



Agent Orange

*On the Consequences of the Use of Herbicides during
the Vietnam War for International Warfare Conventions
and the Role it Played for Subsequent International
Humanitarian and Environmental Law*

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1. Introduction

The practice of destroying or disrupting the enemy's supply chain or anything else that is useful to them is probably as old as warfare itself. Throughout the twentieth century such 'scorched earth' tactics were common practice and widely used. The intervention of the United States (US) in the Vietnamese Civil War in the 1960s meant the start of a new chapter of the history of this military strategy: herbicidal warfare (Westing, 2011).

US troops used 'Agent Orange', a chemical herbicide, to defoliate wide arrays of jungle and destroy crops and networks used by the Vietcong to supply their troops with food and weapons. After the US withdrew their forces from the conflict, the United Nations held several conventions to ban the use of chemical and biological weapons (Zierler, 2011). Although herbicides had been used before by Great Britain during the 'Malayan Emergency', the use of Agent Orange during the Vietnam War led to an ongoing discussion about whether the herbicide was a chemical weapon and whether such agents should be allowed to be used militarily or not. This modern technology seemed to make it possible to undermine a country's ecological means of shelter and subsistence without actively harming its human life. However, other incidents and later reports gave rise to a growing perception that interference with the natural environment may have far-reaching consequences for human life in any affected region (Hanson et al., 2009).

Now, more than four decades later, Agent Orange is no longer in use, but other herbicides have taken its place. This is most famously and recently exemplified by the support of the USA to the Colombian government in its 'War on Drugs' by destroying the coca fields and plantations where the natural resources for the production of cocaine were harvested. This was mainly implemented through the use of air fumigation techniques covering a large array of jungle area. However, studies show that other plants are equally vulnerable to these herbicides as coca plants, with the result that along with the illegal plantations, many local ecosystems are being disrupted by these herbicides as well (Smith et al., 2014).

Since the 1950s, more than 80% of armed conflicts have taken place in biodiversity hot-spots in the southern hemisphere. Biodiversity hot-spots are sites with an extraordinary broad genetic, species, and/or ecosystem diversity (Hanson et

al., 2009). If the use of herbicides will remain common practice in human conflicts, uncountable species of plants and animals and their ecosystems will be endangered, with eventual health-related consequences for humans as well. Besides health risks caused by the herbicide itself, such consequences may include the displacement of local communities, the destruction of arable land, and the death of local flora and fauna.

Accordingly, the concept of 'ecocide' or 'ecological genocide' – referring to any extensive damage or destruction of the natural landscape and disruption or loss of ecosystem(s) in a given territory to such an extent that the survival of the inhabitants of that territory is endangered – has not only stimulated debates at international conventions on nuclear, biological, and chemical warfare, but also stimulated the set-up of more extensive environmental protection efforts (Uesugi, 2013; Zierler 2011).

This bachelor's thesis addresses the consequences of the use of herbicides during the Vietnam War for international warfare conventions and focuses on its role in subsequent international humanitarian and environmental legislation. The main research question is: *What were the consequences of the use of herbicides during the Vietnam War for international warfare conventions and what was its role in subsequent international humanitarian and environmental legislation?* In order to be able to analyze this phenomenon and its causes and effects, two sub-questions will be asked:

(1) What led to the use of Agent Orange during the Vietnam War and how was its use justified by the American war machine?

(2) What were the effects of Agent Orange during the Vietnam War and what effects did its use have on the world stage after the war?

The intricacies of both the (geo-) political history of the use of herbicides in warfare and the impact of various herbicides on diverse environments necessitate an interdisciplinary approach. Only looking at the big picture from different perspectives will enable us to thoroughly understand the full effects of the use of herbicides during the Vietnam War and the consequences it had on international humanitarian and environmental lawmaking after the war. Research on the use of herbicides during the Vietnam War is a socio-political enterprise that encompasses international relations

as well as local human and environmental causes and consequences. As both the study of history and environmental studies emphasize the societal and political aspects of any subject of interest, these two fields of study are integral to an analysis of the effects of international warfare conventions on humanitarian and environmental lawmaking. It is especially essential to factor in all the different facets of the project, something that may be accomplished by the combination of historical and environmental studies.

Thus, historical research can lay the foundation of a broad, objective context and analyze the possible causes and effects of the use of Agent Orange and herbicides during the Vietnam War. Using his structural method, the historian is able to hermeneutically explore the positivist aspects of the war without losing sight of the grander total. It should be noted, however, that the study of history is not usually focused on direct problem-solving; it rather uses hindsight for broad-stroke sketches of possible future scenarios – provided that it is willing to offer any solutions at all.

Likewise, it is necessary to incorporate the field of environmental studies into the project. This field is concerned with the relations and interactions between human and natural systems. It draws knowledge from a wide field of other disciplines – such as politics and administrative sciences, law, geography, sociology, economy, biology, chemistry, and others – to understand these dynamic processes between inter-related systems. In this specific case, the field of environmental studies may provide insights on both the effects of herbicidal warfare on the natural environment and the subsequent reactions from different international stakeholders. By working on the broad-stroke foundation offered by the historian, the environmental scientist may finish off the big picture of the use of herbicides and chemicals in warfare.

The following section will cover the insights of the two disciplines concerning the issue of the use of herbicides during the Vietnam War, including the necessary context from the time before the conflict and the following consequences after it. After that, the findings of the two disciplines will be integrated firstly by creating *common ground*, thus, searching for parallels and differences of the applied concepts, theories and insights; and secondly by creating a *more comprehensive understanding*, thus, drawing a bigger picture of the studied case and answering the main research question. Finally, there will be a conclusion summarizing and evaluating the findings of this bachelor thesis.

2. Disciplinary Part

2.1 History

Different forms of weapons and warfare have been in use throughout history for as long as humans have been able to wield weapons. From poisoned spears, arrows, and darts used by many indigenous peoples to the horrendous chlorine, phosgene, and mustard gas used in the First World War, people have been resourceful in finding various methods of efficiently destroying their opponent. There seems to be a human knack for wanting to increase efficiency and effectiveness of any human technology, and technology made with warfare purposes in mind are no exception. Wanton death and destruction has only increased with the growth of total warfare, wherein civilian populations were no longer necessarily regarded as off-limits.

With the rise of the human rights movement and the realization that certain weapons should be prohibited for even the utmost of circumstances, international conventions have been set up to suppress the use of nuclear, biological, and chemical weapons and warfare (NBC). Quite probably the most famous of these humanitarian warfare conventions is the Geneva Gas Protocol. The protocol for the 'Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare' was signed on the 17th of June 1925 and is a thorough restriction of any and all biological and chemical weapons (Geneva Protocol, 1925).

Herbicide warfare is an interesting distinction from this NBC denomination in that it was not included in the Geneva Protocol of 1925 and has subsequently been available for use in many parts of the twentieth century ('Practice Relating to Rule 76. Herbicides, 2014). Research surrounding herbicide warfare started in England during the start of the Second World War when the plant growth regulators, which allowed armies to target plant life specifically, were discovered, thus explaining why herbicide warfare was not included in the Geneva Protocol. It was only after the Vietnam War that the Environmental Modification Convention was signed, restricting the use of "any technique for changing the composition or structure of the Earth's biota" ('Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques', 2014). Meetings surrounding this convention happened

almost immediately after the Vietnam War, spurring one to think that the war had a significant effect on the possible geopolitical and humanitarian ramifications of herbicidal warfare.

The Vietnam War is infamous for multiple reasons, one of them being Agent Orange, the herbicide used in the American Operation 'Ranch Hand' to destroy the cover and food supplies the Viet Cong in hiding had throughout South Vietnam. Although several differently colored herbicides were used (such as Agent White, Agent Pink, etc.), Agent Orange gained notoriety through being used most regularly.

In this section of the study, the use of herbicides during the Vietnam War will be explored. Specifically, the question as to why the use of herbicides in the Vietnam War was justified for the United States government. In order to answer this question a two-pronged historical analysis will be conducted. First of all, the influence of the Geneva Gas Protocol on herbicidal warfare as well as its usage throughout the twentieth century will be studied. A small focal point of this study will be the Malayan Emergency, a guerrilla war between the British Commonwealth and what would later be known as Malaysia, as the use of herbicides during that period was instrumental in permitting the United States government to utilize herbicides as well. Secondly, the Vietnam War and the use of Agent Orange during the war in particular will be scrutinized. Summarily we can surmise the justifications of the American use of herbicidal warfare during the Vietnam War and compare those to international standards. This part of the research will not look at the specifics of Agent Orange and its effects on both the environment as well as the human effects, but rather at the political history of herbicidal warfare and the international treaties surrounding this type of warfare specifically. Primary sources will be used to attempt to look at the goings-on of the international community and secondary sources will be used to lend support for any claims made.

2.1.1 The Years Preluding the Vietnam War

Even though there were already talks of banning chemical weapons, its use was widespread during the First World War. Irritants such as tear gas and chemical weaponry such as mustard gas and chlorine gas amongst others had left their gruesome marks on an entire generation of men. Those not directly affected by the gases had seen the damage the chemicals could do, or heard the screams of the

dying on the battlefields. The aftermath of the Great War led to several important changes regarding international conflicts and warfare as many states became opposed to the use of such horrible weapons, if they were not already against its usage before the war.

The Geneva Gas Protocol

One of the important decisions made by the international community after the First World War was the 'Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or other Gases, and of Bacteriological Methods of Warfare', or simply the 'Geneva Gas Protocol'. Signed in Geneva in June of 1925 and put into effect in February of 1928, this treaty prohibits the use of "*asphyxiating, poisonous or other gases, and of all analogous liquids materials or devices*" as it "*has been justly condemned by the general opinion of the civilized world*" (Geneva Protocol, 1925). This treaty was initially signed by 38 parties participating in the discussions and has since been signed by another hundred parties. The Geneva Gas Protocol has been seen as a thorough and decisive treaty regarding the use of chemical and biological weapons during warfare.

Whilst the Geneva Gas Protocol prohibits the use of all chemical and biological weapons, it does not prohibit the production, acquisition, and storage of these weapons (Baxter & Buergenthal, 1970). Together with this, the creation of equipment used to spread or disperse the banned chemical and biological weapons was also left unrestricted. However, the biggest question left in the treaty was if the use of irritants such as tear gas or anti-plant chemicals was still allowed (Baxter & Buergenthal, 1970). This question was left open for many years before a satisfying answer could be found. The biggest argument against the view that herbicides are part of the chemical and biological weapons meant by the creators of the Geneva Gas Protocol is that the creators could not possibly have meant to include herbicides as these had not been created or discovered at the time (Baxter & Buergenthal, 1970). However, one can assume that had these been around at the time of the creation of the Geneva Gas Protocol, they would have been included, as a comprehensive treaty regarding chemical and biological weapons affecting humans on a broad scale was intended. A broad scale could easily include plants and animal life as well, as these are vital for many areas of human life, such as agriculture.

Interestingly enough, the United States did not sign the Geneva Gas Protocol until after the Vietnam War. Although the American representative signed the treaty in Geneva, the American Senate was not able to consent to the terms of the treaty and eventually the American signature for the treaty was dissolved (Baxter & Buerghenthal, 1970).

The Malayan Emergency

In the years after the Geneva Gas Protocol was signed, the production and storage of chemical and biological weaponry continued unabated in the international community. This was in part due to the treaty not specifying the prohibition of the production and storage of those weapons, just their use. It was during this period that research in herbicides took off. Mainly the research of the United Kingdom and the United States during the Second World War regarding their use as potential biological weapons helped shape the groundwork of herbicidal warfare (Cobb & Reade, 2011). The British government was able to test the potential of their research of herbicides for the first time during the Malayan Emergency. The Malayan Emergency was a conflict between the British Commonwealth and the Malayan National Liberation Army fought between June of 1948 and July of 1960. In very broad strokes: after Japan withdrew from the British-colonized Malaya (later to be known as Malaysia) the Malayan economy was in disrepair, which affected the British economy as well. To bring the economy back up to speed, the British forces in Malaya forced new regulations and lashed out against any potential protesters. This increased negativity for the British Commonwealth occupying the already disheveled state and on the 16th of June in 1948 the Malayan National Liberation Army (MNLA), an offshoot of the Malayan Communist Party, started the guerrilla war offensive.

Due to the nature of the area in Malaysia – thick, vast jungles containing small winding roads with limited visibility – ambushes by the MNLA were common. Therefore, the Commonwealth decided to make use of their research about herbicides to clear jungle area surrounding potentially important roads and passageways in their campaign, as well as destroying the crops of food grown by the MNLA forces (Cumings, 1998).

Although a sizeable portion of the international community was against the use of herbicides and interpreted the Geneva Gas Protocol as including their ban in the

treaty, Great Britain was not convinced. In December of 1969, a number of years after the Malayan Emergency, the United Nations General Assembly was debating the exact stipulation of the Geneva Gas Protocol regarding herbicides. Concerning an upcoming resolution regarding the matter the United Kingdom stated:

“The evidence seems to us to be notably inadequate for the assertion that the use in war of chemical substances specifically toxic to plants is prohibited by international law” ('Statement before the First Committee of the UN General Assembly, UN Doc. A/C.1/PV.1717', 1969).

Their stance on this subject remained unchanged for years after their use of herbicides during the Malayan Emergency, perhaps exactly because the outcome of that conflict was in the Commonwealth's favor. The successful use of herbicidal weaponry during the Malayan Emergency - together with their unwavering support of its use – helped pave the way for the United States' use of Agent Orange in the Vietnam War (Cumings, 1998; Perera & Thomas, 1985).

The position of the United Kingdom on herbicides, combined with the position of the United States regarding their use of Agent Orange during the Vietnam War, caused the General Assembly to stipulate their position regarding the question if herbicides were included in the Geneva Gas Protocol:

“Any chemical agents of warfare – chemical substances, whether gaseous, liquid, or solid – which might be employed because of their direct toxic effects on man, animals or plants;...” (Baxter & Buergenthal, 1970, p. 865).

The Commonwealth remained unconvinced even after the so-called Resolution 2306A was signed into agreement on the 16th of December 1969 by a majority of the votes. One could argue that seeing the date of the assembly, namely in the year 1969, the resolution seems to be more in line with keeping the United States' use of herbicides in check, specifically concerning Agent Orange. However, the United Kingdom's stance on the matter nine years after Malayan Emergency is telling on their viewpoints regarding herbicidal warfare. Besides, Agent Orange was one of the herbicides used in the Malayan Emergency as well, possibly connecting any

allegations against the United States' use of the herbicides with the Commonwealth's earlier use. In any case, the large number of votes supporting the resolution can be seen as an indication of the position a large portion of the international community held regarding herbicidal agents, and perhaps Agent Orange used in Malaya and later in Vietnam specifically.

2.1.2 During the Vietnam War

Before the Vietnam War not very many people had heard of the country. The war was a Cold War-era conflict between the American-backed South Vietnamese and the communist-backed North Vietnamese armies. As part of the Truman Doctrine, the United States argued that any potential bastion of capitalism and democracy, especially so close to communist Russia and China, should be protected when at risk. The prevailing theory was dubbed the 'Domino Theory' in that it predicted that the fall of one state to communist forces could start a chain reaction of other democratic states falling, hence why the Americans felt it necessary to protect a state with arguably little strategic value. They thought that the collapse of South Vietnam would mean the loss of the entirety of Southeast Asia to communism (Tucker, 1997,). Whilst the North Vietnamese army was attacking from the North, a group of South Vietnamese communist rebels known as the National Liberation Front – or Viet Cong by the Americans – attacked South Vietnam from inside the South Vietnamese jungle. Due to the nature of the jungle, as well as the two-pronged assault, the American army had to split their resources into combating two different enemies in different circumstances.

American Use of Herbicides

The Viet Cong were especially hard to deal with. American soldiers would often go weeks without spotting a soul, only to be ambushed by near-invisible attackers. Kilometers of underground tunnels and networks had been dug out by the Viet Cong, and it was impossible to tell apart a Viet Cong combatant apart from a civilian citizen. To make their guerrilla war against the hit-and-run tactics of the Viet Cong more manageable, the United States employed herbicides to destroy large swathes of the jungle the Viet Cong would hide in. On the legal basis that the British had already

employed herbicidal weaponry during the Malayan Emergency, John F. Kennedy authorized Operation 'Ranch Hand' in November of 1961 (Maj. Buckingham Jr., 1983). Like with the use of Agent Orange in the Malayan Emergency before, the aim of the operation was to defoliate jungle areas around any strategic sites such as important roads, villages and military bases (Tucker, 1997). The justification was that this way they could deprive the Viet Cong of potential locations to be used for ambushes. The reasoning used by the United States involved their domestic use of herbicides to control weeds and other unwanted vegetation in their crops and agricultural industries. If they also used it on their own land it should not necessarily constitute a threat. In a General Assembly meeting the United States representative argued that:

“[...] the Protocol does not apply to herbicides, which involve the same chemicals and have the same effects as those used domestically in the United States, the Soviet Union and many other countries to control weeds and other unwanted vegetation” (United Nations General Assembly Statement of U.S. Representative Nabrit, supra note 26, 1969).

However, this reasoning came under fire when the use of herbicides started to extend to the destruction of Vietnamese crops and farmland. As Operation 'Ranch Hand' expanded to that scope, the justification used by the United States to employ herbicides started to crumble. The political rationale used by the American government to justify an exception to the Geneva Gas Protocol deteriorated by the practical military application of herbicides, as the gradual increase of the destruction of the Vietnamese agriculture and land was not part of the justification given to the United Nations by the United States (Bunn, 1969). Interestingly, the Soviet Union is mentioned specifically in the statement made by the United States representative. Perhaps the ongoing Cold War and the political allegations made by the Soviet Union regarding the American research required the American response to address the fact that not only they but the USSR as well used herbicides domestically.

The American Rationale Behind its Use of Herbicides

Like the United Kingdom before it, the United States did not interpret the Geneva Gas Protocol to include a prohibition of herbicides during war. Like the UK they had started testing the potential uses of herbicides during the Second World War, and had plans to use them against the Japanese on 'Operation Downfall' in 1946 if the war had continued. Precedent had been set by the British Commonwealth before them, having used Agent Orange during the Malayan Emergency (Cumings, 1998). Like the British, the US too was not convinced by the passing of Resolution 2306A in 1969 calling for a specification to the Geneva Gas Protocol to include herbicides. Of course this was well into them having already used Agent Orange and other herbicides in the Vietnam War, so the Americans might have chosen to simply stick to their guns. As the UK were able to justify their use of herbicidal weapons to complete strategic objectives such as the clearing of jungle area surrounding important sites, the American government needed to proclaim these same justifications to their use of herbicides as well and hope they would get the same result.

This hubris regarding herbicides is in part permitted due to the position of power the United States have held in the international community since the Second World War. Since the inception of the United Nations, the American government had held a practical view of the organization: it could simultaneously use the UN and its specialized agencies to their fullest extent while using their own US bilateral programs as a supplement to any issue that needed a little extra help (Mazower, 2012). The United States was the largest provider of funds and staff towards the UN and tried to shape its path significantly over the course of the twentieth century. This enabled the state to have a large sway in the political aspect of the international governing body. They could either use the UN to their advantage or discard them when the UN did not support the American plan. As the largest military and economic power in the world, there was little else than some rhetoric that the United States had to be concerned about. Besides, the United Nations was shaping up to be a disjointed organization with several structural failures such as a weak position of the secretary-general, who was supposed to oversee the political process, and an already archaic proceedings guideline which lead to a slower and more unwieldy system (Mazower, 2012). In reality, the United Nations had to acquiesce

halfheartedly to the United States' actions and proclamations as they did not have the power to stand up against them.

Through a combination of earlier use by the British Commonwealth in the Malayan Emergency and their continuing advocacy of its use, as well as becoming an emerging power position in the international community post World War II, the American government was able to justify their use of Agent Orange during the Vietnam War, not just for the strategic defoliation of jungle area, but also for the destruction of the Vietnamese crops and farmland.

2.1.3 After the Vietnam War

New Conventions After the Vietnam War

When questioned about the use of herbicides during the Vietnam War, the United States have maintained that their usage did not violate the Geneva Gas Protocol (Baxter & Buergenthal, 1970). In fact, it would not be until after the Vietnam War was over that the United States started reconsidering their position with regards to the international conventions surrounding herbicidal warfare specifically. The concern surrounding the artificial modification of the environment for strategic purposes became more prominent after the United Nations Conference on the Human Environment in 1972 ('Convention on the Prohibition of Military or any Other Hostile Use of Environmental Modification Techniques', 1976). The notion that states had the responsibility to ensure that their actions did not harm the environment of other states was adopted at this conference. From there the concern snowballed into a greater resolution prohibiting the use of military environmental warfare to protect states' environments and climates, creating the 'Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques' which was ratified and came into force in May of 1978.

In 1998, the 'Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction' was entered into force as well, further condemning the use of herbicides as weapons of environmental warfare ('Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction', 1992). The world was

turning against most non-conventional forms of weaponry and herbicidal warfare was no exception. Over time and due to pressure the United States have amended their stance on the use of herbicides, but that seems to be done mainly to pacify the international outcries they received concerning their use of herbicidal weaponry during the Vietnam War and later uses. In the US Naval Handbook from 2007 it is stated that:

“The United States considers that use of herbicidal agents in wartime is not prohibited by either the 1925 [Geneva] Gas Protocol or the 1993 Chemical Weapons Convention but has formally renounced the first use of herbicides in time of armed conflict except for control of vegetation within U.S. bases and installations or around their immediate defensive perimeters. Use of herbicidal agents during armed conflict requires presidential approval” (United States, 2007).

They still argue that the Geneva Gas Protocol was not conclusive enough to prohibit herbicides, but have agreed – quite possibly due to international pressure – that they will reduce their use of herbicides during times of conflict. This strategy maintains their air of just behavior during the Vietnam War, whilst adding to the international condemnation of the use herbicidal weaponry – plus keeping the options open for potential future use of herbicides. Their justification remains almost unchanged since the Vietnam War where they initially condoned herbicides for the use of the defoliation of strategically important sites. However, even the use of herbicidal weaponry for other uses remains a possibility, having only to need presidential approval first.

2.1.4 Conclusion

The American use of Agent Orange during the Vietnam War has been a divisive topic throughout the years. Their research into herbicides was paralleled only by the United Kingdom, who had set the tone during the Malayan Emergency having used the herbicide effectively. Like the British Commonwealth, they rejected the notion that the use of herbicides was against the Geneva Gas Protocol, enabling them to further

their research and test their new weapons. Combined with the hubris they had in the international community in part due to their position of power, this led to the United States being confident in their justification of the use of Agent Orange in the Vietnam War regardless of the reaction of the international community. They reacted to the international concerns only once the political upheaval became more drastic and even then they halfheartedly agreed to condemn the use of herbicides in war, allowing themselves to still use herbicides when needed to this day. One would imagine the horrific consequences Agent Orange had on the environment and (perhaps more specifically) on human life would stifle further exploration into herbicidal weaponry but this does not seem to be the case.

2.2 Environmental Sciences

This part will contribute to the bachelor thesis by answering the question: *What are the effects of Agent Orange during the Vietnam War and what effects did its use have on the world stage after the war?* To fully answer this question, this part will focus on four areas: (1) The effects of war on the natural environment in general; (2) the use of Agent Orange during the Vietnam War and its consequences for the local population and natural environment; (3) the aftermath of the Vietnam War with an emphasis on the subsequent international warfare conventions and humanitarian law; and (4) the implications of this development for contemporary conflicts. The last section will be followed by a short conclusion summarizing the findings of this part of the bachelor thesis.

2.2.1 The effects of war on the natural environment

The ecological implications of warfare are complex, multi-scaled, and not limited to war zones or the time period of active hostilities. According to Hanson and colleagues (2009) all stages of war (preparation, war, and postwar activities) have wide environmental impacts. When a country is suffering from conflict and political unrest, environmental concerns usually recede and other priorities emerge to ensure the security of human life and capital. This seems to be a logical and understandable reaction, but it only works in the short-term. If the goal is to achieve and maintain security for humans, Westing (2013) argues, we need to strive towards what he calls 'comprehensive human security'. This concept of human security is made up out of two components: environmental security and social security.

Environmental security is made up out of two sub-components: (a) rational resource utilization (processes to maintain or restore optimal resource services and stocks); and (b) environmental protection (protection from at least medically unacceptable pollution, human intrusion in special areas, and avoidable military actions).

Social security is comprised of four sub-components: (a) political safeguards (based on democracy, freedom of press, and a robust legal system); (b) economic safeguards (minimum income, housing, medical care, elderly care, child care, and education); (c) personal safeguards (based on justice, equity, gender equality, and

respect for others); and (d) military safeguards (based on purely defensive, non-provocative outlook, as well as the rejection of weapons of mass destruction) (Westing, 2013).

Many efforts in the past decades have been undertaken to strengthen social security in the face of conflicts and political unrest all over the world, but environmental security is usually forgotten in times of war which holds potentially dangerous implications in the long-run.

Biodiversity hot-spots

One alarming development in the last decades is that most wars and conflicts are taking place in so-called biodiversity hot-spots that are most valuable to biodiversity conservation efforts and at the same time highly vulnerable to human-induced disturbances. These hot-spots are characterized by an exceptional variety of species on the one hand and large-scale loss of habitat on the other. With a habitat of only 2.3% of the earth's land surface, the 34 identified hot-spots (see figure 1) accommodate at least 42% of all terrestrial vertebrate species and at least 50% of all known plant species.

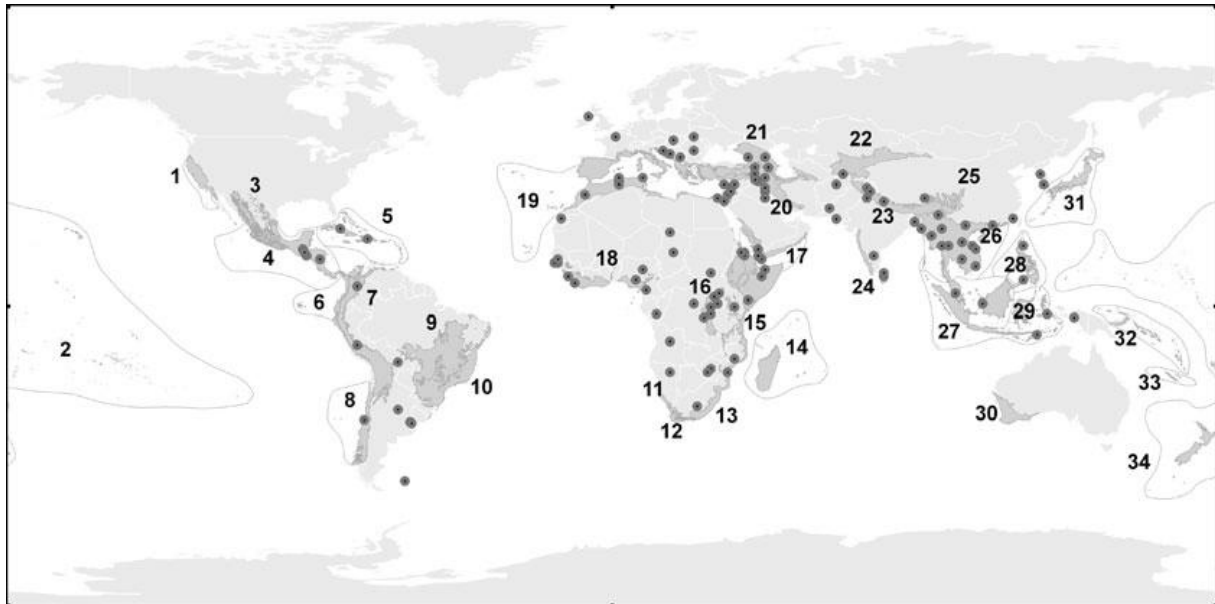


Figure 1. The world's 34 biodiversity hotspots (numbers) and the location of all armed conflicts with over 1000 casualties between 1950 and 2000 (points). Biodiversity hotspots: 1, California Floristic Province; 2, Polynesia, Micronesia; 3, Madrean Pine-Oak Woodlands; 4, Mesoamerica; 5, Caribbean Islands; 6, Tumbes – Choc'o – Magdalena; 7, Tropical Andes; 8, Chilean Winter Rainfall and Valdivian Forests; 9, Cerrado; 10, Atlantic Forest; 11, Succulent Karoo; 12, Cape Floristic Region; 13, Maputaland – Pondoland – Albany; 14, Madagascar and the Indian Ocean Islands; 15, Coastal Forests of Eastern Africa; 16, Eastern Afromontane; 17, Horn of Africa; 18, Guinean Forests of West Africa; 19, Mediterranean Basin; 20, Irano-Anatolian; 21, Caucasus; 22, Mountains of Central Asia; 23, Himalayas; 24, Western Ghats and Sri Lanka; 25, Mountains of Southwest China; 26, Indo-Burma; 27, Sundaland; 28, Philippines; 29, Wallacea; 30, Southwest Australia; 31, Japan; 32, East Melanesian Islands; 33, New Caledonia; 34, New Zealand (Hanson et al., 2009).

The criteria for hot-spots are (1) at least 1500 endemic vascular plant species and (2) a loss of 70% or more of the original vegetative cover. Although animal diversity is not a criterion, about three-quarters of the world's endangered animal species live in those hot-spots (Hanson et al., 2009).

Hanson and colleagues (2009) have examined the spatial overlap between armed conflicts (more than 1000 casualties) and biodiversity hot-spots. Their findings showed that between 1950 and 2000, 118 of 146 recorded conflicts (81%) took place wholly or partially within biodiversity hot-spots. Only 10 hot-spots are located within countries that did not have a significant conflict (see figure 1). This degradation of biodiversity hot-spots can have adverse implications for human security as well when positive feedback loops are created: war reduces ecosystem health and therefore might contribute to future resource conflicts (Hanson et al., 2009).

These findings have two important policy implications: (1) conservation organizations should not only work in stable, but war-torn countries as well in order to effectively conserve global biodiversity; and (2) conservation issues should be integrated into military and humanitarian programs, both to ameliorate root causes and to mitigate the effects of biodiversity loss (Hanson et al., 2009).

Risk-Transfer Militarism

One of the biggest obstacles in achieving a successful integration of environmental protection measures into military and humanitarian programs is the fact that military forces, operations and production facilities are often exempt from these measures and environmental laws in general. This is usually justified by framing these operations as acts in the name of national security. As a result, the world's military forces and corresponding industries account for the highest rate of pollution on earth (Clark & Jorgenson, 2012).

The term 'risk-transfer militarism' refers to the phenomenon of environmental damages, health risks, and casualties being shifted from developed to developing countries in the global south. This is facilitated by an economic and military imbalance between those regions. As a result, extensive environmental destruction and social disruption emerge which further stimulates armed conflicts in regions harboring biodiversity hot-spots (Clark & Jorgenson, 2012).

Up until now, only little attention has been paid to the impacts of militarism on the global environment. Nevertheless, to fully understand the human impact on the

environment, the military dimension of environmental destruction has to be incorporated into conservation efforts.

2.2.2 The Vietnam War (1962- 1971)

The extend of the use of ‘Agent Orange’

During the Vietnam War, the United States (US) used different techniques in order to destroy forest cover and food or industrial crops of the enemy, including: extensive use of herbicides, bombing and shelling, tractor land clearing, incendiary attacks (such as napalm) and unsuccessful attempts for rainfall modification (Westing, 2013). This type of warfare is called environmental warfare: “the manipulation of the environment for hostile military purposes” (Westing, 2013, p. 78).

Especially the use of herbicides had made the biggest impact during this war for two reasons: (1) it was the most effective way to defoliate jungle cover and food crops; and (2) it was the first time that herbicides were used to such an extent as a mean of warfare. Approximately 90% of defoliants and herbicides were used for forest defoliation and 10% for crop eradication (Fox, 2003). ‘Agent Orange’ was the nickname for the most used herbicide of the so-called ‘Rainbow Herbicides’ (see table 1). It was used in roughly 66% of the missions for forest defoliation and 40% of those for crop eradication (see figure 2).

Table 1 Use of military herbicides in Vietnam (1961–1971)^{13,15,29}

Name	Chemical constituents	Concentration active ingredient	Years used	Estimated quantities sprayed (litres)*
Agent Pink†	60%–40% n-Butyl: isobutyl ester of 2,4,5-T§	961–1,081 g l ⁻¹ acid equivalent‡	1961;1965	50,312 sprayed; 413.852 additional on procurement records
Agent Green†	n-Butyl ester 2,4,5-T	(Should have same acid equivalent as Agent Pink)	(Unclear but within timeframe for Agent Pink)	31,026 shown on procurement records
Agent Purple†	50% n-Butyl ester 2,4,-D; 30% n-butyl ester 2,4,5-T; 20% isobutyl ester 2,4,5-T	1,033 g l ⁻¹ acid equivalent	1962–1965	1,892,773
Agent Orange†	50% n-Butyl ester 2,4,-D; 50% n-butyl ester 2,4,5-T	1,033 g l ⁻¹ acid equivalent	1965–1970	45,677,937 (may include Agent Orange II)
Agent Orange II †	50% n-Butyl ester 2,4,-D; 50% isooctyl ester 2,4,5T	910 g l ⁻¹ acid equivalent	After 1968 (?)	Unknown but at least 3,591,000 shipped
Agent White	Acid weight basis: 21.2% tri-isopropanolamine salts of 2,4-D and 5.7% picloram	By acid weight: 240.2 g l ⁻¹ 2,4,-D and 64.9 g l ⁻¹ picloram	1966–1971	20,556,525
Agent Blue (powder)¶	Cacodylic acid (dimethylarsinic acid) and sodium cacodylate	Acid: 65% active ingredient; salt: 70% active ingredient	1962–1964	25,650
Agent Blue (H ₂ O solution)	21% sodium cacodylate + cacodylic acid to yield at least 26% total acid equivalent by weight	Acid weight: 360.3 g l ⁻¹	1964–1971	4,715,731

Other chemicals used in testing programme but not in Vietnam operations include Modified Orange (4-amino-3,5,6-trichloropicolinic acid (picloram) added to Orange), Dalapon, Bromacil, Tandex, Monuron, Diuron and maleic hydrazide. Dinoxol (1890 I) (butoxyethanol esters of 2,4-dichlorophenoxyacetic acid (2,4-D) and 2,4,5-T), Trinoxol (1455 I) (40% ethanol ester of 2,4,5-T) and 378 I Conc D (30% ethyl ester of 2,4,-D in H₂O) were also used in tests during 1961.

* Nominal application rate: 4.78 kg ha⁻¹.

† Contaminated with varying levels of TCDD.

‡ Acid equivalent is the mass of pure acid that results from complete de-esterification or deamination of salts and esters. Total ester masses are approximately 20% greater.

§ 80–20% mixture when mixed with Agent Green. Agent Green was never sprayed alone but was immediately mixed with Agent Pink for spraying.

¶ Proprietary product of Dow Chemical Company (Tordon 101).

|| Ansul Chemical Co. product Phytar 560 was the only arsenical in use before July 1969.

Table 1: Use of military herbicides in Vietnam from 1961 to 1971 (Stellman et al., 2003)

Although the numbers for the amount of defoliants and herbicides sprayed in Vietnam differ to some extent in the literature, estimates are usually around 73 million liters, of which 45 million liters are comprised of Agent Orange, making it by far the most widely used herbicide of all (see figure 2). However, these estimates only include missions executed by plane; there is an unknown number of additional liters sprayed by helicopter, boat, truck or by hand (Fox, 2013).

About one-tenth of the total land area of the country was sprayed with herbicides one or more times, which equals around 1.7 million hectares (see figure 3) (Westing, 2011). According to US military records, 30%-50% of coastal mangroves, 24% of the upland forests and 4% of the total crops were destroyed by the use of defoliants and herbicides. The estimates for the destruction for the whole area are around 10% of the natural and industrial vegetation. In some areas up to 50% of the vegetation was eradicated (Fox, 2013).

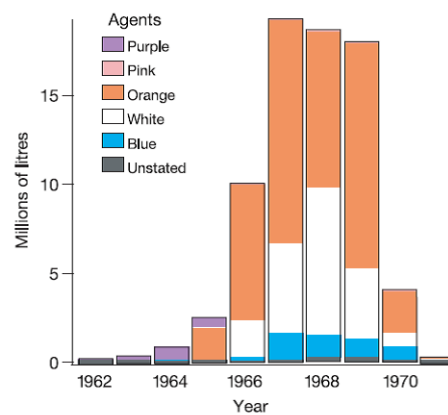


Figure 2: Litres of herbicides sprayed in Vietnam from 1962 to 1971 (Stellman et al., 2003)

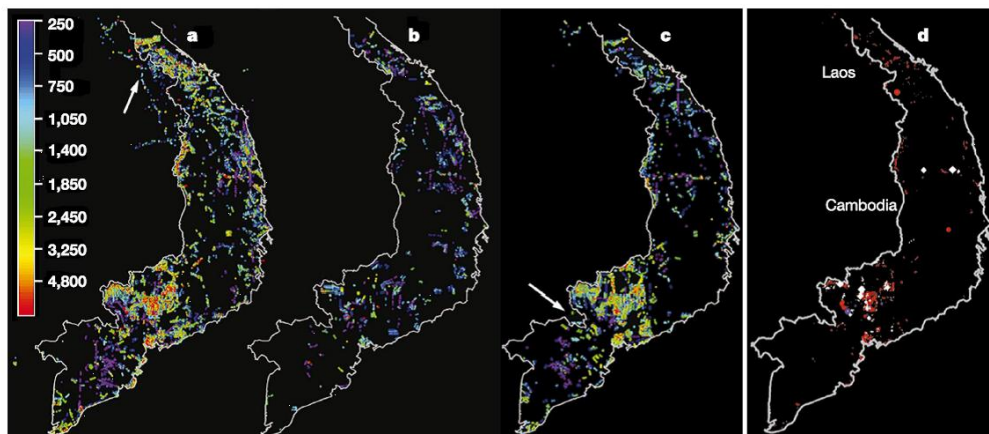


Figure 3 Volumes of herbicide sprayed. **a**, **b** and **c** represent known volumes of Agents Orange, White and Blue, respectively, sprayed by US military forces in RVN, 1961–1971. Volumes are calculated for individual grids spaced at 0.01 degrees (~1.2 km²), that divide up Vietnam in a geographic information system developed by us⁴⁹. Colours in **a**, **b** and **c** correspond to volumes as shown in key. Arrows in **a** and **c** point to missions in Laos

and in the Parrot's Beak region of Cambodia, respectively. **d**, Grids sprayed with volumes greater than 4,800l (about 10% of total), with marker size increasing in proportion to volume and colours corresponding to herbicide codenames. All herbicides containing 2,4,5-T are represented by orange markers.

Figure 3: Volumes of herbicides sprayed (Stellman et al., 2003)

Short- and long-term effects of the use of herbicides in Vietnam

By the time defoliants and herbicides were deployed in Vietnam, little was known about the consequences of such warfare strategies. The desired results of the US using herbicides during the war were: (1) forest destruction to prevent enemy movement and remove cover; (2) crop destruction to disrupt the enemy's food supply; and (3) a forced relocation of indigenous civilians into US controlled territory to impede support to the enemy. But neither the general population nor involved civil and military policy makers at that time anticipated the possible ecological consequences and the related humanitarian implications that such a strategy bears: These include that the adverse effects of defoliation and crop eradication affect the civilian population much more than military forces, and that these negative effects of herbicidal warfare will continue for a long period of time after the conflict has ended (Westing, 2011).

Environment

Agent Orange and the other herbicides deployed in Vietnam killed plants in two ways: either they contained compounds that mimic natural hormones in the plants to interfere with their normal metabolism, or they contained a desiccant, which prevents plants from retaining moisture. In the short-term, herbicides had a massive impact on the local flora. A single herbicidal treatment would result in almost complete abscission of leaves, fruit and flower within two or three weeks. The different affected plant-species show varying levels of vulnerability to the treatment (Westing, 2011). Studies showed that trees older than seven years were usually able to recover from the spraying and remained bare until the beginning of the next rainy season, but younger ones, including other plant-species were not. About 10% of treated plants would suffer inevitable death, with rising mortality-levels for each subsequent spraying (Fox, 2003).

The excessive loss of leaves results in a process called 'nutrient-dumping', which was coined by Westing (2011): "nutrient-rich leaves fall to the ground, newly created leaf litter decomposes rapidly and its nutrients are for the most part lost owing to the dormant or moribund condition of the forest stand (which prevents their recycling) and to the notably poor nutrient-holding capacity of tropical soils. This rapid depletion [...] impoverishes the local ecosystem, a condition which takes years or

even decades to become rectified by natural processes”. This process gives an ecologically and economically inferior, long-lasting plant-community (such as tall grass or low-grade bamboo) the opportunity to take over an eco-system, which ultimately will have adverse consequences for the local fauna, mainly due to habitat loss (Westing, 2011; Fox, 2003). Additionally, when herbicides are used to eradicate food or industrial crops, this can result in not only ecological damage, but can have social implications as well, mainly due to loss of food supply and income of the local population. Although a lot of research has been done concerning the adverse effect of herbicidal warfare in Vietnam, the long-term effects are still being examined and discussed up to today.

Human health

Scientific research concerning the long-term effects of Agent Orange on human health has mostly been focused on the effects of dioxin-contamination. Several of the herbicides deployed during the Vietnam War (Agent Orange, Purple, Pink and Green) contained *tetrachlorodibenzodioxin* (TCDD) – a form of dioxin which is highly toxic for humans and animals. This contamination was due to the manufacturing process, which was adjusted in order to meet the US military demands (Fox, 2013). Consequently, when the herbicides were applied across the Vietnamese jungle, the dioxin accumulated in the food chain and subsequently poisoned the local population over decades (Uesugi, 2013). By 2010, 15 diseases and one birth defect (such as several types of cancer and cardiovascular diseases) were associated with the exposure to chemical herbicides during the Vietnam War (Fox, 2013). However, the consequences of deforestation and crop eradication for the local population are mostly overlooked.

2.2.3 The aftermath of the Vietnam War

Three important ecological conclusions can be drawn after the retreat of US forces from the Vietnam War in 1973 concerning the military use of herbicides: (1) vast arrays of vegetation can be damaged or destroyed with little expense; (2) natural, agricultural, and industrial plant species are equally vulnerable to herbicides; and (3) that there are long-term consequences of such actions (Westing, 2011).

The birth of the concept ecocide

Before the Vietnam War, strategic environmental destruction to such an extent was unknown. This new form of environmental warfare gave rise to a movement against 'ecocide', which was started by scientists who were concerned about the effects of the chemical herbicides deployed. 'Ecocide' or 'ecological genocide' refers to the destruction of a natural environment to the extent that the health and the livelihood of its human inhabitants are endangered (Uesugi, 2013; Zierler 2011). This new concept helped to make environmental warfare and its influence on environment and humans more visible to the public and to policy makers and laid the foundation for initiatives which aimed to make ecocide a crime and to establish an 'international environmental crimes tribunal' (Martinez-Alier et al., 2014). In general, there are nowadays several approaches with legal precedents to limit environmental damage caused by military, including: (1) remaining at peace; (2) establishing zones of peace; (3) limiting of the use of certain weapons; (4) limiting certain means of warfare; and (5) mitigation of damage to natural resources (Westing, 2013).

The influence of herbicidal warfare on international warfare conventions and humanitarian law

The use of chemical herbicides in Vietnam was controversial from the beginning, both in military and civilian circles, mainly because the US was concerned about adverse political consequences. But after the devastating effects of the use of Agent Orange became apparent, they were widely condemned by countless stakeholders and an international discussion about the legal aspects had started. Especially the American government was reluctant to take up the issue, partially because of a lack of scientific evidence and a fear of liability for possible charges against them. Possibly, it was an attempt to save face, that the US would not be known as a country that engages in chemical warfare (Fox, 2013).

But to that time there was no body of international law that explicitly forbid the use of herbicides as a mean of warfare. There was a prohibition of the use of poison or poisonous weapons in Article 23(a) of the *1907 Hague Regulations*, with the limitation that the critical term of poison had never been defined and multiple interpretations were common. Whether a substance was considered a poison or not was usually determined by the intention to do harm. An example for this is the

poisonous gas Zyklon B used by the Germans during the WW II, which was specifically designed to kill the inmates of concentration camps. Agent Orange, however, was not developed and used with the intention to harm humans (ICRC,2014).

The categorization of Agent Orange as a poison, which was essential for any international law claim from potential plaintiffs against the US, was not evident before the 1960s. In that time, just when the US started air fumigation missions in Vietnam, the concept of poison was undergoing a transition. Poisons were now defined by their potential risks to human health, and not by the dosage applied or the intention to do harm (Uesugi, 2013).

In 1967, the year with the highest application rate of herbicides in Vietnam (see figure 2), more than five thousand independent scientist, including 17 Nobel Prize winners and 129 members of the National Academy of Science signed a petition to President Johnson in order to force a stop to the military use of herbicides. Further they recommended a review of American policy concerning chemical and biological weapons (Fox, 2013).

The only other applicable international law regarding the use of herbicides at that time was the *1925 Geneva Gas Protocol*, which condemned "[...] the use in war of asphyxiating, poisonous or other gases, and of all analogous liquids, materials or devices [...]" (Geneva Protocol, 1925). No state that ratified the 1925 Geneva Gas Protocol made reservations or objections that the Protocol should not be applicable to herbicides (ICRC, 2014). However, it wasn't until the *1969 Resolution of the General Assembly of the United Nations "Question of Chemical and Bacteriological (Biological) Weapons"* that herbicides and defoliants were added to the list of banned chemical weapons in the Geneva Gas protocol. Nevertheless, more than forty countries, including big military powers (such as the USA), opposed or abstained from the resolution, which is why it cannot be seen as a statement of consensus. When the US finally ratified the Geneva Protocol in 1975 (two years after the retreat of American troops out of Vietnam), the US Senate clarified that in their understanding the prior use of herbicides in Vietnam did not violate the protocol and that it would only be prospective in effect (ICRC, 2014; Fox, 2013).

Alongside efforts of the international community to prevent herbicidal warfare itself, additional steps were taken to respond to environmental destruction as a corollary of war in general. In reaction to the environmental devastation caused by

the US in Vietnam, the United Nations held a conference on the environment in Stockholm. At the *1972 UN Conference on the Human Environment*, twenty-six principles concerning the relationship of humankind and the environment were formulated to ensure development, peace and welfare within the boundaries of our planet. This declaration in turn would form the foundation for the *1982 UN World Charter for Nature*, which proclaimed five principles of conservation by which all human conduct affecting nature is to be guided and judged. These two UN documents were adopted by almost all UN member states, with one notable exception: the United States. This suggests that the world community acknowledges that the environment deserves protection from devastating effects of war (Caggiano, 1993).

Another international convention which was drafted as a reaction to the use of herbicides during the Vietnam War was the *1976 Environmental Modification Convention*. It prohibits the hostile use of environmental modification techniques having widespread, long-lasting, or severe effects as the means of damage. 'Environmental modification technique' refers to any technique for changing the dynamics, composition, or structure of outer space or of the Earth, including its lithosphere, atmosphere, hydrosphere, and biota (ICRC, 2014; Westing, 2013).

Another protocol that was widely adopted, once some of the means of environmental destruction, executed by the United States during the Vietnam War became known to the public, was the *1977 Protocol on the Protection of Victims of International Armed Conflicts*. This protocol was the first of its kind including relevant environmental constraints (Westing, 2013).

The last United Nations convention with reference to the military use of herbicides is the *1993 Chemical Weapons Convention*. Its seventh paragraph states: "Recognizing the prohibition, embodied in the pertinent agreements and relevant principles of international law, of the use of herbicides as a method of warfare, ..." (ICRC, 2014).

2.2.4 Implications for contemporary conflicts

The previous section addressed the effects of the military use of herbicides on international weapons conventions and humanitarian law. It is usually hard to assess the success, respectively the degree of implementation of a certain international

convention or protocol. One way, however, to look at the military manuals of different countries is to draw a clearer picture of the reality of warfare. Westing (2013) describes several potential advantages of military manuals over international Law of War in general: (a) military manuals translate the abstract Law of War into practical rules for application by armed forces; (b) training forces are learning the rules of a military manual before times of conflict; (c) military manuals form a more enforceable body of national regulations compared to largely unenforceable international legal norms; and (d) due to the open availability of military manuals, they permit and invite military adversaries to follow the same humanitarian constraints.

The US Naval Handbook (United States, 2007) for example, relating to the handling of herbicides, states that “use of herbicidal agents in wartime is not prohibited by either the 1925 [Geneva] Gas Protocol or the 1993 Chemical Weapons Convention but has formally renounced the first use of herbicides in time of armed conflict except for control of vegetation within U.S. bases and installations or around their immediate defensive perimeters. Use of herbicidal agents during armed conflict requires presidential approval”.

Many of today’s wars are fought within the borders of one country. This non-international character of these conflicts makes it difficult to exercise international law. Most of the international humanitarian law can formally only be applied to international armed conflicts. The only relevant international legislation concerning this issue is the *1977 Protocol on Non-international Armed Conflicts*, which, however, only provides rather weak constraints on the means of warfare. Furthermore, many governments regard such conflicts to be national and internal matters which should not be interfered with from outsiders (Westing, 2013).

The war on drugs in Colombia

This brings up the question to what extent the different conventions and protocols to prevent the military use of herbicides are actually having an impact on that practice in today’s modern conflicts. One illustrative example is the so-called ‘War on Drugs’ in Colombia. Since 1994, the Colombian government is fighting illicit coca production to a large part by air fumigation of herbicides on coca plantations (Rincón- Ruiz & Kallis, 2013). The US is involved in this ongoing conflict by providing military support and training, weapons, fumigation of crops, logistical support and delivery of herbicides. A large body of research has shown the adverse effects of glyphosate on human

health, animals, plants, and aquatic ecosystems (Smith et al., 2014). Additionally, not only coca plants are destroyed, but native forest and food crops as well, because glyphosate is a non-selective herbicide (Knudsen, 2013).

When farmers lose their livelihood due to air fumigations, they tend to replace it with coca plants because it grows faster and generates more profit. This sets off a process called 'triple deforestation': coca crops are planted, herbicide spraying is undertaken, both coca and food crops are destroyed, and peasants flee the area to start again in a new location (Knudsen, 2013; Smith et al., 2014; Rincón-Ruiz & Kallis, 2013). This diffusion of coca production has not only serious negative impacts on biodiversity but also it appears that coca cultivation and cocaine manufacture is shifting to other Andean nations, resulting in what is commonly referred to as the "balloon effect" (Smith et al., 2014; Rincón-Ruiz & Kallis, 2013).

There is clear evidence that the use of these herbicides, as practiced in Colombia, would violate international regulations in place in the United States (Smith et al., 2014). In 2008, Ecuador filed a lawsuit against Colombia in the International Court of Justice with the claim that, from 2000 through 2008, herbicidal drift harmed people, their livestock, and diverse rainforest areas (Knudsen, 2013). The lawsuit was dropped by Ecuador in 2013 because Colombia agreed to establish an exclusion zone, in which Colombia will not conduct aerial spraying operations (ICJ, 2013).

The case of the war on drugs is a vivid example for both the short-comings of international legislation concerning the prohibition of herbicidal warfare and risk-transfer militarism as practiced by the United States.

2.2.5 Conclusion

In recent history, many efforts have been undertaken to strengthen human security worldwide in the face of war with an increasing attention for environmental matters. Scholars share the opinion that such a comprehensive approach is crucial to protect human life and capital worldwide, especially because of the tendency that contemporary conflicts are taking place within countries harboring biodiversity hot-spots. Although the war in Vietnam had far-reaching detrimental consequences for the local population and environment, it was a main contributor for the development of new international warfare, environmental, and humanitarian law. By exhibiting environmental destruction on an unprecedented scale, this conflict lead not only to

change of the notion of poisonous weapons, but also brought forth the concept of ecocide which was crucial in claiming the necessary transition towards anti-warfare and environmental protection. The continuous research concerning the effects of Agent Orange and other herbicides on human health and the environment helped render the dangers of such warfare strategies visible. However, two important obstacles remain concerning the prohibition of herbicidal warfare have to be noted: (1) risk-transfer militarism as practiced by the US to safeguard their national interests, thereby often neglecting existing conventions; and (2) the discrepancy between the general applicability of international legislation and the reality of more and more non-international conflicts, inhibiting an effective prohibition of herbicidal warfare.

3. Integration

3.1 Common Ground

The insights found when researching the sub-questions have several differences and similarities. When looking on a temporal scale, we can see that the historical sub-question focuses its attention mostly on the time before the Vietnam War, whereas the sub-question covered by the environmental sciences targets its research at the period after the Vietnam War. Where their paths cross is during the war, as the historical political study on herbicides leads up to the war and the environmental sciences study starts off with the effects of the use of herbicides during the war. This is why Agent Orange and the Vietnam War make a compelling case study: both fields of study intersect at this point.

There is quite a comprehensive interdisciplinarity when comparing the disciplines used, as both of them differ epistemologically (Repko, 2012). Environmental sciences have a more positivistic approach to research and are more of an exact science than history, which in this case has a more constructivist approach. This does not mean the two disciplines are necessarily very far apart, as both do view their subject through a holistic lens. One area of research cannot be fully separated from another as their connection might be just as important as the individual areas of research.

To satisfy the differences between the two disciplines, *common ground* will have to be created. According to Allen Repko (2012) *common ground* is necessary for collaborative communication between disciplines. This will be fundamental to marrying the differing insights found in this bachelor thesis.

First of all, the historian will try to view his research with an imposed view of impartiality, whereas the environmental scientist will not try to hide his subjective viewpoint regarding his subject of study. One side may clearly condemn the use of herbicides during warfare whilst the other would not offer such motive. These seemingly contradictory manners of research have been solved by applying Repko's 'organization' method: "*creating common ground by clarifying how certain phenomena interact and mapping the causal relationships*" (Repko, 2012, p. 346). When looking at the way the historian and the environmental scientist do or do not dictate a motive we can see that the two methods create a pleonasm. Whereas the

historical neutrality does not prohibit a clear motive from the environmental sciences' disciplinary research, the latter cannot function without a certain partiality to promote environmental understanding and protection. Therefore it was chosen that this thesis should impose a specific viewpoint in line with the environmental sciences' standard of practice.

Secondly, the research concerning the justification for the United States to use herbicides during and after the Vietnam War also differed between the disciplines. The historical research found that the main reason the USA still feels justified to use herbicides if necessary was an international hubris. As the biggest economic and military power since the Second World War, it was found that the American government can sway the international community quite heavily - or even disregard them and go ahead anyway with pursuing their goals if the international community does not give its support. The environmental sciences' research noted that instead of an international hubris enabling the US justification, there were quite some doubts before engaging in herbicidal warfare during the Vietnam War because they feared international repercussions. The reaction of the international community after the Vietnam War led to an increase in the amount of international resolutions surrounding herbicidal warfare. This led to US trying to save face instead of admitting their responsibility for the atrocities of the Vietnam War. These seemingly contradicting findings were conjoined into one more thorough answer through the use of Repko's 'organization' technique (2012). Namely, whilst the two viewpoints seem to be contradictory, they are in fact not mutually exclusive. Although the increase in international scrutiny into herbicidal warfare has stifled the United States' use of herbicides, the US still feels entitled to use them if they deem it necessary. Whilst not completely disregarding the international community's distaste for herbicidal warfare, they still regard them as valid tools to use during warfare.

A third situation wherein *common ground* needed to be created was regarding the concept of 'ecocide' used in David Zierler's 'The Invention of Ecocide: Agent Orange, Vietnam, and the Scientists Who Changed the Way We Think About the Environment' (2011). Zierler states that the concept of 'ecocide' - a term used regarding the destruction of an ecosystem to such an extent that the survival of its inhabitants is unsure - was invented after the Vietnam War, as it is the prime example of 'ecocide'. The environmental scientist, having used this concept in his research, started off his study at the beginning of the Vietnam War. However, the historical

study points to the Malayan Emergency as the first use of herbicides in warfare, and could argue that 'ecocide' has taken place in many more instances throughout history, regardless of herbicides. This difference was solved through Repko's technique of 'extension', involving "*addressing differences or oppositions in disciplinary concepts and/or assumptions by extending their meaning beyond the domain of the discipline that originated them*" (Repko, 2012, p. 340). By extending the concept of 'ecocide' beyond the Vietnam War we can presume that it existed before the war as well. However, as the Vietnam War was the first large scale case-study of 'ecocide' it has been used by many as the starting point of their research. Conceptually, 'ecocide' is probably as old as conflict itself, but practically, it is used to refer to large scale conflicts which harm the environment to such an extent that its inhabitants' survival is endangered.

3.2 More comprehensive understanding

On the basis of the created common ground, a broader picture of the use of herbicides during the Vietnam War and its subsequent consequences can be drawn. There are clear indications that the Vietnam War was a turning point concerning the international damnation of herbicidal warfare.

Although herbicides originate from biological warfare research undertaken by the UK and the US during the Second World War, the first application of these chemical agents was not war-related, but instead primarily done by private corporations in order to increase harvests of civil agriculture. The first application of herbicidal warfare goes back to the so-called 'Malayan Emergency', where Agent Orange and other herbicides were first introduced to the battlefield. The setting of this war in a densely vegetated area encouraged the implementation of guerilla tactics. Stripping the enemy of their cover by defoliating arrays of jungle became an invaluable advantage for the British Commonwealth to win this conflict.

At that time, the adverse effects of herbicides on neither human health nor the environment were known, which is why their deployment could not be prevented by existing UN conventions such as the *1907 Hague Regulations* (prohibiting the use of poisonous weapons) or the *1925 Geneva Gas Protocol* (banning the use of a asphyxiating, poisonous or other gases). When the US started intervening in Vietnam it followed Britain's example and used Agent Orange and other chemical agents to defoliate vast arrays of jungle area and destroy food crops controlled by the Viet Cong. The application of herbicides was not easily decided, since the US feared possible accusation of chemical warfare from communist and other countries. However, there were a number of reasons which ultimately helped the US to legitimize herbicidal warfare during the Vietnam War: (1) No body of international legislation prohibited the use of herbicides (Baxter & Buergenthal, 1970), on the one hand because poisonous weapons were defined by the clear intention on killing humans through their use and on the other hand the prohibition of chemical agents and gases was only limited to those with adverse effects on humans or animals (Uesugi, 2013); (2) the British Commonwealth deployed herbicidal warfare with relative success during the 'Malayan Emergency' (Cumings, 1998; Perera & Thomas, 1985); (3) the US' high position of power within the international circuit, making them almost unimpeachable for international prosecution of possible war crimes (Mazower,

2012); and (4) the US had a higher interest in safeguarding their own interests and minimizing potential risks for themselves (risk-transfer militarism) - in this case specifically preventing countries from adopting a communist political system and ideology - than complying with international law (Clark & Jorgenson, 2012).

Nevertheless, after the US started intervening in Vietnam, the detrimental effects of Agent Orange became increasingly visible. A large portion of the chemical agents were contaminated with dioxin due to the manufacturing process which was adjusted to meet the US military's demand. Dioxin is a highly toxic compound for humans and other organisms, causing multiple diseases and birth defects. This unintentional poisoning of the local civil population especially led to two important developments: (1) An increasing body of research concerning the effects Agent Orange (Hanson et al., 2009; and (2) the growing adoption of the perception on an international level that the use of herbicides should be banned as a mean of warfare (Westing, 2013).

Continuous scientific research on Agent Orange showed that, apart from inflicting direct damage on humans, such a large scale application of herbicides has devastating consequences for the environment, which bears adverse effects for humans in the long-run. These findings led scientists to the creation of the concept of 'ecocide' to illustrate the disastrous consequences of Agent Orange for human health and the environment (Zierler, 2011). This did not only make the topic of herbicidal warfare more accessible for subsequent international conventions, but also made environmental destruction (especially in the face of war) a more tangible phenomenon. Although the Vietnam War triggered the formulation of the concept of ecocide, the military strategy behind it is well-known throughout military history: So-called 'scorched earth' techniques are aimed at destroying anything that might be useful to the enemy, including food sources, transportation, communications, industrial resources, and even the local population in the area. Although the 'Malayan Emergency' can be seen as the first clear case of ecocide, it was not until the unprecedented use of herbicides during the Vietnam War that gave rise to this concept.

The growing body of scientific knowledge fueled the international discussion concerning herbicidal warfare. Supported by empirical evidence, the notion of what poisons are went through a transition, towards a definition recognizing the adverse effects on humans even without a clear intention to kill people. This in turn, helped

condemn herbicidal agents as a means of warfare. One of the first attempts to stop herbicidal warfare was the *1969 Resolution of the General Assembly of the United Nations "Question of Chemical and Bacteriological (Biological) Weapons"*, adding herbicides to the list of banned chemicals in the Geneva Gas Protocol. This, however, had little impact on the US, especially as they did not sign the protocol until after the war. Furthermore, after the US retreated from Vietnam, they were reluctant to take up the issue of Agent Orange in order to save face and they opposed the view that their use of herbicides was unjustified and could be seen as a war crime. This position persists in large parts up until today, mainly based on the fact that during the war the potential effects of Agent Orange were unknown and that law cannot be applied retroactively. In the course of years following the Vietnam War, additional conventions and protocols were ratified by the UN in order to pressure the ban of - amongst other things - herbicidal warfare, namely the *1976 Environmental Modification Convention*, the *1977 Protocol on the Protection of Victims of International Armed Conflicts*, and the *1993 Chemical Weapons Convention*.

Despite the devastating consequences for Vietnam and the reluctance of the US to take responsibility for their actions, Agent Orange has also had quite some unexpected positive repercussions, such as being a main contributor for environmental protection efforts. The fact that war disturbs the local environment, which in turn is the basis for subsistence of all people on Earth, stimulated the ratification of conventions such as the *1972 UN Conference on the Human Environment* and the *1982 UN World Charter for Nature*. These documents form the first efforts to make environmental protection paramount as an international goal.

Thus, the use of Agent Orange during the Vietnam War has triggered developments concerning international law and the protection of the environment. However, there are still multiple obstacles in achieving a complete ban of herbicidal warfare. Although the US has signed and ratified most of the legislation mentioned above, they still feel entitled to use herbicides for strategic purposes regardless of changes in international lawmaking. The reasons for that have not change since the Vietnam War: giving safeguarding US interests a higher priority than compliance with international legislation and a superior position of power in the international circuit, making the US relatively immune against international prosecution. This also reflects the fact that international law is generally hard to enforce and it depends on the mutual compliance of all participating states. Furthermore, fringe-groups such as

terrorists or criminal organizations are not bound by international law or can simply ignore it when fighting for their interests.

Another obstacle is the fact that the international law prohibiting the use of herbicides is only applicable to international armed conflicts. Most contemporary conflicts, however, are of a non-international nature, and thus are not covered by multilateral legislation. These loopholes make the contemporary use of herbicides, as for example in the 'War on Drugs' in Colombia, almost impossible to prevent.

4. Conclusion

When looking back at the question of *what the consequences of the use of herbicides during the Vietnam War were for international relations and what its role in subsequent international humanitarian and environmental legislation was*, we can see that, whilst the use of Agent Orange has changed the way the world thinks about herbicides, there is still a lot of ground that needs to be covered. Environmental protection is a paramount international goal that has often taken a backseat to other goals in the past. Although steps have been taken to stop the use of herbicides internationally, the US still feels justified it retains the right to use herbicides strategically. Also, there are still several pitfalls regarding international lawmaking which stand in the way of prohibiting herbicides. These include the way states do not necessarily use herbicides for warfare purposes, or how intra-national parties and fringe-groups do not feel obligated to respond to international laws. Therefore we propose a closer look at the international laws regarding herbicidal warfare and an overhaul of the current system to stop the wanton destruction of the environment (and its inhabitants) that still goes on today and poses a threat for generations to come. A more thorough approach seems necessary to root out the use of herbicidal warfare on both an intra-national and an international scale.

Through the *more comprehensive understanding* gained by factoring in multiple disciplines into a grander total we were able to achieve a more exhaustive research into the uses of herbicides during wartime. With a topic as vast as herbicidal warfare it was necessary to look at more factors than one discipline would normally do - and by to adopt more than one field of study. Only by looking at the big picture can the root causes and effects of herbicidal warfare on international relations and legislature be discerned.

Perhaps the biggest drawback of a 'big picture' approach would be that such a complex problem requires a sizable solution as well. Because of the nature of such a fundamental overhaul it will be difficult to implement a proper solution soon to say the least. As the problem incorporates so many different aspects - from local environmental changes to international political considerations - it will be a monumental achievement to make one resolution or piece of legislature that tends to the entirety of the issue. However, that does not mean that incremental steps cannot compel advancements in the long run. We have already seen changes in

international lawmaking surrounding herbicides and herbicidal warfare since the post-Vietnam era and we would argue that further steps in that direction are necessary - as long as we are mindful of the direction we are heading. Perhaps further study could flesh out more specific goals or milestones to work towards.

The strengths of this thesis are the way it incorporates the different fields of study seamlessly into a bigger whole. Both disciplines enable both a broad study as well as a scrutinizing look, and there was room for both overlap and independency when necessary. A certain adaptability innate in both historical and environmental studies made sure this was possible and this advantage was used to create a focused yet cohesive study from different viewpoints.

However, this broad look and penchant for overlap was also the biggest risk-factor. Both disciplines handle a holistic perspective, which can easily create the illusion that insights are already integrated, leading to the potential fallacy of overlooking important synergies. Additionally, the process of creating *common ground* involves the creative combination of insights, concepts and theories through different techniques, which can also give room for an inconsistent argumentation. Ideally, other disciplines could have given more specific insights to the bachelor thesis, such as international law or political studies, helping to create an even more encompassing integration.

Like the research itself, the scope of this thesis was encompassing and spread-out. However, through extensive study we attempted to answer the question regarding herbicidal warfare and mold an answer out of the material. Although herbicides are still being used as weapons to this day we feel confident that, given the right direction, the international community can come together to thoroughly prohibit its misuse.

5. References

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