Environmental Degradation as both Consequence and Cause of Armed Conflict

Working Paper prepared for Nobel Peace Laureate Forum participants by PREPCOM subcommittee on Environmental Degradation

Prof Arthur H Westing
Dr Warwick Fox
Dr Michael Renner

June 2001

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1. Foreword

The age-old scourge of armed conflict (warfare), with the stakes now massively raised in the face of nuclear and chemical weapons of mass destruction, and the emerging global scourge of anthropogenic (humanly caused) environmental degradation, represent perhaps the two biggest, though potentially controllable, threats to the health and well-being of humankind — and of many other creatures as well — in the twenty-first century. To make matters worse, these two problems can interact in such a way as to feed off each other in a vicious circle, each exacerbating the other. This paper addresses these twin scourges and what might be done to mitigate their often intertwined effects.

2. Overview of two intersecting problems

To understand the relationship between the global environment and armed conflict, it will be useful first to summarize separately the status and dynamics of each.

2.1. Environmental degradation worldwide

Unsustainable discharges of waste gases into the atmosphere and large numbers of species extinctions throughout the world are but two of the most obvious indicators of the increasingly deleterious impact of humankind on the global biosphere. In fact, humans are utilizing all of the world's major renewable natural resources — agricultural soils, forest trees, range grasses, and ocean fishes — at rates ever more greatly exceeding their natural abilities to renew themselves. Humans are introducing pollutants — not only gaseous wastes, but also liquid and solid wastes — into the environment at levels increasingly beyond the point at which they can dissipate or decompose to insignificance. And humans are encroaching ever more drastically upon what remains of relatively wild nature throughout the world. Suitable land for agriculture and other human development, as well as fresh-water supplies, are becoming ever more scarce commodities throughout the world. Indeed, human arrogations of land, fresh water, and other natural resources continue to rise, representing a direct competition with wildlife. In 1850, humans and their livestock accounted for but 5% of total terrestrial animal biomass (an essentially finite amount); a century later this value had reached about 10%; currently it is just over 25%; and within 10 years such displacement (i.e., replacement) by humans of the terrestrial wildlife will have risen to 30% or more.

The various above-noted indicators of increasing levels of environmental degradation worldwide began to significantly exceed biospheric sustainability (i.e., exceed the globe's human carrying capacity) roughly 40 or 50 years ago. The noted degradation (lack of sustainability) can be attributed to a combination of increasing human numbers (these despite rising numbers of malaria, tuberculosis, cholera, and AIDS fatalities); increasing human

needs, desires, and technological abilities; and a reluctance by human society to deal with the problem in regionally and globally unified and otherwise responsible fashions, such reluctance exacerbated by the immense and growing North-South disparities in wealth, and further exacerbated by the immense and growing numbers of displaced persons (refugees).

2.2. Armed conflict worldwide

Human society has sorted itself into a huge array of social groups, large and small, more or less ephemeral, and only partially mutually exclusive. These many social groups derive their coherence and level of permanency from one or more affinities, among them especially geographical, political, ethnic, linguistic, religious, and economic. The most clearly defined and delimited of those social groups are the sovereign states (countries; nations) of the world, today approximately 192 in number. However, both within and overlapping those 192 or so tenaciously sovereign states there exist many hundreds of additional, less formal social groups enjoying varying levels of coherence, power, permanency, and delimitation. The often divergent interests of those many formal and informal groups inevitably lead to disputes (non-violent conflicts) between them. Fortunately for human society, the overwhelming majority of those inter-group disputes (whether interstate or intrastate) are resolved peaceably, that is, without resort to armed conflict. However, throughout human existence a relatively modest fraction of them have been settled by a resort to armed conflict.

Nowadays, considerable numbers of armed conflicts of several to many years' duration are always in progress somewhere or other in the world. By some measures, their numbers have actually been going up somewhat since the end of World War II until about a decade ago. But despite the increasing number of sovereign states since then, the number of interstate (international) armed conflicts has been declining in recent decades while the number of intrastate (non-international) armed conflicts has been rising. In fact, about 163 of the 192 sovereign states consider it necessary to devote a significant portion of their precious resources (material, financial, and intellectual) to maintaining regular armed forces on a continuing basis. They do so in order to deal with threats to their stability and tranquility, whether those be external or internal. On top of that, there are the internal social groups sufficiently dissatisfied with their existing lot to establish and support irregular (insurgent) armed forces that engage in the intrastate armed conflicts alluded to earlier, either with the regular armed forces of their state or with other internal irregular armed forces.

In summary, most sovereign states and the social groups within them are at peace most of the time, addressing their inter-group disputes non-violently, but nonetheless continue to consider armed conflict an acceptable means of solving any seemingly intractable dispute or peaceably unattainable goal, as evidenced by the fact that merely since World War II the regular armed forces of more than 100 sovereign states have engaged in armed conflict.

3. Environmental degradation as a consequence of armed conflict

Armed conflict is by its very nature deadly and destructive, sometimes dramatically so. Most of the environmental degradation caused by armed conflict is of an incidental or ancillary nature, but some of it is intentional, with these two categories of damage being outlined separately below. However, it should be noted at the outset that the ultimate levels of environmental degradation depend not so much on whether they were brought about intentionally or unintentionally (or even whether the weapons employed were old-fashioned or modern), but rather on the objectives, the will, and the tenacity of the parties involved.

3.1. Collateral (unintentional) degradation

Unintentional environmental degradation by armed conflict begins with the preparation for such action, being associated with: (i) establishing military fortifications and other military facilities; (ii) equipping and supplying armed forces with weapons and other military needs, and, in turn, disposing of these once they become obsolete or otherwise unwanted; (iii) training armed forces and testing the weapons they use; and (iv) deployment of armed forces nationally, in other sovereign states, and in areas beyond any national jurisdiction. Then during armed conflict unintentional (collateral) environmental degradation can result from: (i) the often profligate employment of high-explosive munitions against enemy personnel and matériel; (ii) the use of tanks and other heavy off-road vehicles; (iii) the construction of base camps, fortifications, and lines of communication; and (iv) the often heavy exploitation by armed forces in the field of timber, food, and feed, both within the theater of military operations and

beyond. For example, in the Kosovo (NATO-Yugoslavian) Conflict of 1999 the demolition of numerous oil refineries and fuel storage facilities had a substantial collateral impact on the local environment and public health. The aftermath of armed conflict often results in yet further forms of unintentional environmental degradation.

3.2. Deliberate degradation

The pursuit of armed conflict often involves the intentional destruction of field or forest as a specific means of denying to the enemy the benefits of such components of the environment. The benefits being denied to the enemy include access to water, food, feed, construction materials, and access to forest cover or sanctuary. Forests can be devastated for hostile purposes by various means, among them (e.g., during the Second Indochina War of 1961-1975) by spraying with herbicides, by the use of heavy tractors equipped with special forest-clearing blades, by saturation bombing, and at certain times and places, by the setting of self-propagating wild fires — all such actions leading secondarily to the decimation of wildlife as well as to soil erosion. Area denial, barrier, or channeling operations via the employment of land or sea mines result in especially pernicious impacts, particularly on the rural human environment. Moreover, the residual mines are often significantly augmented by a battlefield legacy of other unexploded ordnance, especially in terrestrial operations in which cluster munitions had been employed by the belligerents. The employment of biological, chemical, or especially nuclear weapons is likely to have an extraordinarily severe impact on the environment.

A number of important rivers flow through more than one sovereign state, providing an opportunity for an upstream belligerent to divert or befoul the waters before they reach a downstream enemy with which it is engaged in armed conflict, a potentially major social and environmental calamity in an arid region. In some battlefields (e.g., during the Gulf War of 1991) it is possible to release into the environment large quantities of oil for hostile purposes, which in liquid form lead to terrestrial or marine pollution, and if ignited lead to air pollution.

Under certain conditions, it is possible to manipulate some component of the natural or built environment for hostile military purposes in a way that is intended to result in the release of dangerous pent-up forces. This sort of military effort — which is often referred to as 'environmental warfare' — becomes especially tempting when the hostile manipulation involves a relatively modest expenditure of effort (i.e., of triggering energy) leading to the release of a substantially greater amount of directed destructive energy. Environmental manipulations of particular concern with reference to magnified destructive potential involve attacks on: (i) fresh-water impoundments (e.g., during the Sino-Japanese War of 1937-1945, World War II, and the Korean War of 1950-1953); (ii) nuclear power stations, resulting in the release of iodine-131, cesium-137, strontium-90, and other radioactive elements (recall Chernobyl, 1986); and (iii) industrial facilities that could release dangerous chemicals (recall Bhopal, 1984).

4. Environmental degradation as a cause of armed conflict

It is evident that armed conflicts can lead to environmental problems in terms of both resource scarcity and environmental degradation. However, those same environmental problems, whether caused by armed conflict or by other means, are increasingly understood to play an important role in generating or exacerbating disputes that might lead to armed conflict. Depleting water resources, over-exploiting fisheries, degrading arable land, decimating forests, and altering the natural balance of ecosystems from wetlands to coral reefs are among the principal processes of anthropogenic environmental change. Climate change is likely to augment these challenges.

4.1. General considerations

Although several transboundary environmental disputes exist and some of them could escalate in the future, environmentally induced armed conflict is far more likely to occur within states, rather than between or among them. Thus, China, India, Kazakstan, Kyrgyzstan, Mexico, Spain, Tajikistan, Turkmenistan, the USA, and Uzbekistan are among those states in which growing water scarcities have caused considerable internal disputes and, in a few cases, even violent confrontations.

Nonetheless, the waters of the Jordan and Litani Rivers did play a role in the Middle Eastern armed conflicts between Israel and its Arab neighbours. And conflicting claims over water resources have been cited as a possible cause of future interstate armed conflicts, for example, over the Nile waters among Egypt, Ethiopia, and Sudan, or over the Ganges and Brahmaputra waters between Bangladesh and India. However, should a downstream state be militarily weaker than the upstream state, then it is unlikely to challenge its neighbour in a bellicose manner over

water allocation issues. In any event, riparian states may well conclude that a diplomatic solution — working out an agreed plan to share available water resources — is preferable to a violent solution. But as rising water needs in the coming decades put ever growing pressure on available sources, it becomes far from clear that non-violent means will be pursued by states that find themselves in close water rivalry with their neighbours.

To the extent that environmentally induced armed conflicts are primarily taking place within states, they confirm the overall pattern of contemporary armed conflict alluded to earlier (see Section 2.2). Thus, of 110 armed conflicts active during the decade 1989–1999, 94 were internal (intrastate) armed conflicts; another 9 were principally internal, but also featured intervention by foreign forces; and only 7 (6% of the total) were of an interstate nature.

It is important to keep in mind that there is no such thing as a purely 'environmental' armed conflict. A perusal of available case studies suggests that there has been only one instance in which environmental degradation has been the principal immediate cause in triggering hostilities. The operation of a copper mine on the Pacific island of Bougainville, part of Papua New Guinea, in the 1970s and 1980s caused such massive damage (while the economic benefits accrued primarily to the central government and foreign investors) that the native island population decided to launch a sabotage campaign against the mine. This developed into a full-fledged guerrilla war that shut down the mine and lasted for several years. Although secessionist aspirations had existed on Bougainville, these only rose to the forefront after the environmental devastation had triggered hostilities (with the guerrilla front declaring independence in 1990).

Typically, environmental issues join other factors in generating armed conflict. A multitude of pressures and instabilities threatens to shred the social fabric of many societies, primarily in the non-industrialized world. A toxic brew of growing disparities in wealth, persistent poverty, job insecurity or unemployment, population growth, resurgence of infectious diseases, and environmental degradation is provoking social stress, discontent and polarization — leading to political strife in many states and to devastating violence in some. Even in the case of Bougainville, economic considerations (inadequate offers of compensation for the damage wrought) and ethnic differences came into play.

4.2. Environmental factors *vis-à-vis* armed conflict

The principal pathways in which environmental issues become relevant for disputes leading to armed conflict include: (i) disputes over access to renewable resources; (ii) disease burdens that overwhelm communities' ability to cope and that tear apart fragile social fabrics; (iii) the repercussions of flows of 'environmental' refugees; and (iv) the unequal nature of adverse impacts and burdens. Each of these four factors is next considered in turn.

(i) *Disputes over access to renewable resources:* Disputes leading to armed conflict may arise over access to renewable natural resources such as water, forests, and arable land. This may be the result of a tightening of supplies (depletion or degradation of natural resources), an unsustainable increase in demand (owing to population pressures or increased *per caput* consumption), distributive inequities, or a combination of those factors. Non-industrialized states, particularly those whose economies are heavily geared toward agriculture and other sectors that depend directly on the productivity of the natural resource base, are most immediately affected by environmental problems. There, the needs and interests of contending groups tied closely to the land — farmers, nomadic pastoralists, ranchers, and resource extractors — are often at odds and remain unreconciled.

(ii) *Disease burdens that overwhelm communities' ability to cope and that tear apart fragile social fabrics:* Environmental degradation — the unraveling of the earth's complex ecological safety nets — also causes numerous hardships, such as rising disease burdens and faltering food production. Indeed, societies across the planet are confronting a resurgence of infectious diseases. Environmental factors play an important role in human susceptibility to and transmission of diseases such as malaria, diarrheal diseases, and acute respiratory infections. Worldwide, close to one-fourth of all disabilities can be traced to such factors as polluted air or water and unsafe food. The spread of microbes that carry infectious diseases is facilitated by growing international travel, food trade, and refugee and other human population movements. Also, human encroachment on tropical forests brings people into closer proximity to insects and other animal vectors carrying unknown diseases; the building of large-scale dams encourages the spread of water-breeding disease vectors such as mosquitoes and snails; and climate change enables some diseases and associated vectors to extend their geographic reach and spread to previously unaffected areas.

Malaria, for instance, has staged a lethal comeback, especially in sub-Saharan Africa. It has been riding on the coat-tails of environmental degradation (logging, dam- and road-building, and the warmer temperatures and increased precipitation coming to be associated with climate change) plus the social upheaval caused by armed conflicts and refugee flows. It has been additionally helped along by the emergence of drug-resistant disease strains.

In some regions, particularly in sub-Saharan Africa, the demographic and economic impacts of infectious and respiratory diseases are of sufficient magnitude to overwhelm fragile health systems, cause large-scale economic dislocations, and trigger social upheavals.

(iii) *The repercussions of flows of 'environmental' refugees:* The deterioration of forest watersheds, wetlands, and other ecosystems and their associated eco-services has additional fateful consequences: human communities have less protection against extreme weather events. The decay of ecosystems sets the stage for more frequent and more devastating 'un-natural' disasters — natural disturbances made worse by human actions. The past 50 years have seen a dramatic increase in the human impact of natural disasters, which have increasingly been abetted by the human hand. More than 2 thousand million people worldwide were affected by disasters in the 1990s, and the economic toll of natural disasters during the 1990s alone was more than that of the previous four decades combined. Moreover, the expected climate change is likely to increase the actual worldwide incidence of natural disasters.

Environmental degradation may in some cases be sufficiently extreme to undermine the habitability of a given area and to compel the local population to pack up and leave in search of new homes. Those people are in effect being turned into 'environmental' refugees by the inability to sustain their livelihoods. Indeed, growing water scarcity, soil erosion, desertification, and other environmental calamities are now contributing to the uprooting of large numbers of people, though reliable (or uncontroversial) numerical estimates do not exist. Often, worsening environmental conditions combine with adverse social circumstances to compel people to move: for instance, unequal land distribution forces many peasants in non-industrialized states to cultivate steep slopes, areas cleared in the rainforest, or other unsuitable patches of land. The soil productivity of these areas tends to be exhausted relatively swiftly, forcing people to move on — to even steeper slopes, deeper into the rainforest, into existing protected natural areas, or perhaps to cities, giving up agriculture entirely.

Also, many people are being displaced by large-scale infrastructure projects. During the 1990s, tens of millions of people worldwide lost their homes to make way for dams, roads, logging operations, and other projects. In most cases, they took the brunt of the adverse impacts while not slated to share in any of the economic benefits that may arise from such resource exploitation.

The repercussions from climate change are likely to sharply boost the numbers of those affected. If substantial climate change becomes a full-blown reality, it will compound present environmental challenges by raising sea levels, shifting vegetation zones, and changing precipitation and wind patterns. If heavily populated coastal areas are inundated and crop harvests in some regions are decimated by more frequent droughts, to cite just two possible consequences, there could be dramatic increases in food insecurity.

A flood of 'environmental' refugees may find it difficult to find a new livelihood in other rural areas or already-crowded cities and may even clash with unwelcoming host communities. The influx of people into another region or state can impose a considerable burden on the receiving area in terms of increased competition over land, water, jobs, communal facilities, and social services. This is especially the case if the host state's economy is stagnant or in decline or its government is corrupt and indifferent to the needs of its people, or if the influx is sudden and massive. All too often, newcomers are suspected of taking away jobs, irredeemably altering the local culture and customs, or being generally unwelcome competitors. In many urban settings, the struggle over scarce services is particularly intense. Although population movements do not inevitably bring about armed conflict, the potential for trouble is present. This is particularly the case where political leaders or challengers are eager to capitalize on stirring up xenophobic (anti-foreigner) resentments.

(iv) *The unequal nature of adverse impacts and burdens:* Another potential cause of armed conflict is that the burdens resulting from environmental degradation will be felt highly unevenly by different social groups and communities. This uneven impact may well reinforce existing social and economic inequities or deepen ethnic fault lines, and therefore heighten patterns of polarization in society. As cases from India, Mexico, Nigeria, Papua New Guinea, Sudan, and other states show, poorer communities, minority groups, and indigenous peoples typically bear

the brunt of adverse environmental change, particularly such change triggered by oil drilling, mining, logging, or large-scale dam and irrigation projects. For instance, the Sardar-Sarovar dam and irrigation project in India's Narmada valley will primarily benefit a small number of wealthy farmers, while the burdens — flooding of villages and arable land, decimation of local fisheries, and loss of ancestral lands and cultural monuments — will fall on hundreds of thousands of poorer peasants.

It is not a given that environmental degradation or its repercussions will cause armed conflict. But they do sharpen hardships and burdens, heighten the desperation of those affected, and reinforce the 'zero-sum' nature of many disputes. Because many societies fall short on dispute-prevention and mediation capacities, and political leaders (or their challengers) often find that they can gain influence or strengthen their power by fanning the passions of their constituents, it is very likely that environmental factors will play an increasingly important role in triggering or aggravating disputes that lead to armed conflict.

5. Approaches to mitigating the two intersecting problems

The mitigation of environmental degradation and armed conflict can be approached from legal, institutional, and educational directions, both individually and collectively. However, the sections to follow will make it clear that it becomes a special challenge to make those approaches actually work in practice.

5.1. Legal and institutional approaches focusing on environmental degradation

The degradable environment (the global biosphere) consists of two major, though inextricably interlocking, components: its living or biotic portion (plants, animals, including humans and their livestock, and microörganisms); and its non-living or abiotic portion (air, water, soil minerals, etc.). To some extent, the global biosphere functions as one coherent system, but at the same time it consists of numerous more or less discrete subsidiary systems and sub-systems. Superimposed upon these many ecological systems that blanket the earth are two major political divisions: the territorial realm (currently divided into some 192 sovereign states); and the extra-territorial realm (those domains beyond national jurisdiction, including especially the atmosphere, the high seas, the celestial bodies, outer space, and perhaps Antarctica). The foregoing should make it clear that international environmental treaties are indispensable in addressing those many environmental problems that cross one to several or more international boundaries.

The international instruments meant to prevent or mitigate environmental degradation are thus aimed at one or more of the above-mentioned components, systems, and realms or their subdivisions. As such, those instruments are variously bilateral, regionally multilateral, or universally multilateral in scope. Thus, bilateral treaties exist that serve to protect some of the many smaller ecological systems under divided national jurisdiction, that is, those that straddle the 220 thousand kilometers or so of shared state boundaries. Among these (to name but a few in summary form) are: 1971+1972 Australia/Indonesia (United Nations Treaty Series = UNTS 14122+14123); 1974 Saudi Arabia/Sudan (UNTS 13605); and 1974 France/Spain (UNTS 14591). At the next higher level of consolidation — and in some ways the most important one — there exist a number of regional multilateral treaties, meant to protect such ecogeographical regions under multiple national jurisdiction as: the Mediterranean Sea, via, for example, the 1976 Mediterranean Pollution Convention (UNTS 16908) plus its 1982 Protected Areas Protocol (UNTS 24079); the whole of Africa, via the 1968 African Conservation Convention (UNTS 14689); the Nordic region, via the 1974 Nordic Environmental Convention (UNTS 16770); and the South Pacific region, via the 1986 South Pacific Natural Resources and Environment Convention (not UNTS registered). Various of the Regional Seas Programmes sponsored by the United Nations Environment Programme are also worth lauding in the regional context, prominent among them their resulting 1976 Mediterranean, 1978 Kuwait [Persian Gulf], 1981 South-east Pacific, 1982 Red Sea and Gulf of Aden, and 1983 Wider Caribbean Action Plans.

The best example of an approach to protecting the environment of an extra-territorial domain is the 1982 Law of the Sea Convention (UNTS 31363). Among other applicable ocean instruments, there is the 1973+1978 Marine Pollution Convention plus Protocol [MARPOL] (UNTS 22484). One aspect of the atmosphere is meant to be protected by the 1992 Climate Convention (UNTS 30822) plus its 1997 Kyoto Protocol on Greenhouse Gases (not as yet in force); another is via the 1985 Ozone Convention (UNTS 26164) plus its 1987 Protocol, as amended in 1990 and 1992 (UNTS 26369); a relevant instrument, unfortunately of only regional scope, is the 1979 European Long-range Air Pollution Convention (UNTS 21623). Regrettably, there exists as yet no comprehensive Law of the

Air comparable in scope to the Law of the Sea. And, if the following domain be considered extra-territorial, one can add that the marine living resources surrounding Antarctica are protected via, for example, the 1980 Antarctic Marine Living Resources Convention [CCAMLR] (UNTS 22301).

A sizable number of universal multilateral treaties address one component or other of the global biosphere. The most important of these regarding its biotic component overall are the 1973 Convention on International Trade in Endangered Species [CITES] (UNTS 14537), the 1979 Migratory Animal Convention (UNTS 28395), and the 1992 Biological Diversity Convention (UNTS 30619). Other instruments deal with particular categories of the biota, for example, the 1972 Antarctic Seal Convention (UNTS 16529) and the 1973 Polar Bear Agreement (not UNTS registered). The most important of the multilateral treaties regarding the abiotic component of the global biosphere are meant to protect: important fresh and salt waters, via the 1971 Wetland Convention (UNTS 14583); the soil, via the 1994 Desertification Convention (UNTS 33480); and the atmosphere (see above). One of the key instruments in this category that embraces both the biotic and abiotic components is the 1972 World Cultural and Natural Heritage Convention (UNTS 15511).

Altogether, there are now in force more than 200 regional and universal multilateral environmental treaties. Although the number of these international treaties has risen sharply in recent decades, environmental diplomacy is now more often devoted to strengthening the existing ones rather than drafting new ones (often through the mechanism of additional protocols). Implementation and enforcement are major challenges, indeed. In this regard, it seems almost superfluous to note that all sovereign states must, in parallel with submitting to any international treaty, enact domestic legislation and associated administrative mechanisms that will ensure the fulfillment of the accepted obligations. However, what must without fail be noted here is that although most of the international environmental treaties are in principle applicable during both times of peace and armed conflict (being for the most part silent on that distinction), regrettably it seems to be widely accepted implicitly among the states parties that this body of law is operative only in times and places of peace. Indeed, most of the marine environmental protection treaties go so far as to explicitly exempt naval vessels from their strictures even in times of peace.

5.2. Legal and institutional approaches focusing on armed conflict

Five general approaches via international law can be distinguished that serve to prevent or minimize environmental degradation resulting from armed conflict. These are for the most part applicable to interstate armed conflicts, though some serve an intrastate function as well, which is alluded to below as applicable. And one might well point out once again that in order for military constraints on environmental degradation to have the chance to become operative, they must be reinforced by domestic enabling legislation and unambiguously incorporated into the military manuals and rules of engagement of those many sovereign states maintaining regular armed forces.

The most obvious approach to limiting environmental degradation caused by armed conflict is to prevent the occurrence or likelihood of armed conflict. Here there exists the 1928 Treaty for the Renunciation of War (League of Nations Treaty Series = LNTS 2137). This quite widely adopted, though similarly widely ignored, instrument makes it illegal for its many states parties to engage in interstate armed conflict. Then there exist the 1899 Permanent Court of Arbitration and the 1945 International Court of Justice, both of which provide exemplary mechanisms for the settlement of interstate disputes by non-violent means. It is a tragedy that rather few sovereign states have accepted either of those institutions on a compulsory and unconditional basis, a deficiency that undermines the very concept of the pacific dispute resolution they offer. The jurisdiction that these two courts exercise is over sovereign states. The International Criminal Court (its Statute drafted in Rome in 1998, but not as yet in force) would have jurisdiction over individuals accused of war crimes or other crimes against humanity. As to intrastate dispute resolution, again only a very few sovereign states enjoy the benefits of a sufficiently robust legal system imbedded in a democratic and non-corrupt matrix of governance to which internal (domestic) social groups could turn for the adjudication of real or perceived wrongs.

A second approach to limiting environmental degradation caused by armed conflict, albeit a regional one, is to establish so-called zones of peace within which the world community of sovereign states (or at least some significant fraction of them) agrees not to wage armed conflict. A number of such zones do, in fact, exist, among them: Antarctica, via the 1959 Antarctic Treaty (UNTS 5778); the Svalbard archipelago, via the 1920 Spitsbergen Treaty (LNTS 41); the Åland archipelago, via the 1921 Aaland Island Convention (LNTS 255); and even outer space, the moon, and other celestial bodies, via the 1967 Outer Space Treaty (UNTS 8843) and the 1979 Moon

Agreement (UNTS 23002). A related approach is to establish a nuclear-weapon-free zone, of which a number of such attempts exist, for example: Latin America plus the Caribbean region, via the 1967 Tlatelolco Treaty (UNTS 9068); the South Pacific region, via the 1985 Rarotonga Treaty (UNTS 24592); Southeast Asia, via the 1995 Bangkok Treaty (UNTS 33873); the whole of Africa, via the 1996 Pelindaba Treaty (not yet in force); and the ocean floor beyond the limits of national jurisdiction, via the 1971 Seabed Treaty (UNTS 13678).

A third approach to limiting environmental degradation caused by armed conflict, or at least from some potential aspects of it, is to prohibit or limit the use of weapons that are especially disruptive of the environment. Thus, the use in interstate armed conflict of chemical or biological weapons is prohibited by the 1925 Geneva Protocol on Chemical and Bacteriological Warfare (LNTS 2138); and the very possession of biological and toxin weapons is prohibited by the 1972 Biological Weapon Convention (UNTS 14860), with efforts under way by the states parties since 1996 to draft a protocol to monitor compliance. Certain restraints on the use in interstate armed conflict of anti-personnel land mines are imposed by both the 1981 Protocol II and its 1996 amended version of the 1981 Conventional Weapon Convention (UNTS 22495); and the very possession of anti-personnel land mines is prohibited by the 1997 Land Mine Convention (UNTS 35597). Tragically, there exists as yet no multilateral instrument that would prohibit the use (let alone the possession) of nuclear weapons.

A fourth approach to limiting environmental degradation caused by armed conflict is to prohibit certain means of armed conflict. The best example here is the constraints on attacking agricultural areas, dams, and nuclear electric generating stations, both with reference to interstate armed conflict, via the widely adopted 1977 Protocol I additional to the 1994 Geneva Conventions (UNTS 17512), and to intrastate armed conflict, via the similarly widely adopted 1977 Protocol II to the 1949 Geneva Conventions (UNTS 17513). More generally, 1977 Protocol I additionally establishes the principle of prohibiting means of interstate armed conflict that may be expected to cause the natural environment widespread, long-lasting, and severe damage (however, with those three obligate damage delimiters not otherwise defined). There also exists a rather ineffectual restriction on environmental manipulations for hostile interstate purposes, as established by the relatively unpopular 1977 Environmental Modification Convention [ENMOD] (UNTS 17119). There also exists a modest restriction on the destruction in interstate armed conflict of forests by fire, via 1981 Protocol III of the 1981 Conventional Weapon Convention (UNTS 22495). There are as yet no specific restrictions on bombing (including on the use of cluster munitions) or on the use of tractors for hostile land-clearing purposes.
The fifth approach to limiting environmental degradation caused by armed conflict is to prohibit or constrain destruction, seizure, or over-exploitation of natural resources. For example, destruction or seizure of enemy property is constrained by 1899 Hague Convention II on the Laws and Customs of War on Land, by its more widely adopted revision, 1907 Convention IV, and by the almost universally adopted 1949 Geneva Convention IV for the Protection of Civilians in Time of War (UNTS 973). Non-usufructory exploitation of such enemy resources as forests and agricultural works during an occupation (i.e., exploitation in an environmentally damaging fashion) is prohibited by both 1899 Hague Convention II and 1907 Hague Convention IV.

Finally, it is important to note that the law of war (of armed conflict), various components of which were alluded to above, rests on two fundamental premises: (i) that the right of belligerents to choose methods of warfare is not unlimited; and (ii) that those military actions not precisely regulated are to be controlled by the principles of humanity and the dictates of the public conscience.

5.3. Making the institutional and legal approaches work

There is clearly a wealth of international treaties and related instruments that can be invoked with respect to the protection of the environment. The same can be said with respect to international treaties and agreements preventing or regulating the conduct of armed conflict. These observations apply notwithstanding the existence of significant gaps in both areas, one notable example referred to earlier being the lack of any multilateral agreement that would prohibit the use (let alone the possession) of nuclear weapons (see Section 5.2). Unfortunately, most of the numerous multilateral environmental treaties lack workable enforcement mechanisms, or even any mechanism for monitoring compliance, rendering them substantially weaker than desired. Similar observations could be made with respect to treaties regarding the prevention and regulation of armed conflict.. Moreover, as suggested earlier, even where international environmental treaties are respected, they tend to be set aside in times of armed conflict, and even in regard to matters concerning the readiness for armed conflict, such as the exemption of naval vessels from most of the marine environmental protection treaties even in times of peace (see Section 5.1).

A monitoring component for multilateral treaties must be supported because it offers the opportunity for non-governmental organizations and other citizen groups to publicize any shortcomings in compliance, which provides a way of applying pressure on recalcitrant governments. Multilateral non-binding confidence- and security-building measures might be suggested as a step in the progressive evolution toward multilateral treaties in those cases where states have not as yet reached the point of wishing to enter into binding commitments. And the United Nations Environment Programme and United Nations Commission on Sustainable Development ought to be given more central roles in supporting and coordinating the multifarious international environmental agreements.

The strength of the commitments that individual governments are prepared to make to the above policy suggestions will be a function of that quasi-mythical beast known as 'political will'. Political analysts have long noted a robust correlation between a government's — or at least a democratically elected government's — willingness to listen to the people (and act on the basis of that information) and the likelihood that it will be thrown out of office if it does not. It becomes considerably easier for a government to exercise political will when the alternative is to no longer be the government in power. In light of these remarks, it seems difficult to overestimate the importance of the role of informed citizenries in motivating the political wills of governments with respect to environmental protection and constraints on armed conflict, which duly leads to the matter of education.

5.4. Educational approaches, both formal and informal

In the context of this discussion, it should be clear that the first set of ideas that people in general and political leaders and corporate leaders in particular (as well as other significant social influencers) need to be alerted to is: (i) the very fact that there does, indeed, seem to be good evidence of a causal link between environmental degradation and the possibility or exacerbation of armed conflict; (ii) that the causal arrow runs in both directions; (iii) that environmental degradation and armed conflict can therefore feed off each other in a vicious circle; and (iv) that, as anthropogenic pressures upon the environment increase, it is likely that the risk of environmentally induced or exacerbated armed conflict will also increase.

Many people have hardly thought about these points. Consider the fact that armed conflict can be a direct cause of environmental degradation. To most people, the 'environment' — including both non-sentient living things and other sentient creatures that are not human — is just the background against which human armed conflicts are fought out. The human casualties are what matter; damage to the 'environment' — let alone the suffering of 'innocent bystanders' in the form of other sentient creatures — is a very distant secondary concern, if that. Likewise, many people have hardly thought about the fact that environmental degradation has been and is perhaps increasingly likely to become a precipitating or exacerbating factor in causing disputes leading to armed conflict. This concern is actually beginning to find its way into the national strategic thinking of a number of major states, but still remains outside the sphere of most people's concerns. It is therefore extremely important that the reciprocal links between environmental degradation and armed conflict are clearly conveyed to the global population at large not only through the formal channels of education, but also through the informal ones offered by the various print and electronic media. Whereas formal education is fundamentally important, it is certainly also the case that the media exercise a strong influence on the public and thereby also on the political agenda, both nationally and globally, with respect to natural disasters, humanitarian crises, and armed conflicts.

The upshot of the environmental-degradation/armed-conflict message for the role of public education is not merely to alert people to this reciprocal link, but to provide the educational tools that are necessary to understand it and then to respond to it constructively. This means that there is a need for widespread education and dissemination of knowledge with respect to ecological literacy or 'eco-literacy' on the one hand and non-violent, negotiated forms of dispute resolution on the other hand. Questions concerning the fundamental principles and forms of non-violent, negotiated forms of dispute resolution have received much attention in the past. Therefore, the importance of these matters will simply be underlined here. What has historically received much less attention is the subject of eco-literacy, and that will be the primary focus here.

Stressing the importance of eco-literacy means prevailing upon governments to institute educational policies, and the media to disseminate knowledge and discussion, that have the aim of explaining the basic 'facts of life' with respect to the interlinked and interdependent nature of life on earth, and of discussing the nature of individual and collective human responsibilities in the face of those facts of life. There are several key aspects to this. First, it is

important for people to understand, at least in broad terms, the sheer scale of anthropogenic pressures upon the planet together with the present and likely future consequences of those pressures. This inevitably means considering the ways in which a range of interacting factors contribute to these anthropogenic pressures. Foremost among these factors are the roles of population size and growth, levels and patterns of consumption, and technological capacity (for both environmental good and ill). Reflecting upon those interacting factors should lead different populations, and different groups within those populations, to conclude that they have different kinds of capacities and responsibilities with respect to reducing anthropogenic environmental pressures.

The second, albeit closely related, thing that eco-literate citizens need to understand is that environmental problems do not respect national borders. (The same goes for people who have no choice but to escape from intolerable environmental problems and who become 'environmental' refugees in order to survive.) Major environmental problems (such as those of climate change and sea-level rise caused by global warming, ozone depletion, and loss of biological diversity) are trans-boundary problems that need ultimately to be addressed at the level of transnational regional or universal agreements. It follows, then, that national security increasingly requires global environmental security. Realizing this, eco-literate citizens will urge their governments to make transnational environmental agreements and, significantly, to make them work, as suggested earlier (see Section 5.3).

The third point that should be briefly noted here is that education for eco-literacy is not simply a matter of alerting people to the general message coming from the environmental sciences, but also of introducing them to a discussion of environmental ethics. The formal study of ethics has in the past been restricted almost exclusively to questions regarding human obligations toward other humans (and not necessarily toward all other humans at that). In contrast, the discussion of environmental ethics — that is, of human obligations toward or in respect of the rest of the world — has only begun to emerge since the 1970s in any serious and sustained way. This still emerging area of inquiry constitutes a most important resource for education in the twenty-first century.

When one thinks of the crucial topic of education and the inexorable nature of anthropogenic environmental problems, it becomes easy to accept the notion that human history becomes more and more a race between education and catastrophe. However, there are grounds here for cautious optimism. As literacy and higher education spread ever more widely throughout the world, and global communications become ever more pervasive, these factors might in time lead to a substantial transnational educated elite who would identify more with their peers in other states than with their local compatriots. Better educated (and more affluent) people will be more likely to question all aspects of governmental policy. Formal and informal channels of education have a supremely important role to play in ensuring that this questioning of governmental policy proceeds from a combined socio-literate and eco-literate basis. These two channels of education must therefore be encouraged to play that role.

6. Closing remarks

Several important trends have been noted. Globally, environmental degradation is getting worse whereas the frequency of occurrence of armed conflict seems not to have fluctuated substantially during modern times. However, hidden within this latter observation are two counterposing trends: on the one hand, the number of interstate (international) armed conflicts has been declining in recent decades — despite the trend toward an increasing number of sovereign states — while, on the other hand, the number of intrastate (non-international) armed conflicts has been rising. The pattern of environmentally-induced armed conflict is consistent with this overall pattern of contemporary armed conflict. That said, there is a range of reasons to be extremely concerned about the possibilities of environmentally induced armed conflict in the future. Foremost among these are: (i) disputes over access to renewable resources; (ii) environmentally related disease burdens that can overwhelm communities' ability to cope and that tear apart fragile social fabrics; (iii) the repercussions of flows of 'environmental' refugees; and (iv) the unequal nature of adverse environmental impacts and burdens.

In response to those challenges, it is of the first importance that all governments be encouraged to: (i) adopt international agreements on environmental protection as well as on non-violent dispute resolution; (ii) support innovative measures to make those treaties work; (iii) honour the wealth of agreements already in force; and (iv) use all of those agreements so as to also encourage their adoption and use by non-party states. Education for both eco-literacy and non-violent dispute resolution is likewise of the first importance, not least in helping to drive the political will of respective governments to honour the kinds of international agreements to which reference has just been made.

It seems almost superfluous to add, yet necessary all the same, that the 'options' in regard to proceeding in something like these general ways are decidedly limited. But lest this sound too ominous, it is worth noting that a source of hope may lie in the very seriousness of present environmental trends. That is because environmental problems of global consequence (the continuing loss of renewable resources — and this in the face of a still growing world population; the continuing loss of biodiversity; and the inexorable processes of global warming — exacerbated by the continuing and intertwined instances of armed conflict) are now beginning to occur on a human time scale rather than a geological or evolutionary time scale. A great many people globally might therefore start taking the growing environmental problems and the continuing social violence personally. And when people do that, a great many changes — admittedly for good or ill — can happen remarkably quickly.

<Title note>

* Invited briefing paper for the *Forum for Nobel Peace Laureates* (Freycinet, Tasmania, 17-20 May 2002) of the World Institute for Nonviolence & Reconciliation. The authors are ***Warwick A. Fox*** (Senior Lecturer in Philosophy, Centre For Professional Ethics, University of Central Lancashire, Preston PR1 2HE, United Kingdom, wafox@uclan.ac.uk), ***Michael Renner*** (Senior Researcher, Worldwatch Institute, 25 Treasure Rd, Riverhead, NY 11901, USA, mrenner@peconic.net), and ***Arthur H. Westing*** (Consultant, Westing Associates in Environment, Security, & Education, 134 Fred Houghton Rd, Putney, VT 05346, USA, westing@sover.net).