FOIA Number: 2012-0769-F

FOIA MARKER

This is not a textual record. This is used as an administrative marker by the William J. Clinton Presidential Library Staff.

Collection/Record Group: Clinton Presidential Records

Subgroup/Office of Origin: Council on Environmental Quality

Series/Staff Member: Kathleen (Katie) McGinty

Subseries:

OA/ID Number: 2901

FolderID:

Folder Title:
Militarism

Stack:	Row:	Section:	Shelf:	Position:
S	61	6	1	3

TAKING STOCK

EMERGING DESIGN

the impact *of* militarism ON THE ENVIRONMENT

Preliminary report prepared by Science for Peace

Taking Stock: The Impact of Militarism on the Environment is an ongoing project of Science for Peace, an organization representing over 500 individuals active within the scientific community in Canada.

In December 1991, Science for Peace established a Working Group on Militarism and the Environment. This report is a preliminary version of a more comprehensive study, envisaged as an inventory of the impact of global militarism on the environment.

For further information or to comment, please contact:

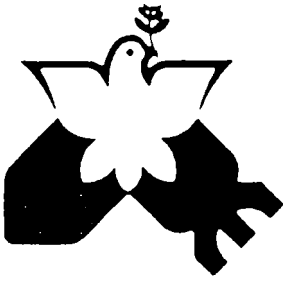
The Working Group on Militarism and the Environment
Science for Peace
University College, University of Toronto
Toronto, Ontario
M5S 1A1
Telephone: (416) 978-3606
Fax: 416-978-5848
E-Mail: Fawcett@UTORPHYS

Acknowledgements:

Science for Peace acknowledges the generous financial support of the Simons Foundation (Vancouver, British Columbia) in the preparation of this report.

Cover page: Emerging Design
Printed on recycled paper: 50% recycled and 10% post-consumer waste.

February 1992.



INTRODUCTION

The world's armed forces are the single largest polluter on earth.[1]
—Ruth Leger Sivard, 1991.

THIS REPORT TAKES STOCK of the overwhelming impact of militarism on the environment.

The world faces a growing list of environmental and human emergencies: ozone depletion, global warming, air and water pollution, desertification, destruction of tropical rainforests, resource depletion, hunger, poverty and war.

In recent years, the public has become more aware of the military's particular contribution to environmental degradation. In the name of "national security", much of the data needed to get a comprehensive picture is inaccessible to the the public.[2] However, our findings show that unrestrained militarism has a deadly impact on the earth and its inhabitants.

This report is a first step in an effort by Science for Peace to compile a comprehensive inventory of the effects of militarism on the environment during the Cold War. Although we illustrate the global dimensions of the problem our study is far from complete.

The continuing commitment of many nations to nuclear weapons, to high military expenditures and to a robust global arms trade suggests that the destructive patterns of the Cold War may be with us for the foreseeable future.[3]

It is important not only to take stock of the extent of the problem, but also to examine alternatives. Therefore, this report looks at some alternative proposals for the use of human, material and financial resources now allocated to militarism.

Part One of this report examines the environmental impact of war, taking as a case study the recent Gulf War.

Part Two looks at the environmental impact of military establishments. In particular, we focus on resource depletion and the hazards of global militarization.

Part Three outlines some proposals for dealing with environmental problems caused by militarism. We include a discussion of the economic and technological conversion of military resources to the civilian area of environmental protection.

1. ENVIRONMENTAL IMPACT OF WAR

Destruction of the environment has been an established method of warfare, both defensive and offensive, from ancient time.[4]

WARS TODAY are almost exclusively fought in developing countries. In the past 45 years, the Third World has experienced 125 wars, with overwhelming human costs:

- A death toll of over 40 million. The proportion of civilian to military casualties rose from 74 percent in the 1980s to nearly 90 percent in the 1990s.[5]

- Millions more have been injured and maimed in wars. For example, in Angola at least 20,000 "... have lost limbs due to planting and harvesting of mine-infested fields."[6] Few will ever receive medical care or rehabilitation. Statistics for many other war-torn countries, such as Afghanistan and Vietnam, tell the same tragic story.

- Fifteen million refugees have fled from war zones.[7] Five million from Afghanistan. One million from El Salvador. In Mozambique one third of the population was driven from their homes. The meaning of the word "refugee" was made vivid in the Persian Gulf war, as the world watched the Kurds flee to the mountains. As a result of the Gulf War, nearly five million people were displaced or became refugees.[8]

In environmental terms, the costs have been equally staggering; entire ecosystems have been destroyed. The examples given below are indicative of the global damage inflicted in these wars:

- One third of Vietnam is now considered wasteland as the result of war. Farmland is pocked by two-and-a-half million bomb craters. Forests were defoliated by 50 million litres of agent orange. "Between 1945 and 1982, Vietnam lost over 80 per cent of its original forest cover."[9] The ecological devastation of the country will take generations to repair.[10]

- In Afghanistan hundreds of thousands of mines litter the fields and mountain passes. Centuries-old irrigation systems have been destroyed.

- In Africa, political upheaval and wars have been major contributors to the famines that repeatedly threaten the survival of millions.

- In Central America, counter-insurgency offensives have included "scorched earth" policies, razing forests, crops and hundreds of villages.

In the words of Ruth Leger Sivard: "The legacies left by the big wars of recent decades will stay to haunt generations to come... . The costs in terms of global progress are incalculable."[11]

The Gulf War is the most recent example of war's destructive potential.

THE GULF WAR: AN ECO-DISASTER

> **"... oil spills and fires, and destruction of the desert ecology by bombs, shells and tanks made the Gulf war the greatest environmental disaster in modern history."**[12]
>
> **The Gulf War began a massive uncontrolled experiment on the environment and its people... This war, fought to secure access to oil supplies and ensure low oil prices, ironically resulted in massive environmental damage caused by the resource it was aimed to protect.**[13]

THE GULF WAR is one of the most documented wars ever. Greenpeace, the Gulf Environmental Response Team, The World Society for the Protection of Animals and the Harvard-led International Study Team on the Gulf Crisis have documented the colossal toll of the war on the environment and people in the region.[14]

Pollution of Gulf Waters and Coastline

Four to eight million barrels of oil were spilled into the sea during the Gulf war.

Four hundred and sixty miles of coastline have suffered massive damage due to oil spills and burning oil wells. "The extensive sheltered bays and mudflats are clogged with oil, killing the flora and fauna vital to the survival of the shallow Gulf ecosystem."[15]

Damage to the marine ecosystem includes widespread destruction of coral reefs, mangroves and sea-grass beds. Crude oil may have long-term chronic effects that will eventually lead to coral death.[16]

The impact on marine life is extensive. Greenpeace researchers found that in some areas: "Rocks are coated in tar, oil covers the beaches above and below the high and low water marks." In most of these areas there is no surviving marine life on the shore. A decrease in Gulf water temperatures has affected marine production, including fisheries.[17]

Four species of dolphins, two of which are on the endangered list, live in areas of concentrated oil pollution. Hundreds of marine turtles have been found dead, representing only a fraction of the overall mortality rate.[18]

Air Pollution

Between **500 and 700 burning oil wells** caused severe atmospheric pollution.

The main environmental consequences of the oil fires are:

- acid rain
- chemical smog (causing respiratory problems)
- reduced solar radiation (causing a 5°C drop in temperature)
- disruption of agriculture (low temperatures and lack of sunlight affect growing seasons)
- soil contamination.[19]

The World Meteorological Organization (WMO) estimated that at the end of the war the oil fires emitted 40,000 tons of sulphur dioxide daily. Sulphur dioxide is a major precursor to acid rain. Emissions were higher than the daily emissions of France, Germany and Britain combined.[20]

Oil fires "... generated a blanket of soot, gases and chemicals over the region."[21] Soot has been found in the precipitation of the Himalayas, Turkey, Iran, Oman and the Southern Soviet Union. Burning wells released hundreds of different chemicals and gases into the atmosphere. The human population was not protected from soot because respirators were not provided.

Land Pollution

Over 100,000 tons of bombs were dropped on Iraq and Kuwait during the forty-day war.[22] Allied forces dropped as many bombs on Kuwait and Iraq as were dropped during all of World War II. Unexploded bombs, land mines and booby traps present a constant and long-term hazard for people and animals.[23]

An estimated one hundred and fifty million barrels of oil spilled, affecting 60 percent of Kuwait. Oil lakes in the desert are a major cause of health problems for people and the environment.

Over one million migratory birds will not live after they land on the oil lakes. House martins coated with oil have been identified as far away as Siberia.[24]

Desertification has been accelerated due to bombing and movements of troops and machinery.[25] The sheer movement of over one million soldiers caused extensive damage to the desert's fragile ecosystem.

The fuel-air bombs used to clean minefields pulverized topsoil and destroyed all nearby vegetation. The coalition forces left huge quantities of refuse, toxic materials and between 45 and 54 million gallons of sewage in sand pits.[26]

Damage to Civilian Infrastructure

The extreme damage to the civilian infrastructure prompted Richard Reid, Middle East Director of UNICEF, to remark:

> **Baghdad was like a human who had all his bones and internal organs removed, with only the skin remaining—outwardly viable, but with all life-sustaining infrastructure, the bones of the society, broken or paralyzed.**[27]

Electrical Power and Water Purification Problems

Water and sewage systems, and power networks were widely destroyed during the war and remain mostly unrepaired. "Much of Iraq's water and water purification facilities function at only a fraction of pre-Gulf Crisis levels or not at all."[28]

Lack of spare parts and chlorine are the major factors impairing water treatment and purification. As late as October 1991, electrical generation had been restored to only 37 percent of the installed capacity.[29]

Iraq's damaged electrical power system has had a profound impact on water purification and wastewater treatment. Environmental and chemical engineers participating in the International Study Team observed the following "common conditions":

> **(1) solid waste accumulating in the streets due to the lack of collection and landfilling equipment;**
> **(2) raw sewage overflowing in the streets and around homes;**
> **(3) raw sewage being dumped directly into the rivers due to impaired or inoperable wastewater treatment plants;**
> **(4) children bathing and playing in these rivers;**
> **(5) people with little to no tap water supply because of impaired or inoperable water treatment and because distribution plants cannot generate adequate line pressure;**
> **(6) people drawing drinking water from holes dug in watermains, which are often contaminated by cross-connections from adjacent sewage pipes.**[30]

Almost the entire population of Iraq (18 million) is directly exposed to water-borne disease through drinking water.[31]

Deterioration of Health Facility Services

The health of Iraqi civilians is deteriorating rapidly due to the effects of war. At the same time, the war has put an enormous strain on health facilities. The International Study Team reports:

- At most health facilities there is a lack of basic medical supplies such as vaccines, antibiotics, anesthetics and syringes.
- Damage to child vaccination programs means that such preventable diseases as measles and polio are resurgent.
- Due to lack of medicine, health facilities are hard pressed to deal with the increases in diseases such as hepatitis and meningitis. Hepatitis has increased throughout Iraq — by as much as one hundred-fold in some areas. Meningitis is now widespread in southern Iraq.
- In southern Iraq, 30 percent of hospital water tested contained coliform — an indication of fecal contamination.
- Water was also very heavily contaminated with coliform at hospitals in Kurdish areas. Moreover, the International Study Team found: "Lavatories are clogged. At several hospitals, raw sewage had backed up into the wards."[32]

Military Deaths

A senior Pentagon official explained in the *New Republic* why U.S. military censors refused to release video footage showing Iraqi soldiers being cut in half by helicopter cannon fire: "If we let people see that kind of thing, there would never be any war."[33]

- Between 75,000 and 120,000 Iraqi military personnel died.
- There were 400 Coalition casualties.

Civilian Deaths

Between 2,500 and 3,000 civilians died as a result of "collateral damage," that is, as a direct result of allied air attacks.[34] However, Greenpeace estimates that another 90,000 Iraqi civilians have died as a result of the longer-term effects of these attacks.

The studies done by Greenpeace and the International Study Team emphasize that civilians continue to die as a result of massive infrastructural damage. **Total Iraqi loss of human life to date has been estimated at between 177,500 and 243,000.**[35]

During the war, two million Kurds fled to the mountains of Turkey and Iran. Thousands of them died from cold and damp conditions, compounded by lack of water, food, electricity, health care, transportation and effective relief.[36]

Child mortality rates have increased dramatically. "The economic and social disruption and destruction caused by the Gulf crisis have had a direct impact on the health conditions of the children of Iraq."[37] The under-five mortality rate nearly quadrupled between January and August 1991. According to the International Study Team:

> **The rise in infant and under-five mortality is likely due to a complex interaction of factors. There are acute shortages of food and essential medicines throughout Iraq. Lack of clean drinking water and poor sanitation have greatly increased water-borne diseases, such as cholera, typhoid, dysentery, and gastroenteritis.**[38]

According to Eric Hoskins, a coordinator of the International Study Team: "...**50,000 children have died due to war and sanctions.**"[39]

The Medical Educational Trust in London estimates that another 170,000 children under the age of five are expected to die in the coming months. UNICEF says that five million children could die in the region.[40]

Economic Impact of the Gulf war

The Gulf War illustrates the links between war, environmental degradation and poverty. The war has led to the general impoverishment of the population. Much of the Iraqi economic infrastructure has been destroyed. Economists participating in the International Study Team on the Gulf Crisis found:

- There is a major shortage of imported goods. It will cost between $1 and $1.5 billion in imports to replenish food stocks in the first year following the war.
- Unemployment is as high as 70 percent, forcing many to resort to street vending for subsistence.
- Consumer prices have increased dramatically. The food price index has risen by 1,500 to 2,000 percent. Wheat costs 50 percent more than it did before sanctions.
- The incidence of poverty is now greater in Iraq than in India.

- The paralysis of economic activity and public services in Iraq is a major cause of hunger and death.[41]

Coalition bombardment effectively terminated everything vital to human survival in Iraq—electricity, water, sewage systems, agriculture, industry and health care. Food warehouses, hospitals, and markets were bombed. Power stations were repeatedly attacked until electricity supplies were at only 4 per cent of pre-war levels.[42]

This widespread destruction in the Gulf will have long-term implications for economic development.

Reconstruction costs indicate the severity of Iraq's economic problems. For example, it will cost $1 billion to replace principal oil pumping stations, and two power generating plants to "...fill the energy vacuum."[43]

The economic implications of the war are also serious for Kuwait. Damage to the oil sector alone has exceeded $100 billion. Oil damage will likely prevent further agricultural or fishery activity. One desalination plant was destroyed, while another two suffered moderate damage. In addition, Kuwaiti industrial plants and machinery were looted by Iraqi soldiers.[44]

Over a year of war and internal conflicts have had a disastrous impact on the economy of Iraq. Due to damaged Iraqi water and electricity infrastructure, food and fuel shortages:

The Iraqi people, especially the women, are overwhelmed by their daily struggle to provide for their children even the most basic needs of food and water.[45]

2. ENVIRONMENTAL IMPACT OF WORLD MILITARY ESTABLISHMENTS

A. RESOURCE DEPLETION: ENERGY, MATERIALS, LAND, AIR, HUMAN AND FINANCIAL

Even in the absence of war, military establishments consume massive amounts of environmental and human resources.

Compared with the civilian sector, the military "... uses more than its proportional share of rare and expensive, and often dangerous raw materials."[46] The armed forces also deplete vast amounts of energy.

Worldwide, military activities use large tracts of land and airspace. In its ongoing work, global militarism has at its disposal a significant portion of the world's human and financial resources. The development of the military sector of the economy takes place at the expense of the civilian sector.[47]

Energy and Materials

Most of the data available on the military's consumption of energy and materials comes from the United States. Indeed, with a military machine of unparalleled proportions, it is not surprising that the U.S. armed forces consume astronomical quantities of energy and materials.

- The Pentagon is considered the single largest domestic consumer of oil. It is very likely the largest worldwide.[48] The Department of Defense purchased 200 billion barrels of oil for military use in 1989 — enough to run all of the U.S. public transit systems in the U.S. for 22 years.[49]

- In less than one hour an F-16 consumes almost twice as much gas as the average American motorist during one year.[50] A modern battle tank's fuel consumption is so high that it can be measured in gallons per mile. From 5 to 15 percent of the U.S. non-fuel minerals are used by the Pentagon.

The global statistics on the military's consumption of energy and materials are equally sobering:

- Approximately one quarter (42 million tons per year) of the world's jet fuel is used by armed forces.

- Nine percent of global iron and steel are consumed by armed forces.

- The worldwide military use of aluminum, copper, nickel and platinum is greater than the entire Third World's demand for these materials.[51]

Land Use

Globally, between 750,000 and 1.5 million square kilometres of land are controlled by armed forces. This does not include the area occupied by arms producing companies.[52]

Michael Renner reports that in recent years more and more land has been turned over to armed forces and consequently withdrawn from public access. Military requirements for land have increased over the past century due to "... the increase in the size of standing armed forces and, more particularly, the rapid pace of technological advances in weaponry."[53]

> **With its choreographed violence, the military destroys large tracts of the land it is supposed to protect. Land used for war games is prone to suffer severe degradation. Maneuvers demolish natural vegetation, disturb wildlife habitat, erode and compact soil, silt up streams, and cause flooding. Bombing ranges transform the land into a moon-like waste land, pockmarked with craters. Shooting ranges for tanks and artillery contaminate soil and groundwater with lead and other toxic residues.**[54]

- In the United States, approximately, 100,000 square kilometers or the equivalent of the entire state of Virginia are allocated to military use. Outside its own borders, the U.S. military controls approximately 8,100 square kilometres.

- In 1991 the Soviet military apparatus controlled approximately 200,000 square kilometers in Kazakhstan alone.

- Over 40 years of the world's largest troop concentration all along the inner German border contributed to serious environmental stress.[55]

Recovery from the effects of some military activities may take thousands of years. Nuclear test sites suffer from contamination that is almost permanent. Some production and testing sites used by the military are rendered completely unusable. For example:

- In 1989, the U.S. Army's Jefferson Proving Ground, in Indiana, was closed because it is polluted with over 6.9 million buried bombs and shells. Clean-up is considered too dangerous and prohibitively expensive.[56]

- In the Soviet Union, Lake Karachay has become so polluted with radioactive wastes that simply standing at its shore for an hour would be lethal.[57]

Airspace and Atmospheric Pollution

The world's armed forces have even more access to airspace than to land. Military activities have greatly contributed to problems such as air pollution and ozone depletion.

- In former West Germany, almost the entire airspace was open to military jets and two-thirds of it to low level flights. Most recent reports state that there are between 700,000 and 1 million sorties per year. West German armed forces jets accounted for 58 percent of air pollutants generated by all air traffic over its territory.

- As much as 70 percent of all airspace is used for military purposes in the United States. The majority of the military flights take place over the Western U.S.A. There are approximately 90,000 training sorties per year. One fifth of these are at very low levels.

- Canada has one of the world's most extensive airspaces for military purposes. Over 100,000 square kilometres are assigned to the Goose Bay Air Base in Labrador. By 1992, the number of low-level sorties flown by Canadian and other NATO jets is projected to increase from 6,656 to 8,400. In Alberta and Saskatchewan, the Cold Lake Air Weapons Range stretches over 450,000 square kilometres of flying area.[58]

One of the most serious effects of military use of airspace results from low-level flights, which disrupt wildlife migration and behavioural patterns. Human health is also affected: Supersonic "booms" occurring in low-level flights can lead to hearing loss, high blood pressure, disturbance of the intestinal tract and other organs, as well as psychological trauma.

In North America, native communities are the most severely affected. In Canada, the Innu of Nitasinan (Labrador) have repeatedly complained to the Canadian government, but the number of flights is increasing over their land. In the U.S., flight training takes place over 14 Native American nations.

Lack of data on atmospheric pollution means that estimates are rough. However, German environmentalist Gunar Seitz estimates that 6 to 10 percent of global air pollution can be linked to armed forces operations.[59] According to the Worldwatch Institute's research, the total release of carbon dioxide as a result of military activity could be as high as 10 percent of total global emissions.[60]

One military contractor, General Dynamics (makers of the F-16), uses 500,000 pounds of CFC-113 yearly. The U.S. military is responsible for half of the

worldwide use of CFC-113. The Department of Defense is a major user of Halon 1211 and CFC-113, which account for 13 percent of overall ozone depletion.[61]

According to John O'Connor of the National Toxics Campaign, **the world's military forces are responsible for the release of more than two-thirds of CFC-113 into the ozone layer.**[62]

The military also uses ozone-depleting substances that have no civilian counterpart. The B-2 Stealth bomber, for example, uses a fuel additive that is a known ozone-depleter but of unknown potency.

Ozone depletion is increasingly being linked to serious health problems such as skin cancer, cataracts, and a number of diseases affected by immunosuppression, such as the AIDS virus.[63]

Human and Financial Resource Depletion

The environmental costs of militarism are compounded by the lost opportunities resulting from the annual diversion of almost $1 trillion in global resources for military purposes. Between 1960 and 1990, world military spending added up to 21 trillion dollars.[64]

In the U.S., government spending for military Research and Development exceeds that for all civilian needs combined.[65] Thus, important sectors as environmental protection, alternative energy sources and energy efficiency are shortchanged.

Sivard draws attention to the distorting effect that heavy military spending has had on the global economy.

> **The enormous sums invested in arms and armies do not provide an economic foundation for development progress. By diverting capital, research facilities, and manpower from civilian enterprise, these expenditures slow productivity gains and stimulate inflation. For a developed country the result can be a gradual erosion of competitive status in the international market. For a fragile developing country, it can be a quick route to bankruptcy.**[66]

World military Research and Development expenditures continue to grow at twice the rate of military expenditures as a whole. Yet there is a lack of funds for monitoring global climatic change, surveying disappearing rainforests and spreading deserts, and for developing appropriate agricultural technologies for rain-fed tropical regions.[67]

Military research and development "... impairs a country's innovative capacity by drawing scientific talent away from the civilian sector."[68] Over 20 percent of all scientists and engineers in the world are employed by the military

sector.[69] World military Research and Development expenditures rose from $13 billion per year in 1960 to $100 billion in 1986.[70]

According to Bruntland,

> **Half a million scientists are employed on weapons research worldwide, and they account for around half of all research and development expenditure. This exceeds the total combined spending on developing technologies for new energy sources, improving human health, raising agricultural productivity, and controlling pollution.**[71]

B. HAZARDS OF GLOBAL MILITARIZATION

> **In their incessant pursuit of prowess and preparedness, the armed forces are poisoning the land and people they are supposed to protect. Military toxics are contaminating water used for drinking or irrigation, killing fish, befouling the air, and rendering vast tracts of land unusable for generations to come.**[72]

Hazardous Wastes

Globally, the U.S. and Soviet armed forces produce the greatest amounts of hazardous waste. These wastes include: fuels, metals, pesticides, polychlorinated biphenyls (PCBs), cyanides, phenols, acids, alkalies, propellants, explosives, and nuclear wastes.

Although the health effects of these substances are underdocumented, there are suspected links between human exposure to them and increased rates of cancer, birth defects, genetic damage, and impairment of internal organs as well as the central nervous system.

According to Renner of the Worldwatch Institute, the production of arms endangers human health. "The production of explosives and propulsion systems, for example, entails potential exposure to such hazardous emissions as chlorine, dibenzodioxins, and dibenzofurans."[73]

The most immediate and dramatic effects are felt by workers directly involved in the weapons production process. These workers are exposed to many different poisons, including solvents, alkalies, metals, noxious vapors, gases and various forms of radiation. The human health hazard increases with long-term exposure.

There are severe environmental threats in nuclear warhead production. For example, the production of a single kilogram of plutonium generates over a thousand litres of liquid high-level radioactive waste, over 200,000 kilograms of low

to intermediate-level waste, and almost 10 million litres of contaminated cooling water.[74]

The military's toxic pollution is global. In the name of national security, military officials have subjected their citizens to decades of radioactivity and lethal wastes. In this report we provide some examples from the track records of the United States, the former Soviet Union, and Canada.

The United States

> **Having been dumping grounds for a lethal soup of hazardous materials for decades, military bases have become health time bombs detonating in slow motion.[75]**

In recent years, the Pentagon has generated between 400,000 and 500,000 tons of toxics annually. This amount is more than five times greater than the toxics generated by the five major chemical companies combined.[76] It does not include the hundreds of thousands of toxics generated by military contractors or by the Department of Energy's nuclear weapons complex.

The U.S. nuclear industry is massive. Since the 1940s, the U.S. has spent $300 billion on design, testing and manufacture of nuclear warheads. During this period, "... approximately 60,000 warheads were produced in a complex of more than 100 facilities in 32 states, employing some 600,000 workers."[77]

Between 1988 and 1989 the military discovered more than 5,000 new toxic sites at U.S. military installations. Over 7,000 former military properties are currently being investigated. Nearly 100 U.S. bases are on the "Priorities List" for cleanup. Eventually, as many as 1,000 may be added to the list, according to the Environmental Protection Agency.[78]

As a result of nuclear weapons and energy research, "... the Department of Energy has introduced quantities of radioactive and hazardous chemical pollutants into the air, soil, ground and surface waters over a period of forty years."[79]

Toxic contamination seeps into groundwater, affecting drinking water across the country. In some cases, where the military has detected contamination in wells close to toxic sites it has simply dug the same wells deeper. The U.S. now has a widespread problem of low-concentration contaminated soils and groundwater.

> **Harm to human health and the environment promises to be the Cold War's most lasting legacy. In terms of money the total cost of cleaning up environmental pollution [in the U.S.] from military activities will likely exceed $300 billion.[80]**

The U.S. military produces nearly one ton of toxic pollutants every minute.[81] According to Shulman, hazardous wastes contaminate more than 20,000 sites on land currently or formerly owned by the U.S. military. The bill

for toxic waste clean-up at U.S. military bases alone is between $20 and $40 billion.[82]

Virtually all of the statistics available on the U.S. military toxic pollution problem are from military sources. Researchers emphasize however that a great deal of the information is suppressed by the Pentagon and the State Department.[83]

Almost every U.S. state has federally-owned and operated facilities with environmental violations and compliance problems. The worst offenders are the Department of Defense and the Department of Energy. Both of these departments remain beyond the legal reach of the U.S. Environmental Protection Agency.

> **The U.S. military is the largest single source of environmental pollution in the country. It is also the biggest environmental outlaw: of the 383 citations issued by the EPA in 1989 to federal facilities, 272 (72%) went to military installations.**[84]

Radiation doses emitted in the 1940s and 1950s from the U.S.'s main plutonium plant in Hanford, Washington, are considered related to current high cancer rates in nearby communities.[85]

According to Wallace and Christilaw, "... the health hazards posed by Hanford are by no means only hypothetical."[86] Renner reports that those living near Hanford have "... received some of the largest amounts of radiation in the world over a long period."[87]

In the vicinity of Hanford, there are also reports of an "... unusually high number of various cancers, miscarriages and other ailments."[88] The U.S. only recently confirmed that the extent of radioactive contamination in the 1940s and 1950s was "... sufficient to cause cancer."[89]

At Hanford, wastes leaked from underground tanks could have manufactured 50 Nagasaki-sized bombs. However, U.S. corporate contractors operating the nuclear weapons facilities are protected from all liabilities and penalties.[90]

The fact that the effects of toxic wastes have no respect for international borders is emphasized by the Hanford situation. Wallace and Christilaw report on the potential affects of Hanford on British Columbia, Canada. They point out:

> **Less than 400 kilometres from Vancouver, and directly upwind from the population centres in the Okanagan and the Kootenays, the Hanford site is home to more than 60% of all military radioactive waste in the U.S., most of it plutonium — contaminated waste from bomb production and spent reactor cores from nuclear-powered U.S. Navy ships.**[91]

Hanford poses a major security threat to British Columbia. There are 177 storage tanks containing 190 million litres of deadly high-level wastes. Many of these tanks threaten to explode. A tank explosion at Hanford "... could send a lethal mixture of radioactive wastes downwind to British Columbia."[92]

Outside the U.S., the severity of the pollution of the Department of Defence's 375 foreign bases remains largely unknown.[93] Moreover, in violation of a 1978 presidential directive, the Pentagon has not produced a program or budget for cleaning them up. U.S. military bases in foreign countries are exempt from U.S. laws and frequently those of the host-nation as well.

Half of U.S. military bases abroad are located in the western part of the new Germany. The U.S. army has contaminated over 300 sites in this area, while the U.S. Air Force acknowledges that it has polluted soil and groundwater at every one of its airfields in Europe.[94]

In Japan, the U.S. armed forces have dumped lead and mercury at the Atsugi Naval Air Station near Tokyo. Industrial plants at military bases pollute air and soil. U.S. naval vessels contribute to water pollution.

Many U.S. bases in the Third World have contributed to severe environmental contamination.[95] For example, there is PCB pollution at U.S. bases in Guam, South Korea, and the Philippines. On Guam, large quantities of solvent and untreated anti-freeze have been dumped by the U.S. Air Force and Navy, contaminating the water supply for three quarters of the island's population.[96]

Canada

It will cost tens of millions of dollars to clean up pollution at 35 Canadian military bases.[97] Pollutants contaminating Canadian bases include gasoline, jet fuel, fire fighting chemicals and lead.

Clean-up costs at Canadian Forces Base (CFB) Halifax are estimated to run over $20 million over the next ten years. Environmental threats at CFB Halifax are posed by fuel leaks, spills and storage problems.

At CFB Goose Bay in Labrador there are at least four million litres of spilled fuel still in the ground. The fuel is so concentrated that "... cleanup crews are able to pump it out and salvage the fuel by removing water and dirt."[98]

It will cost another $10 million to dismantle the Pinetree radar stations across central Canada. Another $100 to $300 million will be needed to dismantle the DEW (Distant Early Warning) Line in the Arctic. According to recent reports: "... most of these stations have lingering pollution problems of some sort, often in the form of soil contaminated by old fuel leaks."[99]

Canada's major contribution to global militarization is uranium, of which Canada is the world's largest producer and exporter. Uranium ends up either in

nuclear weapons or radioactive wastes. The Women's International League for Peace and Freedom comment on Canada's uranium production:

> **Radiation from uranium mine waste is poisoning northern waterways and inducing cancers and genetic problems in newborn children. Canadian uranium ends up in nuclear bombs. By the year 2000, Canada's nuclear reactors will have produced enough radioactive poison to contaminate all the water in the earth's lakes and rivers twice over.**[100]

The Former Soviet Union

Like the U.S., the U.S.S.R. has only begun to admit to nuclear accidents and deliberate radiation emissions from decades past. In our next report, we will attempt to give in-depth information on the Soviet military's responsibility for environmental degradation.

Soviet émigrés have reported major health problems stemming from unsafe uranium mining, processing, waste disposal, and radiation leaks, associated with Soviet nuclear weapons manufacturing, storage and testing.[101]

According to Thomas Cochrane, director of the Natural Resources Defense Council, the situation is even worse in the Soviet Union than in the U.S. **"For the Soviet authorities, managing waste once meant dumping it into the nearby body of water."**[102]

In 1989, the Soviet authorities admitted that a fatal accident occurred in 1957 at Kyshtym, a plutonium processing plant which is the Soviet counterpart to Hanford. High-level nuclear waste stored on the site exploded contaminating 20,000 square kilometres and affecting over a quarter million people. Ten thousand people were evacuated.[103]

In the late 1940s, the Soviets dumped cesium, strontium, and other liquid radioactive wastes into the Techa River. "The river became so polluted that traces of radioactivity showed up in the Arctic Ocean, nearly 1,000 miles away. Those living along the Techa had to be evacuated."[104]

Near the Techa River, Lake Karachay had so much nuclear waste dumped into it in the 1950s that it was finally covered with a thick layer of concrete.[105]

Soviet forces in Eastern Europe have dumped fuel, wastes and unexploded ammunition. In some of these areas groundwater tests reveal toxic contamination 30 to 50 times allowable levels. Six percent of Czechoslovakian territory has been polluted or despoiled by the military. The figure is 10 percent for the former East Germany.[106]

On February 10, 1989, a serious leak occurred following an underground nuclear blast in Kazahkstan. It has been determined by the Soviet Academy of

Medical Scientists that residents of Semipalatinsk, a community near the test site, suffer from increased levels of genetic disease and cancer as a result of the nuclear tests. In 1988, the cancer rate was 70 percent higher than the national average.[107] After years of pressure from local citizens, the Soviet Government agreed in March 1990 to end testing near Semipalatinsk.

Nuclear Testing

The amount of radioactive debris released by all atmospheric testing, before the 1963 Partial Nuclear Test Ban, is estimated between 100 and 1,000 times that released in the Chernobyl accident.[108]

Nuclear weapons testing and production has the most severe and enduring effects. The spread of nuclear debris is global. Between 1945 and 1989, over 1,800 bombs were exploded at more than 35 sites around the world. One quarter of these tests were conducted above ground.

The hazardous substances released in the nuclear testing process will affect humans and their environment for thousands of years. Plutonium, for instance, is an almost permanent environmental poison. It is toxic in microgram quantities and has a half life of over 24,000 years.[109]

Radioactive fallout may have caused as many as 86,000 birth defects and 150,000 premature deaths globally.[110] According to International Physicians for the Prevention of Nuclear War, atmospheric testing alone will cause 2.4 million cancer deaths.[111] Although underground testing cut down on atmospheric contamination, in more than one third of U.S. underground tests, some radiation has escaped through "venting".[112]

If Soviet nuclear testing resumes, it will be conducted on the Arctic island of Novaya Zemlya. In April, 1991, the Canadian Arms Control Centre assembled seventy scientists from seven Arctic countries to assess the danger underground nuclear tests pose to the fragile Arctic environment. They concluded that "... a catastrophic leak of radioactivity cannot be ruled out given the geological structure of Novaya Zemlya."[113]

France and the South Pacific

Since 1966, the French military has conducted almost 160 nuclear detonations on the Pacific atolls of Moruroa and Fangataufa: Forty four nuclear tests in the atmosphere and 115 underground.

The inhabitants of French Polynesia face the long-term health hazard of absorption of radioactive fallout, as a result of nuclear tests conducted in the atmosphere between 1966 and 1974. The full extent of radioactive contamination resulting from these tests is unknown.

Military secrecy and intransigence on the part of the French government have obstructed independent investigation. Radiation test results conducted by

French army doctors are unavailable. Even the French National Radiation Laboratory, which measures radioactive pollution in France, has been denied access to French Polynesia. France continues to claim that safeguards have been taken to ensure the region's health.

When a 1981 typhoon dispersed huge amounts of nuclear waste in the ocean, civilian technicians employed at Moruroa leaked a report that the waste included 10 to 20 kilograms of plutonium. Punitive action was taken against these technicians by the French government.[114]

There have also been increased incidences of ciguatera fish poisoning in the South Pacific since nuclear testing began in the area. Ciguatera poisoning results in vomiting, headache, fever, trembling, and paralysis.[115]

According to Ruff Tilman, the destruction of coral reefs by radioactive fallout, and various military activities, is to blame for the ciguatera poisoning. The outbreaks have occurred both on the Marshall Islands near Bikini and Eniwetok, where U.S. tests took place, and in French Polynesia in the area around Moruroa Atoll, where the French continue to test.[116]

The cavity-ridden Moruroa atoll is leaking radioactivity into the sea. Nuclear testing has hollowed out combustion chambers measuring 100 metres in diameter and produced cracks measuring 300 to 400 metres long. French engineers have referred to the atoll as "Swiss cheese."

Leakage from testing initiated in 1976 has contributed to further contamination of fish, shellfish, squids and sea turtles, which are consumed by the inhabitants of Moruroa and nearby islands.

It takes between 10 and 15 years before the effects of fallout become apparent. The most common radiation-induced diseases are leukemia, brain tumours and thyroid cancers. Since the early 1980s a sharp increase in the number of these cancers has been reported in French Polynesia.[117]

Accidents

Nuclear Weapons Accidents Between 1950 and 1968

In 1990, the U.S. Sandia National Laboratories revealed that hundreds of nuclear accidents have taken place in addition to ones made public in 1981. The report stated that between 1950 and 1968 a total of 1,200 nuclear weapons were involved in accidents:

> **...107 bombs or rockets were unintentionally dropped during storage, assembly or loading;**
> **48 warheads mated to missiles or re-entry vehicles were dropped or involved in other accidents on pads or silos;**
> **41 bombs or warheads went down in airplane crashes;**

26 warheads in containers were involved in storage, assembly, or loading accidents;
24 weapons were jettisoned or inadvertently released from aircraft or ships;
22 weapons and warhead assemblies figured in ground transportation crashes; and four weapons were accidentally crushed or punctured.[118]

Nuclear Weapons and Nuclear Reactors at the Bottom of the Sea

There are now between 15,000 and 16,000 naval nuclear weapons. According to Arkin and Handler:

> **While the record is often sketchy, especially for the early years, there is ample evidence that hundreds of accidents have occurred involving nuclear armed or nuclear powered vessels, and many have involved the weapons themselves.**[119]

As a result of naval accidents, there are at least 50 nuclear warheads and 11 nuclear reactors littering the ocean floor.[120]

The military secrecy surrounding these accidents means that it is impossible to get a complete picture of the problem. However, some examples from Arkin and Handler's research are reproduced below.[121]

LOST AT SEA 1945-89: 50 weapons, 11 reactors

APRIL 18, 1959:
The U.S. Navy dumped the sodium-cooled liquid metal reactor vessel and the reactor plant components of the U.S.S. *Seawolf* into 9,00 feet of water about 120 miles off the Delaware-Maryland coast in the Atlantic Ocean.

APRIL 10, 1963:
The U.S.S. *Thresher*, a nuclear-powered attack submarine, imploded and sank 100 miles east of Cape Cod, Massachusetts, in approximately 8,500 feet of water, killing all 129 aboard, including 17 civilian observers.

OCTOBER 6, 1986:
A Soviet Yankee I-class nuclear-powered ballistic missile submarine with 16 SS-N-6 missiles and probably two nuclear torpedoes—a total of 34 nuclear warheads—sank 600 miles northeast of Bermuda. A fire and explosion, originating in the liquid fuel of a ballistic missile on October 3, led to the sinking.

APRIL 7, 1989:
A Soviet Mike-class submarine, a nuclear-powered attack vessel carrying two nuclear torpedoes, sank in the Norwegian Sea. Some 50 crew members were lost. A short circuit reportedly started the fire which caused the disaster.

The effects of nuclear accidents involving nuclear-powered and nuclear-armed vessels can be far-reaching. The effects on marine fauna and flora include poisoning from radioactive contamination.

A submarine sinking to sea bottom would fill with water and probably break up. After the 1989 Soviet Mike-class submarine accident, Norwegian officials reported leaks of radioactive material in the vicinity.[122]

Accidents involving nuclear-powered and nuclear-armed vessels have serious implications for the maritime environment. As John Lamb and Tariq Rauf have stated:

> **The maritime environment has been excessively militarized and this imposes a significant environmental burden on the world's oceans and seas. In particular, fragile and sensitive areas of the world's oceans, such as the Arctic Ocean, are extremely vulnerable to ecological degradation from military activities, as well as irresponsible commerce and development. Naval arms limitation, therefore, would benefit not only international and regional security, but also one of the most critical elements of the Earth's environment — the oceans.**[123]

In this report, so far we have seen that military activities contribute more than their share to global environmental degradation. According to the findings of the Research Institute for Peace Policy in Germany, 10 to 30 percent of all global environmental degradation can be attributed to military activities.[124]

> **Weapons of war, even when not used, create their own perils. Nuclear weapons are the major source of danger at present. They have not been used in war since 1945, yet their mere existence represents a serious threat to the environment and to public health and safety. Research, production, transport, and maintenance all create potential dangers.**[125]

3. ALTERNATIVES

The most startling implications of the military's misuse of resources come to light when we look at how these resources could be used within the civilian sector.

A very conservative estimate of the cost of reversing the environmental crisis is $774 billion over the next 10 years.[126] This is less than one year of the current $900 billion allocated to global military expenditures.

Redirection of Funds from Military to Environmental Purposes

A number of researchers have illustrated the potential impact of the redirection of military resources to environmental purposes:

> **Forty days of global military spending would be enough to fund a twenty-year United Nations action plan to halt Third World desertification.**[127]
>
> **Eight percent of the current world military budget "... could fund world-wide safe water supply and sewage treatment programs, the reversing of desertification and tropical deforestation, and population control."**[128]
>
> **Five minutes worth of global arms spending, $8 million dollars, could be spent on protecting endangered species and combatting pollution in the oceans for one year.**[129]

Ruth Leger Sivard's World Military and Social Expenditures 1991 includes a section on the environment by Alan Durning, a senior researcher for the Worldwatch Institute. Durning suggests that a global annual fund of $45 billion should be set up for environmental protection. The figure of $45 billion represents only five percent of global expenditures on weapons and warfare.

Durning compares the price tag for military acquisitions with the costs of addressing specific environmental needs. His comparisons illustrate the impact on the environment that an annual diversion of funds from military budgets would have. His alternatives include:

Changing Direction

Clean up hazardous waste.....$10 billion
A lethal mix of toxic wastes, including radioactive elements, contaminates the soil and water in hundreds of thousands of sites worldwide. Finding safe ways to clean up toxins and store wastes is essential. Cleanup costs, though high, are only a fraction of the costs in terms of human lives and human health *or send more arms to the Middle East.*

Reforest the earth.....$2 billion
The tropical forests are disappearing at a rate of 13 to 20 million hectares per year. Forest destruction leads to rapid loss of soil and of nutrient sources, affecting the lives of one-fifth of humanity *or buy another nuclear-armed submarine.*

Protect the ozone layer.....$1 billion
A total ban on CFCs and other chemicals that deplete the protective ozone layer is an urgent global priority. Finding substitutes for CFCs and converting current technology is beyond the means of many Third World nations. Helping them financially to make the transition will speed ozone layer protection *or send the space shuttle on more flights for Star Wars.*

Stabilize the population.....$6 billion
Rapid population growth is regarded by many as the single greatest threat to the planet's health. Yet in developing countries family planning service are not available for 100 million couples who want them. Family planning along with universal female literacy are essentials for population stabilization *or send more arms to the Middle East.*[130]

Global military expenditures are currently three to five times higher than those directed to environmental protection. **"The costs of environmental protection appear enormous until placed against the possible cost of environmental neglect."**[131]

Environmental Security Projects: Cleanup, Monitoring, Communications, Surveillance, Peacekeeping, Emergency Relief

A comprehensive U.N. study on alternative uses for military resources was presented to the U.N. General Assembly in September, 1991. It was chaired by Ambassador Maj Britt Theorin, former chair of the Swedish Disarmament Commission.

The study shows that there are many environmental applications for military-related technologies in the areas of monitoring, surveillance and communications. For example:

- disposing of radioactive and other toxic substances
- tracking changes in the atmosphere, the oceans and surface of the earth
- collecting information about climatic changes and the flow of ocean temperatures
- monitoring transportation of pollutants and toxic materials, and ensuring compliance with ecologically safe methods of waste disposal
- assigning military personnel to environmental clean up and peacekeeping efforts (green helmets or the green cross)
- monitoring environmentally harmful activities
- providing emergency relief and damage control

Economic Conversion: From Military to Environmental Use

In the context of superpower détente and growing environmental crises, environmental technologies represent an opportunity for diversification and conversion.

Most modern technologies are dual purpose, that is, they have both civilian and military applications. There are some areas with encouraging prospects for redirecting military technologies to civilian use. For example:

- Remote sensing, surveillance, radar and satellite technologies currently used extensively by the armed forces, can be applied to environmental monitoring.

- Many information technologies are adaptable to environmental use. For example, computer modelling can simulate the movement and transformation of chemicals as they spread through the air, water, soils, sediments and groundwater.

- Communication technologies could be applied to information sharing on current environmental crises.

Common Security: An Alternative Approach to Environmental and Other Security Problems

The concept of common security emerged in the 1980s with the Palme Commission Report. It concluded:

> **A doctrine of common security must replace the present expedient of deterrence through armaments. International peace must rest on a commitment to joint survival rather than a threat of mutual destruction.**[132]

Common security conveys a vision of positive peace. Security must take into account not only questions of defence, but also the general well-being of global society.

Threats to common security include worldwide threats to human survival such as the lack of food and health care, violations of human rights, the degradation of the environment and the threat of nuclear war.

Achieving a secure global reality does not rest on military power. Rather, the cornerstone of security is inextricably linked to meeting the social, political and economic needs of people and their environment.[133]. As Bruntland put it:

> **Nations must not become prisoners of an arms culture and focus instead on their common future... They must face the common challenge of providing for sustainable development and act in concert to remove the growing environmental sources of conflict.**[134]

CONCLUSION:

> **"The 1980s witnessed a global environmental awakening. It is hoped that the 1990s are poised for a comprehensive rescue plan for the global environment."**[135]

This report calls into question the world's continuing commitment to security through military power. In the twentieth century, military establishments, and the wars they have unleashed have caused unprecedented environmental damage.

The global addiction to military power poses an overwhelming threat to our security. By depleting resources needed to repair the damage and create a sustainable society, this addiction could defeat our efforts to bequeath to future generations a habitable planet.

Science for Peace hopes that this report will encourage public pressure on governments to change their priorities and direct resources to solving the pressing environmental problems that now threaten the planet's life-support system.

References

[1]Ruth Leger Sivard, *World Military and Social Expenditures 1991.* (Washington: World Priorities Institute, 1991), p. 5.

[2]U.S. data is currently is more accessible.

[3]See Michael Klare, "It's Business as Usual," *The Nation*, February 3, 1992, pp. 120-126 and Patrick Tyler, "Pentagon Imagines New Enemies to Fight in Post-Cold-War Era: Plans for Hypothetical Conflicts and Big Budgets," *New York Times*, February 17, 1992.

[4]Secretary General, United Nations, "Charting Potential Uses of Resources Allocated to Military Activities for Civilian Endeavours to Protect the Environment," *Report of the Secretary General,* 46th Session, A/46/364 (September 17, 1991), p. 12.

[5]The figure 40 million is cited in Robert S. McNamara, "The Post-Cold War and Its Implications for Military Expenditures in Developing Countries", World Bank Annual Conference on Development Economics, April 1991, p. 5. The increased proportion of civilian to military deaths is reported in Sivard, *1991*, p. 20.

[6]Victoria Britain, "Target Angola: The U.S.-S.A. Conspiracy," *Southern Africa Report*, October 1987, p. 14.

[7]Jeff Crisp, "Disabled Refugees: Coming Out of the Shadows," *Refugees* (Geneva) July 1989, p. 14.

[8]Hameed Shaikh and Cassim Degani, "Destruction to Iraq Requires Urgent Global Attention," *Ploughshares Monitor* (Waterloo, Ontario) June 1991, p. 1.

[9]Stephen Schwartz, Greenpeace U.S.A. Nuclear Campaigns Legislative Director [Washington], "The Impact of Military Operations on the Environment," report prepared for the S.A.N.E./Freeze Campaign for Global Security, International Working Conference on the Arms Trade, November 1, 1991, p. 2.

[10]Sivard, *1991*, p. 30.

[11]Sivard, *World Military and Social Expenditures 1989*, (Washington: World Priorities Institute, 1989), p. 23.

[12]Quoted in "Eco-casualities of a Dirty War," p. 15.

[13]Greenpeace [Washington], "The Gulf War One Year Later: Casualties and Environmental Effects," news release, January 10,1992, p. 7.

[14]See International Study Team on the Gulf Crisis, "Health and Welfare in Iraq After the Gulf Crisis: An In-depth Assessment," report, October 1991; Greenpeace, "The Gulf War One Year Later;" Michael O'Sullivan, "The New War in the Gulf," *Bulletin: Quarterly of the United Nations Association in Canada* (Ottawa) 17:3 (Summer 1991), pp. 7, 12; Randy Thomas, "Ecocide," Peace Magazine (Toronto) VII:4 (July/August, 1991), interview; David Runnals, "Gulf War Destruction Highlights Need for 'Green Helmets'," *Bulletin: Quarterly of the United Nations Association in Canada* (Ottawa) 17:2 (June 1991); "Eco-casualities of a Dirty War," *Canadian Peace Report* (Toronto) 3:2 (Fall 1991).

[15]Greenpeace, "The Gulf War One Year Later," p. 2. See also Runnals, "Need for 'Green Helmets'" and O'Sullivan, "New War in the Gulf."
[16]Greenpeace, "The Gulf War One Year Later," p. 5. See also Runnals, "Need for 'Green Helmets'" and O'Sullivan, "New War in the Gulf."
[17]Greenpeace, "The Gulf War One Year Later," p. 4.
[18]O'Sullivan, "New War in the Gulf," p. 12.
[19]Runnals, "Need for 'Green Helmets'," p. 14.
[20]Runnals, "Need for 'Green Helmets'," p. 1. See also David Runnals, "What's Gone Unsaid at UNCED: Institutional Options for Sustainable Development," *The Gulf War and Its Implications for the United Nations* (Ottawa: United Nations Association in Canada, December 1991).
[21]Greenpeace, "The Gulf War One Year Later," p. 5.
[22]Eric Hoskins, "Killing is Killing—Not Kindness," *New Statesman and Society*, January 17, 1992, p. 12.
[23]Michael O'Sullivan, "New War in the Gulf," p. 12.
[24]Greenpeace, "The Gulf War One Year Later," p. 2 and O'Sullivan, "New War in the Gulf," p. 7.
[25]Thomas, "Ecocide," p. 6 and Schwartz, "The Impact of Military Operations."
[26]Greenpeace, "The Gulf War One Year Later," p. 2.
[27]Quoted in Hoskins, "Killing is Killing," p. 12.
[28]International Study Team, "Health and Welfare in Iraq," p. 13.
[29]International Study Team, "Health and Welfare in Iraq," p. 12.
[30]International Study Team, "Health and Welfare in Iraq," pp. 14-15.
[31]International Study Team, "Health and Welfare in Iraq," p. 14.
[32]International Study Team, "Health and Welfare in Iraq," p. 11.
[33]Quoted in Marion Mathieson, Vice President and Chair of the Survival of the Planet Committee, National Action Committee on the Status of Women, circular letter (Sydney, Nova Scotia).
[34]"One thing the Gulf War should teach us , if we have not learned it already, is that the planet has become too small for us to continue to fight wars like this any more. The 'collateral damage' in terms of immediate damage and the inexorable decline of regional and global ecosystems is becoming greater with each passing year." From Working Group on the Environmental Implications of the Gulf War, "Collateral Damage: Environmental and Other Considerations of the War in the Gulf," (Toronto: Institute for Environmental Studies, University of Toronto, 1991), p. 7. See Greenpeace, "The Gulf War One Year Later," p. 3 on civilian casualties as a direct result of bombing.
[35]Greenpeace, "The Gulf War One Year Later," p. 3.
[36]Hoskins, "Killing is Killing," p. 12.
[37]International Study Team, "Health and Welfare in Iraq," p. 4.
[38]International Study Team, "Health and Welfare in Iraq," p. 5.
[39]Hoskins, "Killing is Killing," p. 13.

[40]See John Pilger, "How the World was Won Over," *New Statesman and Society*, January, 17, 1992, p. 10.
[41]International Study Team, "Health and Welfare in Iraq," pp. 16, 17.
[42]Eric Hoskins, "Killing is Killing," p. 12.
[43]Mehran Nakhjavani, "The Implication for Economic Development of the Persian Gulf Crisis and Its Aftermath," *The Gulf War and Its Implications for the United Nations* (Ottawa: United Nations Association in Canada, December 1991), p. 5.
[44]Nakhjavani, "Implication for Economic Development," p. 7.
[45]International Study Team, "Health and Welfare in Iraq," p. 18.
[46]International Study Team, "Health and Welfare in Iraq," p. 13.
[47]See Seymor Melman, *The Permanent War Economy: American Capitalism in Decline* (New York: Simon & Shuster, 1974); Dan Smith and Ron Smith, *The Economics of Militarism* (London: Pluto Press, 1983); and Martin Shaw, ed., *War, State and Society* (London: Macmillan Press, 1984).
[48]Michael Renner, "Assessing the Military's War on the Environment," in Lester R. Brown et al., *State of the World 1991: A Worldwatch Institute Report on Progress Toward a Sustainable Society* (New York: W.W. Norton, 1991), p. 137. Statistics are more accessible in the United States on the military's consumption of energy and materials.
[49]Seth Shulman, "Toxic Travels," *Nuclear Times* (Washington) Spring 1990, p. 27.
[50]Renner, "Assessing the Military's War on the Environment," p. 137.
[51]See Renner, "Assessing the Military's War on the Environment," pp. 137-141; and Arthur Westing, "The Military Sector vis-à-vis the Environment," *Journal of Peace Research* 25:3 (September 1988), p. 258.
[52]Renner, "Assessing the Military's War on the Environment," p. 133.
[53]Renner, "Assessing the Military's War on the Environment," p. 133.
[54]Renner, "Assessing the Military's War on the Environment," p. 135.
[55]See Renner, "Assessing the Military's War on the Environment," pp. 133-136 and Secretary General, "Charting Potential Uses of Resources," p. 20.
[56]Shulman, "Toxic Travels," p. 22.
[57]Nicholas Lenssen, "Confronting Nuclear Waste," in Lester R. Brown et al., *State of the World 1991: A Worldwatch Institute Report on Progress Toward a Sustainable Society* (New York: W.W. Norton, 1992), p. 53.
[58]Renner, "Assessing the Military's War on the Environment," p. 136 (on the U.S.A.), p. 139 (on Germany), and p.136 (on Canada). For information on low-level flight tests at Goose Bay, see *Newsletter of the Research Unit of the Innu Nation* 2:1 (January 1992), Innu Nation Research, P.O. Box 1441 Station C, St. John's Newfoundland, Canada A1C 5N8.
[59]Matthias Finger, "The Military, the Nation State and the Environment," *The Ecologist* 21:5 (September/October 1991), p. 221.
[60]Renner, "Assessing the Military's War on the Environment," p. 139.

[61]Keith Schneider, "Pentagon Plans to Move to Protect Ozone," *New York Times*, February 15, 1992. See also Casey Burko, "U.S. Military's Assault on Ozone Criticized," *Chicago Tribune*, March 20, 1989.
[62]CTV, "News," February 11, 1992. See figure "War against CFCs" in Paul Hoversten, "Military CFC Use is Major Cause of Ozone Loss," *U.S.A. Today*, February 11, 1992.
[63]Geoffrey York, "Ozone Depletion Could Activate Serious Health Problems, U.N. Says," *Globe and Mail*, February 13, 1992.
[64]In 1987 U.S. dollars. Sivard, *1991*, p. 11.
[65]Sivard, *1991*, p. 12.
[66]Sivard, *1989*, p. 19.
[67]World Commission on Environment and Development [Brundtland Commission], *Our Common Future* (Oxford: Oxford University Press, 1987)
[68]Renner, *National Security: The Economic and Environmental Dimensions, Worldwatch Paper 1989* (Washington: Worldwatch Institute, May 1989), p. 18.
[69]Westing, "The Military Sector vis-à-vis the Environment," p. 259.
[70]Michael Renner, *National Security*, p. 18.
[71][Bruntland Commission], *Our Common Future*, p. 8.
[72]Renner, "Assessing the Military's War on the Environment," p. 141.
[73]Renner, "Assessing the Military's War on the Environment," p. 145.
[74]Renner, "Assessing the Military's War on the Environment," p. 141.
[75]Renner, "Assessing the Military's War on the Environment," p. 141.
[76]Renner, "Assessing the Military's War on the Environment," p. 143.
[77]Renner, "Assessing the Military's War on the Environment," p. 146.
[78]Renner, "Assessing the Military's War on the Environment," p. 143.
[79]Secretary General, "Charting Potential Uses of Resources," p. 18.
[80]*Defence Monitor* (Washington) 20:6 (1991), p. 6
[81]Shulman, "Toxic Travels," pp. 21-22.
[82]Renner, "Assessing the Military's War on the Environment," p. 150
[83]See Shulman, "Toxic Travels;" Renner, "Assessing the Military's War on the Environment" and Michael Wallace and Jan Christilaw, "Military Threats to the B.C. Environment," paper, 1992.
[84]Schwartz, "The Impact of Military Operations," p. 3.
[85]Renner, "Assessing the Military's War on the Environment," p. 149.
[86]Wallace and Christilaw, "Military Threats to the B.C. Environment," p. 8.
[87]Renner, "Assessing the Military's War on the Environment," p. 147.
[88]Renner, "Assessing the Military's War on the Environment," p. 149.
[89]Renner, "Assessing the Military's War on the Environment," p. 146.
[90]Renner, "Assessing the Military's War on the Environment," p. 146. See also : Wallace and Christilaw, "Military Threats to the B.C. Environment."
[91]Wallace and Christilaw, "Military Threats to the B.C. Environment," p. 5.
[92]Wallace and Christilaw, "Military Threats to the B.C. Environment," p. 8.

[93]Renner, "Assessing the Military's War on the Environment," p. 143.
[94]Renner, "Assessing the Military's War on the Environment," p. 144.
[95]See Joseph Gerson and Bruce Birchard, eds., *The Sun Never Sets: Confronting the Network of Foreign U.S. Military Bases* (Philadelphia: American Friends Service Committee, 1991).
[96]Renner, "Assessing the Military's War on the Environment," p. 144.
[97]Tom Spears, "Canadian Military Under the Gun Over Pollution," *Ottawa Citizen*, September 15, 1991, p. 1.
[98]Spears, "Canadian Military Under the Gun," p. 1.
[99]Spears, "Canadian Military Under the Gun," p. 1
[100]"The Military and the Environment," *WILPF News* [Women's International League for Peace and Freedom–Ottawa Chapter] November 1991, p. 2.
[101]Gabriel Shoenfeld, "A Dosimeter for Every Dacha," *Bulletin of the Atomic Scientists* 45:6 (July/August 1989), p. 13.
[102]Lenssen, "Confronting Nuclear Waste," p. 53.
[103]Renner, "Assessing the Military's War on the Environment," p. 149 and Wallace and Christilaw, "Military Threats to the B.C. Environment," p. 8.
[104]Renner, "Assessing the Military's War on the Environment," p. 149.
[105]Zhores Medvedev, "The Environmental Destruction of the Soviet Union," *The Ecologist*, January/February 1990.
[106]Renner, "Assessing the Military's War on the Environment," p. 144.
[107]Renner, "Assessing the Military's War on the Environment," p. 150.
[108]Secretary General, "Charting Potential Uses of Resources," p. 13.
[109]Wallace and Christilaw, "Military Threats to the B.C. Environment," p. 2.
[110]Renner, "Assessing the Military's War on the Environment," p. 149.
[111]International Physicians for the Prevention of Nuclear War and Institute for Energy and Environmental Research, *Radioactive Heaven and Earth: The Health and Environmental Effects of Nuclear Weapons Testing In, On and Above the Earth* (New York: Apex Press, 1991).
[112]Renner, "Assessing the Military's War on the Environment," p. 149.
[113]Arms Control Centre, "Soviet Nuclear Moratorium Must be Reciprocated by U.S.," news release, October 6, 1991.
[114]Bengt Danielsson, "Poisoned Pacific: The Legacy of Nuclear Testing," *Bulletin of the Atomic Scientists* 46:2 (1990), p. 27.
[115]Danielsson, "Poisoned Pacific," p. 28.
[116]Tilman Ruff, "Bomb Tests Attack Food Chain," *Bulletin of the Atomic Scientists* 46:2 (1990), p. 32.
[117]Daniellson, "Poisoned Pacific," p. 28. See also Renner, "Assessing the Military's War on the Environment," p. 150.
[118]Chuck Hansen, "1,000 More Accidents Declassified," *Bulletin of the Atomic Scientists* 46:5 (1990), p. 9.
[119]William M. Arkin and Joshua M. Handler, "Nuclear Disasters at Sea, Then and Now," *Bulletin of the Atomic Scientists* 45:6 (1989), p. 20.

[120]Arkin and Handler, "Nuclear Disasters at Sea.", p. 22.
[121] Arkin and Handler, "Nuclear Disasters at Sea.", excerpt from p. 22
[122]Lassi Heininen, "Environmental Threats of Military Presence in Northern Arctic Waters," in Lassi Heininen, ed., *Arctic Environmental Problems*, occasional papers no. 41 (Tampere, Finland: Tampere Peace Research Institute, 1990), p. 57.
[123]Testimony of John Lamb and Tariq Rauf [Arms Control Centre, Ottawa] in Canada, House of Commons, "Minutes and Evidence of the Standing Committee on National Defence," February 22, 1990.
[124]Cited in Renner, "Assessing the Military's War on the Environment," p. 139.
[125]Sivard, *1989*, p. 10.
[126]Secretary General, "Charting Potential Uses of Resources," p. 24.
[127]Michael Renner, "Weaving a Conversion Coalition: The Peaceful Economy," *Ploughshares Monitor* (Waterloo: Ontario) XI:3 (September 1990), p. 17.
[128]Benj Heinrichs and Rob Macintosh, "Peace on Earth–Peace With the Earth: Militarism and the Environment," *Peace Education News* 11 (Summer 1990) p. 17. See also [Bruntland Commission], *Our Common Future*, p. 303.
[129]Heinrichs and Macintosh, "Peace on Earth," p. 17.
[130]See Durning's section in Sivard, *1991*, p. 42.
[131]Secretary General, "Charting Potential Uses of Resources," p. 24.
[132]Independent Commission on Disarmament and Security Issues [Palme Commission], *Common Security: A Blueprint for Survival* (New York: Simon & Shuster, 1982), 139.
[133][Bruntland Commission], *Our Common Future*, p. 11.
[134][Bruntland Commission], *Our Common Future*, p. 304.
[135]Secretary General, "Charting Potential Uses of Resources," p. 45.

Selected Bibliography

Albright, David H.; Zamora, Tom; and Lewis, David. "Turn off Rocky Flats." *Bulletin of the Atomic Scientists* 46:5 (1990).

Arkin, William M. and Durrant, Damian. *On Impact: Modern Warfare and the Environment: A Case Study of the Gulf War.* Washington: Greenpeace, May 1991.

Arkin, William M. and Handler, Joshua M. "Nuclear Disasters at Sea, Then and Now." *Bulletin of the Atomic Scientists* 45:6 (1989).

Arms Control Centre. "Soviet Nuclear Moratorium Must be Reciprocated by U.S." News release, October 6, 1991.

Brittain, Victoria. "Target Angola: The U.S.-S.A. Conspiracy." *Southern Africa Report,* October 1987.

Burko, Casey. "U.S. Military's Assault on Ozone Criticized." *Chicago Tribune,* March 20, 1989.

Cowan, Ian B. "Security Implications of Global Climatic Changes." *Canadian Defence Quarterly* 20:2 (1989).

Crisp, Jeff. "Disabled Refugees: Coming Out of the Shadows." *Refugees* (Geneva) July 1989.

Danielsson, Bengt. "Poisoned Pacific: The Legacy of Nuclear Testing." *Bulletin of the Atomic Scientists* 46:2 (1990).

Defence Monitor (Washington) 20:6 (1991).

Deger, Saadat. "World Military Expenditure." *SIPRI Yearbook1991: World Armaments and Disarmament.* Oxford: Oxford University Press, 1991.

Deudney, Daniel. "Environment and Security: Muddled Thinking." *Bulletin of the Atomic Scientists* 47:3 (1991).

Dyer, Gwynne. "Environmental Warfare in the Gulf." *Ecodecision* (Montreal) 2:1 (1991).

Earthtrust. "The Gulf Report: Postwar Observations and Analysis." Report, July 1991.

"Eco-casualities of a Dirty War." *Canadian Peace Report* (Toronto) Spring 1991.

Finger, Matthias. "The Military, the Nation State and the Environment." *The Ecologist* 21:5 (September/October 1991).

Galtung, Johan. *Environmental, Development and Military Activity.* Oslo: Universitetsforlaget, 1982.

Gerson, Joseph and Birchard, Bruce, eds. *The Sun Never Sets: Confronting the Network of Foreign U.S. Military Bases.* Philadelphia: American Friends Service Committee, 1991.

Gleick, Peter H. "Environment and Security: The Clear Connections." *Bulletin of the Atomic Scientists* 47:3 (1991).

Greenpeace [Washington]. "The Gulf War One Year Later: Casualties and Environmental Effects." News release, January 10, 1992.

Hampson, Fen Osler. "The Climate for War." *Peace and Security* (Ottawa) Autumn 1988.

Hansen, Chuck. "1,000 More Accidents Declassified." *Bulletin of the Atomic Scientists* 46:5 (1990).

Heininen, Lassi. "Environmental Threats of Military Presence in Northern Arctic Waters." In Heininen, Lassi, ed. *Arctic Environmental Problems,* occasional papers no. 41. Tampere, Finland: Tampere Peace Research Institute, 1990, pp. 42-69.

Heinrichs, Benj and Macintosh, Rob. "Peace on Earth—Peace With the Earth: Militarism and the Environment." *Peace Education News* (Drayton Valley, Alberta) 11 (Summer 1990).

Holst, Johan Jørgen. "Security and the Environment: A Preliminary Exploration." *Bulletin of Peace Proposals* 19:2 (1989).

Hoskins, Eric. "Gulf War: Killing is Killing—Not Kindness." *New Statesman and Society,* January 17, 1992.

Hoversten, Paul. "Military CFC Use is Major Cause of Ozone Loss." *U.S.A. Today,* February 11, 1992.

Independent Commission on Disarmament and Security Issues [Palme Commission]. *Common Security: A Blueprint for Survival.* New York: Simon & Shuster, 1982.

International Physicians for the Prevention of Nuclear War and Institute for Energy and Environmental Research. *Radioactive Heaven and Earth: The Health and Environmental Effects of Nuclear Weapons Testing In, On and Above the Earth.* New York: Apex Press, 1991.

International Study Team on the Gulf Crisis. "Health and Welfare in Iraq After the Gulf Crisis: An In-depth Assessment." Report, October 1991.

Jardine, Kevin. "A Spasm of Human and Environmental Destruction." *Ploughshares Monitor* (Waterloo, Ontario) XII:2 (January 1991).

Klare, Michael. "It's Business as Usual." *The Nation,* February 3, 1992.

Lamb, John and Rauf, Tariq [Arms Control Centre, Ottawa]. In Canada, House of Commons. "Minutes of Proceedings and Evidence of the Standing Committee on National Defence," February 22, 1990. Testimony.

Langille, H. Peter. *Changing the Guard: Canada's Defence in a World in Transition.* Toronto: University of Toronto Press, 1990.

Lanouette, William. "Weapons Plant at 40: Savannah River's Halo Fades." *Bulletin of the Atomic Scientists* 46:10 (1990).

Lenssen, Nicholas. "Confronting Nuclear Waste." In Brown, Lester et al. *State of the World 1992: A Worldwatch Institute Report on Progress Toward a Sustainable Society.* New York: V.W. Norton, 1992.

London, Julius and White, Gilbert. "The Environmental Effects of Nuclear War-An Overview." In London, Julius and White, Gilbert, eds. *The Environmental Effects of Nuclear War,* American Associations for the Advancement of Science Selected Symposia Series. Boulder: Westview Press, 1984.

MacNamara, Robert. "The Post-Cold War and Its Implications for Military Expenditures in Developing Countries." World Bank Annual Conference on Development Economics, April 1991.

Medvedev, Zhores. "The Environmental Destruction of the Soviet Union." *The Ecologist,* January/February 1990.

Melman, Seymor. *The Permanent War Economy: American Capitalism in Decline.* New York: Simon & Shuster, 1974.

Mische, Patricia. "Ecological Security in an Interdependent World." *Ploughshares Monitor* (Waterloo, Ontario) XI:4 (December 1990).

Nakhjavani, Mehran. "The Implications for Economic Development of the Persian Gulf Crisis and Its Aftermath." *The Gulf War and Its Implications for the United Nations.* Ottawa: United Nations Association in Canada, December 1991.

Newsletter of the Research Unit of the Innu Nation 2:1 (January 1992). P.O. Box 1441, Stn. C, St. John's, Nfld. A1C 5N8: Innu Nation Research.

O'Sullivan, Michael. "The New War in the Gulf." *Bulletin: Quarterly of the United Nations Association in Canada* (Ottawa) 17:3 (Summer 1991).

Oake, George. "Plans to Burn Deadly Waste Raise Alarm." *Toronto Star,* March 1,1990.

Paehlke, Robert C. *Environmentalism and the Future of Progressive Politics.* New Haven: Yale University Press, 1989.

Perry, Thomas L., ed. *Peacemaking in the 1990s: A Guide for Canadians.* West Vancouver, British Columbia: Gordon Soules Book Publishers, 1991.

Pilger, John. "How the World was Won Over." *New Statesman and Society*, January 17, 1992.

Postel, Sandra. "Denial in the Decisive Decade." In Brown, Lester et al. *State of the World 1992: A Worldwatch Institute Report on Progress Toward a Sustainable Society.* New York: V.W. Norton, 1992.

Regehr, Ernie. "A Pattern of War." *Ploughshares Monitor* (Waterloo, Ontario) XII:4 (December 1991).

Renner, Michael. "Assessing the Military's War on the Environment." In Brown, Lester et al. *State of the World 1991: A Worldwatch Institute Report on Progress Toward a Sustainable Society.* New York: W.W. Norton, 1991, pp. 132-152.

_____. "Weaving a Conversion Coalition: The Peaceful Economy." *Ploughshares Monitor* (Waterloo, Ontario) XI:3 (September 1990).

_____. *National Security: The Economic and Environmental Dimensions: Worldwatch Paper 1989.* Washington: Worldwatch Institute, May 1989.

Richardson, Boyce. *Time to Change: Canada's Place in a World in Crisis.* Toronto: Summerhill Press, Toronto: 1990.

Rosenblum, Simon. "Militarism and the Environment." *Ploughshares Monitor* (Waterloo, Ontario) XI:3 (Summer 1990).

Ruff, Tilman. "Bomb Tests Attack the Food Chain." *Bulletin of the Atomic Scientists* 46:2 (March 1990).

Ruff, Tilman. *Fish Poisoning in the Pacific: A Link with Military Activities: Working Paper Number 63.* Canberra: Peace Research Centre, Australian National University, Fall 1989.

Runnals, David. "Gulf War Destruction Highlights Need for 'Green Helmets'." *Bulletin: Quarterly of the United Nations Association in Canada* (Ottawa) 17:2 (June 1991).

Runnals, David. "What's Gone Unsaid at UNCED: Institutional Options for Sustainable Development." *The Gulf War and Its Implications for the United Nations.* Ottawa: United Nations Association in Canada, December 1991.

Schneider, Keith. "Pentagon Plans to Move to Protect Ozone." *New York Times*, February 15, 1992.

Schoenfeld, Gabriel. "A Dosimeter for Every Dacha." *Bulletin of the Atomic Scientists* 45:6 (July/August 1989).

Schwartz, Stephen, Greenpeace U.S.A. Nuclear Campaigns Legislative Director [Washington]. "The Impact of Military Operations on the Environment." Report prepared for the S.A.N.E./Freeze Campaign for Global Security, International Working Conference on the Arms Trade, November 1, 1991.

Seager, Joni. "Operation Desert Disaster: Assessing the Environmental Costs of the Gulf war." *Ecodecision* (Montreal) September 1991.

Shaik, Nameed and Degani, Cassim. "Destruction to Iraq Requires Urgent Global Attention." *Ploughshares Monitor* (Waterloo, Ontario) XII (June 1991).

Shaw, Martin, ed. *War, State and Society.* London: Macmillan Press, 1984.

Shulman, Seth. "Toxic Travels." *Nuclear Times* (Washington) Spring 1990.

Sigel, Lenny. "The Growing Nightmare of Military Toxics." *Nuclear Times* (Washington) Spring 1990.

Sivard, Ruth Leger. *World Military and Social Expenditures 1989.* Washington: World Priorities Institute, 1989.

Sivard, Ruth Leger. *World Military and Social Expenditures 1991.* Washington: World Priorities Institute, 1991.

Smith, Dan and Smith, Ron. *The Economics of Militarism.* London: Pluto Press, 1983.

Spears, Tom. "Canadian Military Under the Gun Over Pollution." *Ottawa Citizen,* September 15, 1991.

Snow, Donald. "Ecology wars." *Nuclear Times* (Washington) Spring 1990.

Snow, Donald. *Militarism and the Environment,* pamphlet series. Victoria, British Columbia: Greater Victoria Disarmament Group, [ca. 1990].

Stockholm International Peace Research Institute. *Warfare in a Fragile World: Military Impact on the Human Environment.* London: Taylor and Francis, 1980.

Suzuki, David. "Let's Scrap the Military But Wage Another Kind of War." *End the Arms Race Newsletter* (Vancouver, British Columbia) 32 (Fall 1991).

"The Military and the Environment." *WILPF News* [Women's International League for Peace and Freedom, Ottawa Chapter] November 1991.

Thomas, Randy. "Ecocide." *Peace Magazine* (Toronto) VII:4 (July/August 1991). Interview.

Tyler, Patrick. Pentagon Imagines New Enemies to Fight in Post-Cold War Era: Plans for Hypothetical Conflicts and Big Budgets." *New York Times,* February 17, 1992.

United Nations. Secretary General. "Charting Potential Uses of Resources Allocated to Military Activities for Civilian Endeavours to Protect the Environment." *Report of the Secretary General.* 46th session, A/46/364 (September 17, 1991).

United Nations Association in Canada. *The Gulf War and Its Implications for the United Nations.* Ottawa: 1991.

Wallace, Michael and Christilaw, Jan. "Military Threats to the B.C. Environment." Report, 1992.

Westing, Arthur. "Chemical and Biological Warfare: The Road Not Taken." *Peace Research* (Hamilton, Ontario) 21:1 (January 1989).

_____. *Environmental Warfare: A Technological, Legal and Policy Appraisal.* London: Taylor and Francis, 1984.

_____, ed. *Global Resources and International Conflict.* Oxford: Oxford University Press, 1986.

_____. "Proposal for an International Treaty for Protection Against Nuclear Devastation." *Bulletin of Peace Proposals* 20:4 (1989).

_____. "The Environmental Aftermath of Warfare in Viet Nam." In *SIPRI Yearbook 1982: World Armaments and Disarmament.* London: Taylor and Francis, 1982.

_____, ed. "The Environmental Component of Comprehensive Security." *Bulletin of Peace Proposals* 20:2 (1989).

_____. "The Military Sector vis-à-vis the Environment." *Journal of Peace Research* 25:3 (September 1988).

_____. "Towards Eliminating the Scourge of Chemical War." *Bulletin of Peace Proposals* 16:2 (1985).

_____. "Warfare in a Fragile World: Conventional, Nuclear and Environmental Weapons." *Bulletin of Peace Proposals* 17:3-4 (1986).

Wirick, Gregory. "Environment and Security: The Case of Central America." *Peace and Security* (Ottawa) Summer 1990.

Working Group on the Environmental Implications of the Gulf War. *Collateral Damage: Environmental and Other Considerations of the War in the Gulf.* Toronto: Institute for Environmental Studies, University of Toronto, 1991.

World Commission on Environment and Development [Bruntland Commission]. *Our Common Future.* Oxford: Oxford University Press, 1987.

York, Geoffrey. "Ozone Depletion Could Activate Serious Health Problems, U.N. Says." *Globe and Mail,* February 13, 1992.