0	1	1
III Corps	0	0	1	6	5
Van Co Dong	0	1	3	4	1
Bassac	0	0	1	0	3
Other	1	1	8	12	31
Indiv Replies	3	1	14	38	61

Figure C-2-3

ANALYSIS BY MISSION--QUESTION 7

Mission	Replies				
	Inc Signif	Inc Slightly	Remained the Same	Dec Slightly	Dec Signif
Interdiction	0	0	4	15	15
River Patrol	0	0	2	12	10
Intelligence	1	0	1	2	5
Air Support	1	0	1	1	6
Construction	0	0	0	0	1
Assault	1	0	0	2	4
Spt Riverine Forces	0	0	2	3	3
Other	3	2	6	15	31
Indiv Replies	3	1	14	38	61

Figure C-2-4

b. Effects of defoliation on the number of attacks on vessels by heavy weapons (Question 8) are shown respectively by area and mission in Figures C-2-5 and C-2-6. The greatest number of replies indicated a significant decrease in the number of heavy weapons attacks on vessels. Because of a large number of replies indicating no effect, the median of replies is a slight decrease. In no area or mission is the preponderant reply an increase. Overall, "decrease" replies exceed "no change" replies almost 4 to 1.

c. Effects of defoliation on the number of attacks on vessels by mines (Question 9) are shown respectively by area and mission in Figures C-2-7 and C-2-8. The median reply for all areas and almost all missions indicates that defoliation had no effect on the number of

mine attacks on vessels. Respondents with the missions of air support and support of riverine forces indicated a slight decrease in the number of attacks. Overall, the "no effect" replies equaled the "decrease" replies, while approximately one-third as many indicated an increase.

ANALYSIS BY AREA--QUESTION 8

	Replies				
Area	Inc Signif	Inc Slightly	Remained the Same	Dec Slightly	Dec Signif
IV Corps	0	2	8	13	14
Rung Sat	1	2	4	14	15
Mekong Delta	0	0	4	8	9
Mekong	0	2	3	3	1
I Corps	0	0	1	1	0
III Corps	0	1	3	4	5
Van Co Dong	0	0	3	6	0
Bassac	0	0	1	0	2
Other	0	2	11	21	17
Indiv Replies	1	5	22	42	44

Figure C-2-5

d. Effects of defoliation on the accuracy of small arms fire directed at vessels (Question 10) are shown respectively by area and mission in Figures C-2-9 and C-2-10. The median reply indicates a slight decrease in the accuracy of small arms fire directed at vessels. A significant decrease is reported for the Mekong, I Corps, and III Corps areas and for the missions of interdiction, river patrol, air support, and assault. No effect is reported for the Van Co Dong and

Bassac areas and for the intelligence and support of riverine forces missions. Although a few individuals reported increases in accuracy, this does not hold for any area or mission examined.

ANALYSIS BY MISSION--QUESTION 8

	Replies				
Mission	Inc Signif	Inc Slightly	Remained the Same	Dec Slightly	Dec Signif
Interdiction	0	3	5	15	13
River Patrol	0	1	1	13	6
Intelligence	0	2	1	2	3
Air Support	1	0	1	0	6
Construction	0	0	0	0	1
Assault	1	0	2	4	1
Spt Riverine Forces	0	0	1	4	2
Other	0	4	16	18	22
Indiv Replies	1	5	22	42	44

Figure C-2-6

e. Effects of defoliation on the accuracy of heavy weapons fire directed at vessels (Question 11) are shown respectively by area and mission in Figures C-2-11 and C-2-12. The median reply indicates a slight decrease in the accuracy of heavy weapons fire directed at vessels. Respondents in IV Corps, Mekong, I Corps, III Corps, Van Co Dong, and Bassac areas and with missions of intelligence and assault indicate no change. The remaining areas and missions report decreases ranging from slight to significant.

ANALYSIS BY AREA--QUESTION 9

Area	Replies				
	Inc Signif	Inc Slightly	Remained the Same	Dec Slightly	Dec Signif
IV Corps	1	5	9	5	4
Rung Sat	0	5	12	6	5
Mekong Delta	0	4	4	1	5
Mekong	0	2	3	3	1
I Corps	0	0	2	0	0
III Corps	1	1	5	2	3
Van Co Dong	0	1	5	0	0
Bassac	0	0	1	1	0
Other	0	3	15	3	10
Indiv Replies	1	10	33	16	17

Figure C-2-7

ANALYSIS BY MISSION--QUESTION 9

Mission	Replies				
	Inc Signif	Inc Slightly	Remained the Same	Dec Slightly	Dec Signif
Interdiction	0	3	12	2	4
River Patrol	0	1	7	3	4
Intelligence	0	1	4	2	0
Air Support	0	1	1	3	1
Construction	0	0	0	0	1
Assault	0	1	3	0	2
Spt Riverine Forces	0	0	1	3	0
Other	1	7	15	8	8
Indiv Replies	1	10	33	16	17

Figure C-2-8

ANALYSIS BY AREA--QUESTION 10

Area	Replies				
	Inc Signif	Inc Slightly	Remained the Same	Dec Slightly	Dec Signif
IV Corps	0	1	12	3	13
Rung Sat	1	1	7	8	16
Mekong Delta	0	1	3	6	10
Mekong	0	2	3	1	9
I Corps	0	0	0	0	1
III Corps	0	0	4	1	6
Van Co Dong	0	1	3	3	1
Bassac	1	0	1	0	2
Other	1	2	8	9	19
Indiv Replies	2	4	24	17	47

Figure C-2-9

ANALYSIS BY MISSION--QUESTION 10

Mission	Replies				
	Inc Signif	Inc Slightly	Remained the Same	Dec Slightly	Dec Signif
Interdiction	1	1	9	4	16
River Patrol	1	0	3	4	13
Intelligence	0	0	3	0	3
Air Support	0	1	0	1	4
Construction	0	0	0	0	1
Assault	0	0	1	1	3
Spt Riverine Forces	0	0	2	2	0
Other	2	3	13	8	17
Indiv Replies	2	4	24	17	47

Figure C-2-10

ANALYSIS BY AREA--QUESTION 11

Area	Replies				
	Inc Signif	Inc Slightly	Remained the Same	Dec Slightly	Dec Signif
IV Corps	1	1	12	3	11
Rung Sat	0	2	8	6	13
Mekong Delta	1	0	4	5	8
Mekong	1	1	4	0	6
I Corps	0	0	1	0	0
III Corps	0	0	6	1	4
Van Co Dong	0	0	3	1	2
Bassac	0	0	2	0	2
Other	0	3	10	6	19
Indiv Replies	1	5	30	15	37

Figure C-2-11

ANALYSIS BY MISSION--QUESTION 11

Mission	Replies				
	Inc Signif	Inc Slightly	Remained the Same	Dec Slightly	Dec Signif
Interdiction	0	2	11	4	14
River Patrol	0	1	4	6	6
Intelligence	0	1	3	1	3
Air Support	0	1	1	0	4
Construction	0	0	0	0	1
Assault	0	1	3	2	0
Spt Riverine Forces	0	0	1	1	2
Other	1	3	20	5	15
Indiv Replies	1	5	30	15	37

Figure C-2-12

f. Effects of defoliation on the effectiveness of retaliatory fire when a vessel was attacked (Question 12) are shown respectively by area and mission in Figures C-2-13 and C-2-14. The median of replies indicates that defoliation significantly increased the effectiveness of retaliatory fire. This is true of all missions and of all areas except Van Co Dong where the median was a slight increase in effectiveness.

ANALYSIS BY AREA--QUESTION 12

	Replies				
Area	Inc Signif	Inc Slightly	Remained the Same	Dec Slightly	Dec Signif
IV Corps	21	12	4	0	0
Rung Sat	26	13	2	1	0
Mekong Delta	13	10	0	0	0
Mekong	10	7	2	0	0
I Corps	3	0	0	0	0
III Corps	7	3	2	0	0
Van Co Dong	5	6	1	0	0
Bassac	4	0	0	0	0
Other	33	15	5	0	0
Indiv Replies	75	38	10	1	0

Figure C-2-13

g. The degree to which defoliation affected the mission (Question 13) is shown respectively by area and mission in Figures C-2-15 and C-2-16. For all areas and for all missions, the median reply indicated that the mission would have been possible but more difficult without defoliation. A very few (11 of 148) respondents

who said that defoliation made their mission more difficult, were engaged in activities which involved beating the guerrillas at their own game and therefore required concealment.

ANALYSIS BY MISSION--QUESTION 12

Mission	Replies				
	Inc Signif	Inc Slightly	Remained the Same	Dec Slightly	Inc Signif
Interdiction	21	4	10	1	0
River Patrol	6	9	0	1	0
Intelligence	5	4	0	0	0
Air Support	9	1	0	0	0
Construction	1	0	0	0	0
Assault	4	2	2	0	0
Spt Riverine Forces	4	3	1	0	0
Other	28	21	4	0	0
Indiv Replies	75	38	10	1	0

Figure C-2-14

h. The responses to Question 14, "Do you see a need for these agents in other future contingency operations?" are shown respectively by area and mission in Figures C-2-17 and C-2-18. Respondents who indicated a positive need for herbicides outnumbered those who saw no need by 12 to 1. They outnumbered those who indicated a possible need 3 to 1. There was no area or mission where "No" answers exceeded "Perhaps" nor where "Perhaps" answers exceeded "Yes" answer.

ANALYSIS BY AREA--QUESTION 13

Area	Replies				
	Impossible Without	Difficult Without	Unaffected	More Difficult	Pvnt
IV Corps	1	32	10	4	0
Rung Sat	3	32	10	4	0
Mekong Delta	0	21	4	0	0
Mekong	1	18	3	1	0
I Corps	0	2	1	1	0
III Corps	1	9	3	3	0
Van Co Dong	0	8	2	2	0
Bassac	1	3	0	0	0
Other	0	52	9	4	0
Indiv Replies	3	109	25	11	0

Figure C-2-15

ANALYSIS BY MISSION--QUESTION 13

Mission	Replies				
	Impossible Without	Difficult Without	Unaffected	More Difficult	Pvnt
Interdiction	0	30	6	7	0
River Patrol	1	23	4	1	0
Intelligence	0	6	4	1	0
Air Support	1	9	2	0	0
Construction	0	2	1	0	0
Assault	0	5	2	2	0
Spt Riverine Forces	0	7	2	0	0
Other	2	48	12	7	0
Indiv Replies	3	109	25	11	0

Figure C-2-16

ANALYSIS BY AREA--QUESTION 14

Area	Replies		
	Yes	Perhaps	No
IV Corps	33	11	4
Rung Sat	36	11	3
Mekong Delta	19	6	2
Mekong	19	4	0
I Corps	3	0	1
III Corps	12	4	0
Van Co Dong	8	3	1
Bassac	3	1	0
Other	45	15	4
Individual Replies	107	35	9

Figure C-2-17

ANALYSIS BY MISSION--QUESTION 14

Mission	Replies		
	Yes	Perhaps	No
Inderdiction	32	11	0
River Patrol	21	6	2
Intelligence	8	3	1
Air Support	9	3	0
Construction	1	1	1
Assault	6	4	0
Spt Riverine Forces	7	1	1
Other	50	18	4
Individual Replies	107	35	9

Figure C-2-18

TAB A
TO
APPENDIX C-2

COVER LETTER AND QUESTIONNAIRE FOR NAVAL FORCES

DEPARTMENT OF THE NAVY
OFFICE OF THE CHIEF OF NAVAL OPERATIONS
WASHINGTON, D.C. 20350

IN REPLY REFER TO

From: Chief of Naval Operations
To:

Subj: Herbicides in Military Operations

Encl: (1) Respondent Credit Data Sheet and Study Group Questionnaire

1. Public Law 91-441, 7 October 1970, requires the Secretary of Defense to contract with the National Academy of Sciences (NAS) for a comprehensive study and investigation to determine the ecological and physiological effects of the defoliation program carried out in South Vietnam. By 1 March 1972, the Secretary of Defense is required to transmit the NAS study (together with his comments and recommendations) to the President and the Congress. To assist the Secretary in presenting a complete and balanced report it is necessary to evaluate the military advantages and disadvantages of herbicides.

2. At the direction of the Department of Defense (DDR&E), the Engineer Strategic Studies Group (ESSG) of the Army is conducting an in-depth study to determine the degree of military benefit which resulted from the Southeast Asia herbicide, or defoliation program. As one aspect of this study, ESSG is examining the effect of defoliants on our Navy river patrol and river assault operations. As a veteran of these operations your experience can help the Navy and the study group in assessing the benefits of using herbicides in possible future military operations.

3. It therefore is requested that you complete enclosure (1) and return it to ESSG in the envelope provided by 30 September 1971. Replies should be based on your own observations. If the questions are outside your experience, say so. Your help in this survey will be greatly appreciated and will allow us to take better advantage of what you learned in Vietnam.

C-2-A-2

G. S. MORRISON
By direction

HERBICIDES AND MILITARY OPERATIONS

RESPONDENT CREDIT DATA

Name _____

Present Rank _____

Present Organization _____

The identification on this sheet will be used only to credit you on the roster of respondents as having complied with the request to furnish information. Your response will be credited and this sheet will be removed and destroyed before your answers are examined. The information you furnish will be aggregated in a computer record and the questionnaire sheets will then be destroyed, making it impossible to match any item with the individual source.

HERBICIDES AND MILITARY OPERATIONS
QUESTIONNAIRE FOR RIVERINE PERSONNEL

1. Organization(s) at time of experience with herbicides:

_____

2. Assignment in SEA: _____

3. Mission: _____

4. Period of SEA Tour:

	Month	Year
From:	_____	_____
To:	_____	_____

5. Area of operations: _____

6. Did you observe the effect of defoliants in your area? Yes____ No____. If your answer is No, please return this questionnaire without answering the remaining questions.

7. As a result of defoliation, the number of attacks on vessels by small arms fire:

a. Increased significantly.

b. Increased slightly.

c. Remained the same.

d. Decreased slightly.

e. Decreased significantly.

f. Don't know.

8. As a result of defoliation, the number of attacks on vessels by heavy weapons, such as mortars, artillery, and rockets:

a. Increased significantly.

b. Increased slightly.

c. Remained the same.

d. Decreased slightly.

e. Decreased significantly.

f. Don't know.

9. As a result of defoliation, the number of attacks on vessels by mines:

a. Increased significantly.

b. Increased slightly.

c. Remained the same.

d. Decreased slightly.

e. Decreased significantly.

f. Don't know.

10. As a result of defoliation, the accuracy of small arms fire directed at vessels:

a. Increased significantly.

b. Increased slightly.

c. Remained the same.

d. Decreased slightly.

e. Decreased significantly.

f. Don't know.

11. As a result of defoliation, the accuracy of heavy weapons (mortar, Artillery, rocket) fire directed at vessels:

a. Increased significantly.

b. Increased slightly.

c. Remained the same.

d. Decreased slightly.

e. Decreased significantly.

f. Don't know.

12. When a vessel was attacked, defoliation made defensive or retaliatory fire:

a. Significantly more effective.

b. Slightly more effective.

c. No more effective.

d. Slightly less effective.

e. Significantly less effective.

f. Don't know.

13. Indicate the degree to which defoliation affected your mission.

a. Mission would have been impossible without defoliation.

b. Mission would have been possible, but more difficult without defoliation.

c. Mission performance was unaffected by defoliation.

d. Mission was made more difficult by defoliation.

e. Mission was prevented by defoliation.

14. Considering the contributions of herbicides to accomplishment of your mission in RVN, do you see a need for these agents in other future contingency operations?

a. Yes.

b. No.

c. Perhaps.

15. Expand as you feel appropriate any previous questions or answers.

APPENDIX C-3

AIR OPERATIONS

APPENDIX C-3

AIR OPERATIONS

1. Purpose. This appendix analyzes the replies of Air Force (other than Ranch Hand) and Marine air personnel who served in Southeast Asia between 1965 and 1970.

2. Scope. Questions concern the effect of defoliation on visibility, reaction time of vegetation to defoliants, duration of effect of defoliants, military value, effect of defoliation on mission accomplishment, and future need for herbicides. The questionnaire and cover letter are appended as Tab A.

3. Respondents.

a. Air Force personnel to receive the questionnaire were selected from a list furnished by the Air Force. The Air Force listing

provided a sampling of missions, areas of operation, aircraft flown, and time periods. Of 272 Air Force respondents to the questionnaire, 201 indicated some acquaintance with defoliant effects or application. The Marine Corps made their own selection and handled the distribution and collection of questionnaires. Of 222 Marine respondents, 115 indicated acquaintance with defoliant effects or application.

b. The number of respondents with a knowledge of defoliation who reported participating in each type mission and flying in each type aircraft is shown by area in Figure C-3-1. Since some respondents operated in more than one area, participated in more than one type mission, or flew in more than one type aircraft, the summaries are not totals of the other entries.

4. Replies to Questions.

a. Increase in vertical visibility (Question 15). The average reply indicated an improvement in vertical visibility of 40 to 60 percent. Reconnaissance personnel in II, III, and IV Corps made an average estimate of 70 to 90 percent. With this exception, the 40 to 60 percent estimate was typical of all missions and areas.

b. Time from application to maximum defoliation (Question 16). The average estimate for all areas and missions was 6 to 8 weeks.

RESPONDENTS WITH KNOWLEDGE OF DEFOLIATION

		Mission												All Missions and Aircraft			Aircraft								
		TACAIR			RECON			FAC			Other						> 300 KT/STRIKE			< 300 KT/STRIKE			FAC/RECON			GUNSHIP/UW AIR		
		AF	Marine	Total	AF	Marine	Total	AF	Marine	Total	AF	Marine	Total	AF	Marine	Total	AF	Marine	Total	AF	Marine	Total	AF	Marine	Total	AF	Marine	Total
South Vietnam	I Corps	38	61	99	1	29	30	33	31	64	18	45	63	79	110	189	32	48	80	8	17	25	34	47	81	15	30	45
South Vietnam	II Corps	44	8	52	1	3	4	35	3	38	17	3	20	86	11	97	33	7	40	11	0	11	36	2	38	18	2	20
South Vietnam	III Corps	39	7	46	3	1	4	40	2	42	19	2	21	85	7	92	32	6	38	9	1	10	40	2	42	20	1	21
South Vietnam	IV Corps	35	6	41	2	4	6	15	3	18	16	2	18	57	7	64	29	4	33	9	0	9	16	3	19	14	1	15
South Vietnam	All Areas	60	61	121	4	29	33	92	31	123	32	45	77	167	110	277	48	48	96	14	17	31	96	47	143	29	30	59

Figure C-3-1

c. Duration of improvement in vertical visibility (Question 17). The average estimate for all areas and missions was 4 to 6 months.

d. Did defoliation make objects or areas of surveillance easier to see or to monitor? (Question 18) All missions in all areas answered "yes." The ratio of "yes" to "no" answers varies from 5 to 1 in I Corps to 10 to 1 in IV Corps. The average for all areas and missions is 7 to 1 for the affirmative.

e. Did defoliation decrease the time required for target acquisition or surveillance? (Question 19) All missions in all areas answered "yes." The ratio of "yes" to "no" answers varies from 3.7 to 1 in I Corps to 16 to 1 in IV Corps. The average ratio for all areas and missions is about 5 to 1.

f. Did defoliation make reconnaissance feasible at a higher or safer altitude without loss of accuracy? (Question 20) All missions in all areas answered "yes." The average ratio for all areas and missions is about 2 to 1.

g. Did defoliated areas serve as a navigational aid? (Question 20) All missions in all areas answered "yes." The ratio of "yes" to "no" answers in all areas is approximately 2 to 1.

h. Were new objects or suspected targets identified or discovered as a result of defoliation? (Question 22) The answer for all areas and all missions is "yes." The ratio of "yes" to "no" answers generally runs somewhat less than 2 to 1.

i. Did defoliation allow more area to be monitored during a flight? (Question 23) All missions in all areas answered "yes." Defoliation was most useful to RECON, FAC, and TACAIR in that order. The average answer for all areas and missions is "yes" with a preponderance somewhat higher than 2 to 1.

j. Were any known mission benefits derived? (Question 24) All missions in all areas answered "yes." FAC and RECON have "yes" preponderance of 6 to 1; TACAIR of 3 to 1. This difference is not surprising, considering the nature of the missions.

k. Effect of defoliation on mission accomplishment (Question 25). The average reply for all missions and areas was that defoliation helped somewhat, but the mission could have been performed without it. However, RECON and FAC missions report that their missions, while possible, would have been more difficult without defoliation. Since the TACAIR mission is somewhat independent of ground visibility because TACAIR targets are marked by the FAC, the reply that the mission would have been possible but more difficult without defoliation is more representative of air operations as a whole.

l. Future need for herbicides (Question 26). The answers, by mission, were as listed in Figure C-3-2. Definite affirmatives came from II, III, and IV Corps. "Perhaps" was the predominant answer in I Corps and Laos. No mission or area gave "no" as the predominant answer.

OPINIONS ON FUTURE NEED FOR HERBICIDES

	Yes	Perhaps	No
TACAIR	55	60	15
RECON	19	11	3
FAC	77	41	16
Other	39	31	7
All Missions	145	116	38

Figure C-3-2

TAB A
TO
APPENDIX C-3

COVER LETTER AND QUESTIONNAIRE
FOR AIR OPERATIONS

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE
WASHINGTON, D.C.

REPLY TO ATTN OF: AF/XO

30 AUG 1971

SUBJECT: Herbicide Survey

TO: Selected Aircrew Members

1. At the direction of the Department of Defense (DDR&E), the U.S. Army's Engineer Strategic Studies Group (ESSG) with Air Force participation is conducting an in-depth study to determine the military benefits gained from the SEAsia herbicide program. Some benefits which may have accrued to the Air Force as a result of herbicide operations may be identified in the TAC air, reconnaissance, and FAC missions. As an aircrew member flying one of these missions, your knowledge can help qualify the degree of benefit gained by the Air Force. Accordingly, request you complete this questionnaire and return it to ESSG in the envelope provided. Replies should be based on your own observations. As far as possible, please provide your most objective and complete responses. If questions are outside your own experience, so indicate.

2. To give the study the benefit of your experience and observations, please respond by 22 September 1971.

1 Atch
Survey Questionnaire

DONAVON F. SMITH, Maj General, USAF
Acting Deputy Chief of Staff
Plans and Operations

QUESTIONNAIRE FOR AF PERSONNEL

Information on Respondent

1. Name: _____

2. Present Rank: _____

3. Present Organization: _____

4. Unit/units to which assigned during SEA tour:

_____

5. Aerial mission during SEA tour:

   a. TACAIR.

   b. RECON.

   c. FAC.

   d. Other (specify)

6. Aircraft flown in SEA:

Over 300 KT/Strike	Under 300 KT/Strike	FAC/RECON	Gunship/UW Air
a. F4	e. B57	j. 01	n. AC130
b. F100	f. A26	k. 02	o. AC119
c. F105	g. A1	l. OV10	p. C123
d. Specify	h. T28	m. Specify	q. Specify
	i. Specify		

7. Duration of SEA tour:

   From: month _____ year _____

   To: month _____ year _____

8. Area in which missions were flown:

   a. In country.

   b. Mostly in country.

   c. 50/50.

   d. Mostly out country.

   e. Out country.

9. In what provinces, zones, or areas were your operations conducted?

   a. In country _____

   b. Out country _____

Information on Effects:

10. Are you aware of any defoliation efforts within your area of operation before or during your tour?

    a. Yes.

    b. No.

(If your answer is NO, you may discontinue answering questions and return the questionnaire with only this portion answered.)

11. Did you observe any evidence of prior defoliation operations within your area?

    a. Yes.

    b. No.

12. Were any defoliation operations conducted in your area during your tour?

    a. Yes.

    b. No.

    c. Unknown.

13. Within areas of defoliation:

    a. There was a significant increase in visibility.

    b. There was no significant effect on vegetation.

    c. The vegetation was affected without significantly increasing visibility.

14. If defoliation was apparent in your area during your tour, the vertical visibility (percent ground visible) in affected areas:

    a. Remained the same with no known additional defoliation efforts.

    b. Was increased by additional defoliation efforts.

    c. Remained the same with additional defoliation efforts.

    d. Decreased despite additional defoliation efforts.

    e. Decreased with no known additional defoliation efforts.

    f. Unknown.

15. By what percentage did defoliation increase vertical visibility in comparison to untreated adjacent areas?

    a. 0% to 40%

    b. 40% to 60%

    c. 70% to 90%

    d. 100%

    e. Other (specify) _____

    f. Unknown

16. If you have knowledge of a defoliation mission within your area, can you estimate a response time for maximum defoliation to occur?

    a. 3-5 weeks.

    b. 6-8 weeks.

    c. 9-12 weeks.

    d. Unknown.

    e. Other (specify) _____

17. In areas defoliated during your tour, where regrowth occurred prior to your departure, a significant improvement in vertical visibility lasted:

    a. 0 months.

    b. Up to 4 months.

    c. 4-6 months.

    d. 7-9 months.

    e. Other (specify) _____

    f. Unknown.

    g. Not applicable.

AS A RESULT OF DEFOLIATION:	Yes	No
18. Objects or areas of surveillance were easier to see or monitor.	( )	( )
19. Less time was required for target acquisition or area surveillance.	( )	( )
20. Visual reconnaissance was feasible at a higher or safer altitude without loss of accuracy during surveillance.	( )	( )

AS A RESULT OF DEFOLIATION:	Yes	No
21. "Burn" areas served as a navigational aid.	( )	( )
22. New objects or suspected targets were identified or discovered.	( )	( )
23. More area could be monitored during duration of flight.	( )	( )
24. No known mission benefits were derived.	( )	( )

25. Defoliation affected your mission to the extent that:

    a. Generally could not have conducted the mission without defoliation.

    b. Mission would have been possible, but more difficult, without defoliation.

    c. Helped somewhat, but mission could have been accomplished without it.

    d. No significant effect on the mission.

    e. Interfered with mission accomplishment.

26. Considering the contributions of herbicides to accomplishment of your mission in SEA, do you see a need for these agents in other future contingency operations?

    a. Yes.

    b. No.

    c. Perhaps.

27. If defoliation affected the accomplishment of your mission, please describe how:

_____

_____

_____

28. Expand, as you feel appropriate, on any previous questions or answers:

APPENDIX C-4

CHEMICAL OFFICERS

APPENDIX C-4

CHEMICAL OFFICERS

1. Purpose. This appendix analyzes the replies of Army personnel who served in RVN as chemical officers at brigade or higher level or as chemical advisors between 1965 and 1970.

2. Scope. The questions cover the timeliness of response to herbicide mission requests, satisfaction of tactical commanders with herbicide mission performance, the degree to which performance corresponded with planning factors, and the need for herbicides in future operations. The questionnaire and cover letter are appended as Tab A.

3. Respondents.

a. Names were selected from a roster showing current and past assignments furnished by the Chemical Corps. Forty-two replies were received.

b. Respondents who indicated experience with herbicides served at the levels indicated in Figure C-4-1. Where a respondent served at more than one level, the table shows the higher.

LEVEL OF RESPONDENTS' SERVICE

Level	Number of Respondents
Brigade	2
Division	13
Special Forces Group	1
Marine Amphibious Force	1
Field Force	2
Advisor	3
MACV	11

Figure C-4-1

4. Replies to Questions.

a. Question 5. "Was approval of herbicide mission requests received soon enough for timely response?"

(1) Replies to Question 5 are tabulated in Figure C-4-2.

(2) The responses indicate that approval of requests for herbicide missions were late more frequently than not.

REPLIES TO QUESTION 5

Response	Number of Responses: Corps I	II	III	IV	Individual Replies
Always	0	0	0	0	0
Generally	7	8	9	6	12
Seldom	9	4	9	3	17
Never	0	0	2	1	2

Figure C-4-2

b. Question 6. "Did the effects of herbicide missions meet the expectations of tactical commanders?"

(1) Replies to Question 6 are tabulated in Figure C-4-3.

REPLIES TO QUESTION 6

Responses	Number of Reponses: Corps I	II	III	IV	Individual Replies
Always	0	0	2	1	2
Generally	15	11	17	9	26
Seldom	1	1	0	0	2
Never	0	0	0	0	0

Figure C-4-3

(2) There is a definite consensus that the expectations of tactical commanders were generally met.

c. Question 7. "Were the effects on vegetation in accord with planning factors?"

(1) Replies to Question 7 are tabulated in Figure C-4-4.

REPLIES TO QUESTION 7

Responses	Number of Responses: Corps I	II	III	IV	Individual Replies
Always	4	5	6	5	8
Generally	12	7	13	5	22
Seldom	1	0	0	0	1
Never	0	0	0	0	0

Figure C-4-4

(2) Most respondents (71 percent) indicated that the planning factors were generally proved by the effects, and a substantial minority (26 percent) said that this was always so.

d. Question 8. "Considering the contributions of herbicides to accomplishment of your mission in South Vietnam, do you see a need for those agents in other future contingency operations?"

(1) Replies to Question 8 are tabulated in Figure C-4-5.

REPLIES TO QUESTION 8

Response	Number of Responses: Corps I	II	III	IV	Individual Replies
Yes	16	11	18	10	22
Perhaps	1	1	3	0	5
No	0	0	0	0	0

Figure C-4-5

(2) All respondents agree that there is a possible need for herbicides in future conflicts; 85 percent replied with a definite affirmative.

TAB A
TO
APPENDIX C-4

COVER LETTER AND QUESTIONNAIRE
FOR CHEMICAL OFFICERS

DEPARTMENT OF THE ARMY
OFFICE OF THE DEPUTY CHIEF OF STAFF FOR MILITARY OPERATIONS
WASHINGTON, D.C. 20310

Dear Sir:

The use of herbicides in Vietnam was authorized by President Kennedy as early as 1961. During the period 1965 to 1970, chemical herbicides were used as a form of combat support to defoliate vegetated areas which were used by the VC as base areas or which provided cover for VC attacks against friendly forces or population centers. They were also used to destroy enemy crops. Their use in Vietnam is the first large scale experience with herbicides in military operations, and their contribution is now being evaluated.

At the direction of the Department of Defense (DDR&E), the Engineer Strategic Studies Group (ESSG) is conducting a study to identify the utility of herbicides in the conduct of military operations. An important part of this study is an analysis of the experience of chemical officers who participated in military operations in Vietnam while herbicides were being used. To give the study the benefit of your experience, please complete the inclosed questionnaire and return it in the envelope provided.

Please respond at your earliest convenience before 22 September 1971.

Sincerely yours,

JOHN R. D. CLELAND
Brigadier General, GS
Senior Army Representative
Herbicide Study Steering Group

HERBICIDES AND MILITARY OPERATIONS

RESPONDENT CREDIT DATA

Name_____

Present Rank_____

Present Organization_____

The identification on this sheet will be used only to credit you on the roster of respondents as having complied with the request to furnish information. Your response will be credited and this sheet will be removed and destroyed before your answers are examined. The information you furnish will be aggregated in a computer record and the questionnaire sheets will then be destroyed, making it impossible to match any item with the individual source.

HERBICIDES AND MILITARY OPERATIONS

QUESTIONS FOR CHEMICAL OFFICERS

1. Organization(s) at time of experience with herbicides:

_____

2. Assignment(s) at time of experience with herbicides:

_____

3. Period covered by experience:

	Month	Year
From:	_____	____
To:	_____	____

4. Regions, zones, and provinces in which you had experience with herbicides:

_____

5. Was approval of herbicide mission requests received soon enough for timely response?

___ a. Always

___ b. Generally.

___ c. Seldom.

___ d. Never.

___ e. Unknown.

6. Did the effects of herbicide missions meet the expectations of tactical commanders?

___ a. Always.

___ b. Generally.

___ c. Seldom.

___ d. Never

___ e. Unknown.

7. Were the effects on vegetation in accord with planning factors?

___ a. Always.

___ b. Generally.

___ c. Seldom.

___ d. Never.

___ e. Unknown.

8. Considering the contributions of herbicides to accomplishment of your mission in the Republic of Vietnam, do you see a need for those agents in other future contingency operations?

___ a. Yes.

___ b. No.

___ c. Perhaps.

9. How could herbicides have been employed more effectively?

_____

_____

_____

_____

_____

_____

_____

APPENDIX C-5

RANCH HAND PERSONNEL

APPENDIX C-5

RANCH HAND PERSONNEL

1. Purpose. This appendix analyzes the replies of Air Force personnel who participated in the herbicide spraying operation (Ranch Hand) in RVN between 1965 and 1970.

2. Scope. The three questions asked concern agent effects only; questions of military value were not believed appropriate for Ranch Hand personnel.

3. Respondents.

a. Names and addresses were furnished by the Air Force. Approximately 300 questionnaires were distributed and 175 responses received.

b. Respondents indicated experience in the areas of operations shown in Figure C-5-1. Since personnel frequently had assignments in

both aircrew and staff capacities and experience in more than one area of operations, the total is greater than the number of respondents.

RANCH HAND ASSIGNMENTS AND AREAS OF OPERATIONS

Assignments	Corps I	II	III	IV
Air Crew	112	103	167	136
Staff	53	62	88	69

Figure C-5-1

4. Replies to Questions.

a. "If you observed an area in which you knew the time of application, what is your estimate of the time to maximum defoliation?"

(1) Replies to the above question (Question 6) are tabulated in Figure C-5-2.

REPLIES TO QUESTION 6

Time (Weeks)	Corps I	II	III	IV	Individual Replies
3-5	46	34	60	45	69
6-8	40	38	55	49	68
9-12	4	9	13	13	16

Figure C-5-2

(2) Analysis of the above tabulation indicates that the results were not uniform in all areas. Comments by respondents indicate that results were dependent on agent used, type of vegetation, and weather. Considering individual replies without regard to area, very nearly equal numbers estimated 3-5 weeks and 6-8 weeks. On this basis, it can only be said that maximum defoliation was achieved 3 to 8 weeks after spraying.

b. "At maximum defoliation, what was the percent of increased vertical visibility (percent ground visible) in relation to untreated adjacent areas?"

(1) Replies to the above question (Question 7) are tabulated in Figure C-5-3.

REPLIES TO QUESTION 7

Percent	Corps I	Corps II	Corps III	Corps IV	Individual Replies
0-40	4	2	8	5	8
40-60	28	28	40	34	46
70-90	46	39	63	50	80
100	11	13	21	18	23

Figure C-5-3

(2) The median figure in each area and for individual respondents is an increase of vertical visibility between 70 and 90 percent.

However, more than half as many reported increased visibility from 40 to 60 percent.

c. "If, following crop destruction missions, you observed the response time, how long was it before the crop was affected?"

(1) Replies to the above question (Question 8) are tabulated in Figure C-5-4.

REPLIES TO QUESTION 8

Time (Days)	Corps				Individual Replies
	I	II	III	IV	
1-2	49	45	67	57	79
3-4	22	25	34	24	39
5-6	7	5	11	7	12

Figure C-5-4

(2) In all areas and among individual respondents, the median reply was 1-2 days. However, a significant number of replies, nearly half as many, indicated a response time of 3-4 days. The difference is due (to some extent) to the agent applied and the nature of the crop (leaf or grain).

TAB A
TO
APPENDIX C-5

COVER LETTER AND QUESTIONNAIRE FOR RANCH HAND PERSONNEL

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE
WASHINGTON, D.C.

REPLY TO ATTN OF: AF/XO

30 AUG 1971

SUBJECT: Herbicide Survey

TO: Selected Aircrew Members

1. At the direction of the Department of Defense (DDR&E), the U.S. Army's Engineer Strategic Studies Group (ESSG) is conducting an in-depth study to determine the military benefits gained from the SEAsia herbicide program. The USAF, as the operator of this program, is participating in the study. Information regarding the reaction time of defoliants, percent of improved vertical visibility, and duration of significantly improved vertical visibility is desirable.

2. As a RANCH HAND aircrew member, your experience, observations, and expertise can be highly beneficial in attaining a realistic figure in these areas. Accordingly, request you complete this questionnaire and return it to ESSG in the envelope provided by 22 September 1971. Replies should be based on your own observation. As far as possible, please provide your most objective and complete responses. If questions are outside your own experience, so indicate.

1 Atch
Survey Questionnaire

DONAVON F. SMITH, Maj General, USAF
Acting Deputy Chief of Staff
Plans and Operations

QUESTIONNAIRE FOR RANCH HAND PERSONNEL

Information on Respondent.

1. Name:_____

2. Aircrew position assigned during SEA tour:_____

3. Staff position assigned during SEA tour:_____

4. Duration of Ranch Hand tour:

	Month	Year
From:	_____	_____
To:	_____	_____

5. Area in which most of your missions were flown. (In cases where areas may approximate equal duration, please check more than one.)

a. ( ) I Corps.

b. ( ) II Corps.

c. ( ) III Corps.

d. ( ) IV Corps.

Information on Effects.

6. If you observed an area in which you knew the time of application, what is your estimate of the time to maximum defoliation?

a. ( ) 3-5 weeks.

b. ( ) 6-8 weeks.

c. ( ) 9-12 weeks.

d. ( ) not applicable.

7. At maximum defoliation, what was the percent of increased vertical visibility (percent ground visible) in relation to untreated adjacent areas?

a. ( ) 0-40%

b. ( ) 40-60%

c. ( ) 70-90%

d. ( ) 100%

e. ( ) Other (specify)_____

f. ( ) Unknown

8. If, following crop destruction missions, you observed the response time, how long was it before the crop was affected?

a. ( ) 1-2 days.

b. ( ) 3-4 days.

c. ( ) 5-6 days.

d. ( ) Other (specify)_____

e. ( ) Not applicable.

9. Expand, as you feel appropriate, on any previous questions or answers.

ANNEX G

BIBLIOGRAPHY

ANNEX G

BIBLIOGRAPHY

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