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# A SYSTEMS ANALYSIS VIEW OF THE VIETNAM WAR 1965-1972

Editor: Thomas C. Thayer

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THE AIR WAR

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6

A SYSTEMS ANALYSIS VIEW OF THE VIETNAM WAR: 1965-1972

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A SYSTEMS ANALYSIS VIEW OF THE VIETNAM WAR: 1965-1972

Contents of the 12 Volumes

- Volume 1 - The Situation In Southeast Asia
- Volume 2 - Forces and Manpower
- Volume 3 - Viet Cong--North Vietnamese Operations
- Volume 4 - Allied Ground and Naval Operations
- Volume 5 - The Air War
- Volume 6 - Republic of Vietnam Armed Forces (RVNAF)
- Volume 7 - Republic of Vietnam Armed Forces (RVNAF)
- Volume 8 - Casualties and Losses
- Volume 9 - Population Security
- Volume 10 - Pacification and Civil Affairs
- Volume 11 - Economics: War Costs and Inflation
- Volume 12 - Construction and Port Operations in South Vietnam

# A Systems Analysis View Of The Vietnam War: 1965-1972

## Volume 5

### THE AIR WAR

	<u>Date</u>	<u>Page</u>
<b>1. <u>INTERDICTION OPERATIONS IN NORTH VIETNAM AND LAOS</u></b>		
Results Of Armed Reconnaissance Sorties Vs. Moving Targets In North Vietnam	Jan 67	1
Armed Reconnaissance In North Vietnam	Apr 67	3
Armed Reconnaissance In North Vietnam	Jul 67	5
Ground-Radar Controlled Bombing	Aug 67	7
Transportation Facilities In North Vietnam	Aug 67	11
Armed Reconnaissance Efficiency In North Vietnam -- A Reappraisal	Nov 67	13
The Cost Of Bombing North Vietnam	Dec 67	15
Truck Destruction In The Steel Tiger Area	Feb 68	18
The Bombing -- Its Economic Costs & Benefits To Vietnam	Feb 68	20
Muscle Shoals/Mud River	Jan 68	34
Muscle Shoals/Mud River: CINCPAC Rebuttal	Mar 68	38
Muscle Shoals	Apr 68	41
Air Operations In North Vietnam	May 68	48
Truck Traffic In North Vietnam And Laos	May 68	49
Interdiction Of Enemy Truck Traffic	Jun 68	50
Joint Staff Comments On June Articles	Aug 68	52
US Bombing Campaign In North Vietnam And Laos	Jul 68	60
Interdiction Campaign Since March 31	Aug 68	75
Interdiction In Laos Since The Bombing Halt	Dec 68	77
Southeast Asia Tactical Aircraft Operations	Jun/Jul 70	83
<b>2. <u>AIR OPERATIONS IN SOUTH VIETNAM</u></b>		
An Appraisal Of ARC LIGHT (B-52) Operations	Sep 67	109
ARC LIGHT (B-52) Operations: Rebuttal	Oct 67	113
Tactical Air Operations In South Vietnam	Aug 69	117
Tactical Air Operations In South Vietnam: A Rebuttal	Jan 70	122
Air Support For Troops In Contact	Nov/Dec 69	125
Airstrikes Near RVN Population	Mar/Apr 71	128
<b>3. <u>SPECIAL</u></b>		
Air Crew Recovery	Jul 67	141
Aircrew Recovery Operations In SEA	Feb 69	145
Analysis Of The Use Of Propeller Versus Jet Aircraft In Laos	Nov 67	148
Use Of Propeller And Jet Aircraft In Laos - Joint Staff Comments	Jan 68	149
Killing Trucks In Laos	Sep 68	151
Jet And Propeller Aircraft Operations In Southeast Asia	Aug 69	155
Winding Down The Air War	Aug/Oct 71	166

#### 4. HERBICIDE OPERATIONS

Effects Of Crop Spraying In South Vietnam	Nov 67	168
Effects Of Crop Spraying In South Vietnam: A Reconsideration	Mar 68	171
The Herbicide Issue	Jan/Feb 71	174
A Preliminary Response To Criticism Of The Use Of Herbicides In RVN	Mar/Apr 71	179
Impact Of Herbicides: An Overview	Mar/Apr 71	182

#### 5. SORTIES AND LOSSES

Southeast Asia Losses - US And VNAF	Jan 67	200
Southeast Asia Aircraft Losses - US And VNAF	Feb 67	205
Aircraft Losses And Production - Korea And Southeast Asia	Feb 67	213
Air Operations	Mar 67	217
Aircraft Losses	Apr 67	225
Aircraft Losses	May 67	229
Aircraft Destroyed On The Ground By Hostile Action	May 67	238
Aircraft Sorties And Losses	Jun 67	239
Aircraft Sorties And Losses	Jul 67	241
Aircraft Sorties And Losses	Aug 67	244
Aircraft Sorties And Losses	Sep 67	247
Aircraft Sorties And Losses	Oct 67	249
October Aircraft Losses	Nov 67	252
Aircraft Sorties And Losses	Dec 67	254
Aircraft Sorties And Losses	Jan 68	259
Aircraft Sorties And Losses	Mar 68	262
Aircraft Sorties And Losses	Apr 68	265
Aircraft Sorties And Losses	Jun 68	269
Aircraft Sorties And Losses	Jul 68	274
Aircraft Sorties And Losses	Aug 68	276
Aircraft Sorties And Losses	Sep 68	280
Aircraft Sorties And Losses	Oct 68	287
Aircraft Sorties And Losses	Dec 68	289
Aircraft Sorties And Losses	Feb 69	293
Aircraft Sorties And Losses	Mar 69	295
Aircraft Sorties And Losses	May 69	298
Aircraft Attrition In SEA	Jul 69	300

#### 6. SA-2 EFFECTIVENESS

SA-2 Effectiveness Against US Aircraft	Jan 67	304
SA-2 Effectiveness Against US Aircraft	Apr 67	305
SA-2 Effectiveness Against US Aircraft	Jul 67	306
SA-2 Effectiveness Against US Aircraft	Oct 67	307
SA-2 Effectiveness Against US Aircraft	Jan 68	308



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### Effects of Crop Spraying in South Vietnam

Two recent RAND Studies\* indicate the use of herbicides in crop destruction in Vietnam does not have a significant effect on the enemy's food supply. The program may be counter-productive in view of its alienation from the GVN of the non-VC population subjected to crop spraying.

The findings are based on 206 interviews with ex-VC and non-VC civilians, USAID statistical abstracts, and crop destruction operations data supplied by CINCPAC. These studies are summarized below, with some OASD/SA comments appended.

#### Summary

The herbicide program can be broken down into two parts: 1) defoliation of forested areas to reduce the cover available to the VC, and 2) destruction of crops to reduce the amount of food available to the VC. During 1966 some 751,000 acres were defoliated and 113,000 acres of crops were destroyed. The RAND report focuses primarily on the crop destruction program.

The report concludes that the crop destruction program has not in any major sense denied food to the VC. MACV estimates the VC forces constitute about 1.5 percent of the population. Allowing for losses in the system, they need no more than 3 percent of all the food consumed in the country. Because of the coercive access the VC have to rice at the consumer level, they are able to transfer most of the burden of deprivation to the local peasant. It would be difficult to destroy enough food, except in localized instances, to prevent the VC from eating. Those interviewed indicated that: (1) their normal food ration was adequate, (2) there was no consistent deterioration in rations in the time period studied (1965 through end 1966) and (3) higher ranking subjects believed the system could adapt to even more intense crop destruction. However, as a result of US/GVN herbicide operations some VC units in the central highlands had serious food problems.

Statistical analysis indicates the intensity of crop destruction operations did not have a significant impact on the amount of rice or rations per VC in a given area. Production, population and access to foreign sanctuary were the significant predictors of the ration. The VC grow little of their own food (an estimated 10 percent), some is imported, but the principal VC source of supply is the indigenous population. Thus, the major portion of the crops destroyed through aerial spraying has inevitably been civilian-owned and

\* Russell Betts and Frank Denton, An Evaluation of Chemical Crop Destruction in Vietnam, RM-5446-ISA/ARPA, September 1967, and Anthony J. Russo, A Statistical Analysis of the U.S. Crop Spraying Program in South Vietnam, RM-5450-ISA/ARPA, September 1967.

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cultivated. RAND estimates that over 500 civilians experience crop loss for every ton of rice denied the VC.

The reaction to spraying operations which destroy civilian crops is almost unanimously hostile. Eighty-eight percent of those interviewed indicated the people blame the US/GVN for the destruction. Crop destruction not only causes food shortages and economic hardships, but it also threatens to disrupt the peasant's total pattern of existence. The civilian population generally lacks knowledge and understanding about the nature and the purpose of these operations. They feel that the spraying shows a lack of SVN concern for their welfare. Many peasants also believe the chemicals used are toxic and can cause illness or death.

The sources suggest also that herbicide operations do not appear to have caused significant refugee movements as may have been anticipated. The civilian who had lost his crops apparently believed he would not be appreciably better off as a refugee in GVN areas, and might not be as well off.

There was some limited evidence from the interviews that the people might be more willing to accept crop spraying as a legitimate (though still highly undesirable) weapon of war, provided the US/GVN could at the same time successfully demonstrate its sincere concern for their welfare. The report notes that "The incidence of SVN aid to people affected by crop spraying was very low. Surprisingly enough, aid from the Viet Cong was more commonly attested to." In addition to aid, better psychological war techniques also appear needed. The crop destruction operations were rarely accompanied by GVN or US warnings and explanation. In the absence of such information, the VC stepped in with their own propaganda. They claim the chemicals are toxic, the GVN lacks concern for them while the VC have a real concern; and the US and GVN are not able to win a guerrilla war since they have to blindly destroy the people to get at the VC.

#### SEA PRO Comment

These studies have some questionable aspects. The sample is small. Furthermore, the studies do not address the effectiveness of spraying VC controlled areas and base camps versus contested areas. One implication of the studies is, however, that the crop destruction program should be limited to local actions in which it is part of a concerted effort to disrupt supply lines or to force the VC to move from selected base areas.

The results of more warning of the peasants of impending spraying are not entirely foreseeable. On the one hand, alienation may be reduced. On the other hand, refugees may be produced on a wholesale basis - something the US has generally avoided. The study cites at least one example where the people concerned were warned of impending herbicide operations and urged to flee to SVN controlled areas; most of them did. This is one way to separate the VC from the peasants. It might be a desirable way, but only if we have prepared adequate refugee centers, determined how to make the refugees economically productive, and managed to separate out the VC who have fled with the refugees.

169

~~CONFIDENTIAL~~

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We agree with RAND that the evidence indicates that the present whole-sale crop spraying program is counter-productive because it neither denies food to the VC nor prevents the alienation of the affected population. Limiting crop spraying to selected areas may still be worth the risks, but even then the program should be accompanied by a public information program.

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EFFECTS OF CROP SPRAYING IN SVN: A RECONSIDERATION

In November we reviewed two RAND studies on herbicide crop destruction. The RAND studies concluded that the present deliberate crop destruction program does not deny food to VC main forces, that large numbers of civilians are affected, and that present crop destruction programs alienate rural people. However, new data shows that MACV crop destruction programs are highly selective as to target, and local results are generally restricted to enemy areas. We conclude that the RAND studies do not evaluate the MACV deliberate crop destruction program as it is carried out, that MACV has established that effects of its crop destruction program are highly concentrated in VC controlled areas, and that further checking is needed of new CINCPAC data which suggests that the number of civilians affected is small. Also, we conclude that answers are still needed to the questions about the adequacy of the allied explanation of all herbicide programs and indemnification for accidental crop destruction. Finally, we conclude that further study is needed of the questions RAND raises about the relation of these programs to pacification.

In November 1967 we reviewed two RAND studies <sup>1/</sup> (henceforth referred to as the evaluation study and the statistical study) of the chemical crop destruction program in South Vietnam. The studies are based on interviews of 206 and 207 returnees respectively. After summarizing the studies, we commented along the following lines: a) the samples of interviewees are small, b) the results of more warning to peasants of impending spraying may result in an undesired generation of refugees, and c) "we agree with RAND that the present wholesale crop spraying program is counterproductive because it neither denies food to the VC nor prevents alienation of the affected population."

Since November, JCS, CINCPAC and MACV have provided evidence that have caused us to reexamine our November evaluation of the RAND reports. In our comments below on the RAND, and the military positions, we modify our November views on the effects of crop destruction programs on the peasant and the question of VC food denial.

1. Can and does the MACV herbicide crop destruction program deny the VC food?

RAND concludes that "because of the wide access the VC have to resources throughout most areas of Vietnam...it would be difficult to destroy enough food to prevent the VC from eating." "Significant or crippling effects on VC rice consumption would result only if a major proportion (perhaps 50 percent or more) of the rural economy were destroyed." "The data consistently suggest that the crop destruction program has not in any sense denied the VC food." "Further, no significant relationship was noted between VC rice rations (main force) and the percentage of regional rice lands sprayed."

<sup>1/</sup> Russell Betts and Frank Denton, An Evaluation of Chemical Crop Destruction in Vietnam, Room 5446 - ISA/ARPA, September 1967, & Anthony J. Russo, A Statistical Analysis of the US Crop Spraying Program in South Vietnam, Room 7450 - ISA/ARPA, September 1967.

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JCS, CINCPAC and MACV state that crop destruction targets are located in VC controlled, sparsely populated, rice deficit areas. MACV seeks to deny a ready rice supply to VC units operating in remote areas, to divert VC manpower to crop production and to weaken VC strength in these areas. Spray aircraft during 1967 received 297 hits from ground fire in 622 crop destruction sorties, thus indicating the hostile terrain over which they fly. JCS reports that MACV destroyed 82,000 tons of rice in 1967. JCS asserts that captured documents (which report local food shortages, diversion of VC/NVA forces to food gathering forays, and diversion of troop labor to grow food) support the effectiveness of the MACV crop destruction program.

SEAPRO Comment. The RAND statistical study uses a methodology which leads to a logically valid conclusion: food cannot be denied to a main VC force unit which has multiple avenues of access to the rural economy. The key points are access and a VC logistical system which can transfer food to herbicide affected areas. Local crop destruction cannot deny the VC main forces food if there is no effective control of food moving between VC controlled and secure areas. We agree with CINCPAC that the MACV program aggravates VC/NVA supply problems and forces them to divert combat troops to obtain food. The amount of impact remains to be determined. We note that MACV has no systematic, quantitative evaluation of its crop destruction program. We believe that the RAND statistical study model might be useful in evaluating the effects on a local area targeted by MACV when MACV secure the relevant data on its herbicide operations.

## 2. How many civilians are affected by crop destruction?

RAND analysis "indicates that the civilian population seems to carry very nearly the full burden of the results of the crop destruction program; it is estimated that over 500 civilians experience crop loss for every ton of rice denied the VC." The RAND statistical study estimates that 325,000 persons had their crops sprayed in 1966.

CINCPAC reports that 63% of all missions were flown against areas where population data indicates there are less than 50 inhabitants per square mile (87% where population density is under 250/sq mile). Therefore, CINCPAC uses average civilian population density in areas of deliberate crop destruction to estimate that a maximum total of 62,000 persons are directly affected.

SEAPRO Comment. MACV destroyed enough food in 1967 to feed approximately 779,000 people, using a CINCPAC estimating technique. RAND points out that much labor is required to grow rice. Therefore, the population density in the areas around rice paddies is high enough so that the MACV estimate of 62,000 persons affected understates herbicide effects. The RAND suggested order of magnitude of hundreds of thousands is probably correct. Enemy control of areas selected for crop destruction prevents collection of precise civilian loss data.

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3. What effect does crop destruction have on the Vietnamese population?

RAND's evaluation study considers the effects of all (both defoliation and crop destruction) programs on crops. Chemical sprays used for defoliation sometimes spill over and destroy friendly crops. The evaluation study concludes that, "it would appear that the crop destruction effort may well be counterproductive....to any long range US/GVN pacification objectives." RAND interviews uncovered deep seated peasant hostility to herbicide operations which result in crop destruction. Psychological operations messages concerning the purpose of US/GVN crop destruction programs had reached only five of 206 interviewees. Further, RAND interviews indicate that MACV indemnification for accidental destruction of crops is ineffective. RAND states that the resulting alienation of people in the countryside is responsive to the GVN, and results in hatred towards the US.

JCS and MACV do not address this RAND claim directly. JCS reports that 98% of crop destruction sorties are targeted on VC controlled (76%) and uninhabited areas (22%). The GVN has an ongoing program to tell the people in these areas that crop destruction will cease if they drive the VC out. MACV has no program to indemnify Vietnamese whose crops it has deliberately destroyed because they are enemy. The GVN considers all persons in VC controlled areas to be VC. Consequently, there is no indemnification for crop destruction of civilians except that which occurs accidentally as the result of defoliation operations in areas classified by the GVN as secure. Here, the GVN Province Chief investigates losses and provides indemnification under MICAP procedures.

SEAFRO Comment: RAND raises important questions about the amount of accidental crop destruction and also allied policies towards the civilians in areas under VC control. The JCS response that 98% of deliberate crop destruction sorties are targeted on VC and uninhabited areas makes it clear that this program is not counterproductive to short range pacification efforts which generally avoid VC controlled areas. In the long run, however, we have doubts about any program that treats all civilians in VC controlled areas as permanent enemies.

As to accidental damage and indemnification, RAND does not provide proof that the present indemnification program is inadequate. Its study makes plain that failure promptly to compensate peasants who suffer crop loss through the defoliation program alienates the peasantry, but the length and pervasiveness of delays in indemnification need documentation. A US investigation must establish the status of compensation and, if appropriate, generate US/GVN follow-up action to cut delays in indemnification. We also suspect that a better job needs to be done in explaining defoliation operations to those affected.

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THE HERBICIDE ISSUE

Summary. A review of articles and letters in Science magazine, a publication of the American Association for the Advancement of Science (AAAS), reveals that a prolonged and thoughtful dialogue on the use of herbicides in RVN has taken place. Most contributors oppose the use of these agents, primarily because of ecological, sociological or economic considerations. In many cases the opposition is based on views extrapolated from limited data.

Four findings appear to be indisputable:

- Areas north and west of Saigon (War zones C & D), the Rung Sat Special Zone, the DMZ, and portions of the coastal area of Southern MR IV have been sprayed heavily and repeatedly.
- Mangrove forests (such as the Rung Sat Special Zone) are very vulnerable to defoliants. A single application kills most trees.
- Repeated spraying kills most trees, mangrove or not. This is the situation in War Zones C and D.
- Regrowth of heavily defoliated areas is inhibited by invasion of bamboo.

All other claims are not well supported by documentary evidence and have been subject to much dispute. The claims include toxicity to man or animals, increased birth defects, climate changes, hardening of soil, psychological impact, and social changes. Most researchers feel they can be substantiated with further studies. They undoubtedly hope the Defense sponsored study by the National Academy of Sciences will provide definitive support for the claims.

The articles in Science are well written, academic works. The authors are generally careful to identify opinion, conjecture or weak arguments. Research is well documented and up to date. The letters about herbicides published in Science are less objective, tending to reflect the bias of the authors.

The people involved in the dialogue should not be dismissed as wild-eyed young radicals. They are, for the most part, respected members of the academic and scientific establishment. The dialogue has served to sharpen their arguments, focus attention on the important and high impact issues, and will almost certainly influence the direction of congressional inquiry and interest.

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### THE HERBICIDE ISSUE

A review of the herbicide articles in Science Magazine (the publication of the American Association for the Advance of Science) indicates that:

- The scientific dialogue on the use of herbicides in Vietnam has been long and thoughtful.
- Most contributors are opposed to the use of herbicides primarily on ecological, sociological and economic grounds.
- Their opposition is based mostly on views extrapolated from limited data.
- The three articles (in the last two years) are well written and thoughtful. The various authors are careful to identify opinion, conjecture, and weak arguments. Research is well documented and up to date.
- The letters contributed to Science on herbicides do not show the same balanced and reasoned approach. The preconceptions of the authors (usually negative) definitely come through.

#### Review of Articles

In the past few years, there have been ten major articles on herbicides. The three articles reviewed below, appeared in the last two years. They concentrate on the use of herbicides in Vietnam.

There seems to be clear agreement that:

- mangrove forests are very susceptible to herbicides,
- tree mortality in other types of forests increases greatly with repeated spraying,
- bamboo invasion of areas which experience high tree loss is a serious problem which could retard (or possibly prevent) a site returning to its natural state.

There also seems to be agreement that there is insufficient evidence concerning:

- toxicity of agents to man or animals,
- long range effects,
- herbicides causing birth defects in humans,
- contamination of food chains,

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- hardening and contamination of soils,
- irreversibility of damage,
- social and psychological effects,
- economic impact.

This may indicate why members of the AAAS are in favor of, and may have encouraged, Congressional support for the NAS study.

Defoliation in Vietnam, Fred H. Tachirley, February 2, 1969:

Mr. Tachirley, a member of the US Department of Agriculture, presents a balanced picture of the program (his efforts were the basis of the US Embassy's 1968 Policy Review). He identifies the apparent sensitivity of mangroves to herbicides, bamboo invasion of defoliated forests, and the killing of trees by repeated spraying as the most severe problems.

Tachirley addresses, and largely dismisses, climatic effects, laterization (hardening) of soil, inability of the forests to regenerate (except for mangroves and sites invaded by bamboo), and toxicity to man or animals. He concludes there have been ecological effects, but they are not irreversible.

Ecological Effects of the War in Vietnam, G. H. Orians and E. W. Pfeiffer, May 1, 1970.

Drs. Orians and Pfeiffer, zoologists from the Universities of Washington and Montana, respectively, have authored a comprehensive article which deals mainly with herbicides (although its title would lead the reader to expect a more balanced treatment of the war's total impact). They confirm the susceptibility of mangrove to herbicides, and the repeated spraying and bamboo invasion problems noted by Tachirley. They specifically note there is little evidence of direct toxic effects on animals. They discuss the impact of herbicides on rubber plantations in great detail, but conclude that (1) the problems of the rubber plantations are the result of multiple factors and (2) they cannot assess the relative importance of each factor.

The remainder of the paper is subtly negative - much conjecture based on limited observation. In at least two cases (stating that the tiger population has probably increased by feeding on battle casualties and stating that people are forcibly transported to Saigon) they are clearly trying to provoke a negative response.

Herbicides in Vietnam: AAAS Study Finds Widespread Devastation (News & Comment), P. N. Boffey, January 15, 1971.

This is the magazine's coverage of the preliminary report of Dr. Meselson, Harvard University biologist, and his AAAS sponsored group, to the annual convention of the AAAS in Chicago. The article, identifying Meselson's conclusions as "assertions," weaves his report into a summary of recent White House actions, a review of the herbicide program, reactions of others at the convention, and criticism of other studies, notably those by the Army. The final study is to be presented "perhaps in a few months time."

Four main "assertions" were attributed to Meselson's group:

- there has been extensive killing of mangrove forest

- half the trees in mature hardwood forests north and west of Saigon (Note: War Zones C & D) are dead and massive bamboo invasion has taken place.

- crop destruction is nearly a total failure because the food would have been consumed by civilians (particularly Montagnards)

- no definite evidence of adverse health effects as a result of herbicide spray was found (Note: this conclusion was qualified and left open to future study).

#### Review of Letters

- Meyer Chessin, botanist, Univ. of Montana, responding to an article (not reviewed above) on benefits of herbicides in the control of woody plants, raises questions of animal toxicity and long range effects.

- Edwin D. Willis, biologist, Oberlin College, responding to the same article, disputes the point that grass developing on defoliated areas is useful, especially in tropical climates.

- K.C. Barrons, Dow Chemical Company, discusses the relatively low toxicity of herbicides to cattle and fish, especially with proper range management, in domestic applications.

- G.H. Orians, University of Washington, and E.W. Pfeiffer, University of Montana state that agent White (picloram & 2, 4-D) is being used in place of Orange (2, 4-D and 2, 4, 5-T) especially in NR III, because Orange tends to drift. They claim they saw much damage from drifting herbicides around Saigon. They then note the persistence of agent White in soil.

- Clarence Leuba, psychologist, Antioch College, criticizes biologists for overlooking the reason herbicides are used--to save lives--and for taking outraged stands without viewing the whole picture.

- J.A. Duke and J.T. McGinnis, Battelle Memorial Institute, note the continuing dialogue on herbicides and suggest a ten point research program with the aim of leaving Vietnam better off thru environmental engineering.

- Roy M. Sachs, University of California, criticized Arthur Westing's (see next item) negative attitude, obvious bias, and lack of objectivity during the AAAS investigating team's visit to Ft. Detrick (and Boffey's account of Westing's visit in Science magazine). He accuses them of ignoring the military realities (especially in Cambodia) and reminds them that they must meet certain standards before they can expect to have access to classified information. The status derived from their appointment to an AAAS committee is not sufficient. Finally, he criticizes the AAAS study for not publishing the full report of dozens of experts at a conference last June.

- A.H. Westing, biologist, Windham College, responding to Sach's letter, agreed that his mandate from the AAAS was limited to an assessment of the biological effects of herbicides in RVN. He denies that he was preoccupied with only adverse effects. He passes off Sach's criticism of his remarks at Ft. Detrick as "inept attempts at humor" intended to break the ice. He concludes by stating that his "personal political and moral views are separate from and irrelevant to the AAAS study."

- William Haseltine, William R. Carter, and Ngo Vinh Long, Harvard University, commenting on the Orians and Pfeiffer article, claim that less attention should be paid to the corrosion of the ecology and more to the effects on Vietnamese society. They claim that defoliation is used to force people into cities. They conclude by calling for an extension of the AAAS resolution to banning the use of all herbicides in war.

- G. H. Orians and E. W. Pfeiffer, replied to Haseltine, Carter and Long's letter, expressing complete agreement and stating their regret that time, circumstances, and evidence did not permit a fuller treatment of the social issue. They state that the 1969 goal of the pacification program was to get 90% of the population under US control and then tied this to an alleged US policy of "moving people from the countryside, which we cannot control, to the cities which we can control."

- Ambassador R. W. Komer, commenting on the Orians and Pfeiffer letter above, categorically denied the accusations they made and correctly stated the pacification goal. He also emphatically pointed out that he "had nothing to do with the (herbicide) program," and objected to "assertions that the pacification program was in any way associated with destroying Vietnam's ecological balance or society." He did not attempt to defend the herbicide program.

A PRELIMINARY RESPONSE TO  
CRITICISM OF THE USE OF HERBICIDES IN RVN

Criticism

Critics contend that herbicides have devastated Vietnam. Specifically they have charged that:

- herbicides are responsible for increased birth defects and infant mortality.
- severe - possibly irreversible - damage has been done to Vietnam's ecology.

The American Association for the Advancement of Science (AAAS) is at the center of the controversy. The scientific and academic community is heavily represented in the association's membership.

Probably the most vocal and widely-quoted critic within AAAS, is Dr. Matthew Meselson, Harvard University biologist. Dr. Meselson recently chaired the AAAS Herbicide Assessment Commission and visited Vietnam in December. In a statement to the AAAS convention in January 1971, Dr. Meselson was reported to have stated:

- "One-fifth to one-half of South Vietnam's mangrove forests, some 1400 square kilometers in all have been 'utterly destroyed,' and even now, years after spraying, there is almost no sign of new life coming back."

- "Perhaps half the trees in the mature hardwood forests north and west of Saigon are dead, and a massive invasion of apparently worthless bamboo threatens to take over the area for decades to come."

- "The Army's crop destruction program, which seeks to deny food to enemy soldiers, has been a near total 'failure,' because nearly all the food destroyed would have been consumed by civilian populations, particularly the montagnard tribes of the Central Highlands."

- "There is no definite evidence of adverse health effects, but further study is needed to determine the reason for a high rate of still-births in one heavily sprayed province and for an increase in two particular kinds of birth defects which were reported at a large Saigon hospital and which were coincident with large scale spraying."

I/ Herbicides in Vietnam: AAAS Study Finds Widespread Devastation (News & Comment) P. M. Boffey, Science, January 15, 1971.

## A Preliminary Response

- Pictures taken on January 25, 1971 show that in the Rung Sat Special Zone, the most frequently sprayed mangrove swamp, the effect of defoliants is quite evident, but the forest is far from "utterly destroyed." Moreover, there is ample evidence of regrowth.

- Pictures taken on January 26, 1971 of the hardwood forested area north and west of Saigon show a dense canopy. Some dead trees are evident (perhaps 10%--far fewer than 50% as charged by Meselson).

- The "failure" of the crop destruction program appears to be a generalization made by Dr. Meselson from an aerial reconnaissance of a single area in Quang Ngai province which was a recent crop destruction target. The conclusion was "substantiated" by reference to "several classified studies conducted under military auspices since 1967 which have come to a similar conclusion." The studies referenced undoubtedly include two RAND studies.<sup>2/</sup> We feel these studies are not adequate to demonstrate the failure of the crop destruction program. On the other hand, we are not yet able to make a case for the military effectiveness of crop destruction--this question will be addressed by an ODDR&E sponsored contract study (which will complement the National Academy of Science Study looking into the effects of herbicides on the ecology and people of RVN). Interrogation of prisoners and Hoi Chanh indicates that VC/NVA forces in the northern regions suffer from serious food shortages and much of their effort is devoted to subsistence rather than military activity. Crop destruction's role, if any, in creating this situation should emerge from the ODDR&E study.

- We agree that there is no definite evidence of adverse health effects, while the jury is still out on the question, DOD has forgone the use of the most effective defoliant, agent Orange, as a precautionary measure. It is conceivable that the higher instances of birth defects and infant mortality noted by Meselson could be the result of defoliation. But they could also be the result of more people receiving medical care, which in turn would tend to generate more complete reporting of such statistics.<sup>3/</sup>

- The possibility that agent Orange may be linked to birth defects has resulted in intensive study. Several efforts are now in progress. Since the chemicals in "Orange" are widely used by farmers in this country, the toxicity problem has to be resolved regardless of what happens to the herbicide program in Vietnam.

- 2/ a. A Statistical Analysis of the US Crop Spraying Program in RVN, RM-5450-ISA/ARPA, A. J. Russo, The RAND Corp., October 1967.
- b. An Evaluation of Chemical Crop Destruction in Vietnam, RM-5446-ISA/ARPA, R. Betts and F. Denton, the RAND Corp., October 1967.
- 3/ Although recent figures are not available, the number of beds in hospitals giving consultation and maternity services showed a steady increase from 1961-1968. In 1968 there was a 30% increase in beds available (16,342 vs 12,582 in 1967). The number of government physicians increased 65% in two years (397 in 1968 vs 240 in 1966). Self employed physicians increased 22% (1252 in 1968 vs 1028 in 1967). (Vietnam Statistical Yearbook - 1968).

### Character of the Issue

The entire herbicide issue is emotionally loaded. The effect on the objectivity of those studying the problems associated with herbicide use is illustrated by the following example.

In December 1967, the AAAS established a formal committee entitled "the Committee on Environmental Alteration." Although this committee had not been set up specifically to study the Vietnam problem, the pressures to do so and to pre-judge the findings were so great that its Chairman, Dr. David R. Goddard, resigned. He explained his action in the following statement:

"One might think that professional scientists would not expect the committee to reach conclusions before it has received scientific evidence, but this is clearly not the case. The correspondence reaching my desk, and the telephone calls--many of them from very distinguished scientists--indicate that many people have prejudged the issue before any committee can be formed. Outsiders are trying to determine the composition of the committee, and the conclusions that it will reach."

In July 1968, the AAAS Board of Directors issued a policy statement recommending essentially that a field study be conducted under the direction of the United Nations to assess the ecological impact in Vietnam.

Later, after receiving a DOD sponsored study of the ecological effects of repeated use of herbicides, in March 1969, the Board decided it should review the report because of the difficulties of getting an unbiased committee together.

4/ House, W. B., et al. Assessment of Ecological Effects of Extensive or Repeated Use of Herbicides. Kansas City Missouri Midwest Research Institute; November 1967. (DDC AD 824-314).

## THE IMPACT OF HERBICIDES: AN OVERVIEW

An analysis of data on herbicide operations in Vietnam shows that:

- Herbicides have not caused widespread devastation. From 1962-1970, herbicide has been sprayed on less than 10% of the land area of RVN.

- In 1967, the year of greatest herbicide use, less than 3% of the country was defoliated; about 2.4% of the land under cultivation was subject to crop destruction.

- HES shows that only about 3% of the population live in defoliated areas; less than 1% live where crops were destroyed.

We also determined that:

- Herbicide operations were conducted under rigid controls involving both US and GVN authorities at all levels.

- Crop destruction was confined to the lightly populated rice deficit highlands of MR's 1 and 2; at no time were crops destroyed in the country's food producing centers (MR 4). Since 1967, the primary targets have been plots of mountain rice and vegetables in hostile areas.

- Most (about 90%) crop destruction was confined to areas in and around known enemy base areas.

Recent pictures taken of heavily defoliated areas show:

- There is considerable regrowth of foliage in the hardwood forests.

- Mangrove swamps (which are very sensitive to herbicides) still show considerable effects. However, there is definite evidence of regrowth along waterways.

- Clearing vegetation with herbicides appears to be much less destructive and certainly less permanent compared to the alternative methods commonly used in areas where military operations are conducted or where military installations are located (eg. Rome plows, "daisy cutters," blasting, petroleum sprays, burning, etc.).

The four plots attached show where herbicide missions were flown in relation to populated areas in RVN.

As can be seen, large scale defoliation (Maps 1 and 2) has been used to help counter VC/VVA forces in:

- The DMZ and mountains of MR 1
- Western Kontum and Pleiku
- War zones C and D
- Mangrove swamps in the Rung Sat Special Zone, the U Minh Forest, the Ca Mau Peninsula and the coast of Vinh Binh and Kien Hoa provinces.

Maps 3 and 4 show the areas where crop destruction missions have been flown from 1965-1970 (map 3) and during 1967 (map 4).