

Impact of War on Environment

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ABSTRACT

The environmental impact of wars begins long before they do. Building and sustaining military forces consumes vast quantities of resources. These might be common metals or rare earth elements, water or hydrocarbons. Maintaining military readiness means training, and training consumes resources. Military vehicles, aircraft, vessels, buildings and infrastructure all require energy, and more often than not that energy is oil, and energy efficiency is low. The CO₂ emissions of the largest militaries are greater than many of the world's countries combined. Militaries also need large areas of land and sea, whether for bases and facilities, or for testing and training. Military lands are believed to cover between 1-6% of the global land surface. In many cases these are ecologically important areas. While excluding public development from these areas can benefit biodiversity, the question of whether they could be better managed as civil protected areas is rarely discussed. Military training creates emissions, disruption to landscapes and terrestrial and marine habitats, and creates chemical and noise pollution from the use of weapons, aircraft and vehicles. Sustaining and renewing military equipment and materiel means ongoing disposal costs, with implications for the environment. It is not just the most hazardous nuclear and chemical weapons that create environmental problems throughout their lifecycle. The same is also true for conventional weapons, particularly where they are disposed of through open burning or detonation. Historically, vast quantities of surplus munitions were also dumped at sea. A history of weak environmental oversight has left many countries with serious environmental legacies linked to military pollution, with impacts on public health and vast costs for environmental remediation. These continue to grow as emerging pollutants like PFAS are identified. These legacies are also a problem around overseas bases where one-sided agreements with host nations can reduce environmental oversight. Indirectly, high levels of military spending diverts resources away from solving environmental problems and away from sustainable development. International tensions stoked by high levels of military spending also reduce opportunities for international cooperation on global environmental threats, such as the climate emergency. It is also important to consider how security policies and militarism are tailored to ensuring access to, and control of, natural resources like oil, gas, water and metals. The environmental impact of conflicts themselves vary greatly. Some international armed conflicts may be brief but highly destructive. Some civil wars may last for decades but be fought at low intensity. Many contemporary conflicts have blurred the lines, lasting years but with sustained periods of high intensity warfare. Who is fighting, where they're fighting and how they're fighting all strongly influence the environmental impact of a conflict.

High intensity conflicts require and consume vast quantities of fuel, leading to massive CO₂ emissions and contributing to climate change. Large scale vehicle movements can lead to widespread physical damage to sensitive landscapes and geodiversity, as can the intensive use of explosive ordnance. The use of explosive weapons in urban areas creates vast quantities of debris and rubble, which can cause air and soil pollution. Pollution can also be caused by damage to light industry and environmentally sensitive infrastructure such as water treatment plants. The loss of energy supplies can have reverberating effects that are detrimental to the environment, shutting down treatment plants or pumping systems, or can lead to the use of more polluting fuels or domestic generators.

KEYWORDS: *impact, war, environment, explosive, weapons, conflicts, pollution, generators, fuels*

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INTRODUCTION

Severe pollution incidents can be caused when industrial, oil or energy facilities are deliberately attacked, inadvertently damaged or disrupted. In some cases, deliberate attacks on oil or industrial facilities are used as a weapon of war, to pollute large areas and spread terror. Other scorched earth techniques include the destruction of agricultural infrastructure like canals, wells and pumps and the burning of crops. Tactics like these threaten food security and livelihoods, increasing the vulnerability of rural communities. Whether unintended or deliberate, these large-scale pollution incidents can lead to transboundary impacts from air pollution or through the contamination of rivers, aquifers or the sea. In some instances, these even have the potential to affect weather or the global climate.[1,2]

Weapons and military materiel used during conflicts also leave environmental legacies. Land mines, cluster munitions and other explosive remnants of war can restrict access to agricultural land and pollute soils and water sources with metals and toxic energetic materials. In major conflicts, large volumes of military scrap may be produced or abandoned, this can contain a range of polluting materials, contaminating soils and groundwater, whilst exposing those who work on it to acute and chronic health risks. Wrecked or damaged ships, submarines and offshore oil infrastructure can cause marine pollution.

Many conventional weapons have toxic constituents, others such as depleted uranium are also radioactive. Incendiary weapons such as white phosphorous are not only toxic but can also damage habitats through fire. While now restricted, the widespread use of chemical defoliants damaged public and ecological health across large areas of Vietnam. [3,4]

Easy access to small arms and light weapons can harm wildlife through facilitating increased hunting and poaching, and the ungoverned spaces created by conflict create the ideal conditions for wildlife crime. Weapons used in wildlife crime have been found to have been sourced from countries affected by conflict. Scientists and researchers may be unable to access areas due to security problems, harming conservation programmes. While national parks and protected areas may lose what protection they had, or protecting them may be made more difficult when poachers are armed. These situations can encourage more militarised conservation, which can have negative effects on relationships with local communities.[5,6]

Deforestation often increases during conflicts. Much of the time this is due to overharvesting by communities who are suddenly reliant on wood and

charcoal for fuel and heating. But it can also be as a result of armed or criminal gangs taking advantage of the collapse of management systems. Civilian coping strategies can also lead to the overharvesting of other natural resources or to environmentally damaging practices such as artisanal oil refining. And in some cases, community systems of sustainable resource management may be disrupted.

Environmental damage and degradation can also stem from resource extraction used to finance conflicts. In many conflicts, armed groups vie for control over oil, mineral resources or timber. Processing methods, such as the use of mercury in gold mining, can pollute water bodies. In addition to armed groups and artisanal workers, private companies may also be active in areas affected by conflict, often operating with minimal environmental oversight.

Human displacement is common to many conflicts. Camps for refugees and internally displaced peoples can have large environmental footprints, particularly where they are unplanned or lack essential services, like water, sanitation and waste management. Their location is also important, as camp residents may be compelled to use local resources such as firewood, which can place local resources under pressure. People displaced by conflict may also move internally to urban areas, swelling the population and placing local environmental services under strain.

In some cases, the areas where displaced people move through may be placed under pressure, for example herders moving their livestock through sensitive ecosystems. Large scale refugee movements can also create transboundary environmental impacts, when areas in neighbouring countries struggle to cope with the influx of people and with meeting their basic needs.

One basic need common to displacement camps and to urban areas experiencing conflict is waste management. Systems often break down during conflict leading to increased rates of waste dumping and burning, improper management and less waste segregation. Waste management systems are just one element of environmental governance that may collapse during conflicts. Local environmental laws and regulations may be ignored, and local and national administrations may lose their capacity to monitor, assess or respond to environmental problems. New administrations may also emerge in areas that are held by non-state actors, and whose approach to environmental governance may differ markedly from that of the government. In recent years there has been a growing trend towards the weaponisation of environmental information during

conflicts, leading to the increased politicisation of environmental risks. [7,8]

Governments may be unable to meet their international environmental obligations, particularly because projects and programmes supported by the international community may be curtailed. In this way a localised conflict may harm the environment nationally by impacting governance and projects countrywide. The existence of a conflict can also create serious technological risks from industrial infrastructure, and then hamper the international cooperation required to address them.

These diverse impacts on the environment mean that conflicts are often viewed as sustainable development in reverse, and may set countries back years. Not just because of new damage, but in the development that would have taken place were it not for the existence of a conflict. But is it all negative? There are times where the existence of conflict can confer protection to areas, for example by slowing unsustainable development that would otherwise have taken place in areas that are insecure, or by excluding human activities due to the presence of explosive remnants of war. But overall, and particularly because of the disruption conflicts cause to societies and to governance, the harms far outweigh the benefits.[9,10]

Discussion

Occupations may be relatively short-lived, or can last decades. While states have an obligation to protect the occupied population, their environmental obligations are less well defined. As with conflicts, occupations can hold back sustainable development, for example by limiting access to materials or technologies, or by acting as a barrier to investment. Pre-existing environmental programmes and projects may be curtailed, or replaced by a new incoming administration.

A lack of investment and development can lead to the slow collapse of critical environmental infrastructure, infrastructure that may be damaged or degraded by periods of violence. Measures taken by the occupied population to oppose the occupier can also lead to environmental harm. The increased military presence can impact landscapes by vehicle movements or training areas, or by the building of walls and fences that can disrupt wildlife movements, or separate people from the resources they are dependent on. Poor waste management at military bases, whether operated by states or private contractors, can harm public health and the environment. Meanwhile, militarised responses to security issues can create more serious environmental harm than civil responses would.

Inequitable resource management is common to occupations, with resource grabs and over-extraction common, whether of water or minerals. Environmental oversight can be limited or preferential, facilitating environmental degradation. The occupied population may be unable to enjoy the same environmental human rights as those of the occupier, and be forced to live with limited resources, poorer environmental services and higher levels of pollution. [11,12]

Politically focused development is common as the occupying power seeks to make its mark on a territory. In this way major infrastructure works may be undertaken with little environmental oversight.

It is rare these days for conflicts to conclude cleanly with a peace agreement and a ceasefire. Low level conflict and insecurity can continue for long periods. In this respect many of the forms of harm that occur during conflicts are also applicable to this phase, particularly in its early stages.

Transitions to peace are typified by weak state control, this means that environmental governance, and the capacity to provide it is often absent. Attention to environmental issues in the face of many competing social and economic priorities is usually limited. These conditions are key to many post-conflict environmental problems. In some instances, peace and power sharing agreements have impeded governance by creating fragmented political systems.

In the immediate aftermath of conflicts, states and international actors may be faced with immediate legacies, such as vast quantities of rubble and debris. If managed poorly, for example through informal dumping, disposal can create new environmental risks. There have been instances where the looting of industrial sites has exposed communities to pollutants, and many of the environmentally harmful coping strategies that people used to survive during conflicts may continue well beyond their end.

In conflicts with high levels of displacement, land rights and ownership issues are common, particularly when returnees move home. Influxes of people can increase environmental pressures in areas from which they have been absent, particularly through agricultural conversion or expansion. This can lead to increased rates of deforestation. Research has shown a sharp increase in deforestation rates in many post-conflict countries, with clearance outpacing the state's ability to control it.

The presence of military forces can extend well into the post-conflict phase. The operation and ultimate closure or handover of bases are associated with pollution issues, particularly where the host nation

may be unable to enforce environmental standards. The use of practices like burn pits has exposed military personnel and communities to hazardous pollution, leaving veterans with ongoing health problems. The post-conflict clearance of landmines and explosive remnants of war can lead to soil degradation and localised pollution, and negative changes in land use when areas are released back to communities. [13,14]

The damage that conflicts do to environmental governance can have implications for environmental protection for years. This can set back progress on issues as diverse as pollution control, resource and protected area management, climate change adaptation and biodiversity protection. Finally, the environmental costs of recovery may be significant. Massive urban rebuilding projects can require huge volumes of resources.

While armed conflicts and military activities can cause or facilitate many different forms of environmental harm, addressing the environment during and after conflicts can also create opportunities for building and sustaining peace, and for helping to transform societies through sustainable recovery.

Shared natural resources can provide the basis for dialogue between warring parties, as can common environmental threats that extend across human boundaries and borders. Unpredictable energy supplies during conflicts can encourage a transition to solar power, while the devastation conflicts cause can be an opportunity to build back greener, or to create new domestic legal frameworks to sustainably manage resources.

However, these opportunities are dependent on more attention being paid to the environment before, during and after conflicts. If we fail to call for greater protection before and during conflicts, damage will be seen as acceptable. And if we ignore the environment after conflicts, we will not only miss out on opportunities to encourage sustainable recovery, we may also be setting states up for future resource conflicts. [15,16,17]

Results

Resources are a key source of conflict between nations: "after the end of the Cold War in particular, many have suggested that environmental degradation will exacerbate scarcities and become an additional source of armed conflict." [18] A nation's survival depends on resources from the environment. [18] Resources that are a source of armed conflict include territory, strategic raw materials, sources of energy, water, and food. [18] In order to maintain resource

stability, chemical and nuclear warfare have been used by nations in order to protect or extract resources, and during conflict. [18][19] These agents of war have been used frequently: "about 125,000 tons of chemical agent were employed during World War I, and about 96,000 tons during the Viet-Nam conflict." [19] Nerve gas, also known as organo phosphorous anticholinesterases, was used at lethal levels against human beings and destroyed a high number of nonhuman vertebrate and invertebrate populations. [19] However, contaminated vegetation would mostly be spared, and would only pose a threat to herbivores. [19] The result of innovations in chemical warfare led to a broad range of different chemicals for war and domestic use, but also resulted in unforeseen environmental damage. The progression of warfare and its effects on the environment continued with the invention of weapons of mass destruction. While today, weapons of mass destruction act as deterrents and the use of weapons of mass destruction during World War II created significant environmental destruction. On top of the great loss in human life, "natural resources are usually the first to suffer: forests and wild life animals are wiped out." [18] Nuclear warfare imposes both direct and indirect effects on the environment. The physical destruction due to the blast or by the biospheric damage due to ionizing radiation or radiotoxicity directly affect ecosystems within the blast radius. [19] Also, the atmospheric or geospheric disturbances caused by the weapons can lead to weather and climate changes.

Several studies have found a strong positive correlation between military spending and increased greenhouse gas emissions, with the impact of military spending on carbon emissions being more pronounced for countries of the Global North (i.e.: OECD developed countries). Accordingly, the US military is estimated to be the number one fossil fuel consumer in the world. Additionally, military activities involve high emissions of pollution. The Pentagon's director of environment, safety and occupational health, Maureen Sullivan, has stated that they work with approximately 39,000 contaminated sites. Indeed, the US military is also considered one of the largest generators of pollution in the world. Combined, the top five US chemical companies only produce one fifth of the toxins produced by the Pentagon. In Canada, the Department of National Defence readily admits it is the largest energy consumer of the Government of Canada, and a consumer of "high volumes of hazardous materials". Military pollution is a worldwide occurrence. Armed forces from around the world were responsible for the emission of two thirds of chlorofluorocarbons (CFCs)

that were banned in the 1987 Montreal Protocol for causing damage to the ozone layer. In addition, naval accidents during the Cold War have dropped at minimum 50 nuclear warheads and 11 nuclear reactors into the ocean, they remain on the ocean floor.[20]

Biological weapons are difficult to detect, economical and easy to use, making them appealing to terrorists. The cost of a biological weapon is estimated to be about 0.05 percent the cost of a conventional weapon in order to produce similar numbers of mass casualties per kilometer square. Moreover, their production is very easy as common technology can be used to produce biological warfare agents, like that used in production of vaccines, foods, spray devices, beverages and antibiotics. A major factor in biological warfare that attracts terrorists is that they can easily escape before the government agencies or secret agencies have even started their investigation. This is because the potential organism has an incubation period of 3 to 7 days, after which the results begin to appear, thereby giving terrorists a lead. A technique called Clustered, Regularly Interspaced, Short Palindromic Repeat (CRISPR-Cas9) is now so cheap and widely available that scientists fear that amateurs will start experimenting with them. In this technique, a DNA sequence is cut off and replaced with a new sequence or code that codes for a particular protein or characteristic, which could potentially show up in the required organism. Though this technique is a breakthrough and is commendable, it can cause serious issues and potential danger if used by people with evil intentions. Concerns have emerged regarding do-it-yourself biology research organizations due to their associated risk that a rogue amateur DIY researcher could attempt to develop dangerous bio weapons using genome editing technology. In 2002, when CNN went through Al-Qaeda's (AQ's) experiments with crude poisons, they found out that AQ had begun planning ricin and cyanide attacks with the help of a loose association of terrorist cells. The associates had infiltrated many countries like Turkey, Italy, Spain, France and others. In 2015, to combat the threat of bioterrorism, a National Blueprint for Biodefense was issued by the Blue-Ribbon Study Panel on Biodefense. Also, 233 potential exposures of select biological agents outside of the primary barriers of the bio containment in the US were described by the annual report of the Federal Select Agent Program. Though a verification system can reduce bioterrorism, an employee, or a lone terrorist having adequate knowledge of a bio-technology company's facilities, can cause potential danger by utilizing, without proper oversight and supervision, that company's

resources. Moreover, it has been found that about 95% of accidents that have occurred due to low security have been done by employees or those who had a security clearance.[21,22]

Conclusion

Chemical warfare is different from the use of conventional weapons or nuclear weapons because the destructive effects of chemical weapons are not primarily due to any explosive force. The offensive use of living organisms (such as anthrax) is considered biological warfare rather than chemical warfare; however, the use of nonliving toxic products produced by living organisms (e.g. toxins such as botulinum toxin, ricin, and saxitoxin) is considered chemical warfare under the provisions of the Chemical Weapons Convention (CWC). Under this convention, any toxic chemical, regardless of its origin, is considered a chemical weapon unless it is used for purposes that are not prohibited (an important legal definition known as the General Purpose Criterion). About 70 different chemicals have been used or stockpiled as chemical warfare agents during the 20th century. The entire class known as Lethal Unitary Chemical Agents and Munitions have been scheduled for elimination by the CWC. [23,24] Under the convention, chemicals that are toxic enough to be used as chemical weapons, or that may be used to manufacture such chemicals, are divided into three groups according to their purpose and treatment:

Schedule 1 – Have few, if any, legitimate uses. These may only be produced or used for research, medical, pharmaceutical or protective purposes (i.e. testing of chemical weapons sensors and protective clothing). Examples include nerve agents, ricin, lewisite and mustard gas. Any production over 100 g must be reported to the OPCW and a country can have a stockpile of no more than one tonne of these chemicals.

Schedule 2 – Have no large-scale industrial uses, but may have legitimate small-scale uses. Examples include dimethyl methylphosphonate, a precursor to sarin also used as a flame retardant, and thiodiglycol, a precursor chemical used in the manufacture of mustard gas but also widely used as a solvent in inks.[25,26]

Schedule 3 – Have legitimate large-scale industrial uses. Examples include phosgene and chloropicrin. Both have been used as chemical weapons but phosgene is an important precursor in the manufacture of plastics and chloropicrin is used as a fumigant. The OPCW must be notified of, and may inspect, any plant producing more than 30 tons per year.

Although herbicidal warfare use chemical substances, its main purpose is to disrupt agricultural food production and/or to destroy plants which provide cover or concealment to the enemy. The use of herbicides as a chemical weapon by the U.S. military during the Vietnam War has left tangible, long-term impacts upon the Vietnamese people that live in Vietnam. For instance, it led to 3 million Vietnamese people suffering health problems, one million birth defects caused directly by exposure to Agent Orange, and 24% of the area of Vietnam being defoliated. The United States fought secret wars in Laos and Cambodia, dropping large quantities of Agent Orange in each of those countries.[27,28] According on one estimate, the U.S. dropped 475,500 US gallons (1,800,000 l) of Agent Orange in Laos and 40,900 US gallons (155,000 l) in Cambodia. Because Laos and Cambodia were neutral during the Vietnam War, the U.S. attempted to keep secret its wars, including its bombing campaigns against those countries, from the American population and has largely avoided recognizing the debilitating effects on the people exposed at the time and the major birth defects caused for generations that followed. It also avoided compensating American veterans and CIA personnel stationed in Cambodia and Laos who suffered permanent injuries as a result of exposure to Agent Orange there.[29,30]

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