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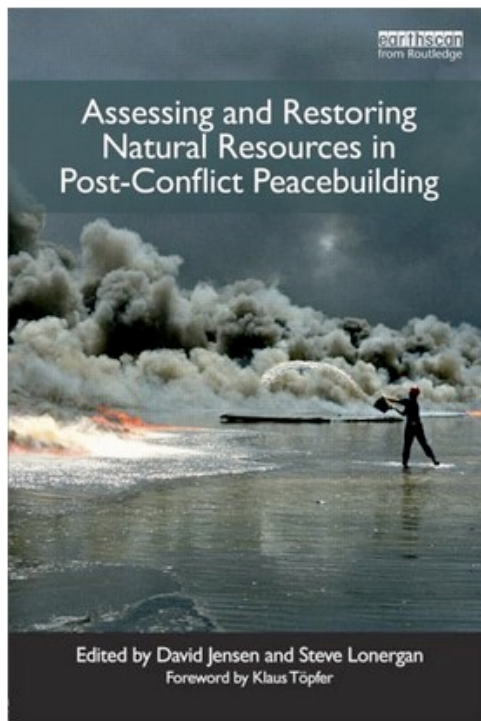
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Salting the Earth: Environmental health challenges in post-conflict reconstruction

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Salting the Earth: Environmental health challenges in post-conflict reconstruction

Chad Briggs and Inka Weissbecker

Without a comprehensive understanding of the environmental and health challenges faced by post-conflict countries and regions, aid may be misapplied and vulnerable populations may be neglected. While economic and political benchmarks are often used to gauge the success of peacebuilding and reconstruction policies, the status of environmental and public health is often a secondary issue.

Environmental conditions and their links to public health remain understudied and inadequately addressed in post-conflict reconstruction (Feldbaum et al. 2006; Brown 2004). Armed conflicts destroy large tracts of land and consume enormous resources, which are often deliberately targeted to undercut the ability of combatants to fight or communities to rebuild. Displaced populations place new pressures on available resources, directly and indirectly causing risks to health.

This chapter reviews the often complex interconnections between environment and health in post-conflict countries. Following a summary of the general health effects of armed conflict and challenges to data collection, examples of environmental health risks in Viet Nam, Iraq and Kuwait, Lebanon, and Sudan are presented. The chapter concludes with suggestions for post-conflict needs assessments and linking public health efforts to peacebuilding.

CONFLICT, ENVIRONMENT, AND PUBLIC HEALTH LINKAGES

There has been much discussion over the past two decades of the connection between the environment and conflict. Tales of a great flood in the Old Testament and the Epic of Gilgamesh may have been based on abrupt climate shifts that changed the course of the Euphrates River around 3200 BC, prompting a series of internecine wars between the Akkadian and Sumerian cities of the region. Following the Third Punic War in Carthage (149–146 BC), Roman troops

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destroyed their enemies' agricultural land by salting it (Ridley 1986). Warring parties barracked troops in the winter and timed conflicts to precede monsoon seasons and severe weather (Essberger 1995). The acclimation difficulties and tropical diseases suffered by European crusaders in the medieval Middle East prompted colonial powers to establish institutes to address tropical medicine (Crosby 2004). Recognition of militaries' impacts on the environment and environmental health resulted in the 1976 Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques.¹ In 1999, the United Nations Environment Programme (UNEP) also established dedicated capacity to conduct post-conflict environmental assessments to identify risks to human health, livelihoods, and security.²

The direct casualties of conflict often overshadow the health effects of wartime environmental destruction. Yet measured in terms of excess morbidity and mortality, health impacts can persist for decades (Murray et al. 2002). The environment, natural or built, underlies public health risks, which interact with economic and social factors to create vulnerabilities in a community. Understanding the real health effects and perceived notions of injustice that perpetuate conflict is crucial to reconstruction (Briggs, Walji, and Anderson 2009; McDonnell 2004; Renner and Chafe 2007).

Direct effects of conflict on health understandably dominate second-order, or indirect, impacts. Armed conflict profoundly affects the physical and mental health of both combatants and civilians (Levy and Sidel 1997). Whereas 14 percent of all deaths were civilian in World War II, the proportion reached 90 percent in several wars during the 1990s (Garfield and Neugut 2000), partly because of the increased number of intrastate conflicts (World Bank 2008). Moreover, beginning with World War I, technology has played a greater role, in combat preparation and operations, affecting the environment and health—through toxicological and radiological impacts and direct destruction—far more than in the past. The total-war model has since been used to justify direct and indirect violence against civilians and destruction of civilian infrastructure.

The indirect health effects of conflict on civilian populations may take years to manifest and may be missed in post-conflict needs assessments (Harris 1999). The indirect impacts can result from destruction of essential infrastructure, including health care facilities and water supplies, transportation, and waste-management systems (Levy and Sidel 1997). Furthermore, widespread violence can affect the environment and natural resources by contaminating soil, food, and water. It can also disrupt livelihoods and leave behind unexploded ordnance (UXO). The destruction and contamination of natural resources can lead to food insecurity and water scarcity, as well as to malnutrition and food- or waterborne illnesses (Levy and Sidel 1997, 2009; Toole and Waldman 1997). Displacement

¹ See www.un-documents.net/enmod.htm.

² For more information, see www.unep.org/conflictsanddisasters/.

of people creates new settlement patterns and overwhelms built environments that are generally unable to cope with increased demands for food, hygiene, and sanitation.

For every combatant killed, it is estimated that one civilian is killed directly and eight more die from lack of food, clean water, shelter, and health care (Murray and Lopez 1996). Although the ratio of indirect to direct conflict-related deaths has frequently been estimated to be nine to one (Levy and Sidel 1997), an empirical basis for the approximation has not been established (Murray et al. 2002).

Even higher numbers of individuals suffer the nonfatal, long-term consequences of conflict, including injuries, physical and mental illnesses, and disabilities (Murray et al. 2002; Levy and Sidel 2009; Pedersen 2002). Christopher J. L. Murray and Alan D. Lopez estimated that nonfatal outcomes of conflict have resulted in 4.8 million disability-adjusted life years (DALYs) lost worldwide, about the same number of years lost due to fires and more than half those lost due to road-traffic injuries (Murray and Lopez 1996).³ By 2020, conflict is expected to be one of the top ten causes of DALYs lost (Murray and Lopez 1996).

CASE STUDIES OF THE ENVIRONMENTAL AND HEALTH IMPACTS OF CONFLICT

Understanding public health risks from environmental degradation caused by conflict requires pre-conflict, or baseline, and post-conflict data in order to identify trends and major risk factors (Liljedahl et al. 2010). Case studies of the direct and indirect environmental and health risks identified in Viet Nam, Iraq and Kuwait, Lebanon, and Sudan, as well as responses and associated challenges, illustrate the importance of gathering and evaluating reliable data.

Viet Nam

Conflict began with the Japanese occupation of French Indochina in 1940. Clashes with French colonial forces erupted in the 1950s, and more intense fighting against U.S. military forces followed from the early 1960s until the U.S. withdrawal in 1973. Hostilities between North and South Viet Nam lasted until 1975 and between reunified Viet Nam and Cambodia until 1979. The direct health impacts of the wars are well documented, but the long-term effects have been difficult to analyze. Total military and civilian casualties numbered in the millions, and millions of Vietnamese were internally displaced or made refugees (Allukian and Atwood 2000). Reconstruction has taken many years, and the environmental health legacy of the conflict, from chemical defoliants used by the U.S. military to UXO, has not been fully addressed.

³ DALY is a measure of overall disease burden, expressed as the number of years lost due to ill health, disability, or early death.



Chemical defoliants

American military leaders approved use of defoliants by the U.S. Air Force because North Vietnamese insurgents used the thick, tropical forest to lie in ambush against U.S. and Army of the Republic of (South) Viet Nam forces. The chemicals thinned the forest cover, reducing surprise attacks; opened up fire zones in communist-allied areas of the rural South, especially in the Mekong Delta; and destroyed food supplies of insurgent forces and their sympathizers. Over 72 million liters of chemicals were sprayed over Viet Nam between 1962 and 1971, exposing approximately 17 million people in South Viet Nam, as part of Operation Ranch Hand. The defoliants, and particularly Agent Orange (named for the identifying stripe on the barrel in which it was delivered), belonged to a larger family of chemicals that often contained the active ingredient 2,4,5-T, a teratogen (an agent that causes developmental abnormalities). Many of the mixes

also had 2,3,7,8-TCDD (dioxin) as a by-product, a more controversial chemical that the U.S. Environmental Protection Agency did not list as a probable carcinogen until 1992 (U.S. EPA 2001; Nguyen 2009).

The ecological damage to Viet Nam was acute: up to half of South Viet Nam's commercial hardwood forests and mangrove forests were destroyed (Zierler 2011). Ecosystems were severely affected, and food production was sharply curtailed. The public health impacts were less well documented, but attention to the chemicals' adverse effects finally resulted from political pressure exerted by American veterans concerned about their exposure during their tours of duty. After long and contentious debate in the United States, they won compensation under the Agent Orange Act of 1991 (Palmer 2005). But Vietnamese not living on U.S. territory have received no direct compensation from the U.S. government. In 2000, the Vietnamese government established the Agent Orange Central Payments Programme, which provided monthly payments between US\$3.40 and US\$7.14 to adults and children suffering from spina bifida and related ailments. However, program funds are insufficient for the approximately over 1 million Vietnamese affected, and the health impacts of Agent Orange continue to drain the economy and family incomes (Nguyen 2009; Palmer 2005). Food production and ecosystem health have not recovered fully because foliage remains damaged and UXO prevents farming in some areas.

Unexploded ordnance

Viet Nam is extensively contaminated by UXO, primarily artillery shells, aerial bombs, and landmines. Although not traditionally considered an environmental risk, UXO fits the definition of a contaminant and is considered a key environmental health issue by the U.S. military (U.S. AEC 1999). Between 1975 and 2009, approximately 42,000 Vietnamese were killed by landmines, and many times more suffered severe injuries. Some 6.5 million hectares—nearly 20 percent of the total land area—remain contaminated with UXO (VAAF and BOMICEN 2009). Although over 4 million landmines and bombs have been cleared since 1975, 600,000 tons of UXO, including landmines, remain. As of 2010, the UN Children's Fund (UNICEF) and the Vietnam Veteran's Association of America have each donated US\$10 million to mine clearance, and the U.S. government has contributed US\$42 million. Because removal of a single mine can cost up to US\$1,000, large-scale clearance is cost prohibitive. Thirty years after the conflict, Vietnamese are still exposed to UXO, and agricultural land remains fallow (VAAF and BOMICEN 2009).

Responses

By the end of the 1970s, UXO and chemical contamination posed enormous difficulties for environmental and health management in Viet Nam. In 1975, many

Western nations, led by the United States, imposed sanctions on Viet Nam, largely cutting the country off from the rest of the world for two decades. Soon after, Viet Nam lost Chinese patronage following disputes over Cambodia. International scientists had little access for many years, and Vietnamese scientists and physicians were not privy to peer-reviewed literature on dioxin or environmental management techniques. Agent Orange remained unstudied in Viet Nam, although anecdotal reports from Vietnamese led to common understanding of the developmental health risks. Likewise, the Vietnamese government, lacking means to remove landmines, left either large areas of the country off-limits or allowed residents to face continued risk of death and injury.

Both concerns were compounded by actions of the Vietnamese government and demographic shifts. Many Vietnamese fled from North Viet Nam after the 1954 peace talks; many more fled from rural areas to avoid fighting, which included B-52 bomber strikes that left large rural areas uninhabited (Allen 2001). After 1975, the Vietnamese government forced millions to relocate in a deliberate attempt to break up communities and encourage them to adopt communist teachings. Millions more left Viet Nam in the 1970s. In total, some 5 million Vietnamese (although the number may count people multiple times) became refugees or internally displaced persons (IDPs). Once population shifts occurred, land use patterns shifted drastically. Traditional land management ceased because of relocation and loss of property rights.

It is impossible to determine exactly how environmental issues affected health, especially in a country where monitoring of both issues was quite weak. Yet the conflict left Viet Nam and its people more vulnerable to conflict-specific and environmental health risks.

In June 2011, the United States and Viet Nam announced a limited joint environmental cleanup program. The US\$32 million project will remove dioxin from twenty-nine hectares of land at the Da Nang air base, where chemical levels are 300 to 400 times higher than international guidelines. Two other former U.S. air bases in the southern locations of Bien Hoa and Phu Cat (located near Qui Nhon) have also been identified for cleanup of soil and groundwater contamination (AP 2011). The United States and Viet Nam hope that the measures will be the first phase of a larger effort to reduce the risks to public health left by the conflict.

Iraq and Kuwait

The cumulative environmental impacts and health risks caused by the war between Iran and Iraq in the 1980s, the 1990–1991 Gulf War (Desert Storm), subsequent UN sanctions, the U.S.-led invasion of Iraq in 2003, and the ensuing insurgency are complicated and extremely difficult to unravel. Fully assessing the environmental conditions in Iraq has been overshadowed by political events and continued violence. In 2005, UNEP reported that destroyed or abandoned industrial sites in Iraq had become environmental hot spots (areas of severe contamination);



however, due to lack of access, UNEP could not assess other long-term structural and indirect environmental impacts.

Oil spills and fires

Deliberate actions during Desert Storm created human and ecological health risks. As they retreated from Kuwait, Iraqi forces deliberately opened oil pipelines into the Gulf, destroyed drill heads in advance of allied forces, and sank oil freighters in the harbor of Kuwait City. Off Kuwait’s coast, two oil slicks merged to cover 2,000 square kilometers (km²) (Readman et al. 1996), the largest-ever marine oil spill. The oil damaged ecologically sensitive regions off the coasts of Kuwait and Bahrain and mangrove forests in Saudi Arabia; however, the long-term effects of the spill to the region remain unclear. Earthworks to deter movement of invading allied vehicles and destruction of Kuwait’s main sewage treatment plant further damaged the environment (UNEP 1993).

The oil fires started when Iraqi military forces detonated explosives on the oil heads of some 700 oil wells (igniting more than 600) across Kuwait and southern Iraq to provide cover, destroy infrastructure, and deny Kuwait and its allies access to oil (UNEP 2003). Dark smoke and soot affected human health in Kuwait and other Gulf states and weather as far away as India. Daily, the smoke carried approximately 50,000 tons of sulfur and 100,000 tons of carbon,

significantly increasing the risk of respiratory illness (Campbell, MacKinnon, and Stevens 2010).

Depleted uranium

The 1990–1991 Gulf War was one of the first known conflicts that employed widespread use of depleted uranium (DU) ammunition. Since that time, DU's military merits have been seriously debated, but its long-term health effects have remained largely unstudied. DU was used in antitank rounds, particularly in the 30-millimeter cannon shells fired by U.S. Air Force A-10 attack bombers, whose cannons were capable of firing high-explosive incendiary rounds at 3,900 rounds per minute. It was also used extensively in U.S. Army M1A1 tank armor.

During the 1990–1991 Gulf War, allied (mostly U.S.) forces used over 350 tons of DU, primarily in army and air force antitank shells (U.S. DOD 2000). During the 2003 invasion, an estimated 1,000 tons of DU munitions were fired, usually on cities (U.S. DOD 2000). DU tends to disintegrate on impact, creating oxidized particles that can be absorbed over time.⁴ The amount of these particles, or aerosols, that are released depends largely on the type of surface with which the munitions make impact. If the round connects with a harder surface, such as an armored vehicle or a building, a significantly higher percentage of the DU will be released as aerosols than if the round misses its target or strikes a softer surface (Hindin, Brugge, and Panikkar 2005). Medical reports and epidemiological evidence from Iraq and Kuwait suggest a strong connection between contaminated areas and developmental abnormalities in children, although, like Agent Orange in Viet Nam, strong causality is difficult to substantiate (Hindin, Brugge, and Panikkar 2005).

The U.S. Department of Defense claims that DU use in Iraq and Kuwait has not significantly threatened human health. Consequently, it does not feel legally obligated to fund cleanup or compensate those who claim DU has affected their health. Unlike landmines, the geographic range and the unclear exposure-risk relationship can make costs of cleanup high and responsibility for assistance to those harmed uncertain (Arfsten et al. 2006; Graham-Rowe 2003; Marshall 2008). Although operating in a conflict zone, like Iraq, and gathering reliable data on the DU discharged into the environment can be challenging, conducting assessments of potential contamination sites is possible if the parties involved in the conflict provide data on the amount and geographic distribution of the DU ammunition discharged. While the United States has not been forthcoming in

⁴ According to a study by Rita Hindin, Doug Brugge, and Bindu Panikkar, “normally 10–35% and up to 70% of the DU is estimated to be aerosolized on impact or when DU catches fire. Most of the dust particles are reported to be smaller than 5 µm in size, i.e., of a size to be inhaled or ingested by humans. They usually remain windborne for an extended time. There is empirical documentation that DU aerosols can travel up to 26 miles and theoretical documentation that they can travel further” (Hindin, Brugge, and Panikkar 2005, 2).

providing this data for Iraq, UNEP has undertaken such surveys in southern Iraq (based upon information provided by the United Kingdom) as well as in other post-conflict situations.⁵

Unexploded ordnance

UXO from landmines and other explosive devices poses an environmental and health hazard throughout Iraq. Since conflicts in the early 1960s, artillery shells and cluster munitions have contaminated 1,718 km² in Iraq. Another 6,370 km² are largely off-limits due to approximately 25 million landmines and 8 million unexploded remnants of cluster bombs (Dolan and Hussein 2009; IMMAP 2006). In 2008, responsibility for cleanup was turned over to the Iraqi Ministry of Environment. In 2009, it described the UXO problem as the country's single biggest environmental problem, one it lacked the resources to handle.

The Mines Advisory Group reported 932 deaths and 1,512 injuries from landmines and UXO in 1991 (Carstairs 2001). Risk of injury or death has continued since, especially in the northern, Kurdish parts of the country and along the Iran-Iraq border. Regions near Basra and on the southern borders are heavily contaminated, often with cluster munitions, which may account for over 20 percent of injuries among children. Injuries to livestock are thought to be much higher and impose significant costs on farmers, although reliable records do not exist (Schreuder 2009). Insurgent or terrorist groups routinely incorporate UXO in improvised explosive devices, which they use against international forces and civilians.

Complete removal of UXO from Iraq will require resources beyond the limited funding and expertise of the UN, United States, Iraq, or nongovernmental organizations. By 2005, removal programs decreased sharply because of inadequate funding and security concerns. The Iraqi government acceded to the UN Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Anti-Personnel Mines and on Their Destruction (the Ottawa Convention) in August 2007.⁶ Yet at the present rate of removal, Iraq will be unable to meet its legal obligation to be mine free by 2018. With current manpower and funding, landmines could remain an issue for the next seventy years. Many areas of the country remain uninhabitable, and reconstruction projects (such as a water treatment plant in Basra) have been postponed because of UXO. Up to 15 percent of the residents have been injured or killed as a result of landmines or cluster munitions (IWPR 2009).

Water and infrastructure

Water was scarce prior to the conflicts between Iraq and Iran, and irrigation already limited the availability of freshwater. The salinity of irrigation water now

⁵ For a more detailed discussion, see Mario Burger, "The Risks of Depleted Uranium Contamination in Post-Conflict Countries: Findings and Lessons Learned from UNEP Field Assessments," in this book.

⁶ For the convention, see www.apminebanconvention.org/overview-and-convention-text/.

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approaches 2,000 parts per million by the time it reaches the Gulf (Ryan 2009). Other factors, such as climate variability and drought, increased food demand, changing land use patterns, and increased upstream use of water, have resulted in chronic water shortages that adversely affect ecosystems (especially riparian areas), food security, and water quality (U.S. DIA 1991). Food production has dropped dramatically; once a substantial exporter of wheat, Iraq is now one of the world's largest importers (Al-Ansary 2012). Malnutrition and vaccine shortages have contributed to outbreaks of measles and mumps. There were over 8,000 cases of mumps reported in the first half of 2004, a twenty-fold increase over 2003 (Peplow 2004).

Damage to environmental infrastructure, notably waste treatment facilities and water treatment plants, has compounded the lack of drinking water. Most sewage in urban areas is released untreated into rivers, and other areas have little access to working sewers or clean drinking water. Cholera outbreaks are routine because of inadequate access to drinking water and little investment in infrastructure (Ryan 2009). Of four major sewage treatment plants that operated in Baghdad before the 2003 invasion, not one remained operational by 2009. Displaced populations, in particular, have poor access to potable water and adequate sewage facilities. Most physicians have fled abroad, and curfews have hampered access to existing medical care. And notably, the insurgency was strongest in areas under severe environmental health pressure (Hill and Fittipaldi 2007).

Responses

Political, international development, and especially public health responses to the wars in Iraq have been largely uncoordinated. Allocation of authority to regional governments and earlier attempts by the Coalition Provisional Authority (CPA) to privatize many services left the federal government fragmented, unable to handle environmental management and health services effectively (Wilson et al. 2009). After 2003, Baghdad had little ability or jurisdiction to address health holistically; the Iraqi constitution did not empower the federal government to address cross-border threats to health. Many international organizations, including the UN, were unable to operate effectively during reconstruction, and insurgent attacks on infrastructure prevented delivery of environmental and health services to significant areas of the country.

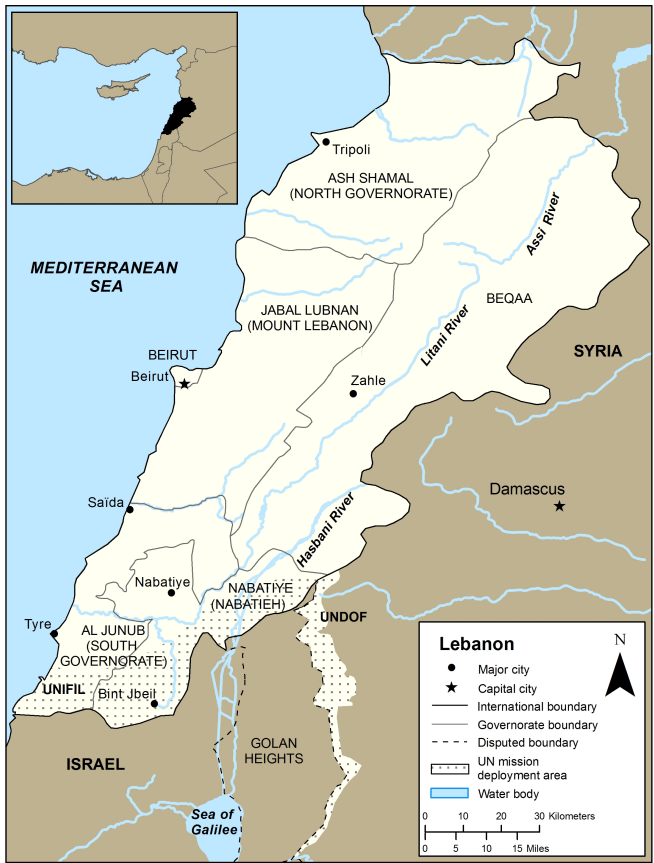
The CPA's approach to governance relied heavily on free-market theories of response.⁷ As a result, administration, enforcement of regulations, and prioritization of environmental and health needs suffered (Chandrasekaran 2007; Phillips 2005).

⁷ Free-market theories of response hold that the reconstruction of Iraq can be achieved by simple and rapid privatization of state-run industries. Naomi Klein, with her so-called "shock doctrine," and Rajiv Chandrasekaran each have criticized the free-market approach in Iraq (Klein 2007; Chandrasekaran 2007).

Effective health policies require monitoring of environmental conditions and action in advance of emerging risks. There should be structures that disseminate information about risks, such as the location of UXO and ways to reduce risks; strategies for adaptation; and processes for redressing harm caused by hazardous environmental conditions. In post-2003 Iraq, most of the responsibility was left to individuals and communities, assisted by international organizations that often could not operate safely or lacked resources.

Lebanon

Lebanon endured sixteen years of civil war and violent conflict from 1975 to 1991, which damaged the economy and the public health infrastructure (Sibai and Sen 2006). Hostilities between Israel and the Lebanese Shiite militia Hezbollah



Note: United Nations Interim Force in Lebanon (UNIFIL) and United Nations Disengagement Observer Force (UNDOF) are UN peacekeeping missions.

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continue on Lebanon's border with Israel, with clashes erupting in the summer of 2006 after Hezbollah forces kidnapped two Israeli soldiers. The conflict, which continued for thirty-three days until the UN brokered a ceasefire, caused over US\$7 billion of damage to the economy and infrastructure of southern Lebanon (Mooney 2007; Darwish, Farajalla, and Masri 2009). More than 1,200 people were killed, and over 5,000 were wounded, mostly civilians (Sibai and Sen 2006).

Unexploded ordnance

Remaining cluster munitions and other UXO from past conflicts pose an ongoing threat, especially in southern Lebanon. Cluster munitions are designed to scatter and explode upon landing but often fail to detonate immediately, making them de facto landmines. Since 1975, mines and UXO have affected an estimated 150 million square meters (m²) of land in Lebanon (E-MINE 2009). Approximately 4 million cluster munitions were dropped on southern Lebanon during the last days of the 2006 conflict, contaminating an estimated 48 million m², and approximately 1 million unexploded munitions remain (WHO 2009). By the end of August 2008, an estimated 30 percent of contaminated land remained uncleared (E-MINE 2009).

Two-thirds of the land contaminated by UXO is used for agriculture (Landmine and Cluster Munition Monitor 2009), which is the main source of income for 30 to 40 percent of Lebanese. Approximately 545 cultivated fields were damaged or made inaccessible by UXO. Farmers face death and disability but have few alternatives for making a living (Landmine and Cluster Munition Monitor 2009). Attention has focused, at the expense of agriculture, on the impact of the conflict on infrastructure, industry, and tourism (Darwish, Farajalla, and Masri 2009). Current and projected losses of agricultural production lie between US\$22.6 and US\$26.8 million (Crowther 2008).

Most of those killed or injured by cluster munitions are civilians, who engage in farming, herding, and collecting wood, as well as children, who find the brightly colored casings attractive. Cluster munitions are particularly dangerous because, unlike landmines, they tend to inflict damage on the eyes and brain (WHO 2009). They not only cause physical but also psychological disability and distress that require years of rehabilitation and support (WHO 2009). As of 2007, there were approximately 2,704 survivors of cluster bombs and landmine explosions living in Lebanon (Landmine and Cluster Munition Monitor 2009).

Responses

Since the 2006 conflict, most of the U.S. funding for post-conflict stabilization and reconstruction has been allocated to military, security, and humanitarian relief programs. Although there has been some U.S. support for demining efforts and water, sanitation, and health projects, fewer resources have been directed toward strengthening economic and social programs (Mooney 2007). In May 2007, the Lebanese government issued the National Mine Action Policy, which laid out

principles and basic provisions for mine clearance, risk education, and, through the Lebanon Mine Action Center, mine victims' assistance. The policy aimed at ensuring medical, psychological, and economic support for victims of landmines and explosive remnants of conflict. It also supported activities to help victims regain full legal rights and reintegrate into society (LMAC 2007). Advocacy against cluster bombs and landmines has increased, resulting in the Convention on Cluster Munitions,⁸ which was signed by ninety-four countries in December 2008. The convention, which has received strong support from Lebanon, bans cluster munitions and requires countries to destroy stockpiles within eight years of signing and to clear land contaminated with cluster munitions within ten years. Party states are also obliged to provide financial, medical, and psychological support to those affected by cluster munitions (WHO 2009).

After the June 2009 parliamentary elections, the U.S.-backed, predominantly Sunni, Christian, and Druze alliance retained control of the Lebanese parliament, and the United States sent aid to the Lebanese military for the first time in almost thirty years. With support from the United States and other countries, the World Health Organization, UNICEF, the International Committee of the Red Cross, the Lebanese army, and the UN Interim Force in Lebanon have continued to clear UXO, but more financial support is needed to complete clearance and give economic support and rehabilitation to those affected by UXO (E-MINE 2009).

Sudan

Sudan has been riddled with destabilizing violence and intertribal and ethno-religious conflict for all but ten years since its independence in 1956. Indeed, within its geographical boundaries, several conflicts have persisted simultaneously (Maitre 2009; Omeje 2010). They have been driven by many factors, including competition for political power; cultural identity; religious, ethnic, and tribal divisions; economic marginalization; and historical feuds (UNEP 2007). While not the sole triggers of conflict, the environment and natural resources, particularly oil and gas reserves, Nile waters, rangeland and rain-fed agricultural land, have been inextricably linked to all levels of feuding between the warring factions. Many of Sudan's conflicts have resulted from tension over the use of natural resources, and persistent conflict has, in turn, harshly affected resources. In all, an estimated 60 percent of the country has been directly harmed by protracted conflict (UNEP 2007).

North-South civil war

Sudan's North-South conflict, which started shortly after independence, came to an official end in January 2005 with the signing of the Comprehensive Peace Agreement between the northern-based National Congress Party and the southern-based Sudan People's Liberation Movement (SPLM).

⁸ See http://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVI-6&chapter=26&lang=en.



Notes:

- A – The Hala’ib Triangle is claimed by Sudan and de facto administered by Egypt.
- B – The Abyei region’s status is not yet determined (UNDFS 2011).
- C – The Ilemi Triangle has been claimed by Ethiopia, Sudan, and Kenya and de facto controlled by Kenya.

While the North-South conflict started long before oil was discovered in central Sudan, competition for ownership of and wealth from the country’s vast oil and gas reserves has been widely recognized as further fuelling and prolonging the civil war. Oil has fostered grievances in the South and has been used as a rallying cry by the SPLM, which charged the Sudanese government with exploiting the resources without benefiting local populations (Haysom and Kane 2009).⁹

⁹ Most current oil production occurs in the disputed border areas between the North and the South, thus enhancing the strategic significance of these areas and severely complicating efforts to demarcate borders. Additionally, roughly 75 percent of Sudan’s proven reserves of 6.3 billion barrels of oil lie in the South, but the only export pipeline that carries the oil to export terminals and refineries runs through the North.

During the civil war, the Sudanese government reportedly engaged in indiscriminate attacks on civilians to depopulate oil-rich areas and further develop infrastructure in partnership with foreign oil companies (Helly 2009). Chinese, Malaysian, and Indian oil investors faced mounting pressure from human rights groups and the wider international community, which were alarmed by the systematic mass killings and lootings by the Sudanese army and its counterinsurgency allies (ICG 2003; Richter et al. 2007).

Competition for benefits accruing from the use of surface water through the Jonglei Canal Project contributed to the 1983 resumption of the North-South conflict (UNEP 2007). Launched in 1980, the plan was to bypass the Sudd wetlands in Southern Sudan to more quickly capture water for downstream users in North Sudan and Egypt. Ultimately, however, the project lacked local support and acceptance and, as a result, sparked violent conflict between the government of Khartoum and the pastoralists, fishermen, and local communities. Tension over attempts to restart the project continues to run high (UNEP 2007).

Conflict in Darfur

For decades, rivalry between sedentary African farmers and nomadic Arab herders over grazing and agricultural lands and water has driven most local confrontations in Darfur. Deforestation, climate change, desertification, and declining agricultural productivity, as well as the rapid spread of deserts southward, have further devastated the dwindling natural resource base (UNEP 2007).

Until 2003, fighting was primarily confined to tribal and local conflicts. But in early 2003, hostilities escalated into a full-scale military confrontation across the three states of Darfur. The conflict, characterized by a scorched-earth campaign by government-sponsored Janjaweed militias, has resulted in mass killings, forced displacement of millions, and looting and burning of villages (Richter et al. 2007; Jaspars and O'Callaghan 2008).

Livelihood and environmental health impacts

While natural resources have significantly contributed to local tension, the protracted civil wars, in turn, have devastated the environment, resource base, and livelihoods of the people (Young et al. 2009).

The conflict has resulted in severe depletion of natural assets through looting or destruction, unsustainable coping strategies, loss of access, displacement, and restricted mobility. Conventional weaponry, such as bombs, artillery shells, and mortars, has led to cratering and has damaged or destroyed buildings, trees, and industrial facilities. Militias, particularly those in Darfur, have deliberately targeted vital natural resource-related infrastructure, such as rural water pumps, and have burned crops and pastures. Minefields, which have been abandoned without marking, continue to cause human casualties and impede access to large areas of land. Dumping waste on UXO, coupled with the impacts of deforestation and soil erosion,

has rendered further tracts of land unusable for agriculture and grazing (UNEP 2007). Obtaining firewood increases security risks, and competition over firewood has led to further conflict between pastoralists and IDPs (Jaspars and O'Callaghan 2008). Lack of pasture and water and a shortage of vaccines have increased disease in livestock (Young et al. 2005). As in other cases, forced displacement has destroyed traditional natural resource management practices and cooperative agreements, as well as the social capital necessary for proper public health efforts.

Approximately 2 to 3 million people have died in the conflicts in Sudan—half a million in the Darfur conflict alone. Over 4 million people are internally displaced as a result of the decades-long conflicts, and an estimated 9 million continue to receive humanitarian assistance (UN OCHA 2010).

The health situation has remained grave, with high rates of preventable diseases such as tuberculosis, malaria, and diarrhea, as well as outbreaks of meningitis, measles, and cholera (Wakabi 2008). South Sudan has the highest maternal mortality rate in the world; skilled staff attend only 5 percent of births (Moszynski 2008). Food insecurity, lack of access to drinking water or sewage systems, and a severe shortage of qualified health care providers contribute to poor population health. Humanitarian relief agencies, which provide most of the health care, have difficulty accessing vulnerable populations because of the absence of infrastructure and persistent insecurity (Moszynski 2008). Inaccessibility of natural resources and food insecurity have also contributed to high rates of malnutrition and infant mortality; 31 percent of children in Sudan are underweight (UNICEF 2006). Continued displacement further jeopardizes health. Large numbers of people, increased violence and riots, risk of disease outbreaks, and high rates of mental disorders such as depression characterize IDP camps (Jaspars and O'Callaghan 2008; Kim, Torbay, and Lawry 2007). Oil extraction has also taken a toll on population health, not only by contributing to violence and conflict but also by reportedly contaminating soil and drinking water with saline water to maintain the pressure of oil reservoirs and dumping industrial waste without safeguards (Calain 2008).

Responses

Because of the humanitarian crisis, most donors have funded emergency aid rather than development (Moszynski 2008). However, addressing natural resource and livelihood issues is vital to finding lasting solutions to the conflict (Young et al. 2009). The 2005 Comprehensive Peace Agreement mandated that a joint technical committee of representatives from the national government and Southern Sudan evaluate contracts with social and environmental problems in mind. The committee was to plan for the consultation and participation of communities in the management of natural resources, specifically oil, as well as for equitable sharing of wealth (ICG 2006).

In July 2009, an international tribunal in The Hague redefined the borders of the disputed area of Abyei, and the government of Sudan and the SPLM

accepted the tribunal award.¹⁰ The new borders placed two major oil fields outside the newly defined Abyei area, and as such those oil fields reverted to Northern Sudan. The residents of the Abyei area, as defined by the tribunal, were supposed to exercise the right of self determination in a referendum, to be undertaken simultaneously with the referendum of Southern Sudan, to decide whether the Abyei area would be part of North or South Sudan. However, because of the failure of the government of Sudan and the SPLM to agree on who are the residents of Abyei area, the referendum did not take place on January 9, 2011, as planned. Consequently, violence erupted again in the run-up to South Sudan's formal independence on July 9, 2011. In May 2011, the government of Sudan accused the SPLM of masterminding the death of a number of Northern soldiers inside Abyei, and few days later the government took over the whole of Abyei.

Significant challenges remain in rebuilding public health infrastructure and aiding the return of IDPs and refugees across the country. Recommendations for recovery and reconstruction in Sudan include the development of alternative livelihoods and restoration of natural resources through reforestation, improved agricultural techniques, better water management, alternative fuels, and upgrading local capacity for natural resource management (Jaspars and O'Callaghan 2008; Hassan, Hertzler, and Benhin 2009). It has also been suggested that interventions around common goals, such as animal health, could provide opportunities for local-level conflict resolution by reestablishing relationships and rebuilding trust between conflicting parties (Almond 1990; Minear 2001). Furthermore, through better natural resource management, sources of the conflict, livelihoods, and food security can be addressed to improve human health.

CONCLUSIONS, CHALLENGES, AND SOLUTIONS

Environmental impacts and associated health risks are difficult to prevent during conflict and may affect survivors well into post-conflict reconstruction and development. Immediate post-conflict hot spots are often the focus of UNEP efforts and humanitarian response. However, the long-term risks, from persistent contaminants, destroyed infrastructure, and degraded natural resources, are equally important to address during peacebuilding. Therefore, peacebuilding practitioners must understand that health and environment are related, based not only on exposure to contaminants but also on how effectively livelihoods and resources are managed in order to reduce disease, increase food security, and mitigate exposure to disasters.

Reliable data are one of the greatest challenges to successfully addressing environmental impacts and public health risks. During and after armed conflict, gathering data on mortality and morbidity is difficult because of the breakdown of infrastructure and health systems and political motivations in obscuring data

¹⁰ For more information, see Salman (2012).

or preventing access to the field. Direct conflict-related deaths are difficult to measure from household surveys, census data, government reports, and press coverage, and indirect deaths and nonfatal consequences of conflict are even more difficult to quantify (Murray et al. 2002). Baseline data on environmental conditions are frequently unavailable or unreliable.

New approaches to gathering data are emerging, including surveying family health when gathering household data on mortality (Murray et al. 2002) and rapid environmental assessments (Liljedahl et al. 2010). But more research and monitoring are needed to document the effects of conflict on public health (Utzing and Weiss 2007), including indirect effects through environmental factors. Madelyn H. Hicks and Michael Spagat suggest calculating a “dirty war index” using data on prohibited and unacceptable combat outcomes, including civilian deaths, torture, disappearances, and use of prohibited or indiscriminate weapons such as antipersonnel landmines (Hicks and Spagat 2008). The index would also account for the destruction of hospitals, as well as food and water infrastructure and resources. Because assessing the consequences of conflict falls within several fields, political scientists, environmental managers, and public health researchers must collaborate more closely (Murray et al. 2002).

Another challenge is finding ways to connect protecting public health to peacebuilding. Fortunately, the links have been increasingly recognized. In 1980, the Pan American Health Organization coined the phrase “health as a bridge to peace,” which the 51st World Health Assembly formally accepted in 1998 as a feature of its Health for All in the 21st Century strategy (PAHO 1988; Loretto, Leus, and Van Holsteijn 2001). Furthermore, “peace through health” has been proposed as a new way to investigate “the downward spiral of war and disease and the positive symbiosis of peace and health” (MacQueen et al. 2001, 1460). “Health-peace initiatives” intend to “improve the health of a population and to simultaneously heighten [a] population’s level of peace and security” (MacQueen and Santa-Barbara 2000, 293).

Health-peace initiatives can promote dialogue by identifying population health as a superordinate goal upon which conflicting parties and stakeholders can agree (Santa-Barbara and MacQueen 2004). Peace through health has had some success in countries such as El Salvador, the Democratic Republic of the Congo, and Afghanistan, where UNICEF and others have negotiated ceasefires during “days of tranquility” to vaccinate children (Weekes and Teagle 1991; Tangermann et al. 2000; MacQueen et al. 2001). Health personnel from conflicting sides can also be engaged in joint health training, programming, and service-delivery initiatives, such as a project involving Israeli and Palestinian health professionals (Skinner et al. 2005).

Collaboration among formerly conflicting parties on environmental cleanup efforts may also build trust and counteract dehumanization of the other side (Winter and Cava 2006; Conca and Dabelko 2002). Environmental grants could be made conditional on contending parties’ working together on a project (MacQueen and Santa-Barbara 2000). Peace-through-health initiatives show some promise but need to be subjected to more careful empirical analysis and investigation (MacQueen

and Santa-Barbara 2000; Santa-Barbara and MacQueen 2004; MacMahon and Arya 2004). Several authors have begun to develop frameworks to aid development and evaluation of initiatives (Bush 2003; Schmelzle 2005).

Natural resource management and restoration can similarly contribute to the socioeconomics of peacebuilding by recreating opportunities for sustainable livelihoods. Public health systems, when coupled with proper environmental management and participation, can help stabilize communities where conflict has left behind long-term risks and chronic health concerns. Addressing environmental health risks (including perceived risks) can help mitigate feelings of injustice and resentment toward national and subnational groups and can have greater political dividends than disability payments long after a conflict has ended.

Environmental and social factors that influence post-conflict public health often remain unaddressed, either through a lack of proper post-conflict assessments or failure of reconstruction policies. At the expense of environmental health, reconstruction efforts often focus on economic and political metrics, not on decreasing the number of vulnerable people, addressing environmental risks, or restoring public health.

Humanitarian response in post-conflict regions may temporarily address acute environmental health risks, but measures remain largely disconnected from longer-term development policies. Post-conflict environmental management could improve health conditions significantly, but it must be acknowledged and prioritized. Early efforts to monitor and assess environmental health needs and vulnerabilities are also required.

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