

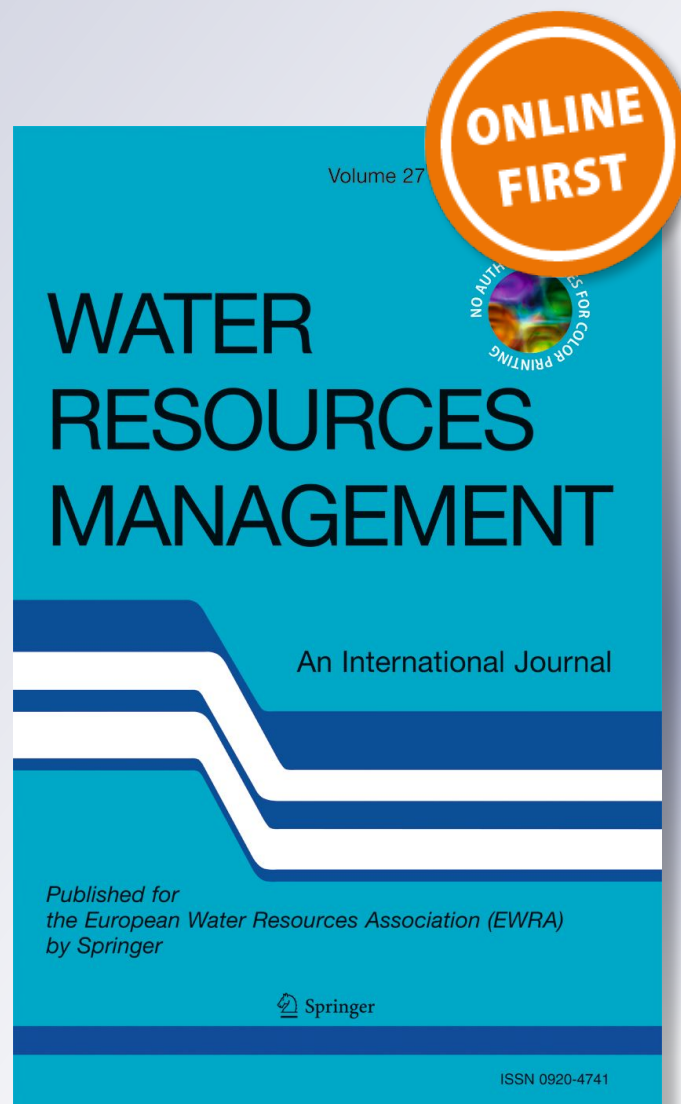
# *Water as a Weapon and Casualty of Conflict: Freshwater and International Humanitarian Law*

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# Water as a Weapon and Casualty of Conflict: Freshwater and International Humanitarian Law

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## Abstract

International humanitarian law has failed to adequately address and protect critical basic civilian infrastructure, especially water resources and managed water systems, because the laws themselves are insufficient or inadequately enforced. This paper addresses the role of violence against water and water systems in the context of international humanitarian laws. Data are presented that suggest an increasing trend of water-related conflicts and recent incidents of violence against natural or built water systems are described. Strategies for improving international systems for protecting critical water infrastructure are presented.

**Keywords** Water · Water systems · Environmental security · International law · International humanitarian law · Laws of war · Water conflict · Syria, Yemen, Iraq

## 1 Introduction

War, by definition, is a brutal, dehumanizing, destructive condition. Over thousands of years of human conflict, a mix of religious teachings, government policies, military guidelines, and international organizations have evolved a modicum of constraints and standards of conduct applicable in wartime – so-called *jus in bello* (“the law in waging war”) (Solis 2016). This body of norms, known as “international humanitarian laws,” has been developed primarily in the context of conflicts between states, although it provides some guidance for behaviors in subnational and civil conflicts. These norms restrict the use of certain kinds of actions, weapons, and behaviors especially against civilian populations, prisoners of war, medical personnel and facilities, and non-military property and infrastructure, including water resources and water systems.

After the direct human and environmental impacts of war and violence, one of the worst consequences for society is the potential for destruction of core elements of civilization and

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modern economic development – the potential for actual “de-development” (Kadri 2014). This has long been recognized, for example in the colloquial expression “bombed back to the stone age.” An early exposition of this philosophy is usually attributed to the late Air Force general Curtis Lemay, who in his 1965 memoir raised the idea of destroying “every work of man in North Vietnam” rather than negotiate a peaceful end to the war there (Lemay and MacKinlay 1965). In 2014, Texas senator Ted Cruz suggested his foreign policy approach to dealing with the Islamic State was to “bomb them back to the Stone Age” (Fox News 2014).

This is more than a brutal colloquialism. An extensive literature shows the adverse effects of conflicts on a wide range of core metrics of economic development. Over the past few decades, persistent war and violence has led to the de-development of cities, regions, and entire countries. Infrastructure has been destroyed, incomes and quality of life has plummeted, fertility, infant survival, and life expectancies rates have fallen, unemployment has soared, large numbers of people have been physically displaced from their homes and lives, and even the most rudimentary aspects of civil society have been challenged, including access to basic energy and safe water and sanitation (Brown and Langer 2012; Collier et al. 2003; Gates et al. 2012).

Existing laws of war as currently framed, interpreted, or applied have largely failed to prevent attacks on civilian water systems, and they do not appear to impose sufficient liability or accountability on governments in a way that offers effective constraints on military operations targeting such infrastructure. Part of the problem is that, in the context of freshwater resources and systems, existing international constraints are weak. Most of the focus of such laws has been to prohibit intentional attacks on civilians or to limit the use of specific instruments of war, including chemical and biological weapons. Less attention has been given to the secondary or indirect consequences of the destruction of civilian infrastructure, raising the question whether legal reforms are needed to more explicitly protect critical civilian water systems and infrastructure and improve enforcement of existing laws.

Despite the substantial body of international law developed over time, three specific problems are identified here, with the purpose of informing water experts and water policymakers about the nature of the links between a set of water challenges and offering a set of legal options for addressing them:

1. Current international laws of war inadequately protect water systems in the context of civil war or local conflicts.
2. Militaries inconsistently identify and differentiate among legitimate and illegitimate targets, and ambiguous language in current laws and agreements creates loopholes for the military.
3. Enforcement of laws of war, and punishment of violators of these laws, is rare and subjective.

## 2 Water Systems as Critical Civilian Infrastructure and Security Risks

Water and wastewater collection and treatment technologies, together with the institutions and experts who manage them, are a foundational aspect of modern civilization. Sophisticated water systems are responsible for the elimination and reduction of water-related illnesses and deaths, protect against floods and droughts, and provide reliable water supply to produce food for literally billions of people. They have reduced poverty and the brutal demands on women and girls forced to do backbreaking work collecting and carrying domestic water. And they are

central to the efforts to meet the global water-related Sustainable Development Goals (SDGs) for 2030 adopted by the UN and global community (United Nations 2016).<sup>1</sup>

Despite the central nature of water systems for modern society, hundreds of millions of people still lack safe and affordable water; over two billion lack adequate sanitation, and there are millions of preventable illnesses and deaths from water-related diseases every year (United Nations Joint Monitoring Programme 2017).

There are also close links between access to water, security, and social and political stability (Conca 2006; Gleick 1993; Postel 2000). The intelligence community in the United States has assessed the links between water, social tensions, state failure, and security concerns, at both subnational and the international levels. In 2012, the Office of the Director of National Intelligence produced several key conclusions related to the use of water as a weapon, political leverage, and terrorism, including:

- “water problems—when combined with poverty, social tensions, environmental degradation, ineffectual leadership, and weak political institutions—contribute to social disruptions that can result in state failure.”
- “the use of water as a weapon or to further terrorist objectives also will become more likely beyond 10 years.”
- “some nonstate actors (terrorists or extremists) almost certainly will target vulnerable water infrastructure to achieve their objectives” and
- “water will also be used within states to pressure populations and suppress separatist elements”(Defense Intelligence Agency 2012).

### 3 The Destruction of Civilian Water-Related Infrastructure and Systems: Laws of War

International laws of war – or international humanitarian laws – protecting civilians and civilian infrastructure provide a framework relevant to attacks on civilian water systems and infrastructure. In theory, that framework prohibits intentionally targeting civilians, limits military attacks to military objectives, and requires that collateral damage against civilians not be excessive in relation to any military advantage gained. This category of law is typically called *jus in bello*: the rules governing the conduct of war.

Disdain for and prohibitions on using water as a weapon or intentionally targeting core civilian infrastructure are rooted in custom, religious rules, and ethical codes of behavior extending back thousands of years. Documents and texts from early Sanskrit, Jewish, Christian, Islamic, and other cultures provide guidelines for the conduct of war and the treatment of non-combatants. In the fourth century BC, Alexander the Great tore down defensive weirs built by the Persians along the Tigris River, describing attempts to block access along the river as “unbecoming to men who are victorious in battle”(Chinnock 1884; Hatami and Gleick 1994). In 1439, Charles VII of Orleans laid down a law that said that officers would be held responsible for ‘the abuses, ills and offences’ committed by the men they commanded (Rigney 2016). In the past century and a half, these guidelines have become more carefully and explicitly defined and codified.

<sup>1</sup> In the context of this paper, the terms fresh water and water systems include potable water, water for irrigation and other human uses, and adequate sanitation systems to safely remove and treat human wastes.

### 3.1 From the 1863 Lieber Code to the 1949 Geneva Convention

In the modern era, the evolution of codes of conduct during war into international laws and agreements began in the late 1800s. The Lieber Code of 1863, promulgated by President Lincoln during the U.S. Civil War, provided guidance for Union armies in the field (Lieber 1863). In part, it stated that

“Military necessity...does not admit of the use of poison in any way, nor of the wanton devastation of a district. It admits of deception, but disclaims acts of perfidy; and, in general, military necessity does not include any act of hostility which makes the return to peace unnecessarily difficult.” (Section 16)

“Nevertheless, as civilization has advanced during the last centuries, so has likewise steadily advanced, especially in war on land, the distinction between the private individual belonging to a hostile country and the hostile country itself, with its men in arms. The principle has been more and more acknowledged that the unarmed citizen is to be spared in person, property, and honor as much as the exigencies of war will admit.” (Section 22, emphasis added)

“The use of poison in any manner, be it to *poison wells, or food*, or arms, is wholly excluded from modern warfare. He that uses it puts himself out of the pale of the law and usages of war.” (Section 70, emphasis added)

The first Geneva Convention, protecting prisoners of war and wounded soldiers, was developed in 1864 and included similar language to protect non-combatants (Schindler and Toman 1988). In 1868, the St. Petersburg Declaration addressed the illegality of actions lacking a clear military purpose and introduced a limitation on certain destructive military tools (St. Petersburg Declaration 1868). The preamble to the Declaration states “the necessities of war ought to yield to the requirements of humanity” and “the only legitimate object which States should endeavor to accomplish during war is to weaken the military forces of the enemy” (Nijhoff 1915). In 1874, the Brussels Protocol expressly forbade “any destruction or seizure of the enemy’s property that is not imperatively demanded by the necessity of war” (Brussels Declaration 1874).

These early declarations informed more comprehensive international law that began to take shape with the 1899 and 1907 Hague Conventions and Declarations. The purpose of the 1907 Hague Convention was laid out in the preamble: “to diminish the evils of war, as far as military requirements permit” (Kalshoven 2016). It included the famous Martens Clause:

“Until a more complete code of the laws of war has been issued, the High Contracting Parties deem it expedient to declare that, in cases not included in the Regulations adopted by them, the inhabitants and the belligerents remain under the protection and the rule of the principles of the law of nations, as they result from the usages established among civilized peoples, from the laws of humanity, and the dictates of the public conscience.”

The Hague declarations include articles protecting basic infrastructure such as water systems, undefended towns, villages, dwellings, or buildings (Article 25), and call for sparing “as far as possible, buildings dedicated to religion, art, science, or charitable purposes, historical monuments” and medical facilities “not being used at the time for military purposes” (Article 27).

Following the Second World War, efforts were made to develop far broader legal protections for civilians and infrastructure expanding on the earlier Hague agreements. The 1949

Fourth Geneva Convention (United Nations Documents 1949) prohibits deliberate or indiscriminate destruction of property belonging to individuals or “the State, or to other public authorities” (Article 53) and “extensive destruction and appropriation of property, not justified by military necessity and carried out unlawfully and wantonly” (Article 147). The most explicit protections for water-related infrastructure, however, were not put in place until the addition of the 1977 Protocols to the Geneva Convention.

### 3.2 The 1977 Additional Protocols to the Geneva Conventions of 1949

Special attention must be given to the two Protocols to the 1949 Geneva Conventions adopted in June 1977 with entry into force in December 1978 (United Nations Documents 1977). Protocol I provides protection for victims of “international armed conflicts” while Protocol II protects victims of “non-international armed conflicts.” Both offer explicit language relevant to the protection of civilian water systems.

Protocol I limits the means and methods of warfare that cause “superfluous injury or unnecessary suffering” or “widespread, long-term and severe damage to the natural environment” (Article 35, paragraphs 1–3). It prohibits indiscriminate attacks on civilians and civilian infrastructure (Article 51, paragraphs 4–5). And it protects civilian infrastructure critical to the survival of civilian populations (with the same language used in Articles 13 and 14 of Protocol II):

“It is prohibited to attack, destroy, remove or render useless objects indispensable to the survival of the civilian population, such as foodstuffs, agricultural areas for the production of foodstuffs, crops, livestock, *drinking water installations and supplies and irrigation works*, for the specific purpose of denying them for their sustenance value to the civilian population or to the adverse Party, *whatever the motive*, whether in order to starve out civilians, to cause them to move away, or for any other motive.” (Protocol I Article 54, paragraph 2, emphasis added.)

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*” (Protocol I, Article 54, paragraph 3, emphasis added).

Article 56 of Protocol I and Article 15 of Protocol II prohibit attacks on infrastructure “containing dangerous forces” including explicitly “dams” and “dykes” if such attacks “may cause the release of dangerous forces and consequent severe losses among the civilian population.”

Article 57 of 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.

These agreements refined protections for civilians even when military objectives are claimed. At the same time, it required that combatants not endanger civilians by locating military targets in or near densely populated areas.

Other international declarations, laws, and agreements address the issue of protecting the environment and natural resources themselves from the consequences of war and conflict. The 1976 Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques includes specific protection of the “hydrosphere,” and Article 35, paragraph 3 of the 1977 Additional Protocol I, which 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.” The World Charter for Nature (and in similar language, the Stockholm Declaration and Rio Declaration), says that states shall “ensure that activities within their jurisdictions or control do not cause damage to the natural systems located within other States” and “nature shall be secured against degradation caused by warfare or other hostile activities” (United Nations General Assembly 1982).

### 3.3 Additional International Protections for Water and Water Infrastructure

Sowers et al. describe a wide range of additional international agreements, statements, and guidelines that also limit attacks on civilian infrastructure like water treatment and delivery systems (Sowers et al. 2017). For example,

- The 1990 Cairo Declaration on Human Rights in Islam states it is prohibited “to destroy crops or livestock, to destroy the enemy’s civilian buildings and installations by shelling, blasting or any other means” (Article 3(b) of the Cairo Declaration on Human Rights in Islam (CDHRI) (Cairo Declaration on Human Rights in Islam (CDHRI) 1990).
- The Rome Statute of the International Criminal Court (ICC), adopted in 1998, provides that “[i]ntentionally directing attacks against civilian objects, that is, objects which are not military objectives” constitutes a war crime in international armed conflicts (Article 8(2)(b)(ii) of the Rome Statute (International Criminal Court (ICC) 1998).
- The UN secretary-general stated in 1999 that “The United Nations [peacekeeping] force is prohibited from attacking, destroying, removing or rendering useless objects indispensable to the survival of the civilian population, such as foodstuff, crops, livestock and drinking-water installations and supplies” (Section 6.7) (United Nations Secretary-General 1999).

The humanitarian justification for these protections rests in part on the understanding that access to safe water and sanitation is critical for human health, and conversely, the destruction of water systems leads to enormous human suffering. The 1991 civil war in Somalia led to the extensive destruction of their water system, which in turn contributed to outbreaks of cholera affecting 55,000 people (Lorenz and Shaver 2003). The destruction of Yemen’s water system between 2016 and 2018 led to cholera outbreaks that as of March 2018 have killed an estimated 2200 people and sickened more than a million (Al Jazeera News 2018). These impacts are worsened when conflicts lead to population displacement and large numbers of refugees. As a result of these public health consequences, the International Committee for the Red Cross (ICRC) has long argued for stronger international humanitarian law to protect water systems and civilian experts who manage them (International Committee of the Red Cross (ICRC) 1994).

## 4 Data on Water and Water Systems as Casualties of Conflict

A comprehensive database of water-related conflicts (the Water Conflict Chronology) is maintained by the Pacific Institute.<sup>2</sup> The entries in the database include instances of violence or threats of violence related to freshwater resources and water system infrastructure, extending

<sup>2</sup> The Water Conflict Chronology is available at [www.worldwater.org](http://www.worldwater.org). As of January 2019 the database include over 650 entries.



back over 4500 years. The entries, with full citations, are grouped in three broad categories (Table 1): trigger, weapon, and casualty.

Entries are included when there is violence (injuries or deaths) or threats of violence (including verbal threats, military maneuvers, or shows of force) involving or relating to fresh water and managed water systems.

#### 4.1 Evolution of Water-Related Threats

In recent years, there has been an evolution in the methods, means, and frequency of attacks on civilian water infrastructure and in the types of groups involved in conflict. More conflicts are taking the form of persistent sub-national conflicts, urban warfare, and civil wars with multiple proxy participants. Traditional tools of war have been enhanced by “smart” missile delivery systems, robotic/drone technologies, and an expansion of computer warfare or “cyberterrorism” raising new forms of vulnerabilities for civilian infrastructure (World Economic Forum 2015).

An analysis of recent trends offers insights into the weaknesses and limitations of current international humanitarian law in this area. The latest update (January 2019) of the Water Conflict Chronology database identifies both the use of water as a weapon and specific attacks on water infrastructure and water systems: water systems as casualties of conflict. Figure 1 shows the number of recorded events, per year, since 1930 and the dramatic increase in recent years. When characterized by the type of conflicts, two trends can be seen since 1980: a shift from multi-state (nation-to-nation) conflicts toward intrastate-civil war-civil unrest events (Fig. 2); and an increase in attacks on water-service infrastructure, including dams, pipelines, water treatment plants, and distribution systems (Fig. 3).

All three figures show a significant and dramatic increase in the number of reported events after the mid-1980s. Because of changes over time in reporting tools and the quality of access to information, definitive conclusions about trends in water-related conflicts should be made with caution. Nevertheless, evaluating data over the past several decades when access to information has been relatively consistent suggests that incidences of water-related conflicts have been rising rapidly. Two possible explanations for the increase are possible: the first is an actual increase in the level of violence associated with water and water systems as a result of increasing water scarcity, an increase the strategic value of targeting and attacking water systems, or a combination of other political, demographic, and strategic factors; the second is that the increase in reported events is the result of changes in the nature of reporting and the improved accessibility of news events rather than a change in the actual nature of conflict. Our research has not yet been able to determine which of these factors, or what combination of

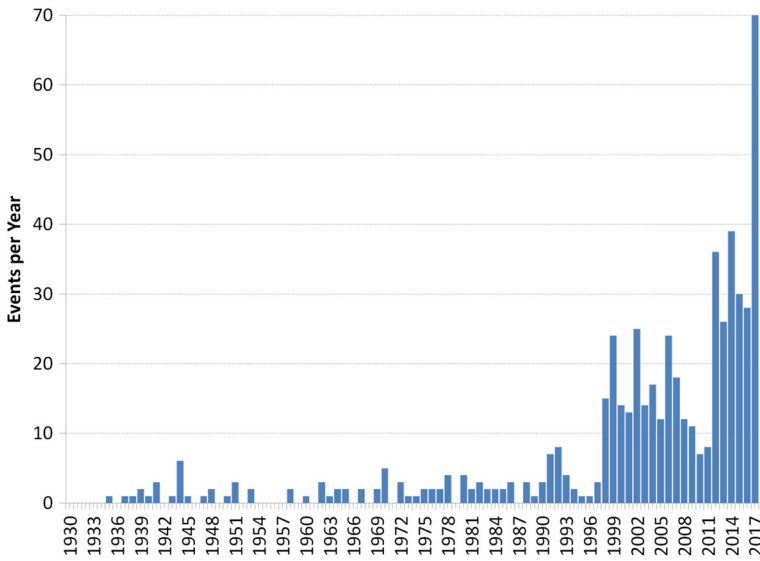
**Table 1** Water Conflict Chronology Categories of Conflict

Each entry in the Water Conflict Chronology is coded as one or more of the following actions of states, nonstate groups, individuals, or a combination of actors in the context of fresh water resources or managed water systems and infrastructure.

“**Trigger**” Water as a trigger or root cause of conflict: where economic or physical access to water, or scarcity of water, triggers violence.

“**Weapon**” Water as a weapon of conflict: where water resources, or water systems themselves, are used as a tool or weapon in a violent conflict.

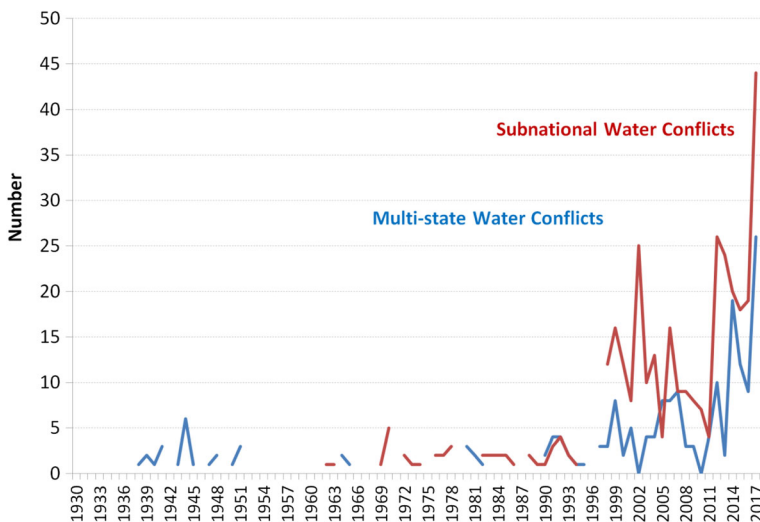
“**Casualty**” Water resources or water systems as a casualty of conflict: where water resources, or water systems, are intentional or incidental casualties or targets of violence.



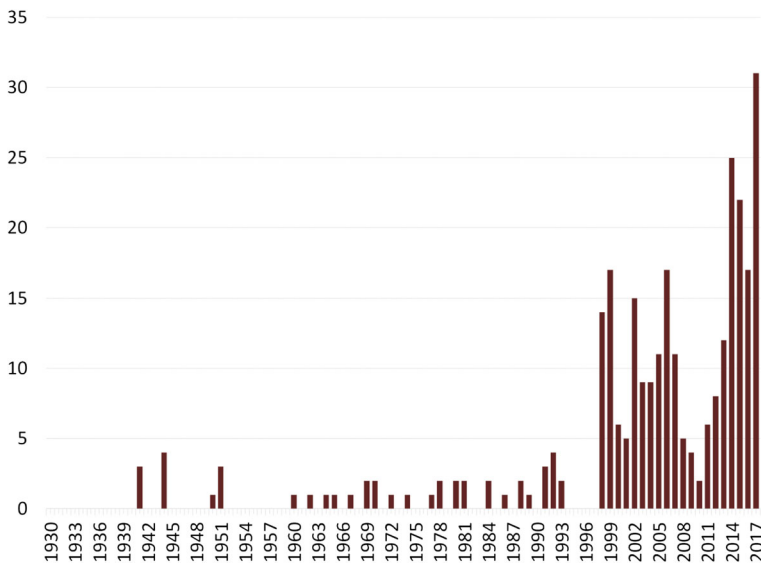
**Fig. 1** Water conflict events, number per year, 1930 to 2017. Data from the Water Conflict Chronology, <https://www.worldwater.org/water-conflict/>

these factors, accounts for the increase, and we look forward to future efforts to address this question.

While the use of water as a weapon and attacks on water systems can be found in every time period and on every continent, the past decade has seen a dramatic increase in such attacks focused in the Middle East region, particularly Iraq, Syria, Yemen, and involving civil conflicts with major outside and proxy forces (Cunningham 2014). In 2017, for example, the spike in total numbers is a result of a combination of two separate problems: an intensification of violence overall in the Middle East (as noted above) and an increase in incidences in Africa



**Fig. 2** Water-related violence through 2017: Multi-state water conflict events (blue) compared to subnational water conflict events (red). Data from the Water Conflict Chronology, <https://www.worldwater.org/water-conflict/>



**Fig. 3** Water systems as casualties or targets of conflict, incidents per year, from 1930 to 2017. Data from the Water Conflict Chronology, <https://www.worldwater.org/water-conflict/>

resulting from disputes over access to scarce water due to rising populations and extensive droughts.

## 5 Limitations and Failures of Current International Humanitarian Law

### 5.1 Application of International Laws of War to Civil War and Sub-National Violence

Recent trends in attacks on water systems highlight problems with the protections offered by current humanitarian laws of war. Most constraints on actions during conflict have been formulated in the context of interstate war, not civil wars, subnational conflicts, or local internal violence. As the UN notes, about 80% of the victims of armed conflicts since 1945 have been victims of non-international conflicts (United Nations 1977). Evaluating the data from the Water Conflict Chronology, a clear shift in recent years can be seen toward subnational (intrastate-civil war-civil unrest) events (Fig. 2), precisely the kinds of conflicts that the 1977 Additional Protocols were supposed to address. Two key problems are identified here: the ambiguity of language in the laws of war that fail to constrain military actions, and the lack of enforcement of existing constraints by the international community.

### 5.2 Challenges of Military Compliance: Identification of Legitimate and Illegitimate Targets; Ambiguity of Language

Militaries inconsistently identify and differentiate among legitimate and illegitimate targets, and ambiguous language in current laws and agreements creates uncertainty as to what is required and could even be seen to leave loopholes in the legal regime. Language in the international conventions and protocols requires, in its most generic form, that militaries discriminate

between legitimate and illegitimate targets, but there is no clear guidance for how to do this beyond the concept of military “necessity” and “proportionality” – taking account of the nature of the threat being addressed and the magnitude of the military response (McMahan 2004).

Specifically, Article 52 of the 1977 Additional Protocol I defines legitimate and illegitimate military targets as follows:

“In so far as objects are concerned, military objectives are limited to those objects 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.”

Similarly, Article 17 of Protocol II states (*italics added*):

“The displacement of the civilian population shall not be ordered for reasons related to the conflict *unless the security of the civilians involved or imperative military reasons so demand.*”

Some nations or governments make efforts to provide guidance to their armed forces. In 1993, in a report to Congress on the protection of natural and cultural resources during times of war, the US Department of Defense stated:

“... Cultural property, civilian objects, and natural resources are protected from intentional attack so long as they are not utilized for military purposes (United States Department of Defense (DoD) 1998).

Similar guidance is provided in the United States Naval Handbook:

“Naval commanders must take all reasonable precautions, taking into account military and humanitarian considerations, to keep civilian casualties and damage to the minimum consistent with mission accomplishment and the security of the force” (United States Department of the Navy 2007).

The United Nations has promulgated similar rules for military forces under UN control (United Nations Secretary-General 1999).

“The United Nations force is prohibited from attacking, destroying, removing or rendering useless objects indispensable to the survival of the civilian population, such as foodstuff, crops, livestock and drinking-water installations and supplies.

The United Nations force shall not make installations containing dangerous forces, namely dams, dikes and nuclear electrical generating stations, the object of military operations if such operations may cause the release of dangerous forces and consequent severe losses among the civilian population.”

Even these guidelines, however, are sufficiently ambiguous to impose few actual constraints on operational efforts in the field. For military commanders, this wording and the concepts of “circumstances ruling at the time,” “imperative military reasons,” and “definite military advantage” open the door to broad and subjective interpretation, and, as noted above, large numbers of actual attacks on civilian water infrastructure. As Falk notes:

“Existing standards embodied in the law of war are easily and consistently subordinated to ideas of ‘mission accomplishment,’ and impose almost no discernable restraints” and

“in ultimate matters of war and peace, law and morality are to be ignored if adherence interferes with the attainment of military objectives”(Falk 2000).

### 5.3 Problems of Enforcement

Even when violations seem clear and unambiguous, enforcement of laws of war and punishment of violators of these laws, are rare and subjective. In theory, the States party to the Geneva Conventions have an obligation to enforce its provisions and to bring to trial persons who have allegedly violated its provisions. A major challenge to reducing the use of water or water systems as weapons or targets of conflict has been the apparent inability or unwillingness of nations – especially the victors in specific conflicts – to enforce relevant provisions or acknowledge and prosecute their own violations. This latter issue is also known as “victor’s justice” – the idea, most prominently illustrated by critics by citing the Nuremberg Tribunal and other war crimes tribunals established following the Second World War, that the victor in a conflict declares that actions taken during or after the conflict were appropriate and just, and that they were necessary and proportionate (McMahan 2004).

As an alternative, international tribunals or courts have been set up to provide another route to enforcement. The Rome Statute, for example, established a permanent International Criminal Court (ICC) to handle war crimes, crimes against humanity, and violations of international humanitarian law when national governments fail to do so (United Nations 1998).

Perhaps the only example of the International Criminal Court directly addressing violations of international humanitarian law in the context of water resources is the indictment of Omar Hassan Ahmad Al Bashir. Al Bashir is, as of this writing, president of the Republic of the Sudan but he has been indicted on five counts of crimes against humanity, two counts of war, and three counts of genocide for actions he ordered in Darfur, Sudan. Among the specific charges are crimes including the contamination of “the wells and water pumps of the towns and villages primarily inhabited by members of the Fur, Masalit and Zaghawa groups that they [Government of Sudan forces] attacked” (International Criminal Court 2018). Despite these indictments, the ICC has been unable to arrest him and act on the indictment. However, the indictments do restrict Bashir’s movement significantly, since other countries that are parties to the ICC Statute would be required to transfer him to the ICC if he entered their territories.

## 6 Conclusions and Proposed Next Steps

Water resources and the infrastructure built to collect, clean, and deliver water and water-related services are vital elements of modern society, critical for human well-being and health. As such, they are covered by international humanitarian law and both formal and informal agreements that explicitly protect civilians and civilian infrastructure from armed conflict. Yet while applicable principles of international humanitarian law appear to be premised on the assumption that such resources and infrastructure would only be damaged collaterally rather than intentionally, there has in fact been a serious escalation of attacks on those water systems in the past few decades in both international and non-international armed conflicts, leading to large numbers of refugees, public health crises, and deterioration of economic and social standards of living. While there are a significant number of legal and institutional prohibitions

against such attacks, they have not been effective at preventing this escalation. Four strategies could help reduce the risks of such actions in the future.

1. International agreements and laws should be strengthened to prohibit wartime environmental damage and targeted “de-development” efforts, and non-signatories should be encouraged to become parties to relevant international laws and agreements.

Core civilian infrastructure that provides basic resource services, including especially water and sanitation systems, are explicitly protected in current international laws of war, but greater clarity is needed to reduce the ambiguity in exceptions for military gain. Targeted and extreme “de-development” actions serve no justifiable military purpose and should be prohibited. Countries that are not currently bound by existing laws of war should be encouraged to become parties to the relevant agreements.

2. Militaries and subnational armed groups should clarify and strengthen internal rules protecting civilians and civilian infrastructure.

In all armed conflicts, conflicting parties should be explicitly informed about prohibitions against attacking civilian water resources supply, distribution, and treatment systems, including electricity systems that power water systems. As a foundation for such information campaigns, the UN General Assembly should issue clear guidelines summarizing international humanitarian law protecting water facilities and such guidelines should be formally adopted by national militaries and subnational militias in training and operational rules. They should also be widely distributed, by traditional means as well as through social media and other relevant internet channels, with the object of reaching non-traditional armed groups.

3. National governments and international legal institutions should prosecute violations of international humanitarian laws that protect water resources and water systems.

Until and unless nations and international legal tribunals prosecute violations of international laws of war, there will be little disincentive for such acts. Successful prosecution of abuses can serve as a deterrent against further violations.

4. Improve the resilience and reliability of civilian water systems.

One option sometimes discussed in the context of protecting civilian infrastructure is “hardening” or expanding protection of such facilities. In February 2017, the UN Security Council adopted a resolution calling on member states to explore ways to assess vulnerabilities, interdependencies, and capabilities of critical infrastructure in the context of potential terrorist attacks including cyberattacks, encouraging states to improve the resilience and reliability of such infrastructure (United Nations Security Council 2017). While such efforts offer advantages in the context of recovering from extreme natural disasters, no affordable level of physical protection of water systems can prevent their destruction in the face of intentional military attacks. This highlights the point that while improvements in the design and protection of civilian water systems are valuable and needed in many places, those economic investments alone are not enough to ensure their protection and continued operation in the face of conflict.

In sum, the present system of laws and agreements protecting water and the infrastructure necessary to deliver it isn't working well enough. Intentional attacks on these systems are becoming alarmingly common. When combined with the incidental harm to them that often results from armed conflicts, the international community is faced with a serious, and growing, problem. This paper has proposed a set of relatively modest measures to address this problem. Recent research and communications projects are tackling these challenges, such as the Water, Peace, and Security Initiative (WPSI) involving the World Resources Institute (US), the Pacific Institute (US), Deltares (the Netherlands), the Hague Centre for Strategic Studies (the Netherlands), Wetlands International (the Netherlands), Oregon State University (US), International Alert (UK), and IHE-Delft (the Netherlands). In addition to such efforts, recent interest at the United Nations Security Council and Secretary General's office also suggests that water and conflict challenges are rising on the international agenda. The suggestions and recommendations above can be taken by States, the UN, and non-governmental groups and can help affirm "the dignity and worth of the human person," and "promote social progress and better standards of life in larger freedom" (United Nations 2015).

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## Compliance with Ethical Standards

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