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Water, Conflict, and Peace: A Decade of Developments

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Abstract

This article examines the evolving relationship between water, conflict, and peace over the past decade. It analyzes transboundary disputes, ranging from the Grand Ethiopian Renaissance Dam to the Helmand River alongside attacks on water infrastructure in Ukraine, Gaza, and Syria, leaving millions without access to safe water. Despite advancements in international legal frameworks to protect water and access to water services, the analysis underscores persistent gaps in implementation and enforcement. The article identifies priority areas for strengthening water protection and cooperation: consolidating legal norms, enhancing accountability mechanisms, integrating scientific approaches, adopting inclusive governance, and embedding water security in peacebuilding efforts.

Keywords: Water; conflict; peacebuilding; infrastructure; international law; governance; accountability

Introduction

With the destruction of the Nova Kakhovka Dam in Ukraine in June 2023, catastrophic flooding displaced thousands of people and devastated ecosystems downstream — a stark illustration of water infrastructure's vulnerability in modern warfare. In Gaza, repeated attacks on water and sanitation facilities have left the civilian population facing acute water insecurity, keeping in sharp focus the humanitarian consequences when water systems collapse during conflict. Simultaneously, along the Nile Basin, the recent entry into force of the Nile Basin Cooperative Framework Agreement in October 2024 following South Sudan's ratification has significantly altered the governance landscape, even as tensions persist between Ethiopia, Egypt, and Sudan over the Grand Ethiopian Renaissance Dam (GERD). These contemporary flashpoints underscore the precarious relationship between water, conflict, and peacebuilding that has evolved dramatically over the past decade.

The physical geography of water conflict has expanded markedly. The Transboundary Freshwater Diplomacy Database catalogs 313 international river and lake basins, a significant increase from 214 basins identified in 1978, and also includes groundwater aquifers and wetlands (McCracken and Wolf, 2019; TFDD, 2024). This expansion reflects not just improved mapping techniques but fundamental geopolitical shifts—the Soviet Union's dissolution transformed once-domestic waterways into international ones, while new states like South

Sudan reconfigured riparian relations within established basins (Salman, 2011). These shifts have occurred as climate change intensifies hydrological uncertainty, challenging water-sharing frameworks conceived many decades ago (Petersen-Perlman et al., 2017).

The tactical targeting of water infrastructure has emerged as a disturbing dimension of modern warfare. From bombed pipelines in Colombia to destroyed desalination facilities in Yemen, water systems have become both casualties and weapons of conflict. The deliberate severing of water supplies in conflict zones from Syria to Sudan reveals how water deprivation functions as an increasingly common method of warfare, often in defiance of international humanitarian law (Weinthal and Sowers, 2019).

Transboundary tensions have similarly intensified across multiple watersheds. The GERD on the Blue Nile continues to generate friction between Ethiopia, Egypt, and Sudan despite years of negotiation attempts (Helal and Bekhit, 2023). Afghanistan's Qosh Tepa Canal project has provoked anxiety among Central Asian neighbors who were not consulted on its development. Iranian and Taliban forces exchanged fire along the Iranian-Afghanistan border in 2023 over diminished flows in the Helmand River. These cases demonstrate how upstream development increasingly collides with downstream water security concerns, particularly in regions with limited institutional capacity for conflict resolution (Yihdego et al., 2017; Dagnes, 2023).

Yet alongside these challenges, the past decade has witnessed meaningful progress in the development and codification of international legal frameworks. The International Law Commission's *Principles on the Protection of the Environment in Relation to Armed Conflicts* (PERAC) in 2022 and the International Committee of the Red Cross's (ICRC) 2020 updated *Guidelines on the Protection of the Natural Environment in Armed Conflict* represent significant advances in codifying obligations toward environmental protection during warfare (ILC, 2022; ICRC, 2020). UN Security Council Resolutions 2417 (2018) and 2573 (2021) have elevated water infrastructure protection to a matter of international peace and security. The human rights framework has similarly evolved, with formal recognition of both the right to water and the right to a clean environment strengthening protection for water resources.

International courts and tribunals have played an increasingly vital role in clarifying and enforcing these norms. The International Court of Justice's judgment in *Costa Rica v. Nicaragua* established that environmental damage, including harm to water resources, is compensable under international law (ICJ, 2018). Similarly, international criminal accountability mechanisms have begun to address environmental crimes, with proposals to recognize ecocide as an international crime, potentially representing a transformative development for water protection.

This article examines the interplay between water, conflict, and peace over the past decade, arguing that despite persistent challenges, meaningful progress has been made in developing legal and institutional frameworks for water protection and cooperation. The progressive development of international law and its application to water resources in conflict-affected areas represents a particularly promising trend. However, implementation gaps remain substantial, with fragmented governance, technical capacity deficits, cuts in global funding, and accelerating

climate change all complicating efforts to translate normative advances into effective protection mechanisms. Through regional case studies and the examination of legal, institutional, and technical developments, this article assesses how water's relationship with conflict and peace has evolved, identifying crucial pathways for strengthening water security in an increasingly water-stressed and turbulent world.

Water Disputes and International Political Conflict

While water conflicts can transpire at the national and subnational levels, much attention has focused on transboundary water conflicts. Despite more than 600 international water agreements signed since 1820, many existing agreements are increasingly unable to account for shifting dynamics in water needs, climate patterns, and political relationships across countries and increasingly within countries (Giordano et al., 2014). As such, water cooperation is likely to wane and conflicts to emerge in basins where agreements are less adaptive, inclusive, or responsive to all riparians, especially for conflict-affected countries such as Afghanistan, Syria, and Sudan, for example, where reconstruction will require rebuilding the water system and addressing ongoing water demands to expand the agricultural sector (De Stefano et al., 2017). Many of these transboundary water disputes are, thus, a result of countries seeking to alter water sharing arrangements or unilaterally undertake infrastructural development to meet domestic demand for additional water.

The Grand Ethiopian Renaissance Dam on the Blue Nile represents one of the most significant water conflicts in recent years. As Africa's largest hydroelectric dam, it has become a flashpoint for regional tensions between Ethiopia, Egypt, and Sudan (Yihdego et al., 2017). For Ethiopia, the dam represents a crucial development project to alleviate chronic electricity shortages and drive economic growth, with investments exceeding \$5 billion. For Egypt, which depends on the Nile for approximately 90% of its freshwater needs, the GERD poses an existential threat to water security and undermines the 1959 Treaty between Egypt and Sudan over the utilization of the Nile's waters (Wheeler et al., 2020). Egypt fears that during periods of drought, the dam's operation could significantly reduce water flow downstream, affecting its agricultural productivity and drinking water supplies (Helal and Bekhit, 2023).

Despite multiple mediation attempts by the African Union, the United States, and the World Bank, negotiations have failed to produce a binding agreement on filling and operation protocols. Ethiopia's unilateral decision to proceed with dam filling has further inflamed tensions, prompting military threats from Egypt. Since 1999, the World Bank has worked with the Nile Basin countries to foster technical cooperation to address the power asymmetries among the riparian states. The Nile Basin Cooperative Framework Agreement (CFA), which entered into force in October 2024, will establish a Nile Basin Commission to replace the Nile Basin Initiative, potentially creating a more comprehensive governance structure (Salman, 2024; Tignino, 2024). However, Egypt and Sudan have not signed the CFA, highlighting the continuing divisions in the basin.

The water disputes between Afghanistan and Iran over the Helmand River exemplify how post-conflict reconstruction can exacerbate transboundary water tensions. The relationship is governed by the 1973 Helmand River Treaty, which allocates 26 cubic meters per second annually to Iran (22 cubic meters as the base allocation plus 4 cubic meters as a gesture of "goodwill and brotherly relations"), with additional provisions during high-flow years (Palmer-Moloney, 2014). What makes this situation particularly complex is that during Afghanistan's decades of conflict, it was unable to fully utilize its allocated water resources, resulting in Iran receiving more water than was officially designated under the treaty; however, as Afghanistan has begun rebuilding and using more of its rightful allocation in recent years, tensions have intensified significantly (Dagres, 2023).

Recent tensions have escalated following Afghanistan's upstream infrastructure development, particularly the Kamal Khan Dam, which opened in 2021 for hydroelectric power generation and irrigation. Iranian officials have repeatedly voiced concerns about water shortages in the eastern province of Sistan-Baluchistan, directly attributing these shortages to Afghan water projects. The situation is compounded by severe drought conditions affecting the entire region, making it increasingly difficult to satisfy the competing water demands of both countries. These tensions have now escalated beyond diplomatic disagreements to military confrontation, with Iranian and Taliban forces exchanging heavy gunfire at the border in May 2023, marking a dangerous escalation in this water rights conflict (Gambrell, 2023). From an international water law perspective, the 1973 agreement has proven inefficient given the lack of ratification by the two countries. Beyond allocations that fail to align with current needs, the agreement provides for a Commission and dispute settlement through arbitration, mechanisms that have not been implemented (Nagheeby, 2024).

When Central Asian states gained independence in 1991, they negotiated a series of water agreements to share the Amu Darya and Syr Darya and to mitigate the desiccation of the Aral Sea (Weinthal, 2002). Yet, Afghanistan was not a party to any of these agreements despite being a riparian on the upper reaches of the Amu Darya. While upstream Central Asian states like Tajikistan have built dams for hydroelectricity (such as the Rogun Dam on the Vakhsh River), Afghanistan has only recently begun to harness upstream waters to develop its agricultural sector. The Qosh Tepa Canal project represents this ambition, designed to divert water from the Amu Darya to irrigate up to 550,000 hectares in northern Afghanistan (Kuchins et al., 2024). This project has revealed a significant governance gap resulting from Afghanistan's earlier exclusion from regional water agreements.

Of particular note was a significant diplomatic breakthrough in June 2022 – an agreement between Tajikistan and Uzbekistan whereby Uzbekistan committed to importing energy produced by the Rogun dam. This bilateral arrangement demonstrates how water-related disputes can sometimes find resolution through creative approaches that address multiple sectors (in this case, linking water management with energy trade). However, this arrangement still excludes Afghanistan from the broader water governance framework.

Beyond these specific cases, several other regions face escalating water tensions. Turkey's Southeastern Anatolia Project, which started in the 1960s and includes 22 dams on the Tigris

and Euphrates rivers, has significantly reduced downstream flows to Syria and Iraq, contributing to water scarcity and agricultural challenges. The 1960 Indus Waters Treaty, which was negotiated and signed for the equitable use of water between India and Pakistan, has come under increasing strain as both nations develop water infrastructure and face growing water demands (Tignino, 2016). India's construction of dams on the western rivers has raised concerns in Pakistan about potential water manipulation, and the treaty has remained on shaky grounds as India over the last decade has periodically threatened to renege on the terms during conflicts with Pakistan. Often considered one of the most resilient water treaties, having withstood wars between India and Pakistan, the Indus Waters Treaty was suspended by India in April 2025 following a deadly terrorist attack in Kashmir (Kebebew et al., 2025).

In the Mekong, China's extensive dam construction on the upper reaches of the river has altered flow patterns downstream, affecting water availability in Thailand, Laos, Cambodia, and Vietnam. Limited data sharing and unilateral decision-making have further complicated management of this critical resource. Recent research on the Lancang-Mekong basin demonstrates that coordinated water-electricity cooperation between upstream and downstream countries could significantly improve both economic benefits and water equity, suggesting that collaborative management of the water-food-energy nexus offers a pathway to address these transboundary tensions (Zhang et al., 2023). Like the Tajikistan-Uzbekistan energy-water agreement, this approach suggests that addressing water disputes through integrated management of multiple sectors may be more effective than water-only negotiations.

Despite these promising examples of cooperation, a common pattern emerges: upstream countries increasingly view water infrastructure as a national development priority, while downstream countries perceive such development as threatening their water security. As climate change affects precipitation patterns and water availability, these tensions are likely to intensify.

Recent Attacks on Water and Water Infrastructure

In the past decade, water infrastructure has increasingly become both a target and tool of conflict, with attacks serving multiple strategic purposes while causing devastating environmental, ecological, and humanitarian consequences, and at times also exacerbating tensions between countries that share transboundary waters (Sowers et al., 2017).

Direct attacks on water treatment facilities, pipelines, pumping stations, and distribution networks have become more common in conflict zones (Schillinger et al., 2022). These attacks aim to deny civilian populations access to clean water and sanitation services in order to degrade civilian morale, force population displacement, or undermine the functioning of urban areas. In recent wars in Ukraine and Gaza, water infrastructure has been deliberately targeted, creating humanitarian crises and public health emergencies (Vyshnevskiy et al., 2023; Weinthal and Sowers, 2019). During the Syrian civil war from 2011 to 2024, water treatment plants and distribution networks in Aleppo and Damascus were repeatedly targeted, leaving millions without access to safe water (Wise, 2025). In rural areas of Somalia and parts of the Sahel, wells, irrigation systems, and water access points have been destroyed to displace populations

or undermine agricultural livelihoods. In coastal regions of Yemen, Saudi-led coalition attacks of civilian desalination facilities have reduced water supply to large populations with few alternatives. All these acts are in violation of international humanitarian law (The Water Diplomat, 2022).

While less common than physical attacks, threats of contamination of water supplies has emerged as a concerning form of warfare. Incidents of intentional poisoning of water sources have been reported in several conflicts, though verification remains challenging. Such attacks range from low-tech contamination with harmful substances to more sophisticated chemical agents. Indirect contamination of water sources can also occur through destruction of industrial facilities, wastewater treatment plants, or hazardous material storage near water bodies. These actions can render water unsafe for extended periods. A growing concern is the vulnerability of water treatment facilities to cyberattacks that alter chemical dosing systems or disable safety mechanisms. While few confirmed cases exist, several attempts have been documented, raising concerns about this emerging threat (Tignino, 2023).

Dams represent particularly significant targets due to their multiple functions. International humanitarian law is clear that dams must not be a target of attack owing to the release of “dangerous forces” that can cause harm to civilians (Additional Protocol 1, Article 56 (1) and Additional Protocol 2, Article 15). Belligerents, however, aim to capture and attack dams to impede troop movements, control water flow, disrupt hydroelectric power generation, and create flood risks for downstream populations. Major dams also represent significant national achievements and symbols of state power. Their destruction or capture can therefore carry important psychological and propaganda value beyond the immediate practical impacts. Concerns about dam safety have been highlighted in Ukraine, where the destruction of the Oskil Dam in September 2022 and the Nova Kakhovka Dam in June 2023 caused catastrophic flooding. In Iraq, the struggle for control of the Mosul Dam between 2014-2017 highlighted how such infrastructure can become central to military campaigns. In Sudan, attacks on power plants, water stations, and dams have intensified during the ongoing civil conflict, causing widespread service disruptions (ICRC, 2025).

Codification and Development of International Law

The last decade has seen codification and progressive development of international law protecting water resources and infrastructure during armed conflict. These developments have been led both by UN bodies and by other institutions. The UN has addressed water protection through its principal institutions: the General Assembly and Human Rights Council recognizing water as a fundamental human right, the International Law Commission developing principles on environmental protection in armed conflicts, and the Security Council acknowledging water-security links through resolutions. Complementing these efforts, other actors including the ICRC, the International Criminal Court, the Geneva Water Hub, and regional bodies have strengthened water protection frameworks. Regional initiatives, such as the Parliamentary Assembly of the Council of Europe's proposed feasibility study for a new legal instrument on environmental protection during armed conflicts and occupation (2023), further demonstrate the

growing international recognition of the need to protect water resources throughout all phases of conflict.

UN-led normative developments

Principles on the Protection of the Environment in Relation to Armed Conflicts

The International Law Commission (ILC), established by the United Nations General Assembly (UNGA) in 1947, is primarily tasked with the progressive development and codification of international law (UN Doc. A/RES/174(II)). One of its notable contemporary contributions are the Principles on the Protection of the Environment in Relation to Armed Conflicts (PERAC Principles), which were developed to “enhance the protection of the environment in relation to armed conflicts” (ILC, 2022). The PERAC Principles were developed in response to the growing recognition of the severe and lasting consequences of armed conflicts on the environment, which in turn undermines and complicates peacebuilding efforts (Dam-de Jong, 2020). The PERAC Principles address this destructive interplay by offering a comprehensive legal and policy framework grounded in international humanitarian law, criminal law, environmental law, and human rights law, as well as practices of state and non-state actors (Lehto, 2023). At the heart of the Principles is the understanding that sustainable peace is inseparable from protecting natural resources, which are essential to food and water security, cultural identity, and fundamental human rights (ILC, 2022, Preamble). Among these resources, water stands out as a vital asset in post-conflict societies, playing a key role in food security, economic recovery, poverty alleviation, and sustainable development (Troell and Weinthal, 2013).

The PERAC Principles call for measures to prevent, mitigate, and remediate environmental harm (Principle 2) before, during (whether international or non-international), and after conflict, including in situations of occupation (Principle 1). Although no PERAC principle explicitly addresses water resources or infrastructure, the framework offers them significant protection. Protecting the environment under the rules of international humanitarian law, including the principles of distinction, proportionality and precautions, applies equally to water (Principles 13 and 14). The Principles encourage the designation of protected environmental zones - ecologically or culturally significant areas that should be demilitarized and shielded from the impacts of armed conflict (Principles 4 and 18). They further prohibit the illegal and unsustainable exploitation of natural resources, particularly in occupied territories, where excessive or reckless use can cause long-term and irreversible harm (Principles 19 and 20).

There is also a Principle on the environmental responsibilities of peace operations, encouraging both the reduction of their ecological footprint and the conduct of post-conflict environmental assessments, thus contributing to the evolution of international legal standards (Principle 7). The Principles also strengthen frameworks for state responsibility, corporate due diligence and reparation, including the landmark recognition that pure environmental damage and harm to nature itself, even in the absence of direct human injury, is compensable (Principles 9, 10, and 11). The Principles further emphasize environmental justice, highlighting the rights and needs of indigenous communities, who often bear the greatest burden of environmental harm in conflict

zones (Principle 5). Finally, the Principles address the remnants of war, including unexploded ordnance and toxic pollutants, which often contaminate critical resources like water, and call for comprehensive remediation and recovery measures in post-conflict settings (Principles 24, 25, and 26).

The ICJ highlighted the importance of the PERAC Principles in its 2024 Advisory Opinion on the Legal Consequences arising from the Policies and Practices of Israel in the Occupied Palestinian Territory, including East Jerusalem (ICJ, 2024a). The Court referred to Principle 20 to affirm that the occupying Power must use natural resources, including water resources, in a sustainable way and its uses must not exceed the military needs of the occupying Power (para.124). In this regard, the Court also noted that “the occupying Power has the continuing duty to ensure that the local population has an adequate supply of foodstuffs, including water (Article 55 of the Fourth Geneva Convention)” (para.124).

Human rights-related developments

Water is recognized as a human right by the UNGA (A/RES/64/292 (2010)) and Human Rights Council (HRC) (A/RES/15/9 (2010)). The right is derived from the right to an adequate standard of living as enshrined in Article 11 of the International Covenant on Economic, Social and Cultural Rights (ICESCR), the right to health in Article 12 of the ICESCR, and the right to life under Article 6 of the International Covenant on Civil and Political Rights (UN Committee on Economic, Social and Cultural Rights, General Comment No.15, para.3). Access to water is a fundamental human right and essential for realizing all other human rights. States and entities, such as armed non-state actors, exercising control over populations must respect, protect and fulfill this right. Attacks on water systems and wastewater treatment plants violate the human rights to water and sanitation, which are indispensable for leading a life in dignity, while also infringing upon other critical rights. The fundamental nature of these rights, coupled with the scale and severity of impacts from their violations — which often carry long-term consequences for civilian populations — elevates these acts to serious human rights violations.

The recognition of the human right to a clean, healthy, and sustainable environment signals a significant shift in framing environmental protection, including access to safe water, as a fundamental human right rather than solely an environmental concern. This recognition has direct implications for the protection of water resources and infrastructure, especially in conflict situations where contamination, destruction, or denial of access to water can cause long-term harm to both human health and ecosystems. Under this framework, these acts can be viewed not only as a violation of international humanitarian law, but also as an infringement on a human right, reinforcing the legal and moral responsibility of states and armed actors to prevent and remedy such harm.

Protection of civilians in the UN Security Council

In recent years, the UN Security Council (UNSC) has increasingly acknowledged, in formal and informal discussions, the critical links between water, peace, and security, recognizing water not only as a development issue but also as a factor influencing stability and human security (see, e.g., S/PV.7818, 2016). For instance, the Arria-formula meeting convened by Switzerland and Mozambique in March 2023 emphasized the protection of water-related essential services and infrastructure for civilian populations during armed conflicts. The most recent Arria-formula meeting, held in May 2025 and convened by Slovenia in partnership with Algeria, Panama, and Sierra Leone, reiterated the urgent need to safeguard water resources and related infrastructure in conflict-affected areas. These discussions illustrate the UNSC's growing awareness of water's dual role as both a potential trigger for conflict and a vital element of peacebuilding and civilian protection.

The UNSC's two unanimously adopted Resolutions 2417 (2018) and 2573 (2021) are vital for water protection. The first one recalls the link between armed conflict and violence and conflict-induced food insecurity and underscores that better respect for international humanitarian law helps mitigate conflict-related food insecurity (S/RES/2417 (2018), paras. 1 and 2). It strongly condemns the starvation of civilians as a method of warfare, the unlawful denial of humanitarian access, and depriving civilians of objects indispensable to their survival (paras. 5 and 6). Resolution 2573 (2021) recognizes the interconnectedness of certain essential services and demands that all parties to armed conflict fully comply with their obligations under international humanitarian law regarding taking due care to spare the civilian population and civilian objects, and refraining from attacking, destroying, removing or rendering useless objects indispensable to the survival of the civilian population, and respecting and protecting humanitarian personnel and consignments used for humanitarian relief operations (para. 3). It reiterates the vital role that capacity building in international humanitarian law can play in supporting efforts to protect such objects (para. 8).

Moreover, the UN Secretary-General's annual reports on the protection of civilians in armed conflict recognize the impact of conflict on food insecurity and water availability and supply, causing contamination, the outbreak of deadly infectious diseases and malnutrition (S/2023/345 (2023), paras 2, 3, 72-89, and 90). The UN acknowledges that long-term peace and stability are closely intertwined with ensuring universal access to water and sanitation services (A/RES/70/1 (2015), 2 and Goal 6). The UNSC further encourages states to consider the human rights dimensions of peacebuilding, emphasizing the importance of equitable access to essential resources such as water during the post-conflict recovery phase (S/RES/2282 (2016), para. 11).

Normative developments by other actors

ICRC's Guidelines on the Protection of the Natural Environment in Armed Conflict

The International Committee of the Red Cross's (ICRC) Guidelines on the Protection of the Natural Environment in Armed Conflict build upon its earlier 1994 Guidelines, reflecting both

evolving legal interpretation and growing urgency surrounding environmental protection in modern warfare (ICRC, 2020). This instrument systematically analyzes international humanitarian law rules, demonstrating how provisions originally intended to protect civilians offer general or indirect environmental protection. It aims to guide warring parties, promote concrete protective measures, and reduce harm to conflict-affected communities.

The Guidelines specifically address the protection of water resources and infrastructure. They adopt an ‘intrinsic value approach’ and clarify that the term natural environment under international humanitarian law includes oceans, other bodies of water, and “natural elements that are or may be the product of human intervention,” including drinking water (ICRC, 2020, para.16). The Guidelines highlight risks associated with using water as a means or method of warfare, emphasizing its potential for indiscriminate effects (ICRC, 2020, paras. 79 and 82). Commentaries on proportionality, precautions, and specific weapons provide numerous examples of water-related harm, including pollution, contamination, damage to reservoirs, or damage to power plants that disrupts wastewater treatment systems (ICRC, 2020, para. 57). Rule 9 on passive precautions and Recommendation 17 (concerning demilitarized zones and non-defended localities) specifically address protecting ecologically important or fragile areas, including aquifers (ICRC, 2020, paras 114 and 208, respectively).

Draft Policy on Environmental Crimes under the Rome Statute

In a significant development for international legal accountability, the Office of the Prosecutor (OTP) of the International Criminal Court — an independent international tribunal separate from the UN system — has initiated a process to expand its focus on environmental harm within its prosecutorial priorities. Its draft policy on Environmental Crimes under the Rome Statute signals a stronger commitment to addressing serious environmental harm under international criminal law (ICC, 2024a). The policy emphasizes that environmental destruction – including ecosystem damage, illegal exploitation of natural resources, and attacks on water infrastructure – can constitute core international crimes such as war crimes, crimes against humanity, and genocide when linked to human suffering or widespread harm. For instance, “deliberately inflicting on the group conditions of life calculated to bring about its physical destruction in whole or in part,” such as denying access to water, could constitute genocide (UN, 1948). This approach could strengthen water resources protection by framing water-related crimes as prosecutable offenses and enhancing accountability for violations.

Geneva List of Principles on the Protection of Water Infrastructure

The Geneva Water Hub developed the Geneva List of Principles on the Protection of Water Infrastructure as a follow-up to recommendations from the Global High-Level Panel on Water and Peace’s 2017 report *A Matter of Survival* (Geneva Water Hub, 2019). This non-binding set of guidelines represents the first comprehensive effort to systematize international legal rules relevant to water infrastructure protection, drawing from international humanitarian law, human rights law, international environmental law, and international water law. The Principles also

propose recommendations extending beyond existing legal frameworks. They aim to clarify the application of current legal protections to water resources infrastructure before, during and after armed conflicts and encourage both states and non-state armed groups to adopt stronger compliance and preventive measures to safeguard water systems (Gleick, 2019).

The Geneva Principles embody a broader initiative to prevent the harmful impacts of armed conflicts on water resources and to enhance the protection of civilian populations and the environment. The Global Alliance to Spare Water from Armed Conflicts, a joint initiative launched in 2024 by the Geneva Water Hub and the governments of Slovenia and Switzerland, actively promotes the dissemination and implementation of the Geneva Principles as part of its objectives.

Armed Non-State Actors and Deed of Commitments

The role of armed non-state actors in protecting water resources and infrastructure has gained increasing attention in recent years. A significant initiative is Geneva Call's Deed of Commitment on the Prevention of Starvation and Addressing Conflict-Related Food Insecurity, which adapts international standards to enable such actors to publicly commit to international humanitarian law and human rights principles (Geneva Call, 2021). This Deed of Commitment is the latest addition to the four other Deeds of Commitment developed by Geneva Call on various thematic issues. Developing such instruments fosters compliance by granting them ownership of these rules and ensuring accountability for their actions. These Deeds of Commitment, witnessed by the Geneva Call and countersigned by leaders of armed non-state actors, are further secured through deposition with the Canton of Geneva, reinforcing their institutional significance. The specific Deed addressing conflict-related food insecurity and starvation prevention explicitly references water in its preambular section, emphasizing objects essential for civilian survival, including drinking water supply and installations. Thus far, only one armed group operating in the Democratic Republic of the Congo has signed this Deed of Commitment (Geneva Call, 2024).

The evolving recognition of the crime of Ecocide

There has been growing international attention to the crime of ecocide. At least twelve countries recognize ecocide as a crime in their domestic legislation; in 2024, Belgium became the first European Union country to do so, while the European Union included a "qualified offense" of ecocide in its revised Environmental Crime Directive (Gill and Enahoro, 2024). In 2024, Vanuatu, Fiji and Samoa formally submitted a proposal for amending Article 5 of the ICC Statute and including the crime of ecocide. According to this proposal, ecocide includes "unlawful or wanton acts committed with knowledge that there is a substantial likelihood of severe and either widespread or long-term damage to the environment being caused by those acts" (ICC, 2024b). This framing comes from the legal definition of ecocide provided by a panel of global experts in 2021 (Stop Ecocide Foundation, 2021). The concept aims to criminalize large-scale environmental harm, including destroying, polluting, or weaponizing water sources. If adopted,

the amendment to the ICC Statute could elevate deliberate or reckless damage to water resources and infrastructure, whether in times of conflict or peace, to the level of a prosecutable international offense. However, the proposed definition would require formal endorsement and adoption by states to become legally binding and enforceable.

From Law to Accountability: Applying and Enforcing International Law Protecting Water Resources and Infrastructure

A growing number of courts and tribunals are adjudicating cases related to wartime attacks on water resources and infrastructure, with most criminal cases focused on the targeting of dams. In Croatia, the Split County Court issued decisions convicting a commander (Borislav Djukic) and soldiers for the 1993 destruction of Peruca dam, which aimed to drown tens of thousands of people downstream—an illegal attack on civilians and civilian objects under Geneva Convention IV (art. 33), Additional Protocol I (art. 51), and Additional Protocol II (art. 13) (Prosecutor v. R. Radulovic et al., 1997; Vladislavljevic, 2018). Djukic's conviction was subsequently quashed by the Croatian Supreme Court, and his case is undergoing renewed prosecution (Vladislavljevic, 2019).

In response to numerous environmental war crimes committed by invading Russian forces, Ukraine created a Specialized Environmental Prosecutor's Office, within the Office of the Prosecutor General (OPGU) to investigate, prepare, and prosecute environmental war crimes cases. The office issued its first notice of suspicion for pillage in 2024 (OPGU, 2024) followed by two notices of suspicion in 2025 for Russian generals regarding the Oskil Dam destruction, charging them with war crimes and ecocide under Ukraine's criminal code (Global Rights Compliance, 2025).

While the International Criminal Court (ICC) has not issued arrest warrants specifically related to the targeting of the Nova Kakhovka or Oskil Dams, it did issue arrest warrants in 2024 for Sergei Kobylash, Viktor Sokolov, Sergei Shoigu, and Valery Gerasimov for targeting Ukrainian electric infrastructure—including charges of directing attacks at civilian objects, causing excessive incidental harm to civilians or civilian objects, and inhumane acts (ICC, 2024c; ICC, 2024d). Notably, the ICC's arrest warrant for Omar Al Bashir on genocide charges was partly based on the systematic poisoning of water sources (ICC, 2010; Gillett, 2018). The ICC's 2024 Draft Environmental Policy builds on this strategy by including wrongful targeting of water resources and infrastructure as evidence of crimes such as genocide (ICC, 2024a). Protecting critical water infrastructure from deliberate targeting during conflict is particularly important in transboundary basins, where damage can trigger cascading effects across borders, complicating post-conflict recovery and water-sharing arrangements essential for regional stability.

Beyond criminal accountability, numerous international courts, tribunals, and mechanisms have adjudicated claims against states, holding them financially accountable for wartime environmental damage, including damage to water resources and infrastructure. The UN

Compensation Commission awarded 109 claims totaling \$5.3 billion for environmental damage from the 1990-91 Gulf War, including water resources damage (Payne, 2016). Financial accountability for wartime environmental damage to water resources is especially crucial in transboundary contexts, where compensation can fund rehabilitation projects that restore water-sharing relationships and prevent renewed tensions over degraded resources during reconstruction.

The Eritrea-Ethiopia Claims Commission (E-ECC) considered whether to award damages for Ethiopian attacks on Harsile Water Reservoir, which provided drinking water for the town of Assab (E-ECC, 2005). The Commission determined the attacks violated Article 54 of Additional Protocol I (protecting objects indispensable to civilian population survival). However, finding no meaningful physical damage, it awarded no financial compensation (para. 105).

The International Court of Justice (ICJ) has decided two cases relating to conflict-related water resource damage. In the joined cases “Certain Activities Carried Out by Nicaragua in the Border Area” (Costa Rica v. Nicaragua) and “Construction of a Road in Costa Rica along the San Juan River” (Nicaragua v. Costa Rica), the ICJ clarified state obligations to compensate for environmental harm. Where Nicaragua allegedly occupied Costa Rican territory and affected water resource flows, the ICJ affirmed “damage to the environment, and the consequent impairment or loss of the ability of the environment to provide goods and services, is compensable under international law,” noting that compensation may include payment for environmental restoration (ICJ, 2018, para. 42). These judgments establish important precedents for how damage to transboundary water resources during conflict should be assessed and compensated, creating a legal foundation for post-conflict rebuilding of cooperative water management regimes damaged through conflict.

Based on the unlawful nature of Nicaragua’s activities in Costa Rican territory (including violations of territorial integrity), the ICJ reaffirmed that breaching international obligations entails a duty to make reparation (ICJ, 2018, para. 29). To award compensation, the Court needed to establish “a sufficiently direct and certain causal nexus between the wrongful act... and the injury suffered by the Applicant” (ICJ, 2018, para. 32). The ICJ acknowledged the complexities of environmental harm assessment, noting that “damage may be due to several concurrent causes, or the state of science regarding the causal link between the wrongful act and the damage may be uncertain” (ICJ, 2018, para. 34). It further held that “absence of adequate evidence as to the extent of material damage will not, in all situations, preclude an award of compensation for that damage” (ICJ, 2018, para. 35). The Court rejected both states’ methodologies for evaluating environmental damage, instead adopting “the ecosystem as a whole” perspective requiring overall assessment of the impairment or loss of environmental goods and services (ICJ, 2018, para. 78). This judgment represents a significant ICJ precedent on environmental compensation, encompassing reparation for both environmental goods and services impairment and restoration measures for internationally important wetlands. In a separate case regarding wartime environmental damage, the ICJ held Uganda liable for pillaging natural resources in eastern Democratic Republic of the Congo, awarding \$60 million in damages (ICJ, 2022a).

The Register of Damage Caused by the Aggression of the Russian Federation Against Ukraine, though in its early stages, warrants mention. Established in 2023 by the Council of Europe, following UN General Assembly Resolution A/RES/ES-11/5 on “Furtherance of Remedy and Reparation for Aggression against Ukraine” (UNGA, 2022), it processes claims for damage, loss, or injury in Ukraine from internationally wrongful acts by the Russian Federation after February 24, 2022. Claim categories include damage or destruction to critical infrastructure (categories B1.1 and C1.1), public buildings and facilities (B1.5), environmental damage (B3.1), and depletion or damage of natural resources (B3.2) (RD4U, 2024). Building on the Register, international negotiations are underway to create a Claims Commission for Ukraine (RD4U, 2025).

The past decade has seen increased use of ICJ advisory proceedings to clarify state rights and obligations regarding water access under the law of occupation. The 2024 Advisory Opinion on the Legal Consequences from the Policies and Practices of Israel in the Occupied Palestinian Territory, including East Jerusalem exemplifies this clarification, clearly stating that Israeli and Palestinian communities must have equal access to water supplies and meet WHO water quality standards (paras. 128 and 129). Currently, the ICJ is examining a request for an advisory opinion on “the obligations of Israel, as an occupying Power....to ensure and facilitate the unhindered provision of urgently needed supplies essential to the survival of the Palestinian civilian population” in the context of the armed conflict in Gaza (ICJ, 2024b).

International water law complements international humanitarian law in preventing and resolving water disputes. This is particularly valuable when transboundary waters are affected by armed conflict, as water law principles can guide restoration of cooperative management systems once hostilities cease. The UN global water conventions – the UN Convention on the Law of Non-Navigational Uses of International Watercourses (UNWC) and the UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes (UNECE Water Convention) – provide a common framework for riparian countries to share and protect transboundary water resources, including both surface and groundwater. Customary principles of international water law, such as the principle of equitable and reasonable utilization, the obligation to prevent significant transboundary harm, and prior notification of planned measures, serve as essential tools for preventing and peacefully resolving interstate water disputes. The 2016 amendment to the UNECE Water Convention represented an important step toward cross-fertilization of international water law principles across regions, transforming it from a regional into a global legal framework. As of April 2025, 12 African countries have joined this Convention, bringing total parties to 50, including the European Union. The UNWC and UNECE Water Convention are complementary at both substantive and procedural levels, providing common general principles to riparian states (McCaffrey, 2019; De Chazournes, 2021). The Meeting of the Parties (MOP) of the UNECE Water Convention provides the sole existing multilateral framework at the UN level offering a platform for sharing best practices and lessons learned among states, including non-parties to the Convention.

While the UNECE Water Convention functions as a living instrument of international water law, supporting the adoption of new freshwater agreements and the establishment of joint bodies, its application in international dispute resolution remains limited, with states rarely invoking it in international judicial proceedings. In contrast, states frequently reference the UN Watercourses Convention in transboundary disputes, as demonstrated in the “Dispute over the Status and Use of the Waters of the Silala” between Chile and Bolivia before the ICJ in 2022. Both countries extensively cited the UNWC to support their claims. Although the ICJ did not recognize Articles 11 and 12 of the UNWC concerning planned measures notifications as reflecting customary principles (ICJ, 2022b, paras. 112 and 117) it acknowledged the parties’ agreement that “the rules applicable to the Silala include, in particular, the right to equitable and reasonable utilization by riparian States, the exercise of due diligence to avoid causing significant harm to other watercourse States, and compliance with the general obligation to co-operate” (ICJ, 2022b, para. 146). This reaffirmed the ICJ’s earlier case law regarding the Gabčíkovo-Nagymaros (1997) and Pulp Mills on the Uruguay River (2010) cases regarding the customary status of equitable and reasonable use, the no-harm obligation, and the duty to cooperate.

The ICJ is not the sole international court resolving water disputes. Arbitration has played a significant role, exemplified by the Kishenganga Arbitral Tribunal, which sought to alleviate India-Pakistan tensions by specifying downstream water flow requirements from the KHEP dam on the Indus River (Permanent Court of Arbitration, 2013, para. 116). Following Pakistan’s initiation of new arbitration proceedings against India under Annexure G of the 1960 Indus Waters Treaty of 1960, the Arbitration Tribunal determined in 2023 that India’s non-appearance in the proceedings did not affect the Tribunal’s competence and that India’s recourse to the Neutral Expert did not preclude the Tribunal from judging the dispute on its merits (Award on the Competence of the Tribunal, July 2023). These arbitration mechanisms offer valuable pathways for resolving disputes over transboundary waters damaged during conflict, providing alternatives to renewed hostilities over increasingly scarce water resources.

International courts and tribunals play a vital role in preventing and managing water disputes. Since the Gabčíkovo-Nagymaros case in 1997, international dispute settlement mechanisms have clarified customary norms applicable to transboundary water resources where conventional law is absent or inadequate. When transboundary freshwater agreements do not adequately address current environmental challenges such as climate change and biodiversity conservation, joint bodies may develop specific agreements. For example, in 2010, the Sava River Commission developed a Protocol on Flood Protection to the Framework Agreement on the Sava River Basin to promote cooperation in the Balkan region and mitigate climate change impacts. Joint bodies may also advocate updating outdated agreements, as demonstrated by the 2012 Water Charter of the Lake Chad Basin, which aimed to amend the provisions of the 1964 Convention and Statute of the Lake Chad Basin Commission. International practice illustrates how parties to transboundary freshwater agreements can address critical environmental challenges through cooperation and legal agreement adaptation.

Accountability and advocacy beyond the legal system

Outside of the courtroom and the abovementioned legal mechanisms, different initiatives and actors are seeking to strengthen accountability toward international law and the protection of water systems during armed conflict through various avenues.

The UN Security Council Resolution 2573 on the protection of civilian infrastructure in armed conflicts, which was unanimously adopted by the Security Council in April 2021 (UN Security Council, 2021), and the Political Declaration on Strengthening the Protection of Civilians from the Humanitarian Consequences Arising from the Use of Explosive Weapons in Populated Areas (EWIPA), endorsed by 83 States in November 2022 and five additional States since then (as of January 2025) (UN Office for Disarmament Affairs, 2025), have been indicative of political will to strengthen the protection of civilians in armed conflict on the international stage. The Global Alliance to Spare Water from Armed Conflict provides an additional focus on water systems specifically (The Water Diplomat, 2024). Building on this political progress, institutional structures will be needed to uphold the commitments made. For example, signatories to the EWIPA Political Declaration committed to the monitoring and sharing of data on the direct and indirect impacts of explosive weapons, as feasible and appropriate. The identification of suitable monitoring processes and platforms for data sharing will be a crucial next step. Endorsing states additionally committed to providing comprehensive training for armed forces and implementing more robust standards for safeguarding civilians by adapting their national policies and practices.

Both on the international stage and within specific armed conflicts, the ICRC plays the key role in advocating for compliance with international humanitarian law. Most notably, this includes ICRC's work to ensure awareness of and adherence to international humanitarian law among the parties to an armed conflict, including both state and non-state actors, as part of its core mandate. However, the ICRC is also using its unique access to conflict parties to engage with the protection of water infrastructure and other civilian objects more directly, for example by negotiating access to damaged infrastructure for repair crews as in the case of the al-Khafsa water treatment plant in Syria, where the ICRC facilitated access of government engineers to the ISIS-controlled area after the plant had been damaged in 2015 (World Bank, 2017). By facilitating repairs to critical water infrastructure across conflict lines, such interventions preserve the physical basis for cooperation that will be essential during post-conflict reconstruction.

Supporting recent advocacy initiatives is a significant technical advancement in the monitoring of conflict impacts. More sophisticated and efficient monitoring approaches, especially those making use of remote sensing, are strengthening the evidence base on the impacts of armed conflict on water and expanding the possibilities of near real time monitoring of impacts in current conflicts. In addition to technological advancements, civic monitoring (i.e., the monitoring of impacts by conflict-affected populations themselves, for instance through citizen science approaches) and cross-sectoral monitoring approaches that make use of the interdependencies of different essential services, are increasingly applied to attain a more holistic picture of conflict

impacts. Recent studies on Gaza (Perlman et al. 2025) and Sudan (Asmally et al., 2025) serve as examples of the potential of such approaches for advocacy and accountability efforts and to inform humanitarian assistance. These advanced monitoring capabilities not only document violations but also generate useful data about the status of transboundary water systems that can inform post-conflict rehabilitation priorities and reduce tensions over water allocation during rebuilding efforts.

Whether they are engaging in humanitarian or development assistance, conflict monitoring or advocacy activities, the role of international organizations in conflict-affected water management systems can be controversial and lead to unintended harm in the absence of conflict sensitivity (Dowdeswell & Hania, 2014; Schillinger et al., 2023). Building on the experiences with water-related programming in conflict settings, the past decade has seen an increase in practical guidance documents to assist organizations in navigating such risks. For example, USAID's Water and Conflict Toolkit, first published in 2014 and updated in 2023 to reflect new insights, provides guidance on the design of conflict-sensitive interventions that can mitigate water-related conflict risks, the coordination with humanitarian and development actors in conflict-affected settings, and the development of programming that encompasses both emergency needs and long-term recovery and stabilization. It emphasizes the need for water programming to address institutional challenges, the varied needs of marginalized groups, the compounding effects of climate change on conflict-affected water systems and the need to enhance data sharing and transparency (USAID, 2023).

Progress, Missed Opportunities, and Gaps

The past decade has witnessed significant progress in the development of legal frameworks and the creation of a more robust normative framework that bridges humanitarian, environmental, and human rights law for the protection of water in fragile and conflict-affected contexts. The 2024 UN World Water Development Report reinforces this progress, emphasizing how water, when managed sustainably and equitably, can promote peace, while acknowledging that poverty, inequality, and conflict can intensify water insecurity (United Nations, 2024).

UN Security Council Resolutions 2417 (2018) and 2573 (2021) have elevated water protection to a central security issue, explicitly condemning attacks on water infrastructure and recognizing their devastating humanitarian consequences. The human rights dimension of water protection has gained substantial traction with the formal recognition of the right to a clean, healthy, and sustainable environment by both the Human Rights Council (2021) and the UN General Assembly (2022). Specialized instruments like the Geneva List of Principles on the Protection of Water Infrastructure and the EWIPA Declaration additionally demonstrate growing international recognition of water's vital importance in conflict settings.

Success stories in transboundary water cooperation offer powerful examples of water's potential as a peacebuilding tool, such as the case of the Sava River Basin, shared by Bosnia and Herzegovina, Croatia, Serbia, and Slovenia (Stec et al., 2011). Collaborative management has

fostered shared interests and institutional frameworks that contribute to regional stability since the early 2000s and continues to provide spaces to address emerging challenges (Komatina and Grošelj, 2014). Progress in judicial and accountability mechanisms has been equally noteworthy, with ICJ judgments establishing the precedent that environmental damage, including harm to water resources, is compensable under international law (*Costa Rica v. Nicaragua*) and emphasizing the need to pursue cooperation over shared waters (*Chile v. Bolivia*).

Despite these advances, significant missed opportunities have hindered the effective protection of water resources in conflict-affected areas. The destruction of the Nova Kakhovka Dam in Ukraine in June 2023 and the widespread damage to water infrastructure in Gaza since October 2023 illustrate the limitations of existing legal frameworks in preventing catastrophic attacks on water infrastructure. Enforcement mechanisms remain weak, and accountability for such violations is rarely achieved. Implementation gaps also persist across multiple dimensions of transboundary water management and water governance. Only 43 countries currently have operational arrangements for 90 percent or more of their shared water resources, despite 153 countries sharing transboundary river, lake basins, and aquifers (UNECE, UNESCO and UN-Water, 2024), and various examples mentioned in this article illustrate the complexities of attaining an equitable and sustainable sharing of transboundary waters in regions marked by fragility and conflict.

Climate change continues to add a layer of complexity to water governance in conflict settings. Existing water agreements often lack mechanisms to adapt to changing hydrological patterns, increasing water scarcity, and more frequent extreme weather events. As climate impacts intensify, the risk of water-related conflicts is likely to grow, particularly in regions already experiencing political tensions or armed conflicts. Recent scientific studies suggest that extreme water events – both floods and droughts – are becoming more frequent and severe, with potentially destabilizing effects on fragile regions. The failure to integrate climate considerations into water governance frameworks represents a significant missed opportunity to build resilience against future water-related conflicts. However, some steps are taken by states to integrate climate change conversations into multilateral frameworks such as the Meeting of the Parties of the UNECE Water Convention.

The Way Forward

Looking to the near future, several priority areas emerge for strengthening water protection in conflict settings. First, the consolidation and clarification of legal norms should continue, with a focus on integrating humanitarian, environmental, and human rights perspectives. The formal proposal submitted to the ICC in 2024 by Vanuatu, Fiji, and Samoa to recognize ecocide as an international crime represents a potentially transformative development. If adopted, ecocide would become the fifth international crime alongside genocide, crimes against humanity, war crimes, and the crime of aggression, creating accountability for severe environmental destruction, including deliberate attacks on water resources.

Second, institutional mechanisms for implementation, monitoring, and accountability require substantive reinforcement. This includes strengthening the capacity of international and regional organizations to support water cooperation in conflict-affected regions, developing more effective early warning systems for water-related tensions, and creating specialized groups to investigate and document attacks on water infrastructure during conflicts. The Global Alliance to Spare Water from Armed Conflict and the 2021 WASH Roadmap represent promising initiatives that could mobilize political support and technical resources for water protection in conflict settings. At the same time, initiatives such as the Transboundary Water Cooperation Coalition launched at the UN Water Conference of 2023, are promising tools to prevent the emergence or the escalation of water conflicts.

Third, the integration of the latest scientific knowledge into water governance is essential in addressing emerging challenges. The advancement of remote sensing technologies, hydrological modeling, and environmental impact assessment methods offers new opportunities for monitoring water resources in conflict zones, documenting environmental damage, and designing more climate-resilient water systems. These scientific tools should be systematically incorporated into water governance frameworks and made accessible to all stakeholders, including conflict-affected communities.

Fourth, inclusive approaches to water governance helps ensure that marginalized groups are not disproportionately affected by water-related conflicts (Offutt, 2022). Women, Indigenous communities, and other vulnerable populations often bear disproportionate burden when water infrastructure is damaged or access to water is restricted during conflicts. To increase their effectiveness, water governance frameworks should explicitly address equity dimensions and ensure meaningful participation of communities in decision-making processes.

Finally, the nexus between water, peace, and security must be more firmly embedded in international diplomacy and peacebuilding efforts. Water cooperation has repeatedly demonstrated its potential as a platform for dialogue even among adversaries. Building on this potential, water issues should be systematically integrated into peace processes, post-conflict reconstruction plans, and conflict prevention strategies.

Despite the challenges and setbacks of the past decade, there are grounds for cautious optimism regarding the future of water protection in conflict settings and the development of transboundary cooperation tools to prevent the emergence of water conflicts. The growing recognition of water's vital importance for human security, combined with advances in legal frameworks, institutional mechanisms, and technical capabilities, provides a foundation for more effective action. With sustained political commitment, adequate resources, and innovative approaches that bridge disciplinary and institutional boundaries, meaningful progress toward effective water protection and prevention of water conflicts are within reach. The stakes remain high — ensuring safe and peaceful access to water for all, including those living through armed conflicts, are fundamental imperatives for human dignity and peace.

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