

Environmental Impact of Wars and Conflicts

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I. INTRODUCTION

Middle Eastern history is scarred by war. At the time of writing, this includes two major ongoing international conflicts (the Arab-Israeli conflict and Iraq), and at least five internal conflicts (Algeria, Somalia, Sudan, Western Sahara/Morocco and Yemen). Lebanon suffered a short but major war in summer 2006 and since then has been in turmoil. Several countries have a combination of both international and civil conflict, including Iraq, the Palestinian Territories and Somalia. In addition, a wave of international terrorism has swept across the region. While the human horror and agony of war is more or less captured by the media, the environmental consequences – the “collateral damage” – is scantily or selectively covered, if at all. Likewise, Arab countries’ policies and decision makers have made limited progress in recognizing and addressing the complex environmental dimensions and impacts of conflict. This chapter aims to shed light on both the environmental causes and costs of armed conflict in the Arab world, and what has been and could be done in response.¹



II. ENVIRONMENTAL LINKAGES TO CONFLICT

Conflicts are typically made up of complex and multiple layers of causality, ranging from ideologies, politics and personalities to economics and trade. Natural resources, or in environmental parlance “ecosystem goods and services,” have also been recognised as one of the potential drivers of conflict. Scholarly debate on the role of the environment as a contributory factor in instigating violent conflict is generally framed around two main precepts: (i) the “resource curse” or paradox of plenty and (ii) resource competition under conditions of environmental scarcity, degradation and long-term change. Whether from the perspective of resource abundance or scarcity, it is important to emphasise that the environmental link to conflict is largely indirect and works in combination with other social, political, and economic stresses. These concepts are discussed below within the context of recent conflicts in the Arab world.

The Resource Curse

Oil is modern civilization’s prized and master natural resource. Geography has it that the Arab region holds at least half of the world’s proven oil reserves.² Although one would expect oil wealth to be a blessing, in some countries it has proved an impediment. The curse of oil is a multi-faceted predicament. According to this theory, the windfall of wealth generated by oil revenues may undermine good governance by fomenting corruption, adventurism and violent conflict. Furthermore, an economy dominated by oil has a damaging impact on other sectors (particularly agriculture) by squeezing them into the periphery and stifling potentially innovative activities that may have been the best means for technological progress and a more sustainable path to development. The Gulf states with their small populations are an exception as they are able to guarantee their citizens high standards of living and generous consumer wealth. Consequently, governance in the moderated form of “fatherly” rule is generally the norm. It is larger, more populous, middle-income countries such as Iraq, however, that may be vulnerable to being trapped by the oil curse. This is because the likelihood of diverting oil wealth in favour of security measures for military purposes and to subdue social unrest is relatively high.

In addition to amplifying the risk of violent conflict, bad governance in some oil producing states undermines sustainable environmental management, as this is built upon the principles of information accessibility, public participation, transparent decision-making based on cost-benefit analysis and accountability. These checks and balances are difficult to achieve under weak governance and hence without restraints big oil operations are prone to having negative environmental impacts. To cite an example, although Environmental Impact Assessments (EIAs) are required under Sudanese law, these are not enforced in practice. The consequent failure of the oil industry to adequately integrate environmental considerations in their projects, has spurred resentment from local communities, particularly in non-Arab South Sudan, (mainly due to the impacts of untreated produced water on pasturelands). Coupled with growing disputes over benefit-sharing, the industry's poor environmental performance has further aggravated disputes over oil in Sudan. It should equally be noted that an absence of or inadequate environmental governance can also be a potential source of conflict for other major infrastructure projects. For example, the ongoing construction of the massive Merowe dam and other planned dams in northern Sudan has been a source of tension, erupting on more than one occasion into violent confrontations. While Merowe is the first dam project in Sudan for which an EIA was prepared, the EIA license was delivered two years after the project physically started and no consultations were held with local representatives and communities on its findings.

At the same time, international competition over the sources of oil has placed the Arab world at the crossroads of a global resource conflict. The last Gulf War in 2003 is arguably partly motivated by the desire to secure the safe flow of oil from the region. There is also scepticism that the international crisis over Darfur is to some extent driven by a contest over energy sources. At the national level competition for oil revenues, whether in the form of budget allocations between government ministries or fighting between militias, fuels and prolongs conflict. Although the North-South conflict in Sudan predates the discovery of oil, competition for ownership of the country's oil reserves was a driving force sustaining the conflict. Wrangling over the division of oil wealth

has contributed to worsening sectarian violence in Iraq. At the local level the ongoing struggle in Basrah to control its major oil industries and the smuggling trade is another case in point.

Environmental scarcity, degradation and long-term change

Although not in diametric opposition to the "resource curse" paradigm, the other end of the debate focuses on environmental scarcity and degradation as a cause of conflict. The underlying premise is that resource scarcity has the potential to trigger social breakdown and violent conflict, the foremost example being the age-old struggle between pastoralists and farmers, religiously symbolized in Cain's (the farmer) slaying of his brother Abel (the shepherd). In ecozone terms, this is sometimes referred to as the "desert versus the oasis" syndrome.

In the predominantly semi-arid environment of the Arab world, the most prominent environmental drivers of local conflict are pastoralist and sedentary competition over agricultural and grazing lands and water sources. It is important to note, however, that conflict over these resources is largely limited to specific environmental settings, and is overall linked to conflict in a minority of cases in the Arab world. For instance, in the populous, irrigated Nile and Tigris-Euphrates valleys clashes between pastoralists and farmers are comparatively rare due to the regularity of water flows and limited overlap of pasture and irrigated lands. Historically conflict between the two groups had less to do with resource scarcity and was largely a result of pastoral and state rivalry over political and economic domination, which in the modern Middle East has virtually ceased.³ The strong presence of central government, the steep decline in nomadic populations and the reliance on artificial water sources are some of the factors reducing such friction.

On the other hand, clashes between pastoralists and farmers are more frequent in environments where both pastoralism and agriculture are dependent on rainfall and water is primarily drawn from naturally occurring point sources. The critical factor is therefore *rainfall*. Extreme fluctuations in precipitation regimes, characteristic of arid and semi-arid regions, render farmers but particularly pastoralists highly vulnerable to

water scarcity, as their entire livestock herds are at risk of being wiped out. The aim of pastoralism is to adapt to this non-equilibrium ecology through mobility. It is particularly during periods of drought that the relationship between pastoralists and farmers begins to strain and risks falling apart. In the past, environmental stress and social tensions could be alleviated as land was relatively plentiful and pastoralists could migrate to new areas. With artificial borders restricting nomadic movement, large increases in human and livestock populations and the expansion of mechanized agriculture on marginal lands, mobility options have significantly diminished, increasing the likelihood of conflict between pastoralists and farmers.

The abovementioned scenario is prevalent in the sub-Saharan limits of the Arab world, namely in Somalia and Sudan. Specifically it is in the Sahel and Savannah zones that this situation has become most acute, due primarily to their suitability to both pastoralism and rain-fed agriculture. The most notorious example of a conflict occurring in such context is the ongoing crisis in Darfur. Clearly, the war in Darfur can not be simply reduced to a resource conflict and its highly political, economic and ethnic aspects among others need to be fully acknowledged. At the same time, in order to adequately understand

the nature of the conflict it is important to recognize that environmental conditions played an important role in precipitating localised conflicts between black Arab pastoralists and African farmers, which became increasingly frequent with the onset of the prolonged drought of the 1970s and reached new heights in the 1990s. Recent studies on conflict in Darfur reveal that competition over grazing and water rights accounted for 30 of the 41 clashes recorded in the period from 1930-2000.⁴

Simply described the Arab tribes (as well as non-Arab Zaghawa) attempted to escape prolonged drought by seeking refuge in the lands of the Fur and Masalit which are rich in water and pasture, such as in the highlands of Jebel Marra. Previous mutual agreements between pastoralists and farmers began to unravel as the former began to turn up earlier than normal (before or during harvest time) and would overstay for undetermined periods. Confrontation became inevitable. The violence escalated to such an extent that casualty figures rose to an estimated 200,000-500,000 deaths in addition to two million displaced. This environmental predicament is not unique to Darfur but shares many similarities with other conflicts between pastoralists and farmers in dryland central Sudan, such as in Southern Kordofan. Except that in Southern Kordofan, mechanized agriculture had a greater role than rainfall vagaries and drought in the instigation of conflict. The horizontal expansion of mechanized agriculture on the clay plains in the high rainfall savannah belt, the traditional winter grazing lands of Hawazma Baggara (cattle herders) and Shanabla camel nomads drove them deeper into the Nuba Mountains in search of water and pasture for their livestock. Again, large-scale armed conflict broke out between pastoralists and the indigenous Nuba farmers. Disorganized and poorly managed mechanized rain-fed agriculture, covering an estimated 6.5 million hectares of which 45-66 percent comprises unauthorized holdings, continues to be a major cause of violent clashes between pastoralists and farmers in central Sudan.

Another variant of the conflict between pastoralists and farmers sees both groups encroaching on forest and wildlife reserves due to scarcity in agricultural and grazing lands, such as in the Dinder National Park (DNP) that is the size of Lebanon,

CLIMATE CHANGE AND CONFLICT

Environmental degradation is further aggravated by climate change, which is essentially acting as the motor spinning the scarcity-degradation-conflict cycle ever faster. In Darfur, for example, a major and long-term drop in precipitation, ranging from 16 to 34 percent in over 80 years, has been recorded with obvious impacts on rangeland quality. Climate change forecast models predict that compared to the 1961-1990 'baseline climate', areas fringing the Sahara such as Northern Kordofan, are set to experience a 0.5 to 1.5°C rise in average annual temperatures by 2030 and 2060 respectively, with an average rainfall decline of five percent. The impacts on agriculture are likely to be disastrous with an estimated 70 percent drop in crop yields. Due to declining rainfall, the spread of the desert which has shifted southwards by an estimated 50 to 200 km since 1930 is expected to continue. Clearly, climate change is a major stress factor that has the potential to create an overwhelming environmental crisis in the Sahel and accelerate the severity, scale and pace of conflict dynamics.

and which is Sudan's largest. In such cases, the conflict which often erupts into violence is between pastoralists and farmers on the one hand and government officials on the other (forest rangers and game wardens who are part of the Sudanese unified police force). As the DNP flanks Ethiopia, border forces have also occasionally been caught up in the fighting due to cross-border pastoral incursions from both sides.

Competition between pastoralists and farmers is further propelled into a negative spiral by environmental degradation. The two principal factors are on the one hand overstocking and overgrazing depleting rangelands, and on the other expansion of both traditional and mechanized agriculture into marginal lands that often encroach on livestock migration corridors and lead to extensive vegetation clearance and deforestation. Combined these pressures accentuate desertification, soil erosion and soil exhaustion. As the natural resource base degrades and dwindles, demands on ever scarcer pastures and water continue to rise due to the high human and livestock population growth rates. For example Sudan, which has the second largest herd on the continent, saw its livestock population increase more than six-fold in less than fifty years; from 22 million in 1959 to 135 million in 2004. Concurrently at the national level, rangelands have shrunk by an estimated 20 to 50 percent, largely due to conversion into mechanized rain-fed agriculture. Consequently, the struggle between pastoralists and farmers is gridlocked in a self-reinforcing vicious circle of growing scarcity that ultimately increases the likelihood of violent conflict and reduces the chances of compromise.

In a similar light, an environmental scarcity analysis provides deeper insight on the nature of the Arab-Israeli conflict. The delimitation of borders in the region has at least in part been inspired by the aim to secure command over hydrostrategic territory. For instance, the extension of the boundaries of mandate Palestine northwards was partly motivated by the aim of incorporating Lakes Tiberias and Huleh as well as some of the Jordan headwaters.⁵ Securing control over the Jordan River's upper catchment is considered one of the key factors behind Israel's occupation and annexation of the Syrian Golan Heights. Expansion of settlements and the course of the Separation Wall have also been linked to

Israel's interest to retain control over the West Bank's strategic recharge zones and rich aquifer reserves.⁶ In Gaza, which relies predominantly on wells, the problem is that of seawater intrusion from over-pumping of groundwater. And finally, suspicion over Israeli intentions to tap the Litani River in Lebanon is another source of contention.⁷ Although not necessarily the sole or prime impetus of war, water scarcity and gaining command over water producing areas is an integral part of the Arab-Israeli conflict.

III. ENVIRONMENTAL IMPACTS OF CONFLICT

Scientific assessment of the environmental effects of conflict are generally categorised as direct and indirect impacts. Direct impacts relate to those whose occurrence may be physically and lineally linked to military action and which typically arise within the immediate short-term (up to six months), whereas indirect impacts are those that can be reliably attributed to the conflict but which usually interact with a web of factors and only become fully manifest in the medium to longer run. Some examples of direct impacts include environmental contamination from bombing of industrial sites, deliberate natural resource destruction, and military debris and demolition waste from targeted infrastructure. Indirect impacts include the environmental footprint of displaced populations, collapse of environmental governance and data vacuum, and lack of funding for environmental protection. This section provides a brief synthesis of the environmental fallout of conflict in three Arab countries: Iraq, Sudan and Lebanon.

Iraq

Given the magnitude of military conflict in Iraq, it is no surprise that its environment has sustained greater war damage than any other country in the Arab world and indeed perhaps worldwide. Over the past three decades the country has leaped from one major war into another and this for the most part in a context of internal civil strife and stern international sanctions.

The Arab world's longest war in the 20th century was Iraq's eight year war with Iran (1980-1988), whose hallmark of trench warfare and

chemical weapons recalls World War One. The heaviest fighting took place in the area of the Shatt al-Arab estuary and the Mesopotamian marshlands (*Al-Ahwar*). At the same time, the entire ~1,500 km length of the Iran-Iraq border, which remains heavily mined to this day, was an active front in which chemical weapons were deployed by the Iraqi Government both against Iran and Iraqi citizens. Despite the lethality of the chemicals employed, their relatively short environmental persistence (ranging from 30 minutes for tabun to 2 years for mustard gas) means that any remaining residue represents a low risk today. Despite occasional raids on cities, the rest of the country was largely spared from military action and hence direct environmental impacts. From space, the heavily scarred landscape of the Iran-Iraq border, with its trenches, bunkers, weapon pits, moats and mine fields, is today reminiscent of a cratered lunar landscape. The physical disturbance of the landscape (wetland and semi-desert) by major earthworks has been so severe that old topographic maps are simply no longer valid. The construction of defensive works and military causeways inside the marshlands contributed to their desiccation, whose surface area had reduced by 20-25 percent in 1990. The extensive date palm plantations fringing the Shatt al-Arab estuary were devastated on both banks of the border, with millions of trees destroyed by shelling, fire and deliberate clearance. The marine environment of the Gulf suffered considerable damage during the so-called “tanker war” in which over 500 commercial vessels were destroyed and major oil installations targeted; the worst incident being the bombing of the Iranian Nowruz platform where almost 2 million barrels of oil were spilled. The conflict’s shipwreck legacy remains an important problem to this day with potentially significant environmental implications that need to be considered in future salvage operations. Finally, the last stages of the war also witnessed the Anfal campaign, in which an estimated 4,000 Kurdish villages were destroyed with evident environmental impacts ranging from large-scale population displacement and destruction of orchards, cropland and pastures. At the end of the war, Iraq’s economy was bankrupt and the work of the environment department, established in 1972 under the Ministry of Health, was now essentially limited to routine sampling of drinking water quality.

It is in this context that Iraq entered into another war with its invasion of Kuwait in 1990. Although the war lasted less than six weeks, the air campaign targeted all types of infrastructure, military and civil, including sewage and water supply plants, power stations, bridges, oil refineries, the manufacturing and petrochemical industries as well as nuclear, biological and chemical weapon facilities. Over 290 metric tons of depleted uranium projectiles were fired into Iraq during the 1991 Gulf War (compared to 9 tons in Kosovo and 3 tons in Bosnia and Herzegovina). It can be assumed that the environmental fallout of such a massive bombing campaign is potentially significant although it was never scientifically assessed. Immediately thereafter Iraq was placed under strict UN sanctions and made to pay compensation for war damages including environmental ones. At the same time it was denied the right to restore key social services and infrastructure, including importation of spare parts to rehabilitate wastewater treatment plants such as that of Al-Rustamiyah in Baghdad which was releasing 300,000 m³/day of untreated sewage into the Tigris River with grave humanitarian and environmental consequences.

Meanwhile, the UN Compensation Commission (UNCC) required Iraq to pay US\$ 243 million to Kuwait, Iran, Jordan, Saudi Arabia and Syria to assess environmental damages allegedly sustained. With more than 600 oil wells detonated producing up to 500,000 metric tonnes of pollutants per day, 25-50 million barrels released on land and the largest marine oil slick in history (6-8 million barrels), the devastation wrought on Kuwait and the Gulf’s marine environment was colossal. The most readily visible sign of environmental damage were the thick clouds of black smoke billowing from the burning well fires for over a month that blanketed the sun and affected air quality in several countries. In the case of Kuwait alone, the damage was estimated at US\$ 40 billion representing 16 percent of its total war claims. Today, the volume of scientific environmental literature on the war’s impacts on Kuwait and the other countries (excluding Iraq) is unrivalled when compared to other conflicts. Finally, the UN Special Commission (UNSCOM) charged with neutralizing Iraqi weapons eliminated hundreds of thousands of litres and over one thousand metric tonnes of chemical warfare



agents and munitions. Environmental contamination generated from such destruction has not been scientifically assessed.

Soon after the declaration of the 1991 ceasefire, Iraq was engulfed in a major popular uprising that was ultimately quelled by the government. Driven to punish their opponents who had sought refuge in the Mesopotamian marshlands, the Iraqi Government launched a massive engineering campaign to drain the second largest wetland system in the Arab world (after the Sudd in Sudan). Huge canals and earthworks were constructed to divert the waters of the Tigris and Euphrates around the marshes and into the Gulf. The net result was that 93 percent of the marshlands had vanished by 2002, shattering the indigenous Marsh Arabs' millennial way of life. Although the destruction of the Mesopotamian marshlands with its substantial biodiversity wealth represents the single largest ecosystem loss in the Arab world in recent times, it has not expressed real concern over this major disaster despite its wider regional ramifications.

Crippled by sanctions, Iraq was in a state of sluggish atrophy when war broke out in March 2003. Although the bombardment was significantly greater than that of the 1991 Gulf War, it was mainly targeted at military facilities, and civil infrastructure was largely spared. In fact, the

principal cause of environmental damage emanated from extensive looting and sabotage of military and industrial facilities as well as oil installations and pipelines. Of the five sites identified by the United Nations Environment Programme (UNEP) as priority contaminated "hotspots", four were looted and one was a military scrap yard. There is ongoing debate on whether the looting was caused by poor planning or is the result of negligence in which case damage sustained should be classified under direct environmental impacts. In any case, the failure to secure such critical installations as the largest Iraqi nuclear programme at Tuwaitha reveals the extent of carelessness and low priority attached to the environment. The net result is that Iraq is littered with thousands of contaminated sites which are continuing to grow every day due to incessant sabotage and military operations. It will only be possible to scientifically assess and quantify the full environmental magnitude of this latest war when the security situation allows for scientific fieldwork to take place.

Several media reports as well as some scientists inside Iraq have been linking depleted uranium (DU) with a reportedly growing incidence of cancer and birth defects, which is grounded more on anecdotal cases and rumour than scientific evidence. For such a connection to be made Iraq would first need to establish national cancer and birth defects registries that it presently lacks. This is not to say that the potential impacts from DU are insignificant but that such claims are unsubstantiated and risk compromising the credibility of future scientific studies. The total amount of DU used in the 2003 war is unknown, but speculative figures from various studies range between 170 to 1,700 metric tons. The United States, while admitting to using DU, has not disclosed how much and where it was used, while the United Kingdom has reported firing 1.9 tons. Limited studies conducted by the Iraqi Radiation Protection Centre in collaboration with UNEP in four selected areas indicate that radiation levels are within natural background levels and well below threshold levels requiring remedial intervention. This would suggest that there appears to be no special threat to the general population and that such risks where they do exist are localised. Persons at greatest risk of radiation exposure are those who may come into direct contact with DU munitions and DU contaminated equip-

ment, particularly those working in scraping operations. It is therefore important that DU contaminated areas be identified and assessed and a monitoring programme for potentially affected populations established.

At the same time, it is important to highlight some of the positive environmental developments that have taken place following the 2003 war. These include the re-flooding of 60 percent of the marshlands mainly from actions taken by local communities which have been reinforced by interventions from the Ministry of Water Resources and Irrigation. A fully-fledged Ministry of Environment has been established and the country has finally opened up to the wider world enabling the transfer of environmental knowledge and technology as well as allowing Iraq to actively engage with international environmental agreements. Indeed Iraq's first accession to an environmental treaty was to the Ramsar Convention on Wetlands in 2006 with the designation of the eastern Mesopotamian marshlands (Hawizeh) as its first protected site; this reflected a full turnaround from its previous policy to drain wetlands.

Sudan

The direct environmental impacts of Sudan's civil war (1962-1972; 1983-2002), Africa's and the Arab world's longest, have been relatively limited. It is in reality a highly complex mosaic of conflicts, the main one being the long-standing war in South Sudan that over time evolved to encompass the Nuba Mountains, southern Blue Nile, eastern Sudan and most recently Darfur, which is presently the only remaining active combat zone. Geographically, armed conflict has been confined to the aforementioned areas, meaning that up to 60 percent of the country, with the exception of the North and most of the centre, has witnessed fighting at one time or another. The main reason why the conflict despite its duration has not had a major direct impact on the environment is because it was essentially a guerrilla war fought with light weapons such as the AK 47 rifle. Moreover, the country's small industrial base, particularly in the underdeveloped and marginalised areas where fighting occurred, meant that there were few military or civil targets that could create significant physical damage or generate a hazardous waste

stream. This is borne out by the fact that the single most significant "industrial" target in Sudan's conflict to date is the Jonglei canal excavator sabotaged at the inception of the second phase of the civil war in 1983, the environmental impact of which is negligible.

The greatest military legacy of the conflict is that of landmines and other explosive remnants of war, affecting 32 percent of the country mainly in southern Sudan. While landmines in and of themselves are generally of minor environmental concern, their main impact is to impede access to land and natural resources such as pastures on which the rural population is highly dependent. In Sudan, some areas have been out of bounds for decades, diminishing the population's resource base and thereby potentially setting in train a cycle of scarcity and environmental degradation. On the other hand, reduced access and depopulation can have positive impacts such as in the Nuba Mountains where there has been extensive regrowth of woodland. Similarly, the Sudd wetlands became an impenetrable "buffer zone" during the conflict, providing refuge for wildlife from poachers. Recent surveys in 2007 in the area of the Sudd have revealed the existence of various wildlife species such as elephants, ostriches, lions, leopards, hippos, buffalo and large populations of migrating antelope species.⁸ Finally, in Darfur there have been consistent reports from local communities as well as by other observers that militias have been using "scorched earth" tactics destroying trees, crops and pastures. Deliberate deforestation and vegetation clearance could have important impacts on the land, water and biotic regimes but it is not possible to quantify the significance of such damage due to a lack of data. Such destructive actions are also likely to strengthen the aforementioned feedback loop of environmental degradation, scarcity and conflict that is already underway in Darfur.

The prolonged length of the civil war has meant that indirect secondary impacts of the conflict are significant. The most severe environmental consequences have been caused by the displacement of an estimated five million people, which is continuing to rise due to the ongoing conflict in Darfur. Representing the largest displaced population worldwide, it has led to deforestation and devegetation around camp areas, unsustainable

groundwater extraction in camps and the development of a relief economy that may exacerbate demands on natural resources. Darfur, with some 2.4 million displaced, may be the most environmentally significant displacement case in the world today due to its fragile dryland conditions. Looting of natural resources in conflict zones by all sides was widespread, the most significant being the extraction of high value timber in the south and fuelwood for charcoal in the Nuba Mountains. Ivory poaching decimated elephant and rhinoceros populations in southern Sudan and bushmeat was hunted for food by the warring parties. Environmental governance collapsed not only in active conflict zones but nationwide and both the military as well as civilians took advantage of the opportunity to act with environmental impunity. The conflict also meant that most of the country was inaccessible for science-based data collection further limiting rational decision-making for resource management and conservation. Finally, the war economy created a funding crisis as provisions for sustainable environmental management practically did not figure in the government's fiscal budget.

Lebanon

Lebanon has been the scene of both civil conflict and international proxy wars since the mid-1970s and remains the only active battlefield in the Arab-Israeli conflict. In July 2006, a 34-day war broke out between Israel and Lebanon causing wide-ranging damage to its civil infrastructure and significant environmental damage. One of the most enduring images of this conflict is the estimated 10,000 - 15,000 tonnes of oil released into the Mediterranean from the bombing of the El-Jiyeh power plant. Affecting 150 km of the 220 km Lebanese coastline and extending partly into Syria, the oil spill severely impacted its sandy beaches and rocky headlands.⁹ Given the heavy type of oil contained in the storage tanks, a considerable proportion sank within the vicinity of the power plant, where it "smothered biota and significantly impacted the seabed."¹⁰ UNEP analysis of seawater quality, marine sediment and biological indicators such as oysters revealed that hydrocarbon contamination levels are generally within background levels for the region. On the whole, therefore, marine life appears to have largely escaped the worst of the disaster. Nevertheless, given the risk of the oil's remobilization it is

important that a monitoring system be established to check pollutant concentrations. In the bigger picture, the main threat to the quality of Lebanese coastal waters continues to come from the 53 wastewater outfalls dumping untreated sewage into the sea (which can be partially attributed to the lack of investment due to past conflicts).

The war's main environmental impacts relate to the substantial volumes of waste generated. The most serious has to do with the vast amounts of demolition rubble generated from the destruction and damage of 30,000 housing units as well as other infrastructure such as bridges and manufacturing facilities. There is generally a low risk of contamination from such inert debris and the main issue here is that of waste handling and disposal, particularly as it is overwhelming existing dump sites. The other principal challenge stems from the disposal and treatment of the collected waste oil spill including contaminated soil, especially as Lebanon lacks remediation facilities. Contamination from targeted industrial sites was generally low and localized, but a handful of these require clean-up. Wide-spread damage to Lebanon's water supply and sewage networks also occurred amplifying the pre-conflict acute deficiency in wastewater treatment capacity, which had recently been undergoing comprehensive upgrading and modernisation.

Despite unsubstantiated press reports that DU had been used in the conflict, UNEP in collaboration with the Lebanese Government conducted an extensive field survey using state of the art equipment and found that there was no evidence of their use. One of the major indirect impacts of the war stemmed from the legacy of up to one million unexploded cluster bombs dropped in South Lebanon. Agricultural land was hardest hit accounting for 62 percent of the total cluster bomb contaminated area. This not only led to major losses in the 2006 harvest season, but effectively rendered a large swath of South Lebanon out of bounds for the local population. Again, the resulting scarcity in farmland from cluster bomb infestation has the potential to generate a new socioeconomic dynamic and set in train a cycle of poverty and environmental degradation. Finally, the conflict led to the outbreak of fires and the loss of economically valuable tree species in southern Lebanon impairing the government's fledgling reforestation programme.

IV. RESPONSES TO THE ENVIRONMENTAL IMPACTS OF WAR

At the country level, national response has been variable but on the whole weak. It was rapid and effective in Lebanon where a coordination cell was established to deal with the oil spill and international support was successfully mobilised for the environment sector. While in Iraq and Sudan the response has been slow and limited due to weak capacity, it is gradually developing. There has been no coordinated regional reaction and each country has essentially had to rely on its own resources.

At the international level, the main response to the environmental consequences of conflict has come from the United Nations Environment Programme (UNEP). The Gulf War of 1991 was the first time that UNEP examined the environmental risks of a conflict, producing a series of desk studies which, however, were curtailed by lack of empirical fieldwork. The defining milestone for UNEP came in 1999 with the publication of its groundbreaking scientific assessment of the Kosovo conflict, which also included for the first time a detailed field-based evaluation of DU contamination. Catalysed by its successful experience in the Balkans, UNEP institutionalised its work in this field by establishing a dedicated Post Conflict and Disaster Management Branch in 2001 with a global mandate to address the environmental impacts of war.

UNEP's scope of work on environment and conflict is centred on supporting post-conflict countries in four main areas: (i) scientific assessment of environmental impacts; (ii) remediation of contaminated "hot spots"; (iii) building and strengthening environmental governance capacity; and (iv) integrating environmental considerations in post conflict reconstruction and development. Most recently, in early 2008, UNEP launched a new programme on the role of the environment in peacebuilding which aims to address the environmental causes of conflict. It will also entail an "environmental diplomacy" component that will actively seek to promote internal reconciliation within conflict affected countries, as well as catalysing re-engagement with neighbours through dialogue and cooperation on shared ecosystems and resources.



Of UNEP's twelve post-conflict assessments, slightly under half have been in the Arab world including Iraq, Lebanon, the Occupied Palestinian Territories, Somalia and Sudan. These flagship reports have by and large succeeded in raising the environment's profile within high-level political agendas, both nationally and internationally. Presenting a synoptic overview of the key environmental challenges facing post-conflict countries, the assessments address the concept of 'environment' in its broadest sense to include issues that may otherwise be classified under energy, forestry, public health, agriculture, transport, education, etc. It also looks through the lens of time at the environmental history and chronic problems pre-dating the conflict. Furthermore, strategic and prioritised recommendations for remedial action are also provided. All the reports have been wholly or partly translated into Arabic and published within a relatively rapid timeframe in both hardcopy and electronic formats, ensuring wide dissemination. For example, the Lebanon report was published five months following the end of hostilities, while for Gaza it was completed within six months of Israel's disengagement.

There is no standardised template for conducting these studies as each assessment is tailored to the nature of the conflict, the priority thematic issues under consideration and the operational constraints within the country concerned. For example, in Lebanon and Gaza the assessment heavily relied on detailed laboratory analysis, while given the size of Sudan it was based on rapid but extensive field visits, satellite image analysis and intensive consultations with a wide range of stakehold-

ers, including civil society. In the case of Iraq, as UNEP was unable to field its experts on the ground due to security restrictions, it trained national partners on sampling methodology and field verification to backstop satellite image analysis. Samples were then taken to international laboratories for independent analysis.

Overall, the common hallmark of UNEP's reports is their timeliness, accessibility to the non-environmental expert and their attractive visual layout combining photographs, satellite images, maps and graphics. The assessments are also distinguished by the rapidity with which UNEP's scientific team is deployed to the field working under a military setting and the international credibility of its scientific findings which are conducted in a transparent manner with the full engagement of national partners. Finally, another practical benefit of these reports is their proven track record in mobilising donor interest and funding to implement follow-up projects and activities.

Drawing on the findings of its assessments, UNEP has designed and delivered environmental clean-up and mitigation measures to reduce direct risks from conflict, such as in Iraq where it collected and secured highly hazardous materials. In Lebanon, UNEP is in the process of strengthening the government's environmental monitoring system to track contamination levels that may have been generated by the conflict. In Darfur work is underway to replant three million trees to help combat land degradation and alleviate fuel wood shortages around Internally Displaced Persons camps as well as help create the necessary conditions for an eventual return process.

Strengthening environmental governance has been UNEP's core activity in post-conflict countries. This has involved capacity building programmes covering a wide spectrum of topics ranging from law and policy development to laboratory training such as in Iraq and Sudan, as well as targeted technical support on specific issues (e.g. hazardous waste) for Palestinian officials. In view of the rapid economic growth rates that are characteristic of countries emerging from conflict such as Sudan and Iraq, UNEP has been providing technical expertise both to the humanitarian community and national authorities to help ensure the environmental sustainability of

their interventions and reconstruction investments. Finally, UNEP has brokered technical cooperation between Iran and Iraq, Iraq and the Regional Organization for the Protection of the Marine Environment (Kuwait Action Plan), the Palestinian Authority and Israel, and between North and South Sudan.

Other international organisations have also been extending their support to post-conflict countries to include an environmental component, particularly the United Nations Development Programme and the World Bank. On the whole, however, these interventions have largely been on a case by case basis and are typically designed with a specific thematic focus (e.g. solid waste, forestry); where the environment in its wider sense is not the driving concern. Moreover, these organisations have a very large portfolio and so do not carry the "environmental flag" in the same way that UNEP does. Nevertheless, they do bring significant resources and expertise to the table and their long-term in-country presence adds continuity and sustainability to their efforts. In 2005, the UN established a Peacebuilding Commission which has begun to consider the environmental connection to conflict in its development of integrated recovery strategies. Environment as a sector has also been incorporated in various coordination mechanisms set-up to consolidate the work of international organizations in post-conflict transition settings, such as the UN Development Group and Inter-Agency Standing Committee at the global level, and the UN Country Team at the country level.¹¹

Both environmental and conflict-resolution non-governmental organisations have also been responding to the specific environmental needs of post-conflict countries and in some cases have proven to be important sources of data and expertise. Some of the key players include, Green Cross International, Greenpeace, International Union for the Conservation of Nature (IUCN) and the World Wide Fund for Nature. For instance, Green Cross conducted scientific environmental analysis of the Gulf Wars, while Greenpeace has been monitoring the depleted uranium issue and was the first to raise the alarm about the environmental fallout from the ransacking of the nuclear facility in Tuwaitha. Greenpeace was also very quick to deploy assessment teams to Lebanon and Iraq immediately

following the conflict. Conservation organisations such as IUCN and Birdlife International have supported biodiversity conservation work in Kuwait following the 1991 war and more recently in Iraq, while the Wildlife Conservation Society has undertaken some pioneering wildlife surveys in southern Sudan. At the same time, national NGOs have been actively engaged, for instance by playing a lead role in the clean-up of the oil spill in Lebanon and in articulating the linkages between conflict and environment in Sudan. In Iraq, civil society has generally been struggling but a few environmental NGOs have emerged after 2003. Finally the role of the media in drawing public attention to the environmental impacts of conflict has also been growing. In the Arab world, *Environment and Development Magazine (Al Bi'a Wal Tanmia)* has been systematically covering the topic in Iraq, Lebanon, Palestine and Sudan.

V. WHAT SHOULD BE DONE?

The Arab world's foremost conflict traps today – Iraq, Palestinian Territories, Somalia and Sudan – as well as the 'swing states' of Algeria and Lebanon, represent the ultimate challenge to its future. For their predicament will not be limited within their borders but will also in a major way define and shape the prospective outlook of the entire region. The present status quo of these war-torn societies living in miserable conditions is a harbinger of future problems for the whole Arab world. Along the same lines, the environmental fallout of conflict ranging from the impacts of refugees to transboundary pollution, as epitomised in the Gulf Wars, will continue to inexorably worsen.

What should the Arab world do to protect its environment from the furores of war? There are two possible entry points for intervention: addressing the environmental links to conflict and responding to post-conflict environmental impacts. More often than not under appropriate circumstances, shared ecosystems and natural resources are more likely to provide the potential seeds of cooperation than conflict. This is poignantly illustrated by the "Picnic Table Talks" over the allocation of Yarmuk waters between Israel and Jordan in the 1950s and by the fact that "water, energy and environment"

was one of the key tracks in the negotiations culminating in their 1994 peace treaty.¹² One of the few areas where there continues to be regular contact between Israeli and Palestinian experts is on water, which has also been included as a "core issue" with the resumption of talks in early 2008.¹³ This demonstrates the potential role of the environment as a neutral concept in providing a platform for dialogue and confidence building for some of the most complex crises facing the world today.

Tackling the "resource curse" that characterizes countries such as Iraq and Sudan requires the development of novel policy and legal frameworks and instituting practical mechanisms for more robust and accountable oversight. Subscribing to international norms, such as those established under the Extractive Industries Transparency Initiative (EITI) and translating them into national laws, is a good starting point for oil producing Arab countries. Both the EITI and similar initiatives such as the Kimberley Process have demonstrated that even very modest steps can go a long way towards improving natural resource governance.

Equally, environmental scarcity, degradation and long-term change should not be taken to convey a message of hopelessness that environmental decline is inevitable. There are always numerous opportunities for contingency including risk reduction, preparedness and early warning. Indeed with the right policies and strategies, environmental scarcity could be a stimulant to technological innovation and institutional reform, as in the cases of Israel, Japan and Switzerland. In places such as Darfur, resources are indeed scarce under prevailing socio-economic circumstances. This, however, is not necessarily because there is an absolute shortage in arable land and water but rather due to ineffective policies, mismanagement and development politics that have marginalised the region. Although Darfur is a major headwater catchment for both the Nile and Lake Chad basins, there is a major data vacuum and underinvestment in tapping its relatively rich water resources. Clearly, development policies based on sound information, investment and maintenance of critical infrastructure and human ingenuity can go a long way in reducing the likelihood of conflict in regions such as Darfur.

In responding to the environmental impacts of conflict, the Arab world through the Council of Arab Ministers Responsible for the Environment (CAMRE) and regional environmental organisations may consider pursuing a combination of the following practical measures:

(i) Funding for the environment

National budget allocations for the environment in all Arab countries is without exception well below one percent. In comparison, both as a share of GDP and in per capita terms Arab countries have the highest military spending rates in the world. Average defence expenditure stands around 7-8 percent of GDP, well above the world standard of 2-2.5 percent.¹⁴ This imbalance in budgetary spending needs to be redressed.

The abovementioned statistics illustrate that rising military expenditure by Arab countries is not only diverting funding from the environment, but also jeopardising the prospects for effective environmental management and protection. The Arab world needs to substantially raise budget allocations for the environment to a minimum target of two to three percent. In this context, environmental management and protection should be considered as a conflict prevention and peacebuilding tool. To minimize the risk of relapse into conflict, it is proposed that an Arab fund be launched to help countries in the region address the environmental root causes of conflict as well as the most immediate impacts of war (e.g. oil spills, chemical contamination, etc.).

(ii) Improve environmental governance

Post-conflict countries tend to have some of the fastest growing economies. According to the International Monetary Fund, Sudan experienced a real GDP growth rate in 2007 of twelve percent, making it the second fastest growing economy in the Arab world.¹⁵ As for Iraq, the IMF foresees its economy to grow by seven percent or even higher in 2008-2009.¹⁶ Rapid economic growth, dependent in these cases almost entirely on the oil boon, imposes great pressures on the environment unless adequate safeguards are introduced. Post-conflict countries are especially prone to overlooking environmental legal requirements and standards given the immediate needs of reconstruction, but this risks undercut-



ting sustainable development and the fragile peace. Good environmental governance based on tested and credible methods such as Environmental Impact Assessment (EIA) and Strategic Environmental Assessment (SEA) can play an important role in helping ensure that reconstruction and development is economically and environmentally balanced. EIA's and SEA's multi-stakeholder consultative approach also carries a conflict resolution element as it seeks to maximize transparency, public participation and equitable benefit sharing.

(iii) Strengthen capacity and cooperation on environment and conflict

It is suggested that an Arab multi-disciplinary expert committee on environment and conflict be established under the auspices of the League of Arab States to examine conflict-environment linkages and improve early warning and assessment capacity. In this undertaking, Arab governments should capitalise on growing international expertise in this field and actively engage with international organisations, particularly the United Nations, to draw on their scientific, technological and financial resources in analysing and mitigating the environmental impacts of war.

Preferably the abovementioned courses of action will be considered before a new war breaks out and creates additional environmental damage.

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NOTES

- The views expressed in this chapter do not necessarily reflect the views of the organization where the author works (UNEP).
- United States Energy Information Administration <http://www.eia.doe.gov/emeu/international/oilreserves.html>
- This is the cyclical confrontation between the "desert" and the "town" as described by the famous Arab historian, Ibn Khaldun, in his theory of history and social conflict, (*The Muqadimah*).
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- This includes the incorporation of environmental concerns in Common Humanitarian Appeals, Post Conflict Needs Assessment, Common Country Assessment, UN Development Assistance Framework and various operational guidelines and strategies.
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