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**Before the
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**For the hearing on “Agent Orange: What Efforts Are Being Made To Address The
Continuing Impact Of Dioxin In Vietnam?”**

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Mr. Chairman, and Members of the Subcommittee,
Ladies and Gentlemen.

First of all, I would like to express my sincere thanks to Chairman Faleomavaega and the Subcommittee for organizing this hearing on: “Agent Orange: What Efforts Are Being Made To Address The Continuing Impact Of Dioxin In Vietnam?” I am pleased to have this opportunity to discuss the the Impact of Agent Orange/Dioxin on the Environment in Vietnam. This issue has been with us – the Vietnamese – for a long time without a comprehensive solution.

I submit this statement in my capacity as a zoologist, ecologist and environmentalist working at the university of Hanoi. For 40 years I have the opportunity to work on the issue of the effects of US toxic chemicals sprayed in the South of Vietnam during the period 1971-2008. Several years before 1970, I have got information from outside that in the south of Vietnam, some kind of herbicides, which are the same kind that are used by farmers against weeds, had been used by the US Army to make the forest defoliated but are not harmful to the ecosystem, to animals or the soil and to humans. But the information from the south of Vietnam at that time is very different: large forest areas had been destroyed, animals had been killed, and the herbicides sprayed were severely harmful to human. During the war, in 1971 and then in 1974 I was sent to the South of Vietnam as a leader of a group of Vietnamese scientists to testify the events.

Our first field surveys were undertaken in 1971 in Vinh Linh of Quang Tri province, north of 17th parallel, and then in 1974, along the Ho Chi Minh Trail, from Quang Tri to Dac Lak for three months. After the war, from 1976 to 2007, our surveys were also conducted in many places in southern Viet Nam, which were severely affected by toxic chemicals. A comparative study was also applied to sprayed and non-sprayed areas by time and space in order to determine the extent of impact of toxic chemicals used on the forest, fauna, flora, soil, water and humans. The war ended over 30 years ago, but in Vietnam there remain many large areas affected by toxic chemicals, which have seen no

economic activity by human so far. This give us the opportunity to observe, do research and correctly evaluate the long-term effect of toxic chemicals/dioxin and other military activities on the environment, forest ecosystems and the life of people in these areas.

I would like to take this opportunity, to express my sincere thanks to many reputed American scientists, such as Arthur W. Galston, E. W. Pfeiffer, Arthur Westing, Arnold Schechter, J. D. Constable and others for their kind and long support, encouragement and help.

The impacts of toxic chemicals during the last war in Vietnam on the environment

Wartime destruction of the natural landscape is nothing new, but the scope of destruction of nature in the Vietnam War is unprecedented in the human history. The damage to the environment was so intense and widespread that it has given rise to the term "ecocide". The attacks on the environment by the US military on a massive scale for many years, were highly systematic and led to the destruction of many ecosystems in large areas of Vietnam. Among the means employed were high-explosive (munitions, napalms, landmines), large-sized bulldozers, and especially toxic chemical herbicides. They all resulted not only in serious health effects, but had an immediate and long-term impacts on the soil, nutrient balance, hydrological regimes, plants, animals, and perhaps even the climate of Vietnam and the region. Nearly four decades later, many of the affected ecosystems have not yet recovered. The long-term consequences include loss of ecosystems and biological diversity, economic stagnation, severe constraints on human development, poverty, malnutrition, disease and other socioeconomic problems. World Bank 1995 mentioned: "*Environmental damage was an important tactic as well as a repercussion of the Second Indochina War of 1961 to 1975. The strategy involved in destruction of natural resource base essential to agrarian society. The theatre of these operations was mainly southern Viet Nam. The result was not only heavy direct casualties and continuing medical complications, but also the widespread disruption and degradation of productive ecosystems*".

The most destructive ecological impact was found on the forest. Before the Vietnam war, forests in southern Vietnam covered an area of about 10.30 million hectares. During the last war, from 1961 to 1971, over 77 million liters of toxic chemicals were used (Stellman et al. 2003), mostly Agent Orange, that contains dioxin compounds (TCDD), a highly toxic substance. Agent Orange-contaminated area make up over 24 percent of the land area of southern Vietnam (FIPI 2007); 86 percent of the amount of toxic chemicals was directed against forested areas; the remaining 14 percent was directed against agricultural lands, primarily rice production. The US attacks affected more than 2 million hectares of forests. The extent of the toxic chemicals' impact varied, but ultimately resulted in the destruction of more than 150,000 hectares of mangroves, about 130,000 hectares of *Melaleuca* forest in the Mekong Delta, and many hundreds of thousands of hectares of inland dense jungle. K. Graham, a US journalist and writer,

mentioned: "No war wreaked environmental damage quite like the Vietnam War that was fought in the rain forests of Southeast Asia. Bombs incinerated trees and fouled waterways. Herbicides killed forests. Other forms of war machinery inflicted still more harm to ecosystems while searching out their human prey" .

The toxic chemicals were sprayed from the 17th parallel, south to Cape Ca Mau. Many types of forest and natural resources in southern Vietnam were affected. This chemical war, the most extensive in history, substantially depleted the forests that are so important to the sustainable development of Vietnam.

The seriousness of forest deterioration

A huge volume of highly-concentrated toxic chemicals was repeatedly sprayed over a vast area during a long period in southern Vietnam. Approximately 34% of the target areas sprayed more than one time and some areas, especially upland forests, were sprayed up to four times. It killed trees and animals, caused pollution to the environment and disturbance of natural ecosystems. It has left behind highly-depleted forest resources. The herbicides sprayed with high concentration have not only destroyed the nutritious composition, making the soil poor and degraded, and it can be said that the areas sprayed with toxic herbicides, under the monsoon tropical conditions like in the Centre and South of Viet Nam, then, the forests are difficult to be rehabilitated naturally. The US toxic chemicals have changed the ecological system on a large areas leading to serious degradation, turning abundance ecological system into a degraded and ragged one, and finally seriously affecting on human being. During exposure to the toxic substances, leaves of hundreds of species of trees fell, particularly large forest woody trees died, leading to a scarcity of the genetic pool of some precious species. As the consequence, forest canopies were destroyed, the forest environment rapidly deteriorated.

Sprayed continually with toxic chemicals, very large forest areas have been completely destroyed (more than hundreds of square kilometers per site), and ecological conditions have changed. Since the forest cover is no more, surface soil is subject to erosion by heavy rain. Favorable conditions for the growth of forest trees, in terms of soil humidity, light, and temperature, are no longer available. Forest tree saplings cannot grow

normally, and it is too difficult for seedlings and seeds to be transferred here from neighboring forests. Besides, once weeds invade the areas, forest fires may occur during the dry season, making it very difficult for forest trees to generate naturally.

Many forest areas were heavily destroyed due to large, lengthy and repeated spraying of toxic chemicals in addition to other effects caused by bulldozers and napalm bombs that burnt out and killed naturally generative species under forest canopies. When forest trees died, species of wild weed such as *Pennisetum polystachyum* (known now to local people as "American grass", *Imperata cylindrica*, and reeds reappeared (Vo Quy 1983). Satellite and aerial images taken from different periods reveal that forests that have not yet rehabilitated, that many of the sprayed tracks have become savanna, and that many steep areas remain bare due to erosion.

Research outcomes have identified more than 3.3 million hectares of natural lands affected by toxic chemicals; of which about 2 million hectares of inland forests have been badly affected to different extents, causing a loss of more than 100 million cubic meters of timber. Many large areas affected by herbicides had remained unsuitable for cultivation or livestock breeding 30 years later.

We can say that Agent Orange, as the main component of the toxic chemicals used by US army during the war in Vietnam, has reversed the natural conditions and turned rich forest ecosystems with high biodiversity into exhausted ones. Favorable habitats for many specific animals of rain forests, especially for large endemic species of Vietnam, have been lost.

Other implications caused by the US chemical warfare include damages to the environment and biodiversity. The massive fall of leaves causes congestion of nutrients. Ten to fifteen millions bomb craters making up 1% of the forest area in South Vietnam have disturbed the land surface, causing soil to be washed off. This consequence has directly hindered forests from the successful rehabilitation. The destruction of forests by toxic chemicals badly affected 28 river basins in the Centre of Vietnam: destroyed forest make up 30% of the total area in 16 basins; 30 - 50% in 10 basins, and more than 50% in two basins. Most of these rivers are short and run through complicated terrains, which directly influence lower sections. Over the past years, floods have destroyed the

Huong, Thach Han, Han, Thu Bon, Tra Khuc, Con, Ve, Cau, and Ba River basins, leading to great human and material losses.

During the Vietnam War, the inland rain forests and mangrove forests were seriously hid. Many animals, including mammals and birds, were killed directly by the toxic chemicals. However, the most serious impact has been the destruction of the ecosystems, which provided habitats for many endemic animal species in Southeast Asia. Most of them have become rare and some are now in danger of extinction (Vo Quy 1983).

Some 366 kilograms of dioxin (Stellman 2003) were sprayed over the landscape, mainly in rural South Vietnam. Even today, the concentration of dioxin is still at a very high level in the soil of most extensively affected areas - about 25 "hotspots" - , such as in some of the former US military bases, and in some places where unintended emergency dumping of Agent Orange occurred. Dioxin contamination is heavily affecting the local environment and inhabitants. Studies in some "hot spots" such as A So area (Thua Thien-Hue), and the Da Nang, and Bien Hoa airbases show that dioxin contamination continue to contaminate people living in the area. The dioxin has passes from the soil to humans via the food chain. Other possible modes of ingestion of dioxin include dust inhalation, absorption through skin, and unintentional direct ingestion of dioxin-contaminated objects by small children (Dwerchuk *et al.* 2002).

We can say that **War does not end** when the bombs have stopped falling and the fighting has finished. Its devastating aftermath continues long after, on the land and in the minds and bodies of people. Over three decades have passed since the ending of the Vietnam War, but many dioxin-sprayed areas continue to deteriorate, and the people in these areas are still suffering. In some areas, without forests, the traditional culture of minority group falls into oblivion.

Forests need to be replanted

In order to regenerate the forest cover in the large areas destroyed by toxic chemicals, it is necessary to reforest because we cannot expect a natural evolution of the affected forests, and we do not know how long it will take. The rehabilitation of forests destroyed by toxic chemicals is an urgent and difficult task and a costly and resource-consuming process. Realizing that forest loss is the most serious factor threatening the long-term productivity of the country's natural resources, we have begun a large-scale planting program in order to regreen our war-scarred land and also correct the mistakes of

rapid development, and to prevent the impact of climate change. The aim is to reforest 40-50% of the country's area in the 21st century. By doing so, we hope to reestablish the ecological balance in Vietnam, to preserve its biodiversity, to do our part in delaying global warming, and most importantly, to reduce the hard and miserable life that the inhabitants of the area has been suffering.

To grow one or two trees is very easy, but to plant thousands of hectares of forests is not simple, especially given the fact that the soil has become far less fertile. After the war, Vietnamese scientists attempted to replant several species of indigenous trees in the areas that had been destroyed by the US's massive toxic chemicals raids. However, their trials failed, largely because the young saplings were killed in forest fires ignited by the intense tropical sunlight during the dry season. Nowadays, we have successfully planted thousands of hectares of rain forests. To protect seedlings from the burning tropical sunlight, Vietnamese scientists have established a forest cover of fast-growing trees. When these trees gain a sufficient height - which takes about three years - we plant several indigenous species of forest trees beneath them.

Nowadays, we have made some effort to re-green the Agent Orange/dioxin ravaged areas, but much more remains to be done, and our available resources are very limited. Follow one of five priority areas identified by the US-Vietnam Dialogue Group on Agent Orange/Dioxin: *Restoring landscape and other aspects of the environment affected by the wartime use of Agent Orange*, in order to improve the quality of the restoration of damaged areas, to overcome the gap in knowledge of local inhabitants, and other possible sources of failure, capacity building initiatives are needed. Priorities include organizing training courses to equip the managers, technical staffs and key farmers in areas affected with the understanding of the effects of toxic chemicals on their environment and their lives; and to provide them the knowledge, skills, and techniques needed for the rehabilitation of degraded lands and therefore to improve their livelihood, to develop a mechanism and network of managers and practitioners of sustainable utilization of natural resources in order to rehabilitate the degraded lands.

In 2008, with the financial support of the Ford Foundation, a project "*Training of trainers in habitat restoration and reutilization of forest areas and other lands damaged by herbicides during the war*" had been developed in one target province, Quang Tri Province, in the centre of Vietnam with the participation of totally 183 persons, among them there are 92 managers and technical staffs and 91 farmers from 7 districts of the province. Awareness of participants for three target groups have been raised significantly. Many participating farmers begin to apply the knowledge obtained from the course into their production and have commitment to share their experience with other farmers. Many other provinces heavily affected by toxic chemicals ask us to organize the same training courses for them and help them to recover the ravaged areas by war.

Conclusion

Alteration of the earth's ecosphere is part of an ongoing process that is increasingly influenced by human activities, of which warfare is among the most destructive. Its negative impact is reflected at virtually all levels of evolution – from simple one-celled organisms to plants and human beings. However, the chemical war conducted by the US

in the South of Vietnam has been the worst yet of all of its kind, and its impact on the environment and human beings is unprecedented in history of humankind. Its tragic consequences persist even today and will continue for generations to come, and the poor, who depend most directly on natural resources, suffer the most from it.

Restoration of the war-ravaged environment is a matter of particular urgency, since well-functioning ecosystems are essential to human health and the reduction of poverty, and Dioxin contaminated “hot spots” need to be cleaned up. The government and people of Vietnam have undertaken a number of activities to overcome the consequences of Agent Orange. However, the efforts made can only meet part of the huge and complicated demands raised by the toxic chemical/dioxin related consequences in Vietnam. In recent years, US government and some NGOs from US, such as For Foundation, Vietnam Veteran American Fund (VVAF) and some American friends have supported Vietnam in research and in overcoming the consequences of Agent Orange/dioxin. The Vietnamese side has highly appreciated these willingness and activities.

There is also a need for research in a number of areas to provide a solid basis for sustainable development. We are trying our best to recover the scar of the war, but, due to our limited resources, we can not fully meet their needs, much as we hope to.

I hope that this hearing on Agent Orange issue convened by the Subcommittee on Asia, the Pacific and Global Environment will provide the US Congress and the US public with a better understanding of the severity of damage of the toxic chemical used by US Army during the war in Vietnam on the environment and the entire Vietnamese people, and call upon their responsibility and humanity to help Vietnamese people to recover the scar of this tragedy of a ravaged war, in order to drive away the “Last Ghost of War” within our two countries: United States and Vietnam. Some good seeds had been sowed and are growing well, but a huge garden is waiting for our further work.

Thank you for giving me the opportunity to appear before all of you today.

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