

RECLAIMING LANDSCAPE AFFECTED BY AGENT ORANGE/DIOXIN SPRAYING DURING THE WAR: A SERIOUS ENVIRONMENTAL CHALLENGE OF VIETNAM DEVELOPMENT

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Abstract

During the last war in Vietnam, over 80 million liters of toxic herbicide were applied over southern Vietnam, mostly Agent Orange (AO) that contains dioxin compounds (TCDD). Some 3.3 million hectares of natural lands suffered toxic substances and of which about 2 million hectares of inland forests have been badly affected at different levels. In many forest areas repeatedly sprayed, forest ecosystems had been completely destroyed. More than 35 years have elapsed since AO was introduced in Vietnam, but no signs have indicated that indigenous forests trees are regrowing naturally. To this day, trace of dioxin can still be found in the soil of most intensively affected areas. These Dioxin contaminations are being heavily affected on the environment, on the life and on the development of the inhabitant of the sites. The rehabilitation of forests badly affected by toxic chemicals is an urgent and difficult task and a costly and resource consuming process. Till now, the Vietnamese people have made some progress in restoring the environmental damage from the war. But much more remains to be done and available resources are very limited.

Introduction

The concept of "ecocide" was a product of the American War in Vietnam. In addition to the human suffering it inflicted, the U.S military attacks on the environment, plants, animals, and their habitats which were conducted on a massive scale for many years, was highly and led to the destruction of entire ecosystem in large areas of Vietnam. Among the means employed were high-explosive munitions, napalm, landmines, mechanical land clearing and especially chemical herbicides. They all resulted in immediate and long-term impacts on the soils, nutrient balance, hydrological regimes, plants, animals, and perhaps even the climate of Viet Nam and the region.

The most profound ecological impact was on the forest. Before the war, forests in south Vietnam covered an area of about 10.30 million hectares, 60-70% of it in the Central Highlands. During the last war, from 1961 to 1971, over 72 million liters of herbicide were applied over southern Vietnam (Westing 1984⁸, IOM 1994²). However, recent studies reviewing spray records from the war reveal that over 80 million liters of herbicide were used (Stellman *et al.* 2003)³, mostly Agent Orange that contains dioxin compounds (TCDD), a highly toxic substance, were sprayed over 24.67 percent of the total area of Southern Vietnam. Of the amount, 86 percent was directed against forested areas; the remaining 14 percent was directed against agricultural lands, primarily for the destruction of rice production. The chemicals were sprayed from the 17th parallel, south to Cape Ca Mau. Most forest types of southern Vietnam were affected. These chemical herbicide attacks, the most extensive in history, substantially depleted the forests that are so important to the sustainable development of Vietnam.

The serious issue of forest covers deterioration

With a huge volume of highly concentrated toxic chemicals repeatedly sprayed over a long period, which caused the death of trees and animals, pollution to the environment, the disturbance of natural ecosystems leaving behind a highly destructive consequence on forest resources. Immediate and long run consequences of toxic chemicals on forest resources and environment are evident. During the exposure to these substances, leaves of hundreds of species of trees and plants, particularly large woody trees of Dipterocarpaceae and Fabaceae within upper and dominant ecological layers fell. Many of species of good woody trees, such as *Pterocarpus macrocarpus*, *Sindora siamensis*, *Azalia xylocarpa*, *Hopea odorata* died, leading to the scarcity of genetic pool of some precious species. As the result, forest canopies were destroyed, forest environment was rapidly altered, and the most part have become fully occupied by replacement vegetation, such species as bamboo in the secondary forests and fast - growing trees of less

economic values have been appeared and encroached the indigenous species of woody trees. Many of forest areas were heavily destroyed due to large, long and repeated sprays of toxic chemicals in addition to other effects caused by napalm bombs and bulldozers that burned out naturally generative species under forest canopies. When forest trees died, such species of wild weed as *Pennisetum polystachyum* (known now to local people as “American grass”), *Imperata cylindrica*, and reeds have encroached. Available satellite and aerial images took through different periods reveal forests that are being not rehabilitated yet and many of toxic chemical sprayed tracks that are only savanna. Many steep areas have remained bare owing to erosion that led to exposure of the bedrock. Research outcomes identified 3.3 million hectares of natural lands suffered toxic substances and of which about 2 million hectares of inland forests have been badly affected at different levels, causing a loss of more than 100 million cubic meters of timber. 50% of the Northeast (of Mekong) region was fiercely hit. The D and C war bases, the Boi Loi and Cu Chi forests were regions suffering millions of litters of toxic substances sprayed, and millions of tones of bombs, of which numerous forests namely Ma Da of Dong Nai, Phu Binh and Bu Gia Map of Binh Phuoc province were completely destroyed. Toxic chemicals were also sprayed over some focal regions such as the Mc.Namara electronic fence of the Quang Tri province, A Luoi area of the Thua Thien- Hue, Sa Thay of Kon Tum province, Can Gio (Duyen Hai) of Ho Chi Minh City and Ca Mau of Minh Hai province. Other implications caused by the US warfare include damages to the environment and biodiversity. The massive fall of leaves has caused the congestion of nutrients. Ten to fifteen millions of craters making up 1% of the southern forest area have disturbed land surface facilitating soil washed off. This consequence has directly hindered forests from the succession and rehabilitation, and badly affected watershed forests of 28 river basins, including 16 basins with 30% of the total area; 10 basins with 30 - 50%; and two basins with more than 50% of the total area suffering the spray of toxic substances. Most of these rivers are short and run through slope and complicated terrain that directly influence on the downstream areas. Typically, floods fiercely destroyed the Huong, Thach Han, Han, Thu Bon, Tra Khuc, Con, Ve, Cau, Ba River basins and others in the past years.

During the Vietnam War, the inland tropical forests and mangrove forests were specially hid. Many animals, including mammals and birds, were killed directly or indirectly by the herbicides. However, the most serious impact was the destruction of ecosystems, which had provided habitat for many endangered animals that lies closest to extinction in southeast Asia such as Kouprey (*Bos sauveli*), Javan rhinoceros (*Rhinoceros sondaicus*), elephant (*Elephas maximus*), banteng (*Bos javanicus*), gaur (*Bos gaurus*), tiger (*Panthera tigris*), gibbon (*Hylobates concolor*), douc langur (*Pygatrix nemaus*), sarus crane (*Grus antigone*), giant ibis (*Pseudibis gigantea*), white shouldered ibis (*Pseudibis davisoni*), white winged wood duck (*Cairina scutulata*), Edwards’s pheasants (*Lophura edwardsi*), Imperial pheasant (*L. imperialis*), crested argus (*Rheinartia ocellata*), and crocodile (*Crocodilus siamensis*)... Most of them become rare and some are now in the danger of extinction. In many forest areas repeatedly sprayed, forest ecosystems had been completely destroyed. More than 35 years have elapsed since Agent Orange was introduced in Vietnam, but no signs have indicated that indigenous forests trees are regrowing naturally. The areas are still covered by wild weeds as many years ago. Fauna is very poor and different from the original. The loss of significant proportion of southern Vietnam’s forest cover triggered a number of related effects. For example loss of timber led to reduce sustainability of ecosystems, decrease in the diversity of plants and animals, poorer soil quality, increase water contamination, heavier flooding and erosion, increase leaching of nutrients and reduction in their availability, invasion of less desirable plant species and possible alteration of both macro- and microclimates. Chemical agents used during the war also had devastating impacts on the agricultural sector, especially rice cultivation, and on fisheries – in the later case, primarily through destruction of vital mangroves.

Some 170 kilograms of dioxin (Westing 1989)⁸, (according to an estimation of Fokin (1983)¹ the quantity of dioxin is 500-600 kg, of Stellman (2003)³ is 386 kg), were dispersed over the landscape, primary in rural South Vietnam. To this day, trace of dioxin can still be found in the soil of most intensively affected areas, for example on the perimeters of some US military bases and at many sites where unintended emergency dumping of Agent Orange occurred. These Dioxin contaminations are being heavily affected on the environment, on the life and on the

development of the inhabitant of the sites. Studies in the vicinity of some “hot spots” such as A So area, one of a former American military base, the Da Nang and Bien Hoa airbases demonstrated that TCDD contamination has spread from soil to humans via the food chain. Possible other modes of ingestion of TCDD include inhalation of dust, skin absorption, and unintentional direct ingestion of soil; in the case of very young children, ingestion may also occur from contaminated objects placed in their mouths (Dwerchuk *et al.* 2002)⁷. Health and Environmental Impacts Mitigation Plan had been organized and implemented into short-term, medium-term and long-term recommendations based on dioxin contamination and other environmental impact finding to date.

Materials, Methods and Discussion

Rehabilitation of forests in Vietnam

The environment of Vietnam is struggling to recover from the effects of these military activities. The rehabilitation of forests badly affected by toxic chemicals is an urgent and difficult task and a costly and resource consuming process. Till now, the Vietnamese people have made some progress in restoring the environmental damage from the war. But much more remains to be done and available resources are very limited. Recognizing that forest loss is the single most serious factor threatening the long-term productivity of the country's natural resources, we have begun a great planting program in order to regreen our war-scarred land and correct the mistakes of rapid development. The aim is to reforest 40-50% of the countryside by the 21st century. In this way, we hope to re-establish the ecological balance in Vietnam, to preserve biodiversity, and to do our part in delaying global warming. To grow one or two trees is very easy, but to plant hundreds of thousands of hectares of forests is not simple, especially under conditions in which the soil is leached and compacted, and the once cool, moist and fertile climate is now dry and blazing. We hope to realize this goal in many ways. Firstly, to achieve success we must have the support of the local people. To facilitate this, we have been promoting public awareness and agro-forestry training in local villages and schools. We are trying to make restoration of degraded land areas a high national priority. Large areas must be reforested. The hill-dwelling people must be helped in adopting more resource-efficient, environmentally-friendly technologies, so that they can use natural resources rationally and sustainably. Forest rehabilitation that ensures the survival of the peasants is desperately needed in many rural regions of Vietnam damaged by toxic chemicals. We are trying to promote sustainable rural development with the involvement of the population. Our vision is now very clear: “to eradicate poverty and lift the people's living standards, Vietnam must grow, industrialize and modernize, but economic, social and environmental needs should be addressed in an integrated manner to be sustainable in the long-term”⁴. Thanks to recent plantation efforts, the forest cover within Vietnam has been increasing every year, and has reached 37.5% of natural land of the country. Many years ago, reforestation in Vietnam was based on monocultural timber production and there were few convincing examples of successful large scale and long-term tree monoculture. Today, we are developing a village-level process, in which local people are producing large numbers of indigenous tree seedlings. These seedlings will be planted in villages and surrounding areas and will also be used for reforestation projects. After the war, Vietnamese scientists attempted to replant several species of indigenous trees in areas that had been destroyed during the massive defoliant raids of the war. These initial trials failed, largely because the young saplings burnt in grass fires that were ignited by the intense tropical sun during the dry season. But we have now successfully replanted thousands of hectares of tropical forests. To protect the seedlings from the burning rays of the tropical sun, scientists have established a forest cover of fast-growing trees. When these trees gain sufficient height, which take about three years, they plant several species of forest trees underneath them.

According to planting experiences from Ma Da Forest Farm, people in many regions are cutting and burning pernicious grass in areas affected by Agent Orange during the war, then planting fast-growing shade trees such as *Acacia*. After three or four years, the seedlings of native forest trees, such as Dipterocarp species, are planted underneath them. It is with hope that, in the future, good tropical forests and beautiful fauna will replace the areas destroyed by Agent Orange, and the Vietnamese people will be able to erase the scar of the devastating war and to correct the mistake of unsustainable development.⁵ Of all the forests that were damaged during the war, the mangrove and *Melaleuca* forests in the Mekong Delta were, perhaps, the most seriously damaged. They were repeatedly sprayed with Agent Orange herbicide and proved particularly susceptible to its effects. Defoliant

eliminated approximately 50% of the country's mangrove forests. As a result, the fisheries and shrimp catches crashed. After the war, the Vietnamese launched a program to replant the mangrove forests in the areas destroyed by herbicides. Large areas were replanted with *Rhizophora apicauca* seedlings. Today, some 70,000 hectares of mangrove forests have been successfully replanted. The mangroves now yield a self-sustaining and profit-making source for fuel and construction wood for the residents of this area. As a result of reforestation, the fisheries are more plenty and the shrimp catch is rising each year. The colonies of wetland birds that had completely disappeared during the war have returned. Over seven major birds colonies are now protected by reserves, new colonies are appearing, and the bird populations are building up to their old levels again. *Melaleuca* forest is a unique type of flooded forest in the Mekong Delta. It once covered an area of 250,000 hectares in low-lying, seasonally inundated areas. But, since the war, only some 116,000 hectares remain. When the war ended, local people made tremendous efforts to restore agriculture on the Plain of Reeds. To dilute the acidity of the soil, they dug more canals to bring in fresh water. However, in most places, the progress was too slow to check the continued denuding of the area. In time, the people came to realize that in order to make the Plain prosper again, the soil had to be well-watered in the dry season and covered with *Melaleuca*, as it once had been. Since then, the local people have built dikes to prevent the Plain water from draining into the canals during the dry season. They have also planted *Melaleuca* on thousands of hectares of acidic soil, since it is the only tree species that can thrive in such conditions.⁶ Now that the wetland habitat of this area has been restored, the natural plants and animals are gradually returning to the Plain. Aside from fresh water fish, which are a source of food for local people, turtles, snakes, and several birds have returned in surprising numbers, including rare species such as the Sarus Crane, Painted Stork, and Adjutant. In early 1986, with the help of researchers from Hanoi University, the people of Tam Nong District delegated 9,000 hectares for Tram Chim Reserve for Cranes, where they hope that the cranes breed once again. There are about 1,000 cranes in Tram Chim today, and many other species of birds have also returned.

There is a Vietnamese saying: "Birds only stay in good lands". Apparently, the restoration efforts of the people in the Plain of Reeds and Tam Nong District have begun to pay off. The Crane is a symbol of happiness and longevity, and its stylized image can be found in most temples within Vietnam. The cranes have finally returned to Vietnam, the beautiful land of peace where they are welcomed by people who appreciate their beauty and benefit from their presence.

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