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HERBICIDES AS AGENTS OF CHEMICAL WARFARE: THEIR IMPACT IN RELATION TO THE GENEVA PROTOCOL OF 1925

By Arthur H. Westing❖

The Geneva Protocol of 1925 contains the following declaration:

“ . . . Whereas the use in war of asphyxiating, poisonous or other gases, and of all analogous liquids, materials or devices, has been justly condemned by the general opinion of the civilised world; . . . and to the end that this prohibition shall be universally accepted as part of International Law, binding alike the conscience and the practice of nations; declare: that the High Contracting Parties . . . accept this prohibition, agree to extend this prohibition to the use of bacteriological methods of warfare and agree to be bound as between themselves according to the terms of this declaration. . . .”

Despite our nation's vigorous support of the Geneva Protocol of 1925 during the period of its formulation and despite the reaffirmation of its principles by various of our government spokesmen during the subsequent decades, we have not as yet ratified this landmark treaty. The United States aside, the list of ratifying or acceding nations includes all NATO members, all major industrial nations, and all nuclear weapon powers. The United States should end its status as a nonparty to the treaty as quickly as is possible.

The tortured legal history and confused current status of the international control of chemical and biological weapons have been the subject of numerous scholarly analyses. In reading some of this material¹ one often finds that the intricacies and nuances of international law as it applies to war defy comprehension. One cannot help agreeing with one Norwegian diplomat who, during the course of the original Geneva Protocol delibera-

tions, concluded that "you cannot regulate war; you can only abolish it."² And yet it does appear both logical and prudent to yield to those who argue that by attempting to impose humanitarian restrictions on the conduct of war one is thereby buying time to provide some future generation with the opportunity "to bring about that unity which is peace."³

Not only should the United States ratify the Geneva Protocol, but it should also strive to have one particular class of chemical weapons—the antiplant agents—specifically included in the Protocol's prohibition. This would be contrary to the present American position, which excludes herbicides as our nation would "understand" or "interpret" the Protocol. Several years' study of the use of herbicides—study including three visits to Indochina (in December 1969, August 1970, and August 1971) to investigate at first hand the effects of such weapons—have convinced me that herbicides can be at least as pernicious in their effects upon human beings and other living things as the agents that our government would agree to condemn.

One could argue the inclusion of herbicides under the Geneva Protocol prohibition on a number of levels. One powerful argument is that a prohibition of chemicals as warfare agents, to be straightforward and unambiguous, should include them *all* rather than attempt to make quantitative distinctions based upon relative degree of toxicity or human impact. For nations cannot agree on where to draw the line. Indeed, the problem of interpretation arising from differences over herbicides between the U.S. and U.S.S.R. is already subverting whatever international effectiveness the Geneva Protocol might have. A second impressive argument is to rely on the good legal and moral judgment of the 82 or more other members of the world community of nations who have publicly condemned the use of herbicides as weapons of war.⁴ We should also consider the fact that only two foreign nations—Australia and Portugal—have publicly condoned such use. A third argument, and one that leads to my later remarks, is that we should heed the scientific and moral judgment of thousands of scientists (including at least 17 Nobel laureates and 129 members of the National Academy of Sciences) who have petitioned our government to renounce the use of herbicides as weapons. A number of scientific organizations have done likewise, including the nation's largest—the American Association for the Advancement of Science.

Despite our absence from the list of Geneva Protocol ratifiers, we have over the decades and through several wars consistently guided our military actions to conform to the Protocol's prohibition, at least as we interpret it. Why is it then that we consider herbicidal chemicals to be permissible? It may be surmised that, on the basis of civil experience, the presumption was made that properly chosen herbicides would kill or harm plants but not people. As such they would appear to be rather innocuous and even humane as weapons go. But, as used by the military, herbicides have an alarming impact on the land and indigenous people only incidentally involved in a war, an impact that continues to be felt for years to come. Their use results in extended human suffering to noncombatants all out of proportion to any immediate military benefits that could be claimed for them.

Herbicides have been used in combat primarily for two distinct purposes. In the first instance, they have been used for the destruction of forests in an attempt to deny daytime cover and sanctuary to the enemy. Roadsides and base perimeters are treated, as well as large contiguous areas of forest. The U.S. is apparently the only nation to have employed this tactic, having done so in Indochina since 1961 or 1962.⁵ In the second instance, herbicides have been used for the destruction of crops in an attempt to deny food to the enemy. The United Kingdom was apparently the first nation to have employed herbicides in this fashion, having used them briefly for crop destruction in Malaya during the early 1950's.⁶ The U.S. has been active in this regard in South Vietnam since 1961⁷ as has Portugal since 1970 in Angola.⁸

A combination of military secrecy, paucity of critical analyses, wartime conditions, and apparent lack of official concern on the part of the user nations makes it very difficult to present a credible evaluation of the military value of these chemical weapons. It also makes it difficult to make a definitive evaluation of the effects on the land and people. However, sufficient information can be brought to bear on the subject to permit some accurate generalizations to support my contention that herbicides should be proscribed as military weapons. In what follows, an attempt will be made to summarize the impact that these chemicals have on the land and people where they are employed, i.e., their impact on the physical and human ecology, particularly in a tropical theatre of war.⁹

EFFECTS OF HERBICIDAL DESTRUCTION ON FOREST AND CROPS

An evaluation of the effects of forest destruction through the military use of herbicides must perforce be limited to two forest types: tropical upland forest (or jungle) and tropical tidal forest (or mangrove swamp). Domestic and other civil herbicide experience with temperate forests is inapplicable because military usage involves much larger contiguous areas, much higher dose rates, much more frequent retreatments, and a very different habitat.

Tropical Upland Forest (Jungle)

In order for herbicidal applications to have significant military effectiveness, a tropical upland forest (or jungle) must be sprayed with dosages exceeding normal civil practice by ten or even twenty fold; in order to sustain the military advantage, treatment must usually be repeated. When such a forest is treated more than once, 70% to 80% or more of the trees are killed. The extant forest resource is thereby largely destroyed. The treated area is subsequently invaded by clearly inferior plants (inferior both ecologically and economically). The most likely of such invaders are either cogon grass (*Imperata*) or low-growing, shrubby bamboos (e.g., *Bambusa*, *Thyrsostachys*), both notorious as pests throughout the tropics.

Once cogon grass has become established, its deep root system and efficient means of propagation make it most difficult (and prohibitively expensive) to eradicate. If nature is left to its own devices, and if fire is not a factor, forest will reestablish itself over a period of one or two decades. On the other hand, should the area be subjected to occasional wild fires, the cogon grass could remain the dominant vegetation indefinitely (forming a semi-permanent tropical grass savannah). It must be added that cogon grass is unpalatable to livestock.

Once the worthless bamboos become established, they form extensive thickets (or bamboo "brakes") which are likely to remain in place for many decades. The tropical forest tree species that originally occupied the site are presented a possible opportunity to regain a foothold only once every several decades, at the time of general flowering and stem (culm) death. As an indication of their permanence, tropical ecologists think of these bamboo brakes as a type of climax vegetation.

Beyond the obvious destruction of the forest resource (i.e., of

the timber trees themselves) and the lengthy delay prior to its reestablishment, there is also considerable subtle damage done to the treated tropical upland forest ecosystem. The major portion of the nutrients in a tropical forest ecosystem is stored in the vegetation (largely in the leaves). Following an herbicidal attack, the leaves drop and quickly rot, releasing their nutrient content. These nutrients are then washed away, for tropical soils are largely unable to capture and store nutrients. Once lost to the ecosystem, the nutrients will not become restored via natural processes for many decades. The productivity of such land thus becomes significantly diminished for an extended period of time.

The drastically altered flora in turn has a major impact on the indigenous fauna, all of which depends directly or indirectly on the vegetation for food and cover. A large number of species will be eliminated from the area, and the replacement community will have higher numbers of fewer species, some of them (including vectors, i.e., disease carriers) in pest proportions. The animals can also be harmed directly by herbicides, the extent of such damage depending, of course, upon which chemicals are being employed. In South Vietnam, for example, one of the herbicides used (2,4,5-T) contained an unknown impurity (dioxin) that was subsequently demonstrated by the U.S. Food and Drug Administration to be highly toxic to animals and to cause birth defects (i.e., to be teratogenic) as well.¹⁰

Tropical Tidal Forest (Mangrove Swamp)

When a tropical tidal forest (or mangrove swamp) is treated with herbicides even once, all of the vegetation is killed outright. Moreover, the ability of new vegetation to recolonize such an area seems to be prevented permanently. Areas sprayed by our armed forces in South Vietnam as long as eight years ago still show virtually no sign of recovery. The reasons for such a remarkably drastic effect are still obscure, but the fact remains: appalling environmental damage results from an herbicidal attack on such a habitat.

Beyond the obvious destruction of the forest resource (important as a source of firewood or charcoal wood and of tannin), there is less immediately apparent damage. The endless reticulation of water channels throughout a mangrove swamp normally supports a rich variety of aquatic animals, including numerous commercial offshore and upstream fishes and crustaceans such

as shrimp. An herbicidally attacked area can no longer support these animals. Moreover, the coastline, no longer protected against wind and tide and wave, becomes subject to erosion. Destruction of tropical tidal forest, being of indefinite duration, is frightening in its possible consequences.

It should be apparent from the foregoing that the use of chemical plant poisons in warfare causes large areas to be laid waste and that the resulting devastation will be felt for many decades into the future. It is felt largely by the civil population at the time of application, and will be felt by their innocent offspring in the generations to follow. Small wonder that one eminent biologist recently was forced to coin an ominous new word for the English language, 'ecocide.'

Crop Destruction

No lengthy statement will be made on the military use of herbicides for crop destruction. Such use, when it affects largely the civil population—as it inevitably seems to—is prohibited by the Hague Convention of 1907. This is a treaty to which we are already a party and one whose principles we reaffirmed at the Nuremberg and Tokyo trials following World War II.¹¹

It must be said, however, that in addition to any intentional food destruction by herbicides, there is also a large amount of unintentional and incidental food destruction during many forest destruction missions. What is particularly appalling, both in Cambodia and South Vietnam, is the extent and seriousness of such damage. It is difficult for an affluent westerner to realize the enormous impact that crop and fruit tree destruction has on a semi-destitute peasant who is totally dependent upon his own produce for his very existence and that of his family. He either stays and starves or else embarks on the miserable life of a refugee. In either event, hunger and malnutrition add to his already formidable burden.

DIRECT TOXICITY OF HERBICIDES TO MAN

Herbicides are a class of chemicals having in common the ability to kill plants. However, since all living things—both plants and animals—share certain biological processes, each of these chemicals has the additional potential of being more or less injurious to man and other animals. (Such chemicals could be toxic or cause birth defects, mutations, or cancer.) Even if ex-

tensive prior testing is carried out, such side effects may become apparent only after the herbicide has been in use for a number of years. By then the damage might be done and it would be too late to reverse the error.

By way of example, our military used 47 million pounds of 2,4,5-T in Indochina over a period of eight years before it was discovered that something of the order of one thousand pounds of dioxin—one of the most poisonous substances known to man—was inadvertently (and through no fault of the military) being applied as an unsuspected impurity. As another possible example, who knows whether the six million pounds of cacodylic acid (containing three million pounds of elemental arsenic) will not eventually become a health hazard to the civil population in the areas treated?

In actual practice, where massive and often indiscriminate applications of any chemical are involved, it becomes virtually impossible to determine whether that chemical eventually will prove to be harmful to humans or not. And this does not even take into account the indirect effects resulting from herbicide-caused food denial or displacement.

CONCLUSION

To conclude, it is my thesis that no chemical is suitable for use as a weapon, no matter how harmless it might seem to be on the basis of domestic, civil experience. When a chemical is introduced massively over wide areas, neither the short-term nor the long-term ecological and public health ramifications are predictable. Moreover, current experience shows that the brunt of such a chemical attack is felt by the civil population and the land upon which these people depend for their wellbeing and livelihood—and that this effect will continue to be felt long after the use of the chemical ceases.

My conclusion—based upon both biological and humanitarian considerations—is that herbicides are chemicals requiring inclusion under the prohibition of the Geneva Protocol, that they are “analogous . . . materials . . . justly condemned by the general opinion of the civilized world.”¹² It is a conclusion I share with numerous biologists here and abroad. Moreover, it might be useful to add that even when all pertinent considerations—both military and civil—are taken into account, the decision can go against the use of herbicides. Recently, Ellsworth Bunker,

our ambassador to Saigon, and Creighton Abrams, the commanding general of our military assistance command there, jointly recommended the complete cessation of our use of herbicides in South Vietnam.¹³



FOOTNOTES

❖ Professor of Botany; Chairman, Windham College (Vt.) Biology Department; Chairman, Windham College Science Division. This article is based on material that Professor Westing presented in testimony before the U.S. Senate Committee on Foreign Relations, 1971.

¹ A. V. W. Thomas & A. J. Thomas, Jr., *Legal Limits on the Use of Chemical and Biological Weapons* (Dallas: S. Methodist Univ. Press, 332 pp.) (1970).

G. Bunn "Banning Poison Gas and Germ Warfare: Should the United States Agree?" 1969 *Wisconsin Law Review* 375.

F. H. Quinby & M. E. Carlin, "Chemical and Biological Weapons: Some Possible Approaches for Lessening The Threat and Danger." U.S. Senate Comm. Labor & Public Welfare, 64 pp. (1969).

C. R. Gellner & L. N. Wu, "Use of Tear Gas in War: A Survey of International Negotiations and of U.S. Policy and Practice." In: Zablocki II; 11-41 (1970).

J. M. McCullough, "Herbicides: Environmental Health Effects; Vietnam and the Geneva Protocol: Developments during 1970." U. S. Libr. Congr. Legisl. Ref. Serv. Public. No. UG 447; 70-303 SP, 50 pp. (1970).

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C. J. Zablocki (ed.), "Chemical-Biological Warfare: U.S. Policies and International Effects." (I) Hearings, (II) Report. U.S. House Representatives Comm. Foreign Affairs, 513+41 pp. (1970).

K. Csatorday, Statement on Chemical and Biological Weapons, U.N. General Assembly Document No. A/C.1/PV. 1451, 81 pp. 54-66. (Extract in: U.S. Arms Control and Disarmament Agency Publ. No. 43, pp. 734-740) (1966).

A. N. Shevchenko. Statement on Chemical and Bacteriological Weapons, U.N. General Assembly Document No. A/C.1/PV. 1548, pp. 61-72. (Extract in: U.S. Arms Control and Disarmament Agency Publ. No. 46, pp. 662-668.) (1967).

M. Petrov, "Important Aspect of Disarmament: On Banning Chemical and Biological Weapons." *International Affairs*, Moscow (2/3):53-56 (1970).

² A. V. W. Thomas & A. J. Thomas, Jr. *supra* note 1 at 72.

³ A. V. W. Thomas & A. J. Thomas, Jr., *supra* note 1 at 250.

⁴ C. R. Gellner & L. N. Wu, *supra* note 1 at 25 & 40.

⁵ A. H. Westing, "Herbicides as Weapons in South Vietnam: A Bibliography," *BioScience*, 21 (in press) (1971).

⁶ M. C. A. Henniker, *Red Shadow over Malaya*, pp. 180f. (Edinburgh: Wm. Blackwood, 303 pp.+8 pl.) (1955).

⁷ "Vietnam: Buildup" *Newsweek* 58 (22):40 (1961). A. H. Westing, " 'Agent Blue' in Vietnam." *The New York Times* p. 27 (July 12, 1971).

⁸ R. M. Smith, "U.S. Suspects Lisbon of Using Herbicides in Angola," *The New York Times* p. 24 (Dec. 9, 1970) (*Cf. id.*, p. 13, Dec. 12, 1970).

⁹ The basis for these remarks has been developed in greater detail in several publications of mine:

A. H. Westing, "Poisoning Plants for Peace," *Friends Journal* 16: 193-194 (1970).

A. H. Westing, Statement on 2, 4, 5-T, Its Impact on the Environment. In: Hart, P. A. (ed.) *Effects of 2, 4, 5-T on Man and the Environment*. U.S. Senate Comm. Commerce, 471 pp.: pp. 76-87 (1970).

A. H. Westing, "Ecocide in Indochina," *Natural History* 80(3):56-61 (1971).

A. H. Westing, "Ecological Effects of Military Defoliation on the Forests of South Vietnam," *BioScience* 21:893-898 (1971)

A. H. Westing, "Herbicidal damage to Cambodia." In: J. B. Neilands, *et al.*, *Harvest of Death* N.Y. Free Press (in press) (1972).

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A. H. Westing, "Forestry and the War in South Vietnam," *Journal of Forestry* 69: (in press) (1971).

¹⁰ K. D. Courtney, *et al.*, "Teratogenic Evaluation of 2,4,5-T," *Science* 168:864-866 (1970).

¹¹ T. Taylor, *Nuremberg and Vietnam: An American Tragedy* (Chicago: Quadrangle Books, 224 pp.) (1970).

¹² *Cf.* Protocol *supra*.

¹³ P. A. Jay, "U.S. is Urged to Stop Killing Vietnam Crops," *The Washington Post* p. A16 (Dec. 17, 1970).

R. D. Lyons, "Military to Curb Use of Herbicides," *The New York Times* p. 5 (Dec. 27, 1970).

It can be added that the use of herbicides by U.S. armed forces in Vietnam ended in early May of 1971.