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Michael Mason

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The Application of Warfare Ecology to Belligerent Occupations

Michael Mason

Department of Geography and Environment, London School of Economics and Political Science, Houghton Street, London, WC2A 2AE, UK, email: m.mason@lse.ac.uk

Abstract

Insofar as warfare ecology aims to examine all war-related conditions, belligerent occupations are a necessary stage in its broad taxonomy. Under international law, belligerent occupations are covered by a distinctive subset of *jus in bello* (humanitarian law), which is imprecise regarding ecological changes. This chapter examines the potential role of warfare ecology in studying belligerent occupations, highlighting the multiple, often indirect, means by which such occupations shape ecological processes. Particular attention is paid to the Israeli occupation of Palestinian territory, due to its protracted duration, although also discussed are environmental effects associated with the US and UK occupation of Iraq. The onus on the occupying power, under international humanitarian law, to protect the conditions of life for civilians can plausibly be applied to the environmental resources of the resident population. It is argued that warfare ecology can make a significant contribution both to assessing the effects of occupations and, through the generation of policy advice, to promote conflict outcomes more sensitive towards ecological processes.

1.0 Introduction

The emergent field of warfare ecology is concerned with the application of environmental research to the full range of war-related conditions. As noted by Machlis and Hanson (2008: 729), an accurate taxonomy of warfare is essential to the development of this field of study, which indicates a need explicitly to incorporate military occupation. All occupations are covered by international humanitarian law, though ‘permissive’ occupations have contested legal status depending on the presumed consent of the displaced sovereign authority and the civilian population within the territory controlled by external military forces. The subject matter of this chapter is restricted to *belligerent* occupations, which under Article 42 of the 1907 Hague Regulations, are defined as territory placed under the control of a hostile army (International Committee of the Red Cross 2010): such occupations lack the consent of the civilian population and its recognized representatives. It should be noted that civilian authorities (domestic or external) may be responsible for governance in belligerent occupations, but only under the supervision of the occupying authority.

Under international law, belligerent occupations come under a distinctive subset of *jus in bello* (humanitarian law), complementing the legal norms governing the conduct of hostilities (Dinstein 2009: xi). These norms are drawn from customary international law, the Hague Regulations (1907), the Fourth Geneva Convention (1949) and Additional Protocol I (1977) to the Geneva Conventions (Protocol I). As humanitarian law has evolved, it has focused increasingly on minimizing the impact of the occupying power on civilian resources and infrastructure until such time as the occupation ceases and legitimate government is re-established. Indeed, the overriding principle of the international law of belligerent occupation is that the civilian population of an occupied territory must benefit from maximal safeguards feasible in the circumstances (Schmitt 2003; Dinstein 2009: 286). It should be noted that the designation of a ‘belligerent occupation’ is often disputed by the state in military control, such as the Israeli position on East Jerusalem and Gaza, and Morocco’s

stance on the Western Sahara. In this chapter, authoritative weight will be accorded to declarations on belligerent occupation by relevant representative bodies of the international community, notably the UN Security Council, the International Court of Justice and the High Contracting Parties to the Fourth Geneva Convention.

After briefly outlining the relevant provisions on environment protection in international humanitarian law, this chapter surveys the environmental effects of belligerent occupations, highlighting the multiple, often indirect, means by which such occupations shape ecological processes. Particular attention is paid to the Israeli occupation of Palestinian territory, due to its protracted duration (since November 1967 as dated by UN Security Council Resolution 242), although also discussed are the environmental effects associated with the occupation of Iraq (deemed by the UN Security Council Resolution 1483 to be under occupation from May 2003 until June 2004, when an Iraqi Interim Government replaced the Coalition Provisional Authority). It is argued that warfare ecology can make a significant contribution both to assessing the effects of occupations and, through the generation of policy advice, to reducing those consequences.

2.0 Belligerent occupation and the environment

Existing humanitarian law prohibits extreme and disproportionate damage to the environment by belligerents during armed interventions. Along with customary international law, the key treaties of relevance are the Hague Regulations, the Fourth Geneva Convention, Protocol I and the Convention on the Prohibition of Military and Hostile Use of Environmental Modification Techniques (1977). However, it is only in recent years that environmental considerations have seriously been treated as a legitimate constraint on warfare, which can be attributed to the precedents created by UN Security Council Resolution 687 (1991) establishing Iraqi liability for environmental (and other) damage during the First Gulf War and also to Article 8(2)(b)(iv) of the Rome Statute of the International Criminal Court (2002), which states that the intentional infliction of “widespread, long-term and severe damage to the natural environment” is a war crime (see Bunker 2004).

While belligerent occupation falls within the scope of international humanitarian law, the application of its provisions on environmental protection are more uncertain; for belligerent occupation typically features low levels of violent conflict, where the occupying power encounters at most sporadic resistance from those opposed to its control. Furthermore, the relevant legal regime for environmental protection covers in practice the routine exercise of authority by the occupying power in its efforts to secure stable governance. The environmental protection duties of humanitarian law are, under belligerent occupation, largely indirect. In its overriding responsibility to meet the needs of the civilian population, the occupying power is obliged to exercise guardianship of natural resources (Hague IV: Article 55) and not to undertake extensive destruction and appropriation of property (Fourth Geneva Convention: Article 147). In addition, Article 54(2) of Protocol I prohibits the destruction, removal and disablement of civilian objects indispensable to the survival of the civilian population, including agricultural areas, drinking water installations and irrigation works. It should be noted that, according to UN General Assembly Resolution 305 (1972), an occupied population retains permanent sovereignty over its natural wealth and resources (Okowa 2009: 244-245). The onus on the occupying power, under international humanitarian law, not to make fundamental changes in the constitutional, social, economic and political order of an occupied territory (Roberts 2006) can therefore plausibly be applied to the environmental resources of the resident population.

There remains debate amongst scholars as to the application of multilateral environmental agreements and customary international environmental norms to warfare. Given the growing body of international environmental law, its potential scope for influence on the practice of belligerent

occupation is substantial. The more restrictive interpretation is that the exceptional status of a belligerent occupation means that only humanitarian norms apply as the specific law (*lex specialis*) tailored to the situation: peacetime environmental norms are effectively suspended insofar as they clash with this *jus in bello* (see Bunker 2004: 204). Less restrictive positions counter that peacetime environmental treaties remain applicable (e.g. Schmitt 1997: 41). In this chapter, the latter perspective is adopted, which is consistent with the understanding in humanitarian law that belligerent occupations should make as much space as possible for the continuation of pre-occupation norms of governance. This covers arguments that international human rights law continues to apply, as well as other international treaties applied in peacetime. It is argued here that the population under occupation continues to be covered by the core customary rule of international environmental law – that states do not cause harm to the environment of other states or areas beyond national control. This means, for example, that these populations are entitled not to suffer environmental injuries caused by the occupier and/or *other states*.

3.0 Assessing the environmental effects of occupations

Like other conflict-related conditions, the presence of a belligerent occupation often presents major practical obstacles to scientific efforts to determine impartially the environmental effects of hostilities. Even if an occupation is stable enough to qualify as ‘post-conflict’, there may be serious limitations in data availability and monitoring, while both the occupying power and political representatives of the occupied may have neither the willingness nor capacity to undertake environmental assessments. It is also the case that the Post-Conflict Needs Assessments (PCNAs) undertaken by the international community have tended to sideline environmental considerations, except insofar as they have obvious linkages to human health, livelihoods and security (UNEP 2009: 5). As formulated by the UN Development Group and the World Bank, PCNAs are undertaken with the consent of the occupying power (following an invasion) or domestic authorities (following a civil war), and are oriented to short-term recovery needs and longer-term reconstruction needs. In the past decade there has been a provision within PCNAs to consider environment as a cross-cutting theme. A recent UNEP review of PCNAs conducted from 2000 to 2006 – including reports on periods of belligerent occupation in Iraq and Georgia – identified a growing recognition of immediate environmental problems, though a neglect of longer-term environmental needs and effects (UNEP 2009).

Outside the PCNA process, UNEP has developed arguably the most credible set of post-conflict environmental assessments (PCEAs) within the international community. Since 1999, it has conducted ten PCEAs, including in Kosovo (2001), Afghanistan (2003), Lebanon (2007) and the Gaza Strip (2009). The PCEA methodology encompasses background research, systematic sampling, fieldwork and laboratory analysis: in the interests of transparency and neutrality, the terms of reference and methodological protocols are shared with all relevant parties. When field assessments are not possible for political or security reasons, UNEP has also conducted *Desk Studies on the Environment* – notably in 2003 for the occupied Palestinian territory and Iraq.

While a comprehensive survey of relevant UNEP environmental assessments is outside the scope of this chapter, their categorization of ecological effects will be followed now in highlighting particular trajectories of change associated with belligerent occupations in practice. This classifies consequences by: direct changes to natural resources and ecosystems – distinguishing here between (i) the effects of large-scale conflicts and (ii) the direct effects of occupation practices – (iii) indirect effects on natural resources and ecosystems, and (iv) reductions to institutional capacity for environmental management. While UNEP post-conflict assessments in practice have tended to focus on negative environmental consequences, there are occasions – some noted below – when military interventions have led to *positive* ecological consequences, whether or not these were

intended. These include removing regimes that have employed environmental pollution as a military tactic (e.g. the firing of oil wells and trenches by Iraqi forces in 2003).

3.1 DIRECT CONFLICT EFFECTS ON NATURAL RESOURCES AND ECOSYSTEMS

The most obvious source of war-related environmental damage within occupied territories is the legacy of large-scale military action either preceding an occupation (e.g. the Coalition attack on Iraq between March-May 2003) or taking place during an occupation (e.g. the Israeli attack on the Gaza Strip, code-named *Operation Cast Lead*, between December 2008-January 2009). At the same time, contemporary armed conflict may exacerbate pre-existing environmental vulnerabilities, posing longer-term risks to the populations of occupied territories. UNEP environmental assessments of armed conflict in Iraq (UNEP 2003b; 2003c) and the Gaza Strip (UNEP 2009a) listed the following problems as significant:

3.1.1 Water and sanitation

In Iraq during Saddam Hussein's regime, poor maintenance of the water infrastructure and unsustainable irrigation practices were, prior to the 2003 conflict, already causing severe contamination of surface water and salinization of agricultural land. This was both the result of misrule and the effects of the international sanctions regime, which blocked imports of equipment and chemicals necessary for water infrastructure maintenance (Physicians for Human Rights 2003: 3). The focus of US and UK attacks on major urban areas resulted in serious impacts on Iraqi water distribution and sanitation systems, in large part because of deliberate cuts to electricity supplies (UNEP 2003b: 71). While water supplies in major cities were restored by April 2003, water networks and pumping stations were subject to acts of sabotage during and after the Coalition occupation, impeding investments in sanitation and sewage systems. Without significant improvements in water infrastructure, the population continues to face a high risk of disease epidemics, as evident from the major cholera outbreak in 2008 (IRIN News 2008). In the Gaza Strip, severe water quality and sanitation problems accentuated by the Israeli blockade and economic sanctions (which were introduced after the election of the Hamas Government in January 2006) were further stressed during *Operation Cast Lead* by Israeli military damage to water wells, as well as to the water distribution and sewage network. For example, a direct hit to the embankment wall of the Az Zaitoun wastewater treatment plant led to a wastewater and sludge spillage affecting 55,000 square metres of agricultural land (UNEP 2009a: 33-36).

3.1.2 Waste

The Iraqi capacity for waste collection and disposal was eroded by the UN sanctions regime preceding the start of the US and UK attack in March 2003. While hampered in its *Desk Study on the Environment* by the lack of information on Iraqi waste management practices, UNEP concluded that accumulations of domestic, demolition and clinical waste were already posing significant risks to human health; and that previous military conflicts – including the 1991 Gulf War – had resulted in large and widespread quantities of military debris and toxic material (UNEP 2003b: 34-37). Impacts of the 2003 conflict was judged to have exacerbated the critical waste management situation in Iraq, aggravating health and safety risks to urban populations: the risks included disease vectors sourced to human remains, clinical and food waste, and exposure to hazardous dust and debris (UNEP 2003b: 71). More confidence is attached by UNEP to its assessment of waste problems in the Gaza Strip on account of the extensive access of its technical team to impacted areas in May 2009. Israeli military actions during *Operation Cast Lead* impacted almost 2,700 buildings in the Strip, generating approximately 600,000 tonnes of debris (UNEP 2009a: 27). While the international community has funded the clean-up of this debris – including provision for

materials recovery and re-use – concerns remain about the insufficient capacity of local landfill sites and the absence of a dedicated facility for processing hazardous wastes. A lingering post-conflict challenge is the presence in landfills of hazardous health care waste mixed with domestic wastes, which can be traced to the disruption of medical waste disposal systems during the Israeli bombardment (UNEP 2009a: 77). As in Iraq, the physical impacts of the conflict overloaded a solid waste infrastructure that was already weak and fragmented.

3.1.3 Pollution from oil fires and spillages

The UN sanctions regime that weakened solid waste management in Iraq also prevented proper maintenance of its oil infrastructure, and UNEP surmised that significant degradation of soil and groundwater, and flaring-induced air pollution, were likely to have been present before the invasion (UNEP 2003b: 38). During the immediate hostilities, Iraqi forces set fire to a number of oil wells (in southern Iraq) and oil-filled trenches (around Baghdad) to impede US/UK surveillance and weapons systems. In contrast to the substantial ecological damage caused by the firing of Kuwaiti oil wells by the retreating Iraqi army in 1991, UNEP observed a more localized diffusion of pollutants in 2003: indeed, given their potential contamination of soil and groundwater bodies, unfired oil trenches were assessed to more environmentally damaging over the long-term (UNEP 2003b: 74-79). Fuel stations and tanks were systematically targeted by Israeli military forces in the 2008/2009 Gaza Strip hostilities, although the UNEP post-conflict environmental assessment uncovered no evidence of major oil pollution incidents (UNEP 2009a: 30-31): here, the small-scale, dispersed nature of Gazan industrial facilities is likely to have reduced the risk of high-consequence oil pollution from military strikes.

3.1.4 Physical degradation of ecosystems

No military actions in the 2003 Iraqi conflict had ecological effects comparable in scale to the massive degradation of ecosystems unleashed by domestic policy choices in the preceding decade, notably the destruction of the Mesopotamian marshlands as a result of the construction of upstream dams and politically-motivated drainage schemes. UNEP's *Desk Study on the Environment in Iraq* illustrates vividly the shrinkage of the southern wetlands, with dramatic losses in biodiversity (2003b: 39-44). Elsewhere in Iraq, over-exploitation of dryland ecosystems had increased the risk of desertification prior to the Coalition invasion. In terms of ecosystem damage during the 2003 Iraqi war, UNEP estimated widespread degradation to desert environments from intensive military activities. The use of depleted uranium munitions by Coalition forces was also highlighted as giving rise to environmental and health risks, although with continuing uncertainties as to the long-term effects (UNEP 2003b: 80-82; UNEP 2003c: 20-21).

For the Gaza Strip, *Operation Cast Lead* had major environmental effects on its already vulnerable farmland. In its 2009 environmental assessment, UNEP reports on the findings of a UNDP post-conflict survey, which claimed that 17% of the total cultivated area of the Gaza Strip was seriously damaged, including 17.5% of the orchards and 9.2% of open fields. A long-term reduction in agricultural productivity is also forecast as a result of the extensive destruction of the vegetation cover, because of: (i) the mixing and degradation of the thin topsoil cover, (ii) the unavailability of heavy ploughing machinery to break up dense soil crusts caused by the tracks of Israeli military vehicles, (iii) increased sensitivity to soil erosion and desertification, and (iv) the intolerance of young fruit and olive saplings to the brackish water now routinely used for irrigation in the Gaza Strip (UNEP 2009a: 32). Furthermore, the rebuilding and restocking of destroyed greenhouses, livestock and poultry farms is severely constrained by Israeli and Egyptian restrictions on the movement of people and materials across their borders with the Gaza Strip.

3.2 DIRECT ENVIRONMENTAL EFFECTS OF OCCUPATION PRACTICES

Direct changes to natural resources and ecosystems may also be caused by occupation practices. Under Article 147 of the Fourth Geneva Convention, destruction and appropriation of civilian property is only justified by ‘military necessity’, which would cover, for example, the unavoidable degradation of water and agricultural resources as a result of the movement and deployment of military assets. Outside such direct consequences, the occupying power is bound by humanitarian law not to utilize natural resources for the purposes of its domestic population: should these resources be privately owned, there is a prohibition against confiscation (Hague Regulations, Article 46) and, if they are publicly owned, there is an obligation to administer them under the rules of usufruct; that is, a right of use that conserves the capital stock of the resources in question (Hague Regulations, Article 55). International environmental law reinforces the principle here that the occupying force should not create long-term environmental damage: Principle 21 of the 1972 Stockholm Declaration on the Human Environment enjoins states not to cause damage to the environment of other states or of areas beyond the limits of national jurisdiction.

Since 1967 the enduring occupation by Israel of the West Bank (including East Jerusalem) and the Gaza Strip provides much practical evidence on the environmental effects of the coercive control of a territory. Israel has always been resistant to the notion that the Fourth Geneva Convention is *de jure* applicable to the occupied Palestinian territory (oPt), though the Supreme Court of Israel has repeatedly ruled that the West Bank and the Gaza Strip are areas subject to the application of law of belligerent occupation (Dinstein 2009: 23). Authoritative representatives of the international community, including the UN and the High Contracting Parties to the Fourth Geneva Convention, have also consistently maintained the international humanitarian law applies to the oPt. This includes the Gaza Strip even after the unilateral Israeli disengagement in September 2005, because, it is claimed, effective control is still exercised by Israel. Similarly, while annexed by Israel in 1980, the international community continues to regard East Jerusalem as subject to occupation. The application of humanitarian law to the oPt raises critical issues about the environmental responsibilities and impacts of the occupying power and its citizens, including the 290,000 Israeli settlers who currently reside in the West Bank (in contravention of Article 49 of the Geneva Convention and Article 8(2)(b) of the Rome Statute of the International Criminal Court).

3.2.1 Water resources

The oPt has low levels of per-capita water availability – three-quarters of the population are estimated to consume between 60-100 liters for domestic use per capita per day (lcpd) compared to 330 lcpd in Israel (Zeitoun 2008: 14). In the West Bank, average water availability for Palestinians is lowest at 50 lcpd compared to 369 lcpd for Israeli settlers. In the Gaza Strip it is just over 90 lcpd, with very poor drinking water quality (World Bank 2009: 13, 28). This situation is of ongoing humanitarian concern as the WHO minimal standard for daily water consumption for direct human consumptive needs is 100 lcpd. According to recent reports by the World Bank (2009) and Amnesty International (2009), Palestinian water insecurity is largely the result of the occupation, as Israel effectively controls shared Israeli-Palestinian water resources. While joint governance rules and water allocations were established under the 1995 Oslo Interim Agreement, these have failed to allow the development of a functioning water infrastructure for the Palestinians, entrenching instead a highly asymmetric access to water resources in the West Bank. In the Gaza Strip, the economic blockade has prevented necessary investments in water and sanitation, including local desalination capacity and the option of transferring water from the West Bank Mountain Aquifer: as a result the Coastal Aquifer is being severely degraded by over-extraction and pollution from sewage and irrigation (UNEP 2009b: 55-62).

The effects of the occupation on water resources are compounded by the Israeli ‘security fence’ or barrier complex constructed first along the border with Gaza in 1987 in response to the *First Intifada*, and then, since 2002, as a Separation Barrier from the West Bank (eventually to reach a planned 763km), running mostly within the Palestinian side of the Green Line and encompassing major Israeli settlements in occupied territory. For the Gaza Strip, this has meant the denial of entry to equipment and supplies necessary to repair water facilities following the recent conflict. In the West Bank, movement and access restrictions on the civilian population are having severe public health and environmental impacts. For the crucial Western Aquifer Basin, for example, which is the largest groundwater resource between the two territories, Israeli prohibition of new Palestinian wells, and restrictions to existing Palestinian wells caught on the Israeli side of the Separation Barrier, are significantly reducing supplies of agricultural water for the northern West Bank (Trottier 2007: 121).

3.2.2 *Agricultural resources*

As agriculture in the West Bank and the Gaza Strip accounts for two-thirds of Palestinian withdrawn water, water deficits induced by the Israeli occupation have significantly constrained the goals of the Palestinian Authority to develop this sector – one that accounts for 10% of Palestinian GDP and 15% of total employment. Coupled with declining water availability, access and movement restrictions have inhibited agricultural labor inputs and the export of agricultural goods (World Bank 2009: 25-26). In the West Bank, plans to increase the contribution of irrigated agriculture (currently only 6% of the cultivated area), which would be supportive of high value vegetable and fruit crops, have been held back by Israeli restrictions on well-drilling. Israeli government and settler activities are also a significant constraint on Palestinian agricultural activities; for example, the politically-motivated destruction of Palestinian olive trees by settlers, along with the clearance of agricultural land for the construction/expansion of settlements and their associated security infrastructure. Similarly, investment in the agricultural sector in the Gaza Strip has been frustrated by the Israeli closure regime imposed following the election into government of Hamas: farmers have substantially reduced the planting of export crops (e.g. cherry tomatoes, peppers, cucumbers) on account of the severe difficulties in moving them across the border.

It should be noted that the agricultural sector is also a crucial underpinning of the food security of the Palestinian population, and here occupation practices have increased the vulnerabilities of households and communities. In 2008 25% of the West Bank population and 56% of the Gaza population were deemed by the Food and Agriculture Organization to be food insecure, resulting in major food aid interventions by international humanitarian agencies (FAO 2008). While recent droughts have affected food production (particularly for the rain-fed cultivated fields and rangelands of the West Bank), these climatic stresses have been accentuated by the security and settlement practices of the occupying power. To be sure, the attribution of agricultural sector impacts to particular occupation practices is often contested between the Israeli Government and the Palestinian Authority, and the institutional weaknesses of the latter are also a contributing factor to food insecurity. However, there is consensus amongst international organizations active in the oPt – e.g. UNDP, FAO, World Food Programme – that the occupation is significantly impeding the development of the Palestinian agricultural sector. This includes indirect environmental effects from the coping strategies employed by local communities (see Section 3.3. below).

3.2.3 *Waste pollution*

In its *Desk Study on the Environment in the Occupied Palestinian Territories*, UNEP (2003a) noted with alarm the various environmental and health threats from waste pollution in the West Bank and Gaza Strip caused by: (i) a lack of treatment facilities for wastewater resulting in pollution of the Mountain (West Bank) and Coastal (Gaza Strip) Aquifers, (ii) the open burning of municipal solid

waste and the mixing in landfill sites of hazardous and non-hazardous waste, and (iii) the lack of storage and disposal options for hazardous wastes. Inadequate management by Palestinian authorities was blamed for some of these environmental risks, but a number were directly linked to occupation practices. For wastewater pollution, it is notable that, since 1967, Israel has only established one sewage pre-treatment plant (at Tulkarem) for the Palestinian population in the West Bank, and has also blocked or delayed the upgrading of the three sewage treatment plants in Gaza. Even more obviously a consequence of occupation is the release of large quantities of poorly treated domestic and industrial sewage by most of the Israeli settlements and outposts in the West Bank: in addition, approximately 200,000 Israelis living beyond the Green Line in East Jerusalem produce substantial quantities of untreated or partially treated sewage that flows eastwards into the West Bank, causing environmental damage to soil and water resources (Amnesty International 2009: 69-70).

In 2003 UNEP judged Israeli environmental authorities to have limited control over an estimated 131,000 tons of solid waste produced by the Israeli settlements in the West Bank (UNEP 2003a: 59-68). Until Israeli National Master Plan 16 (1986) on solid waste treatment, hundreds of illegal waste dumps were scattered across Israel and the oPt. The subsequent decommissioning of dump sites only applied to Israel, and though military orders issued by the Israeli Civil Administration in the West Bank applied Israeli waste disposal standards to settlements, the Palestinian Authority has alleged that the unregulated disposal of untreated solid waste (including hazardous wastes) continues and that decommissioned sites have not been made safe (Tagar and Qumsieh 2006: 12-13; Amnesty International 2009: 70). As with wastewater management, access and movement restrictions associated with the occupation have hampered solid waste management. In the West Bank, curfews and roadblocks, which increased in the wake of the *Second Intifada*, have disrupted the transfer of waste to municipal disposal sites, triggering the creation of unregulated, temporary disposal sites and the open burning of waste. For the Gaza Strip, the temporary storage and burning of waste intensified during and after *Operation Cast Lead*, while the shutting down of incinerators (due to electricity shortages) resulted in the indiscriminate dumping of hazardous wastes in landfill sites (UNEP 2003a: 58-70; UNEP 2009a: 44-54).

3.2.4 Conservation of biodiversity

The variety of physical environments within the oPt gives rise to rich land and marine biodiversity. While there is no systematic database of biodiversity in the Gaza Strip and the West Bank, the oPt shares threats to biodiversity with other territories in the Mediterranean biome – these include rising human population density, urbanization, agricultural land use and invasive species. However, the unique structures and practices of the occupation have negatively affected biodiversity. In the West Bank, the main negative effects have been caused by extensive settlement building, the construction of the Separation Barrier, and the associated growth of a parallel road infrastructure for the use of settlers and the military. Not only have these practices resulted in the loss and fragmentation of wildlife habitats, they have also eroded the rich agricultural biodiversity built up over centuries by Palestinian farmers, from crop varieties to domesticated bees (UNEP 2003a: 95-103). In the Gaza Strip, desertification processes in the southern agricultural lands have been accelerated by the imposition by the Israelis of a closed security area along the border, preventing farmers from gaining access to their lands. The Strip has one protected natural area. In 2002 the Palestinian Authority established the Wadi Gaza Nature Reserve on a salt marsh ecosystem that historically served as a major resting point for migratory birds: this site has been severely degraded by sewage-related contamination, which at least in part is attributable to delays in installing a wastewater treatment plant as a result of the Israeli blockade on materials and investment into Gaza (UNEP 2009a: 41-42, 50).

It should be noted that military interventions do not necessarily generate negative ecological consequences for biodiversity. There are historical examples of landscapes and ecosystems benefitting ecologically from exclusionary zones enforced by the military, such as the Korean and Cypriot demilitarized zones (e.g. Pearson et al. 2010). Similarly, recent efforts to restore the Mesopotamian marshes in Iraq indicate that military interventions and occupations may enable ecological restoration of previously degraded ecosystems (Stevens 2007). Nevertheless, in the Palestinian and Iraqi cases, the direct ecological effects of occupations have been judged by international organizations to be overwhelmingly negative on balance.

3.3 INDIRECT ENVIRONMENTAL EFFECTS OF OCCUPATION PRACTICES

As with conflict more generally, occupation practices can indirectly affect natural resources and ecosystems by influencing (constraining or enhancing) the adaptive coping strategies employed by local populations and displaced people (UNEP 2009b: 6). These indirect environmental effects, mediated by the behavior of the occupied population, are multiple, and can be assessed according to different timeframes and scales, but generally they relate to the means by which affected communities respond to the material and social constraints imposed on them by an occupation. Of course, even assuming the occupying power complies with international humanitarian law, the coercive nature of belligerent occupation often entails significant restrictions on the livelihood options for affected civilians. Aside from the environmental consequences caused by military actions preceding or interrupting an occupation, the civilian population must also cope with, and adapt to, the stresses of occupation practices, such as movement restrictions, personal insecurity and disincentives to wealth creation.

In Iraq under the Coalition Provisional Authority (April 2003 to June 2004), the severe lack of security and stability aggravated humanitarian demands from a population already weakened by the conflict and the preceding UN sanctions regime. The collapse of the oil and agricultural sectors (the two largest sectors of employment), along with insurgent attacks in major urban areas, saw a dramatic reduction in livelihood opportunities (Sen 2003). As the scale of the humanitarian crisis in Iraq was not foreseen by the occupying powers, it overwhelmed their post-invasion governance capacity. The Iraqi population became heavily dependent on international aid, while natural resource use was plagued by corruption and illegal trade, notably in oil. It should be noted that the Coalition Provisional Authority did attempt to facilitate environmental *benefits* in some of the recovery and coping strategies it directed at the occupied population. For example, in October 2003, the US Government began a three-year agricultural reconstruction and development program: \$343 million was invested in activities that included soil conservation, improved water management and support for agricultural livelihoods (USAID 2009). Nevertheless, the great bulk of the \$33 billion in grants and loans pledged by international donors in October 2004 did not address environmental issues (UN Development Group/World Bank 2006: 6).

In a protracted belligerent occupation, as with the Israeli presence in Palestinian territory, there may be long-term damage to the capabilities and assets of the affected population (including refugees and internally displaced groups) resulting in negative environmental effects. Such damage is more likely to the extent that the protective rules of humanitarian law are not effectively implemented or enforced. There is strong *prima facie* evidence that this is the case in both the West Bank and Gaza. In the former area, Israel control of natural resources and movement restrictions on the Palestinian population have increased environmental pressures; for example, rangeland degradation in the south Hebron hills caused by over-grazing, because Palestinians are denied access to traditional pastures and other livelihood opportunities. In the Gaza Strip, the Israel blockade has induced short-term coping mechanisms with negative environmental and social effects; for example, the use of vegetable oils for fuel causing local air pollution, soil contamination as a result of the use of

untreated wastewater for agriculture, and increased water scarcity from unregulated well-digging (UNDP 2010). While Palestinian governance failings are apparent in both the West Bank and Gaza (see Section 3.4 below), the occupying power has major responsibility, both legally and practically.

Climate hazards and other external environmental stresses can also affect the indirect environmental effects of occupation. In Iraq, post-conflict recovery of irrigated agriculture and the Mesopotamian marshlands has been threatened by three years of drought, as well as upstream damming of the Euphrates and Tigris rivers by Syria and Turkey. Benvenisti has argued that the law of occupation includes grounds for the occupying power to safeguard freshwater resources by negotiating with neighboring states (2003: 870-872), though the Coalition Provisional Authority made no such representations to Syria and Turkey. For Palestinians, climate change modeling predicts, over this century, a decrease in precipitation of up to 35% (with significant seasonal variation), a significant warming of between 2.6⁰C and 4.8⁰C, and a tendency towards more extreme weather events. The biophysical impacts forecast include an increased probability of flash floods, droughts, desertification and saline intrusion into groundwater (UNDP 2010: 49-56). According to UNDP, the Israeli occupation has significantly weakened the capacity of Palestinians to cope with, and adapt to, climate hazards, notably from restrictions imposed on the development of efficient water infrastructure, as well as the loss and degradation of agricultural land as a result of security and settlement practices (UNDP 2010).

3.4 INSTITUTIONAL CHANGES

The conflict preceding or interrupting a belligerent occupation can disable or remove the domestic governance institutions within an affected territory. Even if not directly targeted, the collapse of environmental management institutions may lead to uncontrolled resource exploitation and pollution (UNEP 2009b: 6). In addition, the immediate priorities of the occupation government are likely to be the maintenance of the rule of law rather than environmental regulation. International humanitarian law nevertheless calls on the occupying power to pursue an 'effective administration' over the territory it controls, as explicitly noted in Security Council Resolution 1483 on Iraq (Benvenisti 2006: 863). This resolution obliged the US and UK to promote the welfare of the Iraqi people, which included their lawful right to proceeds from the exploitation of oil and natural gas resources. In the case of the occupied Palestinian territory, the unprecedented length of the Israeli occupation has raised far-reaching questions as to how the responsibility for environmental management should be allocated when there are different levels of control exercised over East Jerusalem, the Gaza Strip and the West Bank (including different categories of control within the West Bank, as well as the separate application of Israeli domestic law to the settlements).

Given the complexity and costs of governing an occupied territory, it is not surprising that, subject to the oversight of the occupying power(s), domestic authorities may be allowed to perform governmental functions (Schmitt 2003). In Iraq the Coalition Provisional Authority created an Iraqi Governing Council as early as July 2003, and by September this had established a new Ministry of Environment under the responsibility of a Cabinet-level Minister. As noted by a UN Post-Conflict Assessment Team, the new ministry inherited most of the staff and organizational structure of the previous Environmental Protection and Improvement Directorate. The rationale was to maintain the acknowledged expertise and effective decentralization of Iraqi environmental governance, although the new ministry was judged to require substantial international assistance to cope with the scale of post-conflict environmental damage (UNEP/DEP 2003). What was not foreseen in 2003 was that the severe security situation in Iraq would for years inhibit capacity-building of environmental institutions.

In the occupied Palestinian territory, delegation of various environmental governance functions is enabled by the Oslo Accords, agreed in 1993 (Oslo I) and 1995 (Oslo II) between Israel and Palestinian political representatives. The Accords, which were planned to be interim self-government arrangements until a permanent peace settlement, allowed the creation of the Palestinian National Authority (PNA) as an autonomous political entity. In 2000 the PNA created a Ministry of Environmental Affairs (subsequently renamed the Environmental Quality Authority) to oversee the development of environmental policy in the West Bank and Gaza. With assistance from international donors, the Environmental Quality Authority has developed professional expertise and regulatory competence relating to natural resources, pollution, biodiversity, land degradation and cultural heritage. Other PNA entities – notably the Palestinian Water Authority and Ministry of Agriculture – also have environmental management responsibilities, and cooperate with the environmental authority. While the Oslo Accords facilitated the development of environmental governance in the oPt, this capacity is nevertheless significantly compromised by the Israeli occupation. For example, Israel remains responsible for civil affairs and security in 60% of the West Bank (Area C) and, even outside Area C, movement and access restrictions weaken the exercise of Palestinian regulatory powers. As already noted, Israel also retains control of shared Palestinian-Israeli water resources, which, according to recent independent reviews (Amnesty International 2009; World Bank 2009), are neither equitably allocated nor sustainably managed.

The environmental policy responsibilities of an occupying power come under its humanitarian obligations to take care of the civilian population and to undertake responsible management of natural resources. It remains an open question as to how far an occupying power should facilitate, or allow, improvements in environmental governance capacity that exceed those present in the country prior to occupation. In the scholarship on international humanitarian law, there is a recognition that occupying powers may be justified, under human rights considerations, in altering the constitutional and legal order governing the subject population – what Roberts (2006) labels ‘transformative military occupation’: the introduction of a democratic constitution to Iraq is one such example, which is potentially positive in terms of respect for human rights. If democratic governance becomes a legitimate expectation in the movement away from occupation, it can plausibly be argued that occupying powers should promote environmental management institutions compatible with a democratic political culture. Similarly, the idea that an occupied territory may one day rejoin the international community as a sovereign state generates also the expectation that its environmental management targets are compatible with widely shared norms of environmental law.

4.0 Research and policy implications

There is a modest but growing body of research on the environmental effects of occupations. While attention has typically been drawn to the environmental effects arising from the high-intensity conflict that precedes or interrupts a belligerent occupation, there is increasing recognition of the direct and indirect environmental changes caused by occupation practices themselves. The pervasiveness and often diffuse character of these effects – which may be unintended in terms of the goals of the occupying power – can escape the attention of those tracking more visible disruptions to the physical environment. It is here that warfare ecology can make a significant contribution both to the development of research on the effects of occupations and also to policy considerations for reducing these effects.

4.1 RESEARCH IMPLICATIONS

In their manifesto for warfare ecology, Machlis and Hanson (2008) identify the need for research which considers the environmental effects of more than one stage of warfare, as well as the cumulative and cascading effects of particular actions. They recommend the development and testing of conceptual frameworks which are capable of capturing the trajectories of these changes through coupled biophysical and socioeconomic systems. It is not surprising, therefore, that systems theory lends itself to warfare ecology and that any such systemic explanation needs to be able to accommodate interdisciplinary inputs. As with the ecological study of other stages of warfare, the analysis of occupation practices could productively be undertaken both by extensive comparative surveys and intensive case studies. However, the findings should be integrated into the systemic explanatory frameworks of warfare ecology.

At the same time, environmental research on belligerent occupations can add distinctive analytical components to warfare ecology. In the first place, the interests of the occupying power/people in recovery and reconstruction suggest the opportunity for post-war insights on the long-term effects from contemporary armed conflict. Such insights are necessary for the occupying power to undertake effective administration and meet its international humanitarian obligations. Section 3.1 above summarized some of the key ecological effects encountered in practice during the occupations of Iraq and the Palestinian territory. Warfare ecology can provide a fertile theoretical framework for categorizing and assessing the various consequences across different spatio-temporal scales. It can also suggest hypotheses for advancing understanding of the socio-ecological processes that determine which effects are more significant and why.

Secondly, warfare ecology can illuminate the inter-linkages between, on the one hand, the impacts of intense conflict and, on the other, the direct and indirect environmental effects of occupation practices. Sections 3.2 and 3.3 outlined a diverse range of direct and indirect effects as encountered, again, in Iraq and the occupied Palestinian territory. These environmental effects of occupation practices are under-theorized, in part because of the lack of systematic ecological research on this stage of warfare. The nature of occupation practice, which imposes enduring stresses on the affected civilian population, suggests that vulnerability analysis could offer valuable insights here as part of a warfare ecology approach. Broad-based vulnerability perspectives are most appropriate (e.g. Turner et al. 2003; Adger 2006) as they encompass the role of socio-economic and political pressures on individuals and groups who are also facing war-related environmental effects. Vulnerability analysis is also in tune with the openness of warfare ecology to the multi-scalar operation of human-biophysical processes; for example, how an occupied population may be vulnerable to events outside the control of an occupying power, such as the impacts of climate change and variations in world food prices.

To advance such an understanding, there is a need, thirdly, for the formulation and use of standardized methodologies. There are already examples of best practice to draw upon in order to guide warfare ecological analyses of occupations. The environmental assessment methodology developed by UNEP is arguably the most mature and scientifically robust: UNEP now has over a decade of experience conducting post-conflict environmental assessments (PCEAs), and these studies demonstrate the importance of context-sensitive data gathering and analysis. As noted above in Section 3.0, the diverse methods employed in practice have included background research, remote sensing, fieldwork and laboratory analysis. Of course, PCEAs are usually conducted in a reactive fashion, with a methodological focus on sites severely damaged by conflict rather than occupation practices, although there are exceptions – for example, the environmental desk study of the occupied Palestinian territory (UNEP 2003a). Warfare ecology can make a significant scholarly contribution by considering the wider ecosystem context of post-conflict environmental

effects. Indeed, its holistic perspective could assist PCEA practitioners in considering longer-term environmental vulnerabilities.

4.2 POLICY IMPLICATIONS

There are also policy implications that arise from the application of warfare ecology to the study of belligerent occupations. Needless to say, these implications include adding occupation-specific insights to the policy outcomes suggested by Machlis and Hanson for warfare ecology more generally (2008: 733-734). Thus, ecological research on occupations may assist military planners in preventing or mitigating the long-term ecological and humanitarian impacts of warfare. Such research may also facilitate a more effective recovery of those ecosystem services essential to meeting the basic needs of a vulnerable population in an occupation, e.g. water, food and fuel security. Insofar as an occupying power seeks to cooperate with humanitarian agencies, warfare ecology could facilitate an agreed methodological framework for assessing environmental effects. Warfare ecology could, in addition, provide insights on the restoration of natural resource-dependent economic sectors, with a view to supporting sustainable livelihoods and other human development goals for occupied populations. Indeed, UNEP (2009b) has recently recommended widening the environmental scope of post-conflict needs assessments to include longer-term environmental trends in relation to sustainable natural resource use.

Whether or not an occupation is belligerent, the protection of environmental resources has become a legitimate responsibility for military or civilian forces governing in post-conflict territories. However, the coercive character of belligerent occupation is a distinctive policy challenge, as the legal obligation on an occupying power to undertake effective administration conflicts with the notion that the affected population has the right to full democratic governance – at least as long as the occupation lasts. As noted above (Section 3.4), it remains an open question under humanitarian law as to how much an occupying power is obliged to facilitate or promote the environmental governance capacity of domestic institutions under its effective control. In the occupied Palestinian territory, for example, limits imposed by Israel on the regulatory authority and scope of Palestinian institutions have impeded the implementation of environmental policy. In Iraq under the Coalition Provisional Authority, efforts to build effective environmental institutions were undermined by continuing lawlessness and violent resistance.

5.0 Conclusion

Belligerent occupations are part of the conflict continuum covered by warfare ecology. They are also covered by a distinctive subset of international humanitarian law (*jus in bello*) – the legal norms governing the conduct of war. Existing humanitarian law includes provisions that prohibit unnecessary environmental damage, yet their application during periods of occupation is uncertain, relating largely to the control of civilian resources and infrastructure by the occupying power. The legal norms governing occupation are also hampered by the absence of an international enforcement agency: at best, these norms are selectively enforced by relevant states and international organizations. This chapter examined the potential role of warfare ecology in accounting for the environmental effects of belligerent occupations, highlighting the multiple, often indirect, means by which such occupations affect ecological processes. Substantive examples were drawn from the occupation of Palestinian territory by Israel and the occupation of Iraq by the Coalition Provisional Authority.

It was argued that warfare ecology can make a major contribution to assessing the effects of occupations and, through the generation of policy advice, to promote means for reducing negative

ecological consequences. Nevertheless, there remains unresolved the question as to the nature and scope of environmental protection duties borne by an occupying power under international humanitarian law. On the one hand, these seem largely indirect: in its overriding responsibility to meet the needs of the civilian population, the occupying power is obliged at best to exercise the guardianship of natural resources under its control. On the other, this role of 'temporary trusteeship' indicates that the occupied population actually retains permanent sovereignty over these resources and associated ecosystem services. If the latter is the case, then warfare ecology has a vital role to play in showing how the environmental responsibility of an occupying power is much more than the prevention or mitigation of particular impacts arising from its military activities. Indeed, it implies that the occupying power must strive to ensure that the occupied population is also protected from other sources of significant environmental harm.

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