PRELIMINARY REPORT

HERBICIDE ASSESSMENT COMMISSION

of the
AMERICAN ASSOCIATION FOR THE
ADVANCEMENT OF SCIENCE

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Introduction. The Council and the Board of Directors of the AAAS have for several years sought to encourage scientific study of the effects of the large-scale military use of chemical herbicides on the ecology and on human welfare in South Vietnam. In December 1969 the AAAS Board appointed Matthew S. Meselson, Professor of Biology at Harvard University, to develop a plan for such a study, authorizing an expenditure of $80,000 for the purpose. Meselson appointed Arthur H. Westing, Professor of Botany at Windham College in Vermont, to direct the Herbicide Assessment Commission, the title under which this AAAS activity is known.

In the first phase of its work the Commission reviewed the pertinent literature and solicited information and advice from numerous experts in the U.S., Vietnam and elsewhere. This was followed by a conference in June, which brought together twenty-three experts in various fields for an intensive week of study and planning.

During August and September of this year, Meselson and Westing, together with Dr. John D. Constable, Professor of Surgery at Harvard Medical School, and Mr. Robert E. Cook, graduate student in ecology at Yale University conducted a study tour in South Vietnam. The purpose of the tour was to identify the chief problems and to determine facilities, methods, and locations most suitable for future studies. What follows is a preliminary report of their findings and recommendations. A detailed report will be published at a later date.

1. Mangrove forests. Much of the coastal area of the Mekong Delta region is occupied by mangrove forests. As a rough approximation, half of these forests, some 1,400 square kilometers, have been sprayed with herbicides. For as yet undetermined reasons, mangrove species have proved to be particularly sensitive. Essentially all vegetation is killed. Preliminary aerial and ground inspection by the Commission showed little or no recolonization by mangrove tree species after three or more years. However, there is scattered growth of the fern Acrostichum aureum, the shrub Wedelia biflora, and a few other species. Without vegetation, the area obviously cannot support most of the bird and ground animal species associated with the previously existing mangrove forests. A possibly important exception are crabs, large numbers of which were observed in barren areas. By devouring seedlings, crabs may be retarding revegetation. There are signs of erosion along the denuded coastlines but as yet they are slight. Major typhoons, which on the average strike the mangroves about every five years, have not occurred since herbicide was sprayed.

Studies aimed at reclamation of this land could be started immediately. Mangrove forests once provided a major source of fuel wood and charcoal. Mangroves also play an important role in providing food and nursing grounds for fish and crustaceans, although the magnitude of this contribution is not known. An attempt to estimate the impact that the permanent loss of mangrove forests would have on the fishing industry should be made before

deciding how much of the former mangrove area should be replanted to tidal forests and how much devoted to other purposes. The urgency of replanting depends on the pace of erosion and soil deterioration and on the time scale of possible overgrowth of undesirable and hard to eradicate species such as Acrostichum. These time factors may well allow several years, but they could and should be studied immediately.

2. Tropical Hardwood Forests. Approximately one-fifth of South Vietnam's merchantable hardwood forests have been sprayed, including many of the oldest and most valuable stands. Aerial inspection of forests in a wide arc north of Saigon extending from the Cambodian frontier in the west to the South China Sea on the east showed more than half of the forest to be very severely damaged. Over large areas, most of the trees appeared dead and bamboo had spread over the ground. A danger in this is that the invading species may be essentially worthless and very expensive to eradicate. Bamboo will retard the re-establishment of forest trees, at least for many decades. A further hazard is that large amount of nutrient minerals previously tied up in forest vegetation may have been released and leached out of sprayed forests by the heavy tropical rains. Whether or not this process, which may be called nutrient dumping, has occurred on a scale large enough to seriously reduce soil fertility can be determined by relatively simple ground measurements. Intelligent planning of forestry policy, including reforestation, requires prompt attention to these and other possible herbicide

effects. The true conditions of the forests including, but of course not restricted to the effects of herbicides, should be determined by aerial and ground inventory at the earliest possible date.

3. Contamination of Food Chains. The Commission collected samples of shrimp, fish, human milk, and other materials for analysis for the presence of herbicides, their impurities, and their breakdown products. As yet, we are developing methods for the required analyses. Emphasis is being given to improved methods for the analysis of 2,3,7,8-tetrachlorodibenzodioxin. Dioxin, as this material is called, occurs as an impurity in Orange, the principal herbicide used in Vietnam. Its potential importance lies in the fact that it is exceedingly toxic, may be quite stable in the environment, and, being fat soluble, may be concentrated as it moves up the food chain into the human diet. Very rough model calculations suggest that it is not impossible that significant amounts of dioxin are entering the Vietnamese diet. This is certainly not to say that this is occurring, but it should not be very difficult to make an accurate study of the question. The main obstacle at present is the lack of sufficiently sensitive and reliable methods for the analysis of dioxin.

4. Health Effects. A principal concern here has been the possibility of the induction of birth anomalies by 2,4,5-T, dioxin, or both. Such effects have been found in laboratory experiments with animals and led to an order last April stopping the use of agent Orange. The U.S. Army and the South

Vietnamese Ministry of Health have recently published a survey of stillbirths, hydatiform moles (placental tumors), and malformations, based on South Vietnamese hospital records for the past ten years. A slight but encouraging downward trend is reported in all three categories. Unfortunately most of the data come from Saigon, which has, of course, not been treated with herbicides. Indeed, probably no more than five or ten percent of the South Vietnamese population has been directly sprayed and we have essentially no data on this group. They would be very underrepresented in Ministry of Health records. However, persons living outside of Saigon have been more heavily exposed to herbicides than those living in the Capital. This could occur not only by occasional direct exposure but also by exposure to drift and to herbicide residues in food and water. Upon subtracting the Saigon data, the Army study does, in fact, show a decided upward trend in stillbirths, moles, and deformities in the rest of the country. However, it would be totally incorrect to consider this as proof of an effect of herbicides. More complete recording and increased referral of difficult pregnancies from the countryside to the provincial hospitals could easily account for the observed trends. More thorough surveying in selected provinces might help to settle this question. Although the Commission could only study limited areas, we did evaluate in detail the birth records in Tay Ninh, a very heavily defoliated province. We found that for the years 1968 and 1969, the Tay Ninh provincial hospital showed a higher rate of stillbirth than any of those reported in the Army study.

Another approach would be to look for strikingly unusual deformities in heavily sprayed areas although the Commission found none reported within the Ministry of Health system. Still another type of survey would focus on the relative frequencies of each of several commonly identified malformations in hospitals conducting pediatric surgery. However, there is only one large hospital of this type and, because it is in Saigon, obvious limitations are imposed. Its records do show a disproportionate rise in 1967 and 1968 of two anomalies, cleft palate and spina bifida. It would be important to examine these trends more closely. Still, this could never prove a causative connection with herbicides. The survey approach offers little hope of proving or disproving any relation between herbicide exposure and the incidence of birth defects unless one can find sizeable groups of similar people living under similar conditions, one heavily exposed and the other not exposed. If such populations exist and can be studied, it would be worthwhile to survey children at various ages for anomalies.

It may well be that we can learn more about this subject from the indirect approach of determining the amounts of herbicide residues in the diet and in human tissue, waiting for future research to determine the implications, if any, of whatever levels are found.

5. Crop Destruction. Some 2,000 square kilometers of land in South Vietnam have been sprayed in order to destroy food crops. It has been authoritatively estimated that this entailed the destruction of enough food to

feed approximately 600,000 persons for a year. Our observations in Vietnam lead us to believe that precautions to avoid destroying the crops of indigenous civilian populations have been a failure and that nearly all of the food destroyed would actually have been consumed by such populations. Even so, if the affected civilians were distributed throughout the country or if they lived in food surplus areas, the impact would be small compared to other hardships, since the food destroyed amounts to less than two percent of the national crop in any one year. However, anti-crop spraying has been largely confined to the food-scarce Central Highlands, the entire population of which is only about one million. Most of these are Montagnards, tribal peoples racially and linguistically distinct from the lowland Vietnamese. These peoples are animists, closely tied to their land by tradition and religious belief. We believe the anti-crop program may have had a profound impact on a large fraction of the total Montagnard population of South Vietnam and we believe this to be a point for urgent consideration. As for retrospective studies, these could best be done by one or more of several highly respected anthropologists who have spent many years studying and living among the Montagnards.

6. Military Considerations. It should be made clear that the studies undertaken and recommended by the Herbicide Assessment Commission are after the fact and without reference to the military utility or desirability of the use of herbicides. Although these are certainly matters that could be subjected to study and evaluation, this would be completely outside the assignment given the Commission by the AAAS.