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Targeting Environmental Infrastructures, International Law, and Civilians in the New Middle Eastern Wars

Abstract

Research in conflict studies and environmental security has largely focused on the mechanisms through which the environment and natural resources foster conflict or contribute to peace-building. An understudied area of research, however, concerns the ways in which warfare has targeted civilian infrastructure with long-term effects on human welfare and ecosystems. This paper seeks to fill this gap. We focus on better understanding the conflict destruction of water, sanitation, waste, and energy infrastructures, what we term environmental infrastructures, by drawing on an original database compiled by the authors of the post-2011 wars in the Middle East and North Africa (MENA). While research across the social sciences has examined the targeting of civilians and environmental destruction during wars, including the issue of urbicide, we expand the study of targeting environmental infrastructure to (1) examine the role of different types of actors (international vs. subnational), (2) document the type of infrastructure targeted, form of attack, and impacts and (3) situate increased targeting of environmental infrastructure in the changing context of war-making in the MENA. Comparatively analyzing the conflict zones of Libya, Syria, and Yemen, we show that targeting environmental infrastructure is an increasingly prevalent form of war-making in the MENA, with long-term implications for rebuilding states, sustaining livelihoods, and resolving conflicts.

Key Words: environmental infrastructure, Middle East and North Africa, international law, human security, war

Introduction

Scholars of conflict studies, international law, and environmental security have posited a number of direct and indirect links between warfare and the environment, examining the impacts of environmental change on different forms of violence, including riots, civil wars, and interstate conflict (e.g., Homer-Dixon, 1994; Gleditsch, 2012; Koubi et al., 2014).¹ Other studies have explored how developments in international law seek to mitigate the impacts of warfare on the environment (Austin and Bruch, 2000; Tignino, 2016) and support post-conflict peacebuilding (Jensen and Lonergan, 2012). Fewer studies have analyzed how warfare destroys environmental infrastructures and imposes long-term costs on human welfare and political governance (except see Gleick, 2006).

Scholars in geography, planning, and urban studies have highlighted the destruction of infrastructure in urban settings (Graham, 2008, 2010, 2011), including the study of urbicide (e.g., Kipfer and Goonewardena, 2007). The 'new wars' in the Middle East and North Africa (MENA) since 2011 demand similar attention from scholars of environmental conflict and peacebuilding. Warring parties in the MENA have increasingly targeted water and energy infrastructures as tactical weapons of warfare (e.g., King, 2015), dual-use objects, and as forms of 'collateral damage'. Here, we define environmental infrastructures as systems of providing water, energy, waste, and sanitation that sustain human livelihoods and well-being. Environmental infrastructures serve as the bedrock of human security, particularly in urban areas, and the principal mechanisms that mediate human impacts on natural ecosystems.

We make several contributions to the emerging literature on infrastructure and war. First, we argue that the targeting of environmental infrastructures has emerged as a central aim of the parties in these conflicts, rather than as an unintended consequence. Targeting infrastructure allows militias and state security forces to displace urban populations, punish civilians perceived as sympathetic to the enemy, and gain access to the infrastructures that underpin modern life. Capturing oil depots, gas lines, and refineries has helped fuel these conflicts, both directly through control of fossil fuels to supply domestic needs, and indirectly by selling oil and gas to fund continued fighting. Because the production and distribution of water and energy are tightly coupled in the

¹ The environment covers not only natural ecosystems and surroundings, but also natural resources, including renewable and nonrenewable resources.

MENA, bombing power plants or sabotaging transmission lines effectively shuts down water pumping stations, water treatment plants, and sewage treatment plants. In an increasingly urbanized region, most of the population directly depends upon complex webs of infrastructure for water, energy, and transport to sustain human welfare and livelihoods. Cities as infrastructure nodes (e.g., Coward, 2009) have thus borne the brunt of fighting in the post-2011 conflicts in the MENA.

Second, as observed in the so-called 'new wars' of the 1990s, intermittent periods of rebuilding and reconstruction of infrastructure are often not durable, as regional and domestic conflicts fester even when intensified periods of violence subside (Kaldor, 2012). Repeated cycles of infrastructure destruction mean that the livelihoods and security of generations of citizens suffer, in contrast to the more time-limited experience of Europe in the two world wars, the Korean War, the Vietnam War, and the Indo-Pakistani Wars. We suggest that wars in Iraq, the Gaza Strip, and Lebanon during the 1990s emerged as the first round of infrastructural wars in the MENA, precedents that spread to Libya, Syria, and Yemen after the 2011 uprisings. In all these instances, repeated infrastructure destruction has hindered the rebuilding of state institutions essential to peace building (Paris, 2004).

Third, the repeated targeting of environmental infrastructure reflects the multiplicity of war-making forces involved in these conflicts. As highlighted in the 'new wars' literature, the agents of war include not only domestic and foreign militaries, state security forces, and hired ranks of thugs and mercenaries, but also client and proxy forces supported by regional and global powers. The variety of actors involved complicates attempts at humanitarian assistance and creates norms of conflict in which all parties employ indiscriminant and punitive tactics. The ability of humanitarian actors to deliver assistance to those in need is upended as government forces and insurgents capture or divert assistance (Terry, 2002) and target humanitarian organizations directly. The extent of infrastructure destruction and human suffering between 2011-2016 has aggravated what scholars have termed 'de-development' (Roy, 1987) or 'development in reverse' (Collier et al., 2003).

Fourth, despite international humanitarian law and international environmental law that prohibit attacks on civilian infrastructure essential for human survival or that

cause damage to the natural environment, international law has acted neither as a deterrent nor as a means to prosecute perpetrators (Tignino, 2016). This is despite the fact that over the last half century, international law has articulated mechanisms to protect both civilian and environmental infrastructures, sparked by the increasing prevalence of "degenerate wars" -- that is, wars where the deliberate targeting of civilians becomes commonplace (Shaw, 2003). Taking into account that international humanitarian law first addressed civilian damage and then expanded to cover the environment, we shed light on some of the gaps in international law regarding environmental infrastructures, especially regarding dual-use infrastructure.

To explore these propositions, we organize the paper into four sections. In the first section, we review the literature on 'new' and 'degenerate' wars, focusing on the post-Cold War period, while the second section examines the diffusion of these forms of conflict to the MENA. The third section examines the inadequacy of evolving international norms and legal regimes within the context of infrastructural wars in the MENA. The fourth section then analyzes state deconstruction through infrastructural wars in the post-2011 period of the Arab uprisings, focusing on Libya, Syria, and Yemen. These cases allow us to illuminate the ways in which technologically-advanced external militaries target environmental infrastructure (e.g., primarily from the air) versus the way in which internal paramilitary organizations target and seek control over environmental infrastructures (e.g., from the ground). Overall, we show that the targeting of environmental infrastructure is an increasing prominent part of war-making in the MENA, with long-term implications for rebuilding states, sustaining livelihoods, and restoring peace.

'Infrastructural Wars': Targeting Human Welfare and the Environment

Targeting natural resources and the systems that underpin human use of these resources is not new in the history of warfare (Stone, 2000). Water resources have often been intentionally targeted or utilized as "weapons of war" (Freeland, 2015; Gleick, 1993, 2006). Armies and rebel groups have used rivers and hydrological infrastructures as both offensive and defensive forms of weapons. Numerous historical examples of poisoning wells exist, including those during the Persian campaign against Scythia (e.g., see Freeland, 2015: 5). Twentieth century examples include the Allied bombing of Germany's water supply facilities and dams (Jones et al., 2006) and the Soviet destruction of Afghan irrigation systems during the Soviet-Afghanistan War (Formoli, 1995; for other examples, see Troell and Weinthal, 2014). While deliberate attacks on the environment have elicited international condemnation over the last few decades, environmental damage has typically been portrayed as the collateral damage from war.²

A number of scholars have argued that the nature of war-making has changed (Strachan and Scheipers, 2011). Many of the "new wars" in the 1990s were intrastate wars, fought by hybrid combinations of state and non-actors that blurred lines between combatants and civilians and increasingly claimed civilian as opposed to military lives (Kaldor, 2012).³ As often emphasized, war became safer for soldiers but riskier for civilians, particularly women, children, and the elderly (Graham, 2005; Valentino et al., 2004; Downes, 2008). Downes (2008: 1), finds that over the 20th century, between 50 to 62 percent of all deaths in warfare were noncombatants.

The vulnerability of civilians has resulted in part from the urbanization of war and the critical role that infrastructure plays in sustaining urban areas. As Graham (2005) notes, the apparent goal in contemporary conflicts is often one of "deliberate demodernization" by "switching cities off." Aradau (2010) further observes that urban infrastructure has undergone a process of securitization since the 1990s whereby policymakers view "critical infrastructures" as essential to national security (also see Lakoff and Collier, 2010). Thus, environmental infrastructure is a crucial nexus tying urban centers to the conduct of modern warfare (Graham, 2005; Coward, 2009). Integrated infrastructures linking water, energy, and transport systems have enabled urban centers to expand over larger distances, resulting in the growth of expansive peri-

² Legal scholars have sought clarification regarding when war-related damage to the environment is considered 'collateral,' pointing out ambiguities in the humanitarian principle of proportionality (e.g., Hourcle, 2001).

³We use the concept of new wars as a heuristic, since the conflicts we are most interested in involve hybrid combinations of state and non-state actors, impose significant impacts on civilians and the environment, and call attention to the role of natural resources in fueling conflict. We acknowledge some of the critiques of the new wars thesis that suggest that some features of these wars marked prior wars (e.g., see Newman, 2004). Other critiques of the new war literature include Dexter's (2007) focus on how new war discourses help justify Western intervention.

urban areas that increase the vulnerability of civilians to warfare (Coward, 2009). The dependency on national systems connected through a few urban nodes is striking in the MENA given highly centralized energy and hydrological infrastructures. Oil and gas pipelines in remote areas, for instance, are frequently targeted in the post 2011-wars because flows of hydrocarbons to port cities are essential for export revenues to central governments and for domestic power generation.

Across the conflict zones of the MENA, disparate parties have targeted environmental infrastructures in order to displace and terrorize civilian populations, expand territorial control, and redraw demographic balances in favor of particular identities. The recent MENA conflicts highlight difficulties in adequately enumerating civilian causalities and in distinguishing between civilian populations, hired thugs, state security forces, and local armed groups. The proliferation of non-state actors involved in armed conflict has limited the activities of humanitarian organizations, especially as they seek to maintain neutrality (ICRC, 2009). Humanitarian organizations are themselves increasingly targeted, violating principles of neutrality.

The destruction of environmental infrastructures makes for public health crises in cities at the epicenters of these conflicts. In Aleppo, Falluja, Mosul, Aden and other contested cities, urban sieges and the targeting of journalists, humanitarian organizations, and civil society actors have made it difficult to accurately document civilian death tolls (e.g., Cockburn, 2017). Particularly in cities where sieges have hindered repair of environmental infrastructures, factors such as hunger, malnutrition, water-borne diseases, and lack of medical care interact to increase civilian mortality. The ICRC, has long expressed concern that civilians are at risk in cities suffering from a lack of electricity, clean drinking water and sanitation (ICRC, 1994).

The environmental and health aftermaths of 'new wars' often unfold over long periods of time to devastating effect, a form of what Nixon (2011) termed 'slow violence.' While direct civilian casualties from air strikes, shelling, and urban warfare are extensive in the post-2011 wars in the MENA, it has been far more difficult to assess the 'secondary' impacts of these wars on civilians. The Toxic Remnants of War Project, for instance, delineates a number of pathways by which environmental pollution and infrastructure destruction impact public health long after the cessation of conflict. These also include the toxic impacts of explosive weapons in heavily urbanized areas, emissions from targeting industrial sites, uncontrolled burning of wastes and weapons stockpiled, and contaminated rubble (Zwijnenburg and te Pas, 2015: 39-59). The consequences of using chemical weapons on civilian populations in the MENA conflicts has also not been well documented.

Environmental Infrastructures and International Law

Despite sustained efforts to expand the treaties, norms, and principles intended to constrain the conduct of war-making in the 20th century, the wars of the 1990s revealed the limits of international legal mechanisms to address the impacts of targeting environmental infrastructure. Many of the current mechanisms to address civilian and environmental impacts of war originated with attempts by international organizations and legal scholars to address war's impact on the environment in the aftermath of the Vietnam War, particularly the widespread use of the defoliant Agent Orange (Westing, 1983). These instruments include the 1976 Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques (ENMOD), the 1977 Additional Protocol to the Geneva Conventions of August 12, 1949 (Protocol I); and the 1977 Additional Protocol Relating to the Protection of Victims of Non-International Armed Conflicts (Protocol II), which applies to internal armed conflicts.

These instruments provide a starting point for analyzing the extant legal framework that applies to targeting environmental infrastructure (UNEP, 2009). As part of the basic rules pertaining to warfare, Article 35 of Additional Protocol I (paragraph 3) prohibits "methods or means of warfare which are intended, or may be expected, to cause widespread, long-term, and severe damage to the natural environment." Additional Protocol I (Article 54, paragraph 2) states that "it is prohibited to attack, destroy, remove or render useless objects indispensable to the survival of the civilian population," which includes civilian infrastructure such as "drinking water installations and supplies and irrigation networks." Militaries are to avoid attacking such installations so as not "to leave the civilian population with such inadequate food or water as to cause starvation or force its movement" (Additional Protocol 1, Article 54, paragraph 3). Article 57 of Additional Protocol I covers precautionary measures during warfare, suggesting military

actions are disproportionate when the "collateral damage" to civilian objects and noncombatants is excessive in relation to the military gains (UNEP 2009: 13).

All told, military planners are to avoid harming civilians during war (Dill, 2015) and military forces are expected to distinguish between targeting civilian objects and military objectives (Amnesty International, 2006).⁴ Militaries are expected to use minimal force to achieve their ends and not inflict unnecessary suffering and/or destruction from, for example, the poisoning of water wells (Austin and Bruch, 2000; UNEP, 2009). Iraq's burning of Kuwaiti oil fields during the 1990-1991 Gulf War prompted the UN Security Council to pass UN Resolution 687, which held Iraq "liable under international law for any direct loss, damage, including environmental damage and the depletion of natural resources" (UN Resolution 687, 1991: 7).

The distinction between military and civilian objects, however, becomes muddled with dual-use objects, which have greater salience in urban centers. Widespread attacks on dual-use infrastructure systems – e.g., electricity and telecommunications that are used by military and civilian personnel alike—put large numbers of civilians at risk and deny them legal protection (Graham, 2005: 174). Conflict in Syria, for example, has been ubiquitous in urban centers and in the surrounding suburbs of Aleppo, Damascus, Homs, Hama, Idlib, Ar-Raqqa, and Dar'a (Tharoor, 2016). With both international and subnational actors targeting environmental infrastructures, collateral damage has been extensive in these areas. International law typically deals with issues of collateral damage under the principle of proportionality, whereby military decision-makers are expected to take into account potential damage to environmental and civilian infrastructure when making targeting decisions (Tignino, 2016). Yet military considerations of collateral damage often do not adequately consider coupled infrastructure effects, such as when a power plant is bombed and consequently water and sanitation systems shut down, affecting the health and survival of civilians. International criminal law (i.e., the Rome

⁴ According to Additional Protocol I, art. 52 (2), military objectives are those which "by their nature, location, purpose or use make an effective contribution to military action and whose total or partial destruction, capture or neutralization, in the circumstances ruling at the time, offers a definite military advantage." Civilian objects, in contrast, are "all objects which are not military objectives" (Additional Protocol 1, art. 51 (1).

Statute) offers another legal mechanism for protecting the environment during international conflict, albeit one that is rarely used, by designating intentional infliction of harm to the environment as a "war crime" (Jensen, 2005: 175).

The Origins of Infrastructural Wars in the MENA

The targeting of infrastructure has long been a part of conventional war, notably the carpet bombing of cities during World War II and the US use of aerial bombing across Vietnam, Laos, and Cambodia during the Vietnam war. In the 1990s, however, the US was at the forefront of articulating air power doctrines that emphasized targeting urban electrical, oil, and communication infrastructures. (Graham, 2005). Part of what the US military termed the 'revolution in military affairs', the goal was to use 'precision' bombings to paralyze daily life and shorten the duration of formal war (Graham, 2005: 176). The 1991 Gulf War, in which the US and allies targeted Iraqi infrastructures and the retreating Iraqi army targeted Kuwait's oil fields, exemplified the importance of targeting electricity and energy infrastructures. The US-led coalition targeted 28 electrical plants in 215 air sorties, and 28 refineries in 518 sorties (Gellman, 1991). In a Congressional review conducted a year after the war concluded, Pentagon officials admitted that much greater damage was done to the electrical network than originally envisioned by war-planners (Tran, 1992: 10), with the Iraqi national power grid rendered inoperable after the first week (Gellman, 1991). As is well known, the impacts on civilian infrastructures-- water treatment plants, sanitation networks, refrigeration, electric pumps, and hospitals-- were devastating. Coalition bombing shut down water supply, water purification, and sewage treatment systems (Fidler, 2000: 458). As The Washington Post reporter Barton Gellman noted at the time, US planners "took great care to avoid dropping explosives directly on civilians.... but they deliberately did great damage to Iraq's ability to support itself as an industrial society" (Gellman, 1991). The subsequent UN sanctions on Iraq hindered rebuilding of environmental infrastructures, by prohibiting the import of items with potential dual civilian-military use. The US and the UK blocked the import of "replacement pumps, generators, chlorinators, and other items essential to reconstruction" (Sawyer, 2002).

The coalition attacks on Iraqi infrastructure did not result in censure under international law despite widespread condemnation. Attacks by Saddam Hussein's forces on Kuwait's oil fields as part of a deliberate scorched earth strategy in 1991, however, led the post-2003 Iraqi government to press charges under the Rome Statute. The Supreme Iraqi Criminal Tribunal formally charged Saddam Hussein and eleven of his associates using the intentionality requirement, which requires that an act be known in advance to cause "widespread, long-term, and severe damage" to the environment (Freeland, 2015: 6).

Other 'infrastructural wars' also unfolded in the MENA in the two decades prior to the 2011 Arab uprisings. Israel's recurrent conflicts with Hamas in the Gaza Strip and with Hizbollah in southern Lebanon also normalized the targeting of environmental infrastructures. The Israeli Defense Forces (IDF) targeted Palestinian and Lebanese civilian infrastructures used for electricity, water, and sewage treatment through aerial bombing as part of larger military campaigns into densely populated areas in 2004, 2005, 2006, and 2008. These forms of collective punishment of civilian populations fit a longer historical pattern in Israeli military doctrine of disproportionate response to specific militant attacks.

Israel and Egypt also imposed a blockade on goods entering the Gaza Strip after Gazans elected a Hamas-led government in 2006 after years of dissatisfaction with the Palestinian Authority. Echoing the Iraq sanctions justification, Israel and Egypt argued that items with potential civilian-military dual use should not be allowed into Gaza as long as Hamas was in power. As in Iraq, the blockade includes essential items needed for maintenance and reconstruction of environmental infrastructures (B'Tselem, 2016). The blockade on Gaza has reduced food security and significantly affected water and energy infrastructures essential to the provision of public services; "About 95% of water pumped there [in Gaza] is contaminated and non-potable. Gaza residents receive electricity only a few hours each day, partly because of the fuel shortage. The electricity shortage also impacts water and sewage facilities, which rely on a constant supply" (B'Tselem, 2016: 2).

On the Egyptian side of the Gaza Strip, President al-Sisi's government brazenly razed large swaths of the Egyptian city of Rafah and its surrounding farmlands between

2013 and 2015 a part of widening a 'buffer zone' between Gaza and Egypt. In 2015, the government announced it would bulldoze the entire city and relocate the population, having already destroyed 3,255 buildings and associated urban infrastructures in what Human Rights Watch termed a likely violation of international humanitarian law (Human Rights Watch, 2015; Farid 2015). The government's stated goal was to shut down smuggling tunnels between Rafah and Gaza and limit attacks by jihadist networks on Egyptian security forces. These attacks, however, escalated after Al-Sisi violently repressed the Muslim Brotherhood and other mainstream Islamist groups in the 2014 military coup, prompting an upsurge in radicalization and violence.

These tactics of urban blockades, bulldozing, and 'precision' air attacks on civilian environmental infrastructure diffused more broadly across the Middle East and Southwest Asia after 2001. The US invasions of Afghanistan in 2001 and Iraq in 2003 galvanized resistance movements and urban insurgencies (Kaldor, 2012). Air strikes called in by special forces, drone attacks, urban warfare, extended detention of thousands of local prisoners, and the cultivation of local proxy forces became central to US war strategies. In embarking on an unending 'war on terrorism' after the Al Qaeda attacks on US soil in 2001, the Bush Administration embraced the political narrative, long employed by colonial powers, that terrorist threats justified the suspension of the laws of war and of international humanitarian law (Graham, 2010: 237-239). For instance, US interpretations of international humanitarian law after 2001 sought to undermine the universal reach and scope of these doctrines by creating exempt spatial zones (e.g. Guantanamo, 'failed states') and special categories of persons (''unlawful combatants'') (Hajjar, 2006).

Environmental Infrastructural Wars in the Middle East and North Africa after 2011

Environmental infrastructural wars in the MENA spread to Libya, Yemen, and Syria after the Arab uprisings that began in 2011. We empirically document how warfare has changed by tracking the targeting of infrastructures associated with oil, gas, water, electricity, and sanitation across these conflict zones. Our analysis draws upon a database we compiled based upon reports by humanitarian organizations, UN agencies, think tanks, human rights groups, and media reports, primarily from leading English-language outlets. We code discrete instances of targeting infrastructure in Yemen, Syria, and Libya for the last five years. We code infrastructure targeting by (1) type of environmental infrastructure; (2) location and date (3) actor involved in targeting of infrastructure (e.g., national government, non-state group, or external force); (4) intentionality of the actor where known (5) extent and duration of damage, (6) civilian casualties and other health impacts and (7) type of ecosystem damage.⁵ In addition, we code for instances where sustained blockades and sieges of cities and ports produce shutdowns and shortages in fuel, water, electricity, and sanitation systems. As Figure 1 shows, instances of infrastructure targeting have significantly increased since 2011.

INSERT FIGURE 1

For each case study, we provide an analysis of infrastructure targeting and a country map that shows the sectors targeted, the type of actor targeting each sector, and the number of instances of targeting. While the country maps are illustrative, they suggest that the targeting of environmental infrastructures is often a central aim of the parties in these conflicts, rather than simply a form of collateral damage.

Syria

Since a mass uprising swept through Syria in 2011-2012, the regime of President Bashar al-Assad has waged a particularly brutal form of state-sponsored war. The regime set snipers on demonstrators, engaged in mass incarceration, torture, and disappearances, and besieged cities and opposition-held neighborhoods by cutting off food, electricity, fuel, water, and medical supplies. Supported by Russia, Iran, and Hizballah, President Assad's regime retook a number of opposition areas in the last two years at heavy costs in civilian lives. The long-running war has fragmented and militarized the once nonviolent opposition into competing militias, including extremist Sunni organizations that have

⁵ The authors' Coding Handbook for the MENA Infrastructure Project and coding of the data used in this article are available upon request. We code water infrastructure as water utilities, pipes, treatment plants, dams, water pumping stations, and bottling facilities; energy infrastructure as gas/oil pipelines, oil trucks, oil fields, electricity lines/towers, power transmission lines, electricity facilities, power plants, gas processing plants, and oil terminals; and transportation as ports, bridges, airports, and trains.

attracted significant external support from Saudi Arabia, Qatar, Bahrain, Turkey, and several Persian Gulf states (Lynch, 2016: 112). As a result, numerous well-armed militant groups have carved out parts of Syria in attempts to form semi-autonomous regions. As of 2016, the Islamic State of Iraq and al Sham (ISIS) retained some influence in Syria's northern and eastern governorates, while Jabhat Al-Nusra sought to create a government within Idlib. The Kurdish US-backed People's Protection Units have also created autonomous enclaves in northern Syria.

Our data shows that all the warring groups fighting to control Syria have deliberately targeted environmental infrastructure and killed innocent civilians (also see Human Rights Council, 2015). External and internal actors alike have targeted environmental infrastructures of all types. The conflict in Syria exemplifies how the purposeful targeting and destruction of environmental infrastructures has become central to war-making strategies of all parties, with cities as nodes of infrastructure bearing the brunt of the conflict.

INSERT MAP 1

Parties to the conflict also violate international humanitarian law without serious response from the international community. The Human Rights Council concluded that the "warring parties conduct hostilities with little, if any regard for the laws of war" and that consequently "civilians continue to be the main victims." (Human Rights Council, 2015: 6). From March 2011 until January 2017, over 250,000 people had been killed in Syria, with over one million injured and half of the population forced to flee the violence and lack of basic services (UNOCHA, 2017). The cities of Idlib, Hama, Homs, Aleppo, Deir Ez-Zor, Dara'a, Tadmur, Raqqa, and Damascus along with its surrounding towns all saw significant destruction to their environmental infrastructures alongside indiscriminate killing of civilians. As a doctor observed to Amnesty International staff, "Hospitals, water and electricity are always the first to be attacked. Once that happens people no longer have services to survive" (Amnesty International, 2016a).

Frequent attacks by many of the warring parties on electricity generating plants, transmission lines, water pumping stations, and oil refineries have been instrumental in

limiting civilian access to public water, sanitation networks, and energy supplies. Specifically, 25 of the 52 coded targeting incidents (~48%) in Syria concern energy infrastructure, broadly defined. Syria's two main oil refineries have been damaged repeatedly by various forces, with fuel depots, storage tanks, and reservoirs set on fire (Zwijnenburg and te Pas, 2015: 24). By 2013, the government's Ministry of Electricity reported 30 inactive power stations and 40 percent of high voltage lines attacked (Ibid: 37). In the first half of 2014, electricity outages left large portions of the governorates of Aleppo and Deir ez-Zor without running water (Ibid: 29). In 2015, the US-led coalition attacked a power plant causing blackouts throughout Aleppo (BBC, 2015). Militias seeking to weaken Assad's control of Aleppo have also been known to cut water to the city to punish residents and weaken the regime's hold (Human Rights Council, 2015).

In September 2016, government forces bombed a water pumping station that supplies 250,000 people in eastern Aleppo; in retaliation militants switched off a pumping station that supplies water to 1.5 million residents in western Aleppo (Oliphant, 2016). In 2017, about 1.8 million Aleppo residents were cut off from water because of a technical failure, but the pumping station resides within ISIS controlled territory, and it had refused to grant technicians permission to make needed repairs (UNOCHA, 2017). Throughout Syria, attempts to repair intentionally attacked water infrastructure have been hindered by the warring parties.

Researchers with Amnesty International have documented daily bombings by Russian and government forces of electricity and water facilities, markets, hospitals, and schools in eastern Aleppo. These reports note that targeted areas were "located away from military targets such as battle frontline, military checkpoints or vehicles" (Amnesty International, 2016b). It appears that the intent of these bombings is to empty the opposition-held parts of the city of its civilian population (Amnesty International, 2016b). As one journalist noted, "The pattern of bombings suggests that Russia's aim in northern Syria, like that of the Assad regime, is to destroy civilian habitat, food production, markets, healthcare and the infrastructure needed to sustain life. Mass displacement increasingly appears to be the aim of the military operation, and not just a side effect, humanitarian aid officials say" (Gutman, 2016). A humanitarian report focused on rebel-held eastern Aleppo found that 66 percent of residents reported difficulties in accessing drinking water, while two-thirds of households reported that electricity was supplied for three to four hours a week (REACH, 2015). Of those surveyed, 95 percent reported using generators to provide a few hours of electricity daily. Whereas most residents before the war relied on the municipal water system, 31 percent had moved to accessing boreholes (private untreated and unregulated wells) and 22 percent were paying private vendors (Ibid). Jabhat al Nusra attacked the city's main water station in the summer of 2015, closing water supply to much of the city until repairs were made. During a heat wave in July 2016, attacks on an electric transmission station that pumped water to the eastern and western portions of Aleppo shut down water supply to those areas. Alternative transmission lines brought into service were damaged a day later, leaving the remaining 2 million people in the city without municipal water supplies for over a week (UNICEF, 2016).

Water resources and infrastructure have not only been frequently targeted but have become military targets to be fought over. In 2017, fighting erupted between government forces and rebels over control of Wadi Barada's Ain al-Fijeh spring that supplies 70 percent of Damascus' freshwater (Loveluck and Habib, 2017). In January 2017, 4 million residents in Damascus were deprived of municipal water after the water grid in Wadi Barada was bombed (Loveluck and Haidamous, 2017). This forced residents to rely on either private water trucks or collected rainwater, both of which proved to be unsafe, causing an outbreak of waterborne diseases (Ibid.).

In its attempt to form a state across the conflict-torn states of Iraq and Syria, ISIS has sought to control water and oil infrastructures. ISIS controlled nearly 60 percent of Syria's oil production in 2015 (Zwijnenburg and te Pas, 2015: 24). It has controlled Syria's Tabqa Dam since 2013, enabling it to control the supply of water and hydropower to Aleppo and neighboring cities and to use the dam to shelter fighters (Saad and Gladstone, 2013). To weaken ISIS, the US and Russia have focused efforts on targeting ISIS-controlled production and distribution of oil and gas. These included bombing small-scale makeshift and modular oil refineries, which ISIS has increasingly turned to provide for its fuel needs. These makeshift refineries reportedly cause significant local environmental damage, while oil products release a variety of pollutants when burned for

domestic purposes. Concerns over health impacts prompted several opposition groups, including the Free Syrian Army, to warn against building such refineries (Zwijnenburg and te Pas, 2015: 26).

The targeting of electricity and water infrastructure also compromises the provision of sanitation, which increases waterborne diseases in conflict-torn Syria. As a result, civilians in some areas are plagued by diarrhea, dehydration, malnutrition, and gastrointestinal diseases. The intentional targeting of environmental infrastructure not only creates immediate humanitarian suffering but also perpetuates a cycle of poverty as children spend their days searching for essential resources, such as water, fuel, and food, instead of attending school (UNOCHA, 2017). The impacts of targeting of environmental infrastructure have also contributed to the large number of refugees and internally displaced persons fleeing conflict-affected areas, reaching an estimated 6.6 million Syrian inside the country and 4.9 million Syrians outside by June 2016 (UNOCHA, 2017).

Yemen

Yemen provides another instance of a war fought in large part by targeting environmental infrastructure and thus civilian wellbeing. Yemenis joined mass protests in January 2011 following the explosive example of set by Tunisians. Protests in the Yemeni capital Sana'a and in provincial cities quickly moved from general calls for reform to demands that the president, Ali Abdullah Saleh, step down. Saleh had been in power for 11 years as the president of unified Yemen and held power for 12 years before that as president of then-North Yemen. In 2011, "Change Square" in Sana'a became as famous as Tahrir Square in Egypt and the Pearl Roundabout in Bahrain as the epicenters of youth-led nonviolent contestation.

President Saleh had long ruled the fragmented, weak Yemeni state through complex webs of patronage that linked his regime to tribal leaders and the military-security services (Dresch, 2002; Lackner, 2014). Saudi Arabia backed Salah's regime, viewing northern Yemen as its sphere of influence. However, Saleh faced ongoing significant opposition from other quarters. These included North-South differences based on divergent patterns of historical development. North Yemen became an independent state with the breakup of the Ottoman Empire in 1918, while southern Yemen, centered on the port of Aden, remained a British protectorate until nationalist agitation made the British position untenable by the late 1960s. South Yemen's nationalist movement, like other revolutionary, anti-imperialist parties, embraced Marxism and turned to the Soviet Union for protection. However, oil discoveries in the North-South border zones during the 1980s increased incentives for unification, as did the breakup of the Soviet Union in 1989. North and South Yemen formally unified in 1990.

Perceptions of southern marginalization in the union, however, contributed to the emergence of the secessionist movement known as al-Hirak in 2007. In the north, the religious-political movement Ansar al-Allah, also known as the Houthi movement, became prominent in the 1990s among the Zaidi Shi'a community. Ansar al-Allah engaged in open conflict with the central government by 2004. In addition, Yemeni groups affiliated with Al-Qaeda in the Arabian Peninsula (also known as Ansar al-Shari'a) came to international attention with the 2000 attack on the warship, the USS Cole. The US thus entered Yemeni politics through intensive security cooperation with the Saleh government in order to limit the reach of al-Qaeda in southeastern Yemen.

This complex internal picture was largely ignored in the 2011 Saudibrokered transition that saw Saleh cede the presidency to his long standing vicepresident, Abdo Rabbo Mansour al-Hadi. This plan overlooked demands of the 2011 protests and the subsequent National Dialogues, which called for a more thorough-going break with the old regime and the formation of a power-sharing transitional government to oversee new elections. Unsurprisingly, the ascension of Hadi was rejected by many of the protesters and by the northern Houthi movement. In 2014, the country descended into open civil war as the Houthi movement swept south, taking Sana'a and besieging the cities of Ta'iz and Aden. Saleh, disavowing the accord that had ushered him from power, rallied his forces to join the Houthis, creating a powerful anti-government coalition with large numbers of Saleh loyalists defecting to join him from the security and military forces (ICG, 2016). Saudi Arabia swiftly intervened on the side of al-Hadi, as did the US and the UK. Beginning in 2015, a Saudi-led coalition launched an air campaign in support of Hadi's government that has proved particularly indiscriminate in targeting civilian infrastructure. The coalition also enacted a naval blockade on imports that produced devastating effects on the functioning of basic infrastructure and ability of ordinary Yemenis to obtain food, energy, and water. Our data shows that the Saudi-led air campaign targeted seaports, airports, roads, bridges, hospitals, and a water-bottling plant.

The war in Yemen illustrates the significant role of external forces in targeting environmental infrastructure. Of the 47 incidents reported in our database where we could distinguish between external and internal actors, 25 percent were carried out by external actors, often targeting basic services (see Map 2). In a report sent to the Security Council in January 2016, the UN-appointed panel of Yemen experts reported that it had documented "119 coalition sorties relating to violations of international humanitarian law" and that "the coalition had conducted airstrikes targeting civilians and civilian objects" (Quoted in MacAskill, 2016). According to the Assessment Capacities Project (ACAPS), "more than one-third of 8,600 airstrikes between March 2015 and August 2016 hit civilian sites."⁶ Coalition air attacks included five strikes on hospitals run by Médecins Sans Frontières, echoing airstrikes on hospitals in Syria by Russia and the Assad regime. Despite these well-publicized assessments, the air campaign in Yemen continues at the time of publication.

INSERT MAP 2

Direct targeting of civilian infrastructure is compounded by the blockade of ports and transportation networks, limiting supplies of fuel, food, and imports needed to sustain the operation of civilian infrastructure. As in Iraq under the 1990s sanctions regime, coupled systems of water, energy, sanitation, and food

⁶ <u>https://www.acaps.org/country/yemen/crisis-analysis#</u>, downloaded February 12, 2017.

provision have collapsed in synergistic ways. Fuel imports in September 2016, for instance, fell to a reported 1 percent of monthly requirements, resulting in fuel costs 286 percent higher than pre-war prices (Twigg, 2016). Shortages of fuel undermined the operation of water, sanitation, and health services, which depend upon electricity and fuel supplies. Combined with poor rains and escalating prices for necessities, an estimated 14.4 million Yemenis were food insecure in November 2015, according to the UN Humanitarian Needs Assessment, including 7.6 million who "need immediate life-saving food assistance" (UNOCHA, 2015:16). This includes 1.3 million acutely malnourished children. The 2016 Needs Assessment Report noted that at 82 percent of Yemen's population, or 21.2 million people "required some kind of humanitarian assistance to meet their basic needs or protect their fundamental rights" (UNOCHA, 2015: 3).

In the water and sanitation sector, three out of four Yemenis, or 19.3 million people, "require support to meet their basic water, sanitation, and hygiene needs" (Ibid.: 180). The UN estimated that since the conflict intensified in March 2015, 9.8 million of these 19.3 individuals had newly lost access to water and sanitation, in large part due to shortages of fuel and restrictions on transport. The UN also noted that artillery, rocket, and air strikes destroyed water systems directly serving 900,000 people. Most cities face significant risk of waterborne diseases, while lack of fuel and electricity have particularly decimated rural public services. As disease incidence rises, the health system has largely collapsed, with with seventy medical facilities entirely destroyed, another 200 damaged, and 600 facilities closed due to lack of fuel, staff, and supplies, (UNOCHA, 2015: 21).

Since 2012, the Yemeni conflict has seen jihadist groups such as Al Qaeda in the Arabian Peninsula and ISIS extend territorial control, including over basic infrastructure (ICG, 2016). For example, in Yemen's fifth largest city, Mukalla, Al Qaeda took control of the provincial capital and its oil harbor after looting military bases and banks in April 2015.

As Map 2 further illustrates, the post-2011 period also saw a sustained increase in attacks by internal actors, most notably Islamist and tribal groups, on the energy infrastructure. Our data shows that of the 35 incidents undertaken by

internal actors, over 90 percent of these attacks targeted the energy infrastructure. Most attacks focused on sabotaging the 483-kilometer Ras Isa oil pipeline, the 323-kilometer LNG pipeline, or various sub-pipelines, in order to deprive the central government of export revenue from fossil fuel exports. Attacks on the electricity infrastructure, through mortar attacks on electricity transmission lines, have also escalated, with an attack in 2014 temporarily turning off the national energy grid as well as oil and gas processing facilities. Saudi air strikes also targeted Yemen's main oil export terminal, Ras Isa port, in January 2016, which had not been exporting oil for months (Kennedy, 2016).

As in Syria, some cities besieged by opposition or government forces for months on end have witnessed the breakdown of basic services and the use of starvation as a weapon. The Houthi siege of Ta'iz represents one of the most dire situations; in place since August 2015, the siege has cut off basic water and sanitation services, leaving 200,000 persons without access to supplies.⁷

Libya

Inspired by the 2011 uprisings in Tunisia and Egypt, Libyans also protested against President Muammar Qadhafi's authoritarian regime. In response, Qadhafi used excessive military force that inflamed protest across the country. Seeking to prevent the massacre of civilians in Misrata, the North Atlantic Treaty Organization (NATO) employed a sustained air campaign to support opposition militias on the ground to topple Qadhafi's regime (Colgan, 2015). Qadaffi's government had never built the architecture of a state bureaucracy, governing instead through tribal relations and dependent upon oil revenues to fill state coffers (Vandewalle, 1998). This meant that when the regime collapsed in October 2011, no extant state institutions remained to mediate competing demands by local armed groups.

Libya, like Syria and Yemen, has seen various armed groups divide the country into different areas of control, engulfing the civilian population in violence. These groups include Operation Dignity, Ansar al-Sharia, Shura Councils, Libya Dawn, tribal groups,

⁷ <u>https://www.acaps.org/node/457/crisis-analysis/7700/move/top</u>, downloaded February 10, 2017.

and Western-backed groups. In 2014, groups pledging allegiance to ISIS emerged, gaining control of cities in eastern Libya. External actors, such as US and Egyptian military, have in turn conducted airstrikes against these groups. According to the Human Rights Council, all warring parties have engaged in direct violations of international humanitarian law, including targeting of civilians, neighborhoods, buildings, schools, medical facilities, transportation infrastructure, environmental infrastructures and humanitarian personnel (Human Rights Council, 2016a,b). From satellite imagery, some civilian neighborhoods have been completely destroyed (Human Rights Council, 2016b).

Our documentation shows that while both internal and external parties indiscriminately target environmental infrastructures, internal actors, have carried out most of the attacks in Libya. As shown in Map 3, less than 10 percent of attacks were carried out by external actors. Densely populated residential areas in Benghazi, Tripoli, Warshafana, Nafusa Mountains, and south Libya, were targeted with heavy weapons, including Grad rockets and rocket-propelled grenades, causing significant damage to environmental infrastructures and killing scores of innocent civilians (Human Rights Council, 2016a,b). More than 435,000 people were internally displaced in 2015 alone (Human Rights Council, 2016a). In Benghazi, over half of the population fled the violence (Human Rights Council, 2016b). The fighting and destruction also means that 1.9 million people need essential humanitarian aid for basic health care, water, and food (Human Rights Council, 2016a).

INSERT MAP 3

These attacks have included water and energy infrastructures. Qaddafi's government had invested heavily in building the 'Great Man-Made River', a conveyance scheme carrying groundwater from the Nubian Sandstone aquifer in the south to urban populations on the northern coast. In 2011, NATO bombed a plant that built pipelines for the project (Ahmed, 2015); since then, owing to ongoing conflict, the GMR infrastructure has "sustained considerable damage" (REACH, 2016: 17). According to the Human Rights Council, "major water networks have been disrupted, which has affected access to

safe drinking water, sanitation and hygiene" throughout Libya (Human Rights Council, 2016a: 10). Armed groups have also destroyed water wells resulting in the cutting off of water to civilians (Human Rights Council, 2016b). In March 2016, groups sympathetic to ISIS attacked a power plant and a water plant near the city of Sarir, located adjacent to a major oil field (Turkish Government News, 2016). Communities across Libya have reported decreases in available drinking water. Decreasing water availability reflects both persistent drought and extensive damage to the public water system, as well as lack of fuel for pumping and purification of water (REACH, 2016). The conflict has also endangered the provision of other basic services, including sanitation and waste management. Around 500,000 people are in desperate need of safe water and sanitation (Humanitarian Response, 2015). Shortages of water supply and fuel have also negatively affected agriculture and food availability (REACH, 2016).

With few organizations reporting on infrastructure destruction in Libya over the last five years, mapping the ensuing effects remains challenging. The REACH Initiative – one of the few organizations carrying out assessments in Libya – found that the electricity grid sustained the highest level of damage of any type of basic infrastructure, as reported by 72 percent of communities in 2016 (REACH, 2016). Early in June 2015, groups sympathetic to ISIS gain control of a power plant distributing electricity to Tripoli (Reuters, 2015). In January 2016, an internal warring group bombed a power plant causing blackouts across Benghazi followed by power rationing (Libya Channel, 2016).

As in Yemen, internal non-state actors have focused their attacks particularly on the energy infrastructure since Gaddafi's downfall (see Map 3). Nearly 60 percent of attacks in our database have targeted the energy sector, including oil tankers, pipelines, and power plants. Rival forces, including groups sympathetic to ISIS, have carried out numerous attacks on the oil infrastructure. ISIS has targeted the oil infrastructure (including oil tanks and oil facilities) and towns near these facilities as it has lacks some of the personnel needed to operate these facilities and can deny the Tripoli government access to oil export revenues (Reardon, 2016; LaFranchi, 2016). These attacks on the oil infrastructure have reduced oil output significantly; by the end of 2015, Libyan oil output had dropped below 400,000 barrels per day, less than a quarter of oil produced before the 2011 uprising (Mohareb and Dipaola, 2015).

Conclusion

The escalation, duration, and multi-party nature of the MENA's new wars mean that destruction and control of environmental infrastructures has increasingly become an end in itself. Air strikes, shelling, and urban sieges target energy and water infrastructures to force capitulation of cities and deprive rival groups of energy resources and revenues. The advent of infrastructural wars in the region can be traced to tactics and discourses employed by external and internal parties in prior conflicts in Iraq, Lebanon and Gaza. In these instances, environmental infrastructures were repeatedly targeted through air campaigns by outside powers and attacks by internal factions, while long-term damage to environmental infrastructures was a signature feature of the sanctions regime on Iraq in the 1990s and the ongoing blockade of Gaza.

A new wave of infrastructural wars emerged in the region in the aftermath of state repression and the emergence of multiparty wars in Yemen, Syria, and Iraq. As our data shows, water systems, oil and gas pipelines, refineries, electric power lines and stations, and sanitation services were targeted by both external and internal actors. External and regional powers—such as Russia, the US, Assad's regime in Syria, NATO in Libya, and Saudi-led coalition in Yemen—have relied on air power to target facilities, justifying aerial bombing in terms of 'dual-use' infrastructures or targeting facilities under 'rebel' control. Internal actors also sought to capture infrastructure to extend territorial control over local populations (e.g., ISIS and dams in Syria), punish communities viewed as sympathetic to adversaries, and deprive rivals of revenue and resources (e.g., various groups in Yemen and in Libya targeting pipelines and refineries).

Our findings show that the internal, regional, and international dimensions of targeting environmental infrastructure in these wars poses grave challenges for international humanitarian law and international environmental law. Most MENA countries, like the US, refuse to sign international treaties such as the Rome Statute, opposing international legal frameworks as infringements of sovereignty. While UN agencies and humanitarian organizations have strived to document the destruction of infrastructure as well as human rights abuses, the multiplicity of actors and interest in these uncivil wars has hindered mechanisms for bringing warring parties to account.

While the international legal community has sought to address war-related destruction of the environment and of civilian infrastructure, the broader range of human insecurity and ecological degradation that ensue from targeting environmental infrastructures remain inadequately addressed in evolving legal frameworks. In this article, we have sought to provide a preliminary account of the broader human security impacts of targeting environmental infrastructure during conflict.

We recognize that measuring the long-term impacts (i.e., the 'slow violence' of targeting infrastructure) on civilian populations and local ecologies remains challenging, as does incorporating these impacts into international legal frameworks. UNEP has pioneered post-conflict environmental assessments, but the lack of baseline ecological and health data in many war-torn societies complicates these efforts. Future research into the conflict targeting of infrastructure, whether in the Middle East or elsewhere, could thus seek to develop integrated health-environmental assessments that include longer-term impacts.

The authors' ongoing research into specifically the post-2011 Middle Eastern wars will tackle a set of related questions. These include how humanitarian organizations with ground operations in these conflicts, such as the ICRC, Médecins Sans Frontières and local groups, have coped with the unprecedented targeting of their field staff and facilities and whether environmental infrastructures can be more adequately safeguarded through advancements in international law and better enforcement mechanisms. The authors are also expanding their database to include new sources of information (including 'scraping' of social media and satellite imagery) to more thoroughly map the extent and duration of environmental infrastructure targeting.

Another question requiring future research is how fractured states, civic actors, humanitarian organizations, and international donors can muster resources for reconstruction once the current conflicts subside. Based on the prior experiences of Iraq, Gaza, and Lebanon, unless durable political settlements are reached among adversaries, reconstruction will likely be hampered by repeated cycles of destruction by states and rebel groups targeting international assistance projects (Likosky, 2006). As research shows, hydrological and energy infrastructures are essential to rebuilding lives and livelihoods (Troell and Weinthal 2014). The repeated destruction of water, sanitation, and energy complicates and prolongs the process for restoring basic services and fostering development. Well known post-war reconstruction efforts, such as post World War II reconstruction of Europe and Japan, relied on creating functioning social welfare states and inclusive political systems. Both seem distant prospects for the current conflicts in the region, as parties to the conflicts have yet to reach decisive conclusions and significant outside commitments to rebuilding are lacking. Middle Eastern states thus have few prospects for quickly restoring environmental infrastructures and services to pre-war levels. Adverse health and environmental consequences of current infrastructural wars will thus last long after the conflicts finally cease.

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References

Ahmed N (2015) War crime: Nation deliberately destroyed Libya's water infrastructure. *Ecologist*, 14 May. Available at: http://www.theecologist.org/News/news_analysis/2869234/war_crime_nato_deliberately destroyed libyas water infrastructure.html.

Amnesty International (2006) *Israel/Lebanon: Deliberate destruction or "collateral damage"? MDE 18/0072006.* 22 August. Available at: https://www.amnesty.org/en/documents/MDE18/007/2006/en/.

Amnesty International (2016a) *Hospitals have become the new frontline*. 3 March. Available at: https://www.amnesty.org.uk/syria-hospitals-are-new-front-line.

Amnesty International (2016b) *Syria: UN must act to end onslaught aimed at purging civilians from eastern Aleppo.* 20 October. Available at: https://www.amnesty.org/en/latest/news/2016/10/syria-un-must-act-to-end-onslaught-aimed-at-purging-civilians-from-eastern-aleppo/.

Aradau C (2010) Security that matters: Critical infrastructure and objects of protection. *Security Dialogue* 41(5): 491-514.

Austin JE and Bruch CE (eds.) (2000) *The Environmental Consequences of War: Legal, Economic, and Scientific Perspectives*. Cambridge, UK: Cambridge University Press.

BBC (2015) International coalition targets main power plant in northern Syria. *BBC Monitoring Middle East, SANA news agency website, Damascus*, 18 October.

B'Tselem (Jerusalem) (2016) Reality check: Almost fifty years of occupation. *B'Tselem*, 25 June. Available at: http://www.btselem.org/publications/201606_reality_check.

Cockburn P (2017) Who supplies the news? London Review of Books 39(3): 7-9.

Colgan J (2015) Oil, domestic conflict, and opportunities for democratization. *Journal of Peace Research* 52(1): 3-16.

Collier P, Elliot L, Hegre H, Hoeffler A, Reynal-Querol M, Sambanis N (2003) *Breaking the Conflict Trap: Civil War and Development Policy*. Washington, DC: World Bank and Oxford University.

Coward M (2009) Network-centric violence, critical infrastructure and the urbanization of security. *Security Dialogue* 40(4–5): 399–418.

Dexter H (2007) New war, good war and the war on terror: Explaining, excusing and creating western neo-interventionism. *Development and Change* 38(6):1055–1071.

Dill J (2015) *Legitimate Targets? Social Construction, International Law and US Bombing.* Cambridge, UK: Cambridge University Press.

Downes A (2008) Targeting Civilians in War. Ithaca, NY: Cornell University Press.

Dresch P (2000) *A History of Modern Yemen*. Cambridge, UK: Cambridge University Press.

Farid S (2015) Razing Rafah: The toll of the buffer zone. *Al Arabiya News*, 27 January. Available at: http://english.alarabiya.net/en/perspective/analysis/2015/01/27/Razing-Rafah-The-toll-of-the-buffer-zone.html.

Fidler DP (2000) War and infectious diseases: international law and the public health consequences of armed conflict. In: Austin JE and Bruch CE (eds.) *The Environmental Consequences of War: Legal, Economic, and Scientific Perspectives*. Cambridge, UK: Cambridge University Press, 444-466.

Formoli TA (1995) Impacts of the Afghan-Soviet war on Afghanistan's Environment. *Environmental Conservation* 22 (1): 66–69.

Freeland S (2015) Addressing the Intentional Destruction of the Environment during Warfare under the Rome Statute of the International Criminal Court. Belgium: Intersentia.

Gellman B (1991) Allied air war struck broadly in Iraq. Washington Post, June 23.

Gleditsch NP (2012) Whither the weather? Climate change and conflict. Journal of Peace

Research 49(1): 3-9.

Gleick PH (1993) Water and conflict: Fresh water resources and international security. *International Security* 18(1): 79-112.

Gleick PH (2006) Water and terrorism. Water Policy 8: 481-503.

Graham S (2005) Switching cities off: Urban infrastructure and US air power. *City* 9(2): 169-194.

Graham S (ed.) (2008) *Cities, War, and Terrorism: Towards an Urban Geopolitics*. Malden, MA: Blackwell.

Graham S (ed.) (2010) *Disrupted Cities: When Infrastructure Fails*. New York, NY: Routledge.

Graham S (2011) *Cities Under Siege: The New Military Urbanism*. London: Verso Books.

Gutman R (2016) Syrian government offensive, aided by intensive Russian bombing, directly targets civilian infrastructure. *The Nation*, 10 February.

Hajjar L (2006) International humanitarian law and "wars on terror": A comparative analysis of Israeli and American doctrines and policies. *Journal of Palestine Studies* 36(1): 21-42.

Homer-Dixon, TF (1994) Environmental scarcities and violent conflict: Evidence from cases. *International Security* 19 (1): 5-40.

Hourcle, LR (2001) Environmental law of war. Vermont Law Review 25: 653-693.

Humanitarian Response (2015) *Humanitarian response plan for Libya*. November. Available at:

https://www.humanitarianresponse.info/system/files/documents/files/libya_hrp_final_19_11_2015.pdf.

Human Rights Council (2015) Report of the Independent International Commission of Inquiry on the Syrian Arab Republic. 13 August.

Human Rights Council (2016a) Investigation by the Office of the United Nations High Commissioner for Human Rights on Libya. 15 February.

Human Rights Council (2016b) Investigation by the Office of the United Nations High Commissioner for Human Rights on Libya: A detailed findings. 23 February.

Human Rights Watch (2015) Look for another homeland: Forced evictions in Egypt's

Rafah. 22 September. Available at: https://www.hrw.org/report/2015/09/22/look-another-homeland/forced-evictions-egypts-rafah.

International Committee of the Red Cross (ICRC) (1994) International Symposium on Water in Armed Conflicts. Press release. Available at: https://www.icrc.org/eng/resources/documents/news-release/2009-and-earlier/57jm46.htm.

International Committee of the Red Cross (ICRC) (2009) *Water and war: ICRC response. Ref. 0960.* 16 July. Available at: https://www.icrc.org/en/publication/0969-water-and-war-icrc-response.

International Crisis Group (ICG) (2016) *Yemen: Is peace possible? Report no. 167.* Available at: http://www.crisisgroup.org/en/regions/middle-east-north-africa/iraq-iran-gulf/yemen/167-yemen-is-peace-possible.aspx.

Jensen, D and S Lonergan 2012 Assessing and Restoring Natural Resources in Post-Conflict Peacebuilding. London: Earthscan Press.

Jones, SG, LH Hilborne, CR Anthony, LM Davis, F Girosi, C Benard, RM Swanger, AD Garten, and A Timilsina 2006 *Securing Health: Lessons from Nation-building Missions*. Santa Monica, CA: RAND Center for Domestic and International Health Security.

Kaldor M (2012) *New and Old Wars: Organized Violence in a Global Era.* 3rd ed. Stanford, CA: Stanford University Press.

Kennedy C (2016) Saudi air strikes on Yemeni oil port; ISIS attacks Libyan oil port. *Oil Price.com*, 21 January. Available at: http://oilprice.com/Energy/Energy-General/Saudi-Air-Strikes-on-Yemeni-Oil-Port-ISIS-Attacks-Libyan-Oil-Port.html.

King MD (2015) The weaponization of water in Syria and Iraq. *The Washington Quarterly* 38(4): 153-169. DOI: 10.1080/0163660X.2015.1125835.

Kipfer S and Goonewardena K (2007) Colonization and the new imperialism: On the meaning of urbicide today. *Theory and Event* 10(2). DOI: 10.1353/tae.2007.0064.

Koubi V, Spilker G, Böhmelt T and Bernauer T (2014) Do natural resources matter for interstate and intrastate armed conflict? *Journal of Peace Research* 51(2): 227–243.

Lackner H (ed.) (2014) *Why Yemen Matters: A Society in Transition*. SOAS Middle East Issues. London: Saqi Books.

LaFranchi H (2016) ISIS attacks on Libya: Why oil might not be its top goal. *The Christian Science Monitor*, 11 January 11.

Lakoff A and Collier SJ (2010) Infrastructure and event: the political technology of preparedness. In: Braun B and Whatmore SJ (eds.) *Political Matter: Technoscience*,

Democracy and the Public. Minneapolis, MN: University of Minnesota Press, 243-266.

Libya Channel (2016) blackouts across Benghazi as main power plant shelled for third day. *Libya's Channel*, 13 January. Available at:

http://en.libyaschannel.com/2016/01/13/blackouts-across-benghazi-as-main-power-plant-shelled-for-third-day/.

Likosky MB (2006) *Law, Infrastructure, and Human Rights*. New York, NY: Cambridge University Press.

Loveluck L and Habib H (2017) A once-beautiful valley in Syria is now a microcosm of the country's war. *The Washington Post*, 4 January.

Loveluck L and Haidamous S (2017) Frustrations rise in Damascus as water pipes run dry. *The Washington Post*, 15 January.

Lynch, M (2016) The New Arab Wars: Uprisings and Anarchy in the Middle East. New York: Public Affairs, Perseus Books.

MacAskill E (2016) UN Report into Saudi-led strikes in Yemen raises questions over UK Role. *The Guardian*, 27 January.

Mohareb H and Dipaola A (2015) Libyan oil output drops as factions fight over energy assets. *Bloomberg Business*, 4 November. Available at: http://www.bloomberg.com/news/articles/2015-11-04/libya-oil-output-drops-as-factions-fight-over-energy-assets.

Newman E (2004) The 'new wars' debate: A historical perspective is needed. *Security Dialogue* 35(2): 173–189.

Nixon R (2011) *Slow Violence and the Environmentalism of the Poor*. Cambridge, MA: Harvard University Press.

Oliphant R (2016) Two million without water as Russian and Syrian warplanes batter Aleppo for second night. *The Telegraph*, 24 September. Available at: http://www.telegraph.co.uk/news/2016/09/24/two-million-without-water-as-russian-andsyrian-warplanes-batter/.

Paris R (2004) *At War's End: Building Peace after Civil Conflict*. Cambridge, MA: Cambridge University Press.

Protocol Additional to the Geneva Conventions of 12 August 1949, and relating to the Protection of Victims of International Armed Conflicts (Protocol I), 8 June 1977.

Protocol Additional to the Geneva Conventions of 12 August 1949, and relating to the Protection of Victims of Non-International Armed Conflicts (Protocol II), 8 June 1977.

REACH (2015) *Eastern Aleppo food security and livelihoods assessment. Assessment report.* June. Available at: http://www.reachresourcecentre.info/system/files/resource-documents/reach_syr_aleppo_food_security_and_livelihoods_assessment_july2015_0.pd f.

REACH (2016) *Libya multi-sector needs assessment III*. June. Available at: http://www.reachresourcecentre.info/system/files/resourcedocuments/reach_lby_report_multi_sector_needs_assessment_update_june_2016.pdf

Reardon M (2016) Libya, extremism and the consequences of collapse. *Al Jazeera News*, 28 January. Available at: http://www.aljazeera.com/indepth/opinion/2016/01/libya-extremism-consequences-collapse-160128054629594.html.

Reuters (2015) Islamic State Seizes Power Plant Near Libyan City of Sirte. *Reuters*, 9 June. Available at: http://www.reuters.com/article/us-libya-security-idUSKBN00P0ZI20150609.

Roy S (1987) The Gaza Strip: A case of economic de-development. *Journal of Palestine Studies* 17(1): 56-88.

Saad H and Gladstone R (2013) Syrian insurgents claim to control large hydropower dam. *The New York Times*, 11 February.

Sawyer J (2002) In Basra, effects of Gulf War linger, and US gets blame. *St. Louis Post-Dispatch*, 27 May.

Shaw M (2003) War and Genocide. Cambridge, UK: Polity Press.

Stone C (2000) The environment in wartime: An overview. In: Austin JE and Bruch CE (eds.) *The Environmental Consequences of War: Legal, Economic, and Scientific Perspectives*. Cambridge, UK: Cambridge University Press, 16-35.

Strachan H and Scheipers S (eds.) (2011) *The Changing Character of War*. Oxford, UK: Oxford University Press.

Terry F (2002) *Condemned to Repeat? The Paradox of Humanitarian Action.* Ithaca, NY: Cornell University Press.

Tharoor I (2016) Syria's ruined cities will need decades, not years, to recover from war. *The Washington Post*, 26 May.

Tignino M (2016) *Water During and After Armed Conflicts: What Protection in International Law?* Leiden, Netherlands: Brill.

Tran M (1992) US destruction of Iraq's power plants a 'mistake'. *The Guardian*, 24 February, 10.

Troell J and Weinthal E (2014) Shoring up peace: Water and post-conflict peacebuilding. In: Weinthal E, Troell J and Nakayama M (eds.) *Water and Post-conflict Peacebuilding: Shoring Up Peace*. London, UK: Earthscan Press, 1-23.

Turkish Government News (2016) Suspected DAESH terrorists attack power, water plant in Libya. *TRT WORLD*, 15 March. Available at: http://www.trtworld.com/mea/suspected-daesh-terrorists-attack-powerwater-plant-in-libya-67952.

Twigg S (2016) Yemen: The devastation of a nation, largely ignored. *The Guardian*, 27 January.

United Nations (1991) UN Security Council Resolution 687, S/RES/687 (1991),

United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA) (2015) *Humanitarian needs overview 2016: Yemen.* 22 November. Available at: http://reliefweb.int/report/yemen/2016-humanitarian-needs-overview-enar.

United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA) (2017) *Syrian Arab Republic: Aleppo situation report no. 14.* 20 January. Available at: http://reliefweb.int/sites/reliefweb.int/files/resources/Aleppo%20SitRep%2014.pdf.

United Nations Environment Programme (UNEP) (1999) *Final report: The Kosovo conflict: consequences for the environment and human settlements*. Available at: http://www.grid.unep.ch/btf/final/finalreport.pdf.

United Nations Environment Programme (UNEP) (2009) *Protecting the environment during armed conflict: An inventory and analysis of international law.* Available at: http://www.un.org/zh/events/environmentconflictday/pdfs/int_law.pdf.

UNICEF (2016) Taps run dry for 2 million people as fighting intensifies in Aleppo. *UNICEF*, 9 August. Press release. Available at: http://www.unicef.org/media/media_92067.html.

Valentino B, Huth P and Balch-Lindsay D (2004) Draining the sea: Mass killing and guerrilla warfare. *International Organization* 58(2): 375-407.

Vandewalle D (1998) *Libya since Independence: Oil and State Building*. Ithaca, NY: Cornell University Press.

Westing A (1983) The environmental aftermath of war in Vietnam. *Journal of Natural Resources* 23: 365-389.

Zwijnenburg W and te Pas K (2015) *Amidst the Debris: A Desktop Study on the Environmental and Public Health Impact of Syria's Conflict.* 2015 October. Netherlands: PAX.