
ENVIRONMENTAL DAMAGES IN ARMED CONFLICT: A CASE STUDY OF GAZA THROUGH THE LENS OF INTERNATIONAL ENVIRONMENTAL LAW

Ajithaa RN, B.A. LL.B. (Hons.), School of Law, M S Ramaiah University of Applied Sciences

ABSTRACT

Environmental damage has increasingly become a critical yet underexamined consequence of contemporary armed conflict. Traditional international humanitarian law primarily focused on regulating the conduct of hostilities and protecting civilians, while the ecological consequences of warfare received comparatively limited attention. However, modern conflicts frequently occur in densely populated regions where environmental systems, infrastructure, and civilian survival mechanisms are closely interconnected. As a result, military operations can cause extensive environmental degradation, including contamination of water sources, destruction of agricultural land and damage to ecosystems essential for public health and food security.

This study examines environmental damage in the Gaza conflict through the framework of international environmental and humanitarian law. It traces the historical evolution of environmental protection in armed conflict and analyses key legal instruments such as the Additional Protocol I to the Geneva Conventions and the Rome Statute of the International Criminal Court, which recognize severe environmental destruction as a potential violation of international law. The paper further evaluates the environmental consequences of the Gaza conflict, including damage to water infrastructure, marine ecosystems, and agricultural systems. Through comparative analysis with conflicts such as Vietnam, the Gulf War and Ukraine, the study highlights recurring patterns of wartime environmental destruction and identifies persistent gaps in legal accountability. The research ultimately argues for stronger legal protections and improved accountability mechanisms to address environmental harm in armed conflict.

Keywords: Environmental Damage in Armed Conflict, Gaza Conflict, International Humanitarian Law, Environmental Accountability, Wartime Ecological Protection.

Introduction

Environmental damage has become one of the most serious yet underexamined consequences of modern armed conflict. While the traditional laws of war primarily focused on regulating the conduct of hostilities and protecting civilians, the ecological impact of warfare has increasingly emerged as a critical legal and humanitarian concern. Armed conflicts today often occur in densely populated regions where natural resources, infrastructure, and civilian survival systems are closely interconnected. Destruction of water systems, agricultural land and industrial facilities can therefore trigger cascading environmental consequences that persist long after hostilities cease.

International organizations have repeatedly highlighted the scale of this challenge. Reports by the United Nations Environment Programme document hundreds of environmental incidents linked to armed conflicts worldwide, including contamination of water sources, destruction of ecosystems, and large-scale pollution caused by damaged infrastructure. Such environmental degradation not only harms ecosystems but also directly affects civilian populations by threatening access to clean water, food production, and public health systems.

The Gaza conflict presents a particularly significant case for examining the relationship between warfare and environmental harm. The Gaza Strip is a small and densely populated coastal territory with fragile environmental systems and limited natural resources. According to the World Health Organization, over 95 percent of Gaza's groundwater has long been considered unsafe for human consumption due to salinity and contamination. Damage to water infrastructure, sanitation networks and agricultural land therefore produces severe ecological and humanitarian consequences.

This study analyses environmental damage in the Gaza conflict through the lens of international environmental and humanitarian law, assessing whether existing legal frameworks are sufficient to address wartime ecological destruction ¹.

Historical Evolution of Environmental Protection in Armed Conflict

The protection of the natural environment during armed conflict is a relatively recent concern

¹ U.N. Env't Programme, *Protecting the Environment During Armed Conflict: An Inventory and Analysis of International Law* 5–7 (2009); World Health Org., *Gaza Strip: Water, Sanitation and Hygiene Situation Report* (2021).

in international law. For much of history, the law of war focused primarily on regulating the conduct of hostilities between states and protecting civilians and property rather than safeguarding ecosystems. Only gradually did the international community begin to recognize that warfare could cause extensive and long-lasting harm to the environment. The evolution of legal norms addressing environmental protection in armed conflict can broadly be understood through several historical stages: early indirect protection under classical laws of war, the environmental devastation witnessed during major twentieth-century conflicts, the emergence of environmental consciousness following the Vietnam War, the development of specific treaty protections in the 1970s and finally the incorporation of environmental destruction into the framework of international criminal law.

Early Laws of War: Indirect Protection of the Environment

Before the twentieth century, international humanitarian law did not explicitly address environmental protection. The primary objective of early codifications of the laws of war was to regulate military conduct and limit unnecessary suffering among combatants and civilians. Environmental considerations were largely absent. Nevertheless, certain provisions indirectly protected elements of the natural environment because they were connected to civilian property and agricultural resources.

One of the earliest codifications of the laws of war was the Lieber Code, formally titled *Instructions for the Government of Armies of the United States in the Field*. Drafted during the American Civil War, the Lieber Code sought to regulate military behaviour and prohibit wanton destruction. While it did not explicitly mention environmental protection, it condemned unnecessary devastation of property and agricultural resources, thereby offering indirect safeguards to the natural landscape.

This approach was later reflected in the Hague Convention II and the Hague Convention IV, which codified key principles governing warfare. The Hague Regulations annexed to these conventions prohibited the unnecessary destruction or seizure of enemy property². Article 23(g) of the 1907 Hague Regulations specifically forbids the destruction or seizure of enemy property unless such destruction is “imperatively demanded by the necessities of war³”

² *Instructions for the Government of Armies of the United States in the Field* (Lieber Code), General Orders No. 100, arts. 15–16 (Apr. 24, 1863).

³ *Instructions for the Government of Armies of the United States in the Field* (Lieber Code), General Orders No. 100, arts. 15–16 (Apr. 24, 1863).

Although the provision was primarily concerned with property rights, it had the incidental effect of protecting farmland, forests, and other natural resources essential for civilian survival. However, environmental harm was not treated as an independent legal concern; rather, it was understood as damage to property belonging to the enemy state or its civilians.

Scholars such as Yoram Dinstein have noted that these early legal frameworks reflected the priorities of the period. The environment was valued mainly for its economic and strategic importance rather than for its intrinsic ecological significance. Consequently, environmental protection remained indirect and limited.

Environmental Devastation During World War II

The Second World War dramatically demonstrated the scale at which modern warfare could devastate natural environments. The conflict witnessed widespread destruction of forests, farmland, and urban ecosystems as a result of large-scale military operations and strategic bombing campaigns. Scorched-earth tactics were frequently employed, particularly in Eastern Europe, where retreating forces deliberately destroyed agricultural land, infrastructure and natural resources to prevent their use by advancing enemy armies.

The bombing of industrial centres further produced severe environmental consequences. Air raids destroyed factories, oil refineries, and chemical plants, releasing pollutants into the air, soil and water systems. Such destruction revealed how industrial warfare could generate long-term environmental contamination extending far beyond the immediate battlefield.

Despite the magnitude of these impacts, international law at the time provided virtually no specific protections for the natural environment. Existing legal instruments addressed only the destruction of property or civilian objects⁴. As later analyses by the International Committee of the Red Cross have observed, the experiences of the Second World War exposed a significant gap in the legal regulation of wartime environmental harm.

The Vietnam War and the Rise of Environmental Awareness

A major turning point in the legal and political awareness of wartime environmental damage occurred during the Vietnam War. In an effort to remove forest cover used by opposing forces

⁴ Int'l Comm. of the Red Cross, Guidelines for Military Manuals and Instructions on the Protection of the Environment in Times of Armed Conflict, ¶¶ 3–5, U.N. Doc. A/49/323 (Aug. 19, 1994).

and destroy crops that could sustain them, the United States military conducted extensive herbicidal warfare. The most well-known chemical used during these operations was Agent Orange, a defoliant sprayed across vast areas of forest and agricultural land.

The ecological consequences were profound. Millions of hectares of forest were destroyed, leading to widespread deforestation and habitat loss. Soil degradation and contamination occurred in affected regions, while biodiversity suffered severe declines due to the destruction of vegetation and wildlife habitats. In addition to environmental damage, exposure to toxic chemicals produced long-term health effects among civilian populations.

These events sparked global debate regarding the legality and morality of environmental destruction in warfare. Scholars such as Arthur H. Westing highlighted the concept of “environmental warfare,” drawing attention to the possibility that military strategies could intentionally manipulate or devastate ecosystems. The Vietnam War therefore marked a crucial moment in the development of environmental consciousness within international law and politics.

Emergence of Specific Environmental Treaties in the 1970s

In response to growing concern about environmental warfare, the international community began developing treaties specifically designed to limit environmental damage during armed conflict. One of the most significant developments was the adoption of the Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques. The convention prohibits the deliberate manipulation of natural processes, such as altering weather patterns or triggering geological phenomena, for hostile purposes when such actions would have widespread, long-lasting or severe effects⁵.

Another milestone was the adoption of Additional Protocol I to the Geneva Conventions, which introduced explicit provisions protecting the natural environment. Article 35(3) prohibits methods or means of warfare intended or expected to cause widespread, long-term and severe damage to the natural environment. Similarly, Article 55 obliges parties to armed conflicts to protect the environment against such damage and prohibits attacks that may harm the health or

⁵ Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques art. 1, May 18, 1977, 1108 U.N.T.S. 151.

survival of civilian populations through environmental destruction⁶. These provisions represented the first clear recognition within international humanitarian law that the environment itself requires protection during armed conflict.

Late Twentieth-Century Development: Environmental Harm as a War Crime

The final stage in the historical evolution of environmental protection in armed conflict emerged with the development of international criminal law in the late twentieth century. The adoption of the Rome Statute of the International Criminal Court established the International Criminal Court and introduced provisions addressing environmental destruction in warfare.

Article 8(2)(b)(iv) of the Rome Statute defines as a war crime the launching of attacks with the knowledge that they will cause widespread, long-term and severe damage to the natural environment that would be clearly excessive in relation to the anticipated military advantage. This provision marked a significant development by linking environmental destruction to individual criminal responsibility under international law. In doing so, it moved environmental protection beyond state obligations and placed accountability directly on military and political leaders responsible for unlawful conduct.

Conclusion of the Historical Evolution

The historical development of environmental protection in armed conflict reveals a gradual shift in international legal thinking. Initially, environmental protection was only incidental, embedded within broader rules protecting property and civilian objects. The devastating environmental consequences of twentieth-century warfare, particularly during the Vietnam War, catalysed greater awareness of ecological harm caused by military operations. This awareness led to the creation of specialized treaties in the 1970s and the eventual recognition of environmental destruction as a potential war crime under international criminal law⁷. Together, these developments illustrate the progressive integration of environmental considerations into the legal framework governing armed conflict.

Contemporary Relevance of Environmental Damage in Modern Warfare

Environmental damage caused by armed conflict has acquired renewed urgency in the twenty-

⁶ Protocol Additional to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of International Armed Conflicts (Protocol I) arts. 35(3), 55, June 8, 1977, 1125 U.N.T.S. 3.

⁷ Rome Statute of the International Criminal Court art. 8(2)(b)(iv), July 17, 1998, 2187 U.N.T.S. 90.

first century. Unlike earlier periods when environmental harm was often treated as an incidental by-product of military operations, contemporary warfare demonstrates that environmental destruction has become both more extensive and more consequential for civilian survival and global ecological stability. Rapid urbanization, technological advancements in weaponry and the targeting of critical infrastructure have significantly altered the relationship between warfare and the natural environment. As a result, environmental protection during armed conflict has evolved from a peripheral concern into a central issue within international humanitarian and environmental law.

One of the most significant features of modern warfare is the increasing prevalence of combat within densely populated urban environments. Contemporary conflicts frequently unfold in cities where civilian infrastructure and ecological systems are deeply interconnected. Attacks on energy facilities, water treatment plants, dams and industrial installations often produce cascading environmental consequences that extend far beyond the immediate battlefield. According to the United Nations Environment Programme, damage to critical infrastructure in conflict zones frequently leads to long-term environmental contamination and the collapse of essential public services. Similarly, the International Committee of the Red Cross has observed that modern conflicts increasingly endanger water systems and energy networks upon which millions of civilians depend. When such infrastructure is destroyed, the resulting environmental harm can disrupt entire ecosystems and compromise public health for years or even decades.

Environmental destruction in warfare also generates severe humanitarian consequences. Pollution of water sources, destruction of farmland and the release of toxic substances into the air directly threaten the health and survival of civilian populations. In conflict zones where sanitation systems collapse, untreated wastewater often contaminates rivers and coastal waters, increasing the risk of disease outbreaks. Agricultural damage can further exacerbate food insecurity by eliminating local sources of sustenance. These environmental consequences illustrate the growing intersection between environmental protection, human rights and international humanitarian law. Legal provisions protecting “objects indispensable to the survival of the civilian population,” such as water installations and agricultural areas⁸, highlight

⁸ Protocol Additional to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of International Armed Conflicts (Protocol I) art. 54, June 8, 1977, 1125 U.N.T.S. 3.

the recognition that environmental harm can produce catastrophic humanitarian effects.

Recent armed conflicts provide stark evidence of the contemporary relevance of environmental protection during war. In the ongoing hostilities in Gaza, extensive damage to water infrastructure, widespread debris contamination and the breakdown of wastewater treatment systems have created severe environmental challenges. Assessments by the United Nations Environment Programme indicate that destruction of sanitation facilities has contributed to the discharge of untreated sewage into the Mediterranean Sea, posing serious risks to marine ecosystems and public health. Agricultural land has also been damaged or rendered unusable due to military activity and debris accumulation. Similar environmental risks have emerged in the conflict in Ukraine, where industrial facilities, oil depots and chemical plants have been damaged during hostilities. The destruction of the Kakhovka Dam in 2023 resulted in massive flooding, displacement of communities and the degradation of river ecosystems, illustrating the profound environmental consequences that attacks on critical infrastructure can produce.

Historical precedents further demonstrate the devastating environmental effects of warfare. During the 1991 Gulf War, the deliberate release of oil into the Persian Gulf and the burning of Kuwaiti oil wells produced one of the largest environmental disasters associated with armed conflict. The Gulf War Oil Spill resulted in widespread marine pollution, severe air contamination, and long-term ecological damage across the region. Such incidents underscore the potential for environmental destruction during armed conflict to reach transboundary and even global scales.

Another emerging concern is the strategic targeting of environmental systems as a method of warfare. Military operations may focus on dams, energy infrastructure, agricultural resources, or industrial facilities in order to weaken an adversary's economic and logistical capacity. While such tactics may offer short-term military advantages, they can generate profound environmental consequences that persist long after hostilities have ended. International humanitarian law prohibits methods of warfare expected to cause "widespread, long-term and severe damage" to the natural environment, yet enforcement of these rules remains limited in practice.

The relationship between warfare and climate change further amplifies the significance of environmental protection in contemporary conflicts. Destruction of forests, burning of oil

facilities, and damage to industrial infrastructure release substantial quantities of greenhouse gases into the atmosphere. Armed conflicts therefore contribute not only to local environmental degradation but also to global climate challenges. As scholars and international organizations increasingly recognize the environmental dimension of armed conflict, growing calls have emerged for stronger legal protections. Proposals to recognize ecocide as an international crime and to enhance environmental monitoring during armed conflicts reflect a broader effort to strengthen accountability mechanisms within institutions such as the International Criminal Court.

Taken together, these developments illustrate that environmental damage in modern warfare is neither incidental nor limited in scope. Contemporary conflicts reveal the profound ecological and humanitarian consequences of environmental destruction, highlighting the urgent need for more robust legal frameworks capable of preventing and addressing such harm.

International Legal Framework Governing Environmental Protection in Armed Conflict

The protection of the natural environment during armed conflict is governed by a fragmented but evolving body of international law that draws primarily from international humanitarian law (IHL), environmental treaties, and international criminal law. Although environmental protection was not historically the central concern of the laws of war, contemporary legal instruments increasingly recognize that environmental destruction can produce severe humanitarian, ecological, and transboundary consequences. The current legal framework is therefore built upon a combination of treaty provisions and customary rules that seek to regulate military conduct and mitigate environmental harm⁹. However, despite these developments, significant limitations remain in the effectiveness and enforceability of these protections.

The foundation of the legal framework regulating armed conflict is the Geneva Conventions, which constitute the core instruments of international humanitarian law¹⁰. While the Geneva Conventions themselves do not explicitly mention environmental protection, they provide indirect safeguards through provisions aimed at protecting civilians and civilian objects. Under the principles of distinction and proportionality, parties to a conflict must distinguish between

⁹ U.N. Env't Programme, *Protecting the Environment During Armed Conflict: An Inventory and Analysis of International Law* 3–7 (2009).

¹⁰ Geneva Convention (IV) Relative to the Protection of Civilian Persons in Time of War, Aug. 12, 1949, 6 U.S.T. 3516, 75 U.N.T.S. 287.

military objectives and civilian objects, and attacks must not cause excessive harm relative to anticipated military advantage¹¹. Environmental resources such as forests, agricultural land, freshwater sources, and ecosystems often fall within the category of civilian objects unless they are directly used for military purposes. Additionally, international humanitarian law prohibits attacks on objects indispensable to the survival of the civilian population, including drinking water installations, irrigation systems and agricultural areas¹². According to commentary by the International Committee of the Red Cross, these provisions indirectly protect ecosystems because environmental destruction can jeopardize civilian survival by undermining access to water, food, and sanitation¹³.

More explicit environmental protections were introduced through the Additional Protocol I to the Geneva Conventions, which represents one of the most significant developments in the legal regulation of wartime environmental damage. Article 35(3) prohibits the use of methods or means of warfare that are intended or expected to cause “widespread, long-term and severe damage to the natural environment.” Complementing this provision, Article 55 imposes an obligation on parties to protect the natural environment against such damage and prohibits warfare methods that may endanger the health or survival of civilian populations through environmental destruction¹⁴. These provisions marked the first explicit recognition within international humanitarian law that the environment itself deserves protection during armed conflict. Nevertheless, scholars and humanitarian organizations have noted that the threshold of “widespread, long-term and severe” damage sets a particularly high standard for proving violations, which has limited the practical enforcement of these rules.

Another important legal instrument is the Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques, adopted in response to concerns raised during the Vietnam War regarding environmental warfare. The ENMOD Convention prohibits the deliberate manipulation of natural processes, such as altering weather patterns, triggering earthquakes, or modifying ocean currents, when such actions would have widespread, long-lasting, or severe effects¹⁵. Unlike other legal instruments that address

¹¹ Protocol Additional to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of International Armed Conflicts (Protocol I) arts. 48, 51(5)(b), June 8, 1977, 1125 U.N.T.S. 3.

¹² Id. art. 54.

¹³ Int'l Comm. of the Red Cross, Guidelines for Military Manuals and Instructions on the Protection of the Environment in Times of Armed Conflict, ¶¶ 4–6, U.N. Doc. A/49/323 (Aug. 19, 1994).

¹⁴ Protocol Additional to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of International Armed Conflicts (Protocol I) arts. 35(3), 55, June 8, 1977, 1125 U.N.T.S. 3.

¹⁵ Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification

environmental damage resulting from conventional military operations, ENMOD focuses specifically on the intentional use of environmental modification techniques as weapons. While this treaty represented an important step toward regulating environmental warfare, its scope remains limited because it does not cover ordinary environmental damage caused by traditional military operations.

Environmental protection during armed conflict is further reinforced through international criminal law under the Rome Statute of the International Criminal Court. Article 8(2)(b)(iv) of the Rome Statute classifies as a war crime the launching of an attack with the knowledge that it will cause widespread, long-term and severe damage to the natural environment that would be clearly excessive in relation to the concrete and direct overall military advantage anticipated. This provision is significant because it establishes the possibility of individual criminal responsibility for environmental destruction during armed conflict. In theory, military commanders and political leaders could be prosecuted before the International Criminal Court for actions resulting in catastrophic environmental harm. However, prosecutions under this provision remain rare due to the stringent evidentiary requirements and the difficulty of demonstrating the required level of environmental damage and intent.

Beyond treaty law, environmental protection in armed conflict is also reinforced through customary international humanitarian law. According to studies conducted by the International Committee of the Red Cross, customary rules require parties to armed conflicts to consider environmental consequences when planning military operations and to avoid unnecessary environmental damage. These customary norms are particularly important because they apply even to states that have not ratified certain treaties.

Despite the existence of these legal frameworks, several structural weaknesses limit their effectiveness. Many provisions rely on vague thresholds such as “widespread,” “long-term,” and “severe,” terms that lack precise legal definitions and therefore complicate enforcement¹⁶. Furthermore, international law lacks strong enforcement mechanisms capable of consistently holding violators accountable. Empirical studies by the United Nations Environment Programme indicate that armed conflicts have generated hundreds of environmental incidents worldwide since 1990, including damage to water infrastructure, industrial pollution and

Techniques art. 1, May 18, 1977, 1108 U.N.T.S. 151.

¹⁶ Rome Statute of the International Criminal Court art. 8(2)(b)(iv), July 17, 1998, 2187 U.N.T.S. 90.

ecosystem destruction. Yet relatively few cases have resulted in legal accountability.

Taken together, these instruments demonstrate that international law increasingly recognizes the importance of protecting the natural environment during armed conflict. However, the fragmented nature of the legal framework, combined with high evidentiary thresholds and weak enforcement mechanisms, continues to limit its effectiveness. These shortcomings have become particularly visible in contemporary conflicts, including the ongoing environmental crises associated with warfare in Gaza and other regions, thereby underscoring the urgent need for stronger and more coherent legal protections.

Environmental Consequences of the Gaza Conflict

The environmental consequences of the Gaza conflict represent one of the most severe and complex ecological crises associated with modern warfare. Unlike traditional battlefields where environmental damage was often localized, the dense urban geography of Gaza means that military operations have produced cascading ecological impacts affecting water resources, marine ecosystems, agricultural land, air quality and long-term soil health. Environmental degradation in Gaza therefore illustrates how contemporary armed conflict can generate both humanitarian and ecological emergencies that persist long after the cessation of hostilities.

One of the most critical environmental impacts concerns the destruction of water and sanitation infrastructure. Gaza depends almost entirely on the Coastal Aquifer, the territory's principal freshwater source. According to assessments by the United Nations Environment Programme and the World Health Organization, even before the most recent escalation, more than 95 percent of Gaza's groundwater was considered unsafe for human consumption due to high salinity and contamination. Damage to water wells, pipelines, pumping stations and desalination facilities during military operations has further strained this already fragile system. As wastewater treatment facilities cease functioning due to infrastructure destruction and electricity shortages, untreated sewage increasingly contaminates groundwater and coastal waters, intensifying both environmental degradation and public health risks.

The breakdown of infrastructure has also resulted in significant marine pollution along the Mediterranean coastline. Environmental assessments by the United Nations Environment Programme indicate that the collapse of wastewater treatment systems has allowed large quantities of untreated sewage to flow directly into coastal waters. This discharge contaminates

marine ecosystems, damages fisheries, and threatens biodiversity in the eastern Mediterranean. The consequences extend beyond Gaza itself, as ocean currents carry polluted waters along regional coastlines. Marine contamination therefore illustrates how environmental damage caused by conflict can acquire transboundary ecological implications.

Another pressing environmental concern is the accumulation of massive quantities of rubble and debris generated by large-scale destruction of urban infrastructure. Preliminary estimates by the United Nations Development Programme suggest that the conflict has produced tens of millions of tonnes of debris across the Gaza Strip. Such debris frequently contains hazardous materials, including asbestos from older construction materials, heavy metals and residues from explosives. Over time, these substances can leach into surrounding soil and groundwater systems, creating persistent environmental contamination. Managing and safely disposing of this debris therefore presents a major environmental governance challenge for post-conflict reconstruction.

Agricultural ecosystems have also suffered significant damage. Satellite imagery analysed by the Food and Agriculture Organization shows widespread destruction of farmland, irrigation systems, orchards, and greenhouses. Agriculture plays an essential role in Gaza's fragile food system, and damage to agricultural land undermines both ecological stability and food security. Soil degradation caused by heavy military activity, debris accumulation, and explosive residues further reduces the productivity of agricultural ecosystems, potentially affecting food production for years to come.

Air pollution generated by bombardment and fires represents another dimension of environmental harm. Explosions, burning buildings and the destruction of industrial facilities release particulate matter and toxic chemicals into the atmosphere. These pollutants degrade air quality and may contaminate soil and vegetation through atmospheric deposition. Environmental researchers have warned that prolonged exposure to such pollutants can harm both human health and local ecosystems.

Taken together, these environmental consequences demonstrate that the Gaza conflict has produced multilayered ecological damage affecting water systems, marine environments, agricultural landscapes, and atmospheric conditions. As the United Nations Environment Programme has repeatedly noted in studies of conflict-affected regions, environmental damage generated during war often persists for decades due to the slow recovery of contaminated soil

and water systems. In Gaza, the environmental costs of conflict therefore extend far beyond immediate destruction, highlighting the urgent need for long-term environmental restoration and stronger mechanisms of legal accountability under international environmental and humanitarian law.

Judicial Interpretation and Accountability under International Law

The question of accountability for environmental damage in armed conflict occupies a complex space within international law. While the destruction of ecosystems, water systems and agricultural resources can have devastating humanitarian consequences, determining legal responsibility for such harm remains difficult. International judicial institutions play a crucial role in interpreting the legal obligations of states and individuals during armed conflict and in determining whether violations of international law have occurred. In the context of the Gaza conflict, judicial interpretation and accountability mechanisms have become increasingly significant, as environmental destruction intersects with broader questions of humanitarian protection and international responsibility.

Two international judicial bodies are particularly relevant in this context: the International Court of Justice and the International Criminal Court. These institutions operate within distinct but complementary legal frameworks. The International Court of Justice adjudicates disputes between states and determines questions of state responsibility under international law. Its rulings clarify the interpretation of international humanitarian law, environmental law and treaty obligations. By contrast, the International Criminal Court focuses on individual criminal responsibility and has jurisdiction to prosecute persons accused of committing international crimes, including war crimes and crimes against humanity. Environmental destruction during armed conflict may therefore generate both state responsibility before the ICJ and individual criminal liability before the ICC.

Judicial interpretation of environmental protection during armed conflict has evolved gradually through international jurisprudence. One of the most significant pronouncements on the subject appears in the advisory opinion of the Legality of the Threat or Use of nuclear weapons. In this landmark opinion, the ICJ emphasized that the environment “is not an abstraction but represents the living space, the quality of life and the very health of human beings.” The Court acknowledged that environmental considerations form an integral part of international humanitarian law and must be taken into account when assessing the legality of military

actions¹⁷. Although the case concerned nuclear weapons, its reasoning established an important judicial principle: environmental protection is inseparable from humanitarian concerns in armed conflict¹⁸.

Further clarification emerged in the decision of the ICJ in *Armed Activities on the Territory of the Congo*, where the Court examined Uganda's military activities in the Democratic Republic of Congo. The Court held that the unlawful exploitation of natural resources in occupied territory violated international law and confirmed that states can bear responsibility for environmental and resource-related damage arising during armed conflict. This case reinforced the idea that environmental harm, particularly the destruction or exploitation of natural resources, may constitute a breach of international obligations.

Within the context of the Gaza conflict, questions of accountability have gained renewed international attention. Proceedings before the International Court of Justice have addressed aspects of the ongoing hostilities through the case *South Africa v Israel*. While the primary focus of the case concerns allegations under the Genocide Convention, the Court's provisional measures issued in January 2024 emphasize the protection of civilians and the need to ensure access to humanitarian assistance, including food, water and medical services¹⁹. Environmental destruction, such as damage to water infrastructure, agricultural systems, and sanitation facilities, can directly affect these humanitarian conditions. As noted in environmental assessments by the United Nations Environment Programme, the collapse of water and sanitation systems in Gaza has significantly increased environmental contamination and public health risks, highlighting the indirect legal relevance of environmental degradation within broader humanitarian litigation.

Parallel to these state-level proceedings, the International Criminal Court is conducting investigations into alleged international crimes in the Palestinian territories. In 2021, the ICC Prosecutor opened an investigation into the situation in Palestine, which includes alleged crimes committed in Gaza. Under Article 8(2)(b)(iv) of the Rome Statute of the International Criminal Court, intentionally launching attacks with the knowledge that they will cause "widespread, long-term and severe damage to the natural environment" that is clearly excessive

¹⁷ *Legality of the Threat or Use of nuclear weapons*, Advisory Opinion, 1996 I.C.J. Rep. 226, ¶ 29 (July 8).

¹⁸ *Armed Activities on the Territory of the Congo (Dem. Rep. Congo v. Uganda)*, Judgment, 2005 I.C.J. Rep. 168 (Dec. 19).

¹⁹ *Application of the Convention on the Prevention and Punishment of the Crime of Genocide (S. Afr. v. Isr.)*, Order on Request for the Indication of Provisional Measures, 2024 I.C.J. ____ (Jan. 26).

in relation to the anticipated military advantage constitutes a war crime²⁰. In theory, this provision allows the prosecution of military commanders or political leaders responsible for environmentally destructive attacks. However, in practice, such prosecutions remain rare due to the high evidentiary threshold required to prove both the scale of environmental damage and the intent or knowledge of the perpetrators.

Significant structural challenges continue to impede accountability for environmental damage in armed conflict. International legal standards often rely on vague thresholds such as “widespread,” “long-term,” and “severe,” terms that lack precise definitions and complicate legal interpretation. Moreover, international courts depend heavily on state cooperation for investigations and enforcement. Without political support and access to affected areas, gathering reliable environmental evidence can be extremely difficult. Reports by the United Nations Environment Programme have repeatedly highlighted that environmental damage in conflict zones frequently remains under-documented and under-prosecuted despite its long-term consequences.

In response to these limitations, legal scholars and international organizations have increasingly called for stronger accountability mechanisms. Proposals to recognize ecocide as an international crime have gained traction among environmental law experts who argue that large-scale environmental destruction during armed conflict should be treated as a grave international offense. Expanding environmental monitoring mechanisms and strengthening the jurisdictional capacity of international courts are also frequently proposed reforms.

Taken together, judicial interpretation and accountability mechanisms reveal both the potential and the limitations of international law in addressing environmental destruction during armed conflict. While international courts provide important legal avenues for interpreting environmental obligations and assigning responsibility, the Gaza conflict illustrates the continuing challenges of translating legal principles into effective accountability.

Comparative Analysis with Other Armed Conflicts

Understanding the environmental consequences of the Gaza conflict requires situating it within the broader history of environmental destruction in warfare. Comparative analysis allows scholars to determine whether the environmental damage observed in Gaza represents an

²⁰ Rome Statute of the International Criminal Court art. 8(2)(b)(iv), July 17, 1998, 2187 U.N.T.S. 90.

exceptional case or reflects patterns that have emerged in other armed conflicts. By examining the Vietnam War, the Gulf War, and the Russian invasion of Ukraine, it becomes possible to identify recurring mechanisms of environmental destruction, the legal responses they generated, and the persistent gaps in accountability. These comparisons also help illuminate the distinctive ecological vulnerabilities of Gaza²¹.

Vietnam War: Environmental Warfare and Chemical Devastation

The Vietnam War is widely regarded as the first conflict in which environmental destruction became a central feature of military strategy. Between 1961 and 1971, the United States conducted large-scale herbicidal operations under “Operation Ranch Hand,” deploying approximately 19 million gallons of herbicides, including the defoliant Agent Orange, across Vietnam, Laos, and Cambodia. According to studies cited by the U.S. National Academy of Sciences and later environmental research, this campaign destroyed nearly 3 million hectares of forest and devastated large areas of agricultural land²².

The ecological consequences were profound and enduring. Dense tropical forests were stripped of vegetation, wildlife habitats were destroyed and soil fertility declined dramatically. In many areas, forests failed to regenerate even decades after the conflict. Moreover, contamination by dioxins contained in Agent Orange produced long-term environmental and public health effects. These consequences transformed global perceptions of warfare’s ecological impact and prompted international concern about environmental warfare. Scholars frequently identify the Vietnam War as a catalyst for the adoption of environmental protections in international humanitarian law, including the Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques.

When compared with Gaza, an important distinction emerges. Environmental destruction in Vietnam was partially intentional and systematic, as herbicides were used to eliminate forest cover and crops. In Gaza, by contrast, environmental damage primarily results from the destruction of urban infrastructure, including water systems, sanitation networks and residential buildings. Nevertheless, both conflicts demonstrate how warfare can fundamentally

²¹ U.N. Env’t Programme, *Protecting the Environment During Armed Conflict: An Inventory and Analysis of International Law* 9–15 (2009).

²² Inst. of Med., Nat’l Acad. of Sci., *Veterans and Agent Orange: Health Effects of Herbicides Used in Vietnam* 24–26 (1994).

disrupt ecosystems and undermine civilian livelihoods.

Gulf War: Resource Sabotage and Environmental Catastrophe

Another pivotal example of wartime environmental destruction occurred during the Gulf War. As Iraqi forces retreated from Kuwait in 1991, they deliberately ignited more than 600 Kuwaiti oil wells and released approximately 6–8 million barrels of oil into the Persian Gulf, producing one of the largest oil spills in history. According to assessments by the United Nations Environment Programme, these actions caused extensive damage to marine ecosystems and coastal habitats²³.

The environmental consequences were dramatic. Thick oil slicks spread across large areas of the Persian Gulf, suffocating marine life and contaminating coastal wetlands that served as critical habitats for birds and marine species. Simultaneously, the burning oil wells generated massive plumes of smoke that darkened the skies for months, releasing large quantities of pollutants into the atmosphere. Soil contamination and air pollution persisted long after the conflict ended.

Comparatively, the environmental damage in Gaza differs in its mechanism but shares similar humanitarian consequences. In the Gulf War, environmental destruction occurred through the deliberate sabotage of natural resources. In Gaza, environmental degradation has largely arisen from the destruction of critical infrastructure in a densely populated urban environment. Yet both conflicts reveal how environmental harm can escalate into regional ecological crises and produce long-term consequences for human health and environmental recovery.

Ukraine War: Industrial and Infrastructure-Based Environmental Risks

The ongoing war in Ukraine provides another instructive comparison. Since the beginning of the Russian invasion of Ukraine, environmental monitoring agencies have documented hundreds of environmental incidents linked to military activity. Reports by the United Nations Environment Programme indicate damage to oil depots, chemical plants, and industrial facilities, resulting in contamination of soil, rivers, and groundwater.

One of the most significant environmental events occurred with the destruction of the

²³ U.N. Env't Programme, *The Environmental Impact of the Gulf War* 17–21 (1991).

Kakhovka Dam destruction, which unleashed massive flooding across southern Ukraine. The collapse inundated farmland, destroyed wetlands, displaced communities and disrupted ecosystems along the Dnipro River basin. Additionally, the war has raised serious concerns regarding the safety of nuclear facilities, including the Zaporizhzhia Nuclear Power Plant, demonstrating how modern warfare can create environmental risks with potentially global consequences²⁴.

In comparison with Ukraine, Gaza presents a different but equally severe ecological challenge. Ukraine's environmental risks are associated primarily with industrial infrastructure, dams, and nuclear facilities across a vast geographic area. Gaza's environmental damage, by contrast, occurs within an extremely small and densely populated territory of approximately 365 square kilometres, where ecological systems and human settlements are tightly interconnected. As environmental researchers and humanitarian reports have noted, this spatial concentration intensifies the ecological impact of infrastructure destruction, particularly with regard to water scarcity, sanitation collapse, and marine pollution.

Comparative Insights

Examining these conflicts together reveals several important patterns. First, environmental destruction in warfare occurs through diverse mechanisms: chemical warfare in Vietnam, resource sabotage in the Gulf War, industrial and infrastructural damage in Ukraine and urban infrastructure destruction in Gaza. Second, environmental damage often generates long-term ecological consequences that persist decades after hostilities cease. Third, despite the existence of international legal frameworks intended to protect the environment during armed conflict, accountability for wartime environmental destruction remains extremely limited.

The Gaza conflict therefore does not represent an isolated case but rather forms part of a broader historical pattern in which warfare inflicts profound ecological damage. However, Gaza's unique geographic constraints, fragile environmental systems, and heavy reliance on limited natural resources make its environmental vulnerability particularly acute. This comparative perspective underscores the urgent need to strengthen international legal mechanisms capable of preventing and addressing environmental harm in armed conflict.

²⁴ U.N. Env't Programme, *Ukraine: Environmental Impact Assessment of the War 8–14* (2023).

Proposed Policy Recommendations

The preceding analysis demonstrates that environmental destruction during armed conflict is neither incidental nor temporary. The case of Gaza illustrates how damage to water systems, agricultural land, and marine ecosystems can create enduring ecological crises that extend far beyond the immediate battlefield. Despite the existence of international humanitarian law and environmental treaties, enforcement mechanisms remain weak and fragmented. As reports by the United Nations Environment Programme and humanitarian assessments published by the United Nations Office for the Coordination of Humanitarian Affairs repeatedly emphasize, environmental harm in conflict zones often persists for decades due to the absence of effective monitoring, accountability, and post-conflict restoration frameworks.

Drawing upon the lessons from Gaza as well as comparative conflicts such as Vietnam, the Gulf War, and Ukraine, it becomes clear that international law must evolve to address the environmental dimensions of warfare more effectively. The following policy recommendations aim to strengthen accountability, enhance environmental protection during armed conflict, and ensure that ecological restoration becomes an integral component of post-conflict recovery. These recommendations are grounded in international legal scholarship, United Nations²⁵ environmental assessments, and analyses produced by Palestinian environmental researchers and civil society organizations documenting the ecological impacts of conflict in Gaza.

1. Establish an Independent International Environmental Monitoring Mechanism for Armed Conflicts

One of the most significant obstacles to accountability for environmental damage during war is the lack of reliable and independent environmental data. Many conflict zones lack the technical capacity or political conditions necessary for systematic environmental monitoring. An independent monitoring mechanism operating under the auspices of the United Nations Environment Programme could provide impartial assessments of environmental damage in conflict areas.

Such a mechanism should combine satellite imagery, remote sensing technologies, and on-the-ground environmental expertise to document damage to ecosystems, water systems and

²⁵ U.N. Env't Programme, *Protecting the Environment During Armed Conflict: An Inventory and Analysis of International Law* 3–10 (2009).

agricultural land. Environmental monitoring units could deploy rapidly following major military incidents to assess contamination risks and infrastructure damage. Transparent environmental reporting would strengthen legal accountability by providing credible evidence for international investigations while also informing humanitarian and environmental recovery efforts.

2. Strengthen Legal Definitions of Environmental Harm in International Humanitarian Law

A central weakness in the current legal framework lies in the vague thresholds used to define environmental damage. Terms such as “widespread,” “long-term,” and “severe,” which appear in Article 35(3) and Article 55 of Additional Protocol I and Article 8(2)(b)(iv) of the Rome Statute, lack precise legal definitions. This ambiguity has significantly hindered enforcement and prosecution.

The international community should therefore develop clearer legal standards that define measurable environmental harm. Scientific indicators, such as contamination levels in soil and groundwater, biodiversity loss, and ecosystem degradation, could provide objective benchmarks for determining violations. By aligning legal thresholds with scientific environmental indicators, international law would be better equipped to evaluate environmental destruction during armed conflict.

3. Recognize Ecocide as an International Crime

Growing legal scholarship has proposed the recognition of ecocide as an international crime alongside genocide, crimes against humanity and war crimes. Environmental law scholars and international legal experts argue that severe and widespread ecological destruction should trigger individual criminal liability.

If incorporated into the Rome Statute of the International Criminal Court, the crime of ecocide could significantly strengthen accountability mechanisms. This would enable the International Criminal Court to prosecute individuals responsible for large-scale environmental destruction, even in cases where the strict thresholds currently required for environmental war crimes cannot easily be proven. Such a development would signal a fundamental shift in international law by recognizing that the protection of ecosystems is essential for the protection of human

life²⁶.

4. Integrate Environmental Restoration into Post-Conflict Reconstruction Frameworks

Environmental recovery must become a central component of post-conflict reconstruction. Conflicts frequently leave behind contaminated soil, damaged water infrastructure, and destroyed agricultural systems that undermine long-term economic and ecological stability. Environmental restoration programmes should therefore be incorporated into international reconstruction initiatives led by organizations such as the United Nations Development Programme and humanitarian agencies²⁷.

In the context of Gaza, environmental recovery strategies could include large-scale water infrastructure rehabilitation, debris management programmes to remove toxic rubble, and soil remediation initiatives to restore agricultural productivity. Independent Palestinian environmental researchers and civil society organizations have repeatedly emphasized that ecological restoration is essential not only for environmental sustainability but also for long-term public health and food security.

5. Enhance Protection of Environmental Infrastructure under International Humanitarian Law

Finally, international humanitarian law should expand protections for critical environmental infrastructure such as water treatment plants, desalination facilities and agricultural irrigation networks. These systems are essential for civilian survival and ecological sustainability, yet they often suffer severe damage during armed conflict.

Strengthening legal protections for such infrastructure could involve clarifying their status as objects indispensable to civilian survival and establishing stricter legal scrutiny for attacks that may damage them. Greater emphasis on environmental considerations in military planning and targeting decisions would help prevent ecological devastation before it occurs.

Taken together, these policy recommendations seek to bridge the gap between legal principles

²⁶ Independent Expert Panel for the Legal Definition of Ecocide, Commentary and Core Text of the Proposed International Crime of Ecocide 5–8 (Stop Ecocide Found., 2021).

²⁷ U.N. Env't Programme, From Conflict to Peacebuilding: The Role of Natural Resources and the Environment 16–20 (2009).

and practical enforcement. The environmental consequences of the Gaza conflict demonstrate that modern warfare can generate ecological crises with profound humanitarian implications. Addressing these challenges requires not only stronger legal norms but also institutional mechanisms capable of monitoring environmental damage, enforcing accountability and restoring ecosystems in the aftermath of conflict. Strengthening these frameworks is therefore essential to ensure that environmental protection becomes a meaningful component of international peace and security.

Conclusion

The protection of the natural environment during armed conflict has gradually emerged as an important concern within international law. Earlier legal frameworks focused primarily on regulating warfare and protecting civilians, while environmental damage was largely treated as an indirect consequence of military operations. Over time, however, the devastating ecological impacts witnessed in conflicts such as the Vietnam War and the Gulf War demonstrated that warfare can cause long-lasting harm to ecosystems, natural resources, and public health. These experiences contributed to the development of legal protections under instruments such as the Additional Protocol I to the Geneva Conventions and the Rome Statute of the International Criminal Court, which recognize severe environmental destruction as a potential violation of international humanitarian law.

The Gaza conflict illustrates the profound environmental consequences that modern warfare can produce. Damage to water infrastructure, agricultural systems and sanitation facilities has generated serious ecological degradation that directly affects civilian survival. According to assessments by the United Nations Environment Programme, environmental damage in conflict zones often persists for decades due to contamination of soil and water resources.

Despite existing legal frameworks, enforcement remains limited due to high evidentiary thresholds and weak accountability mechanisms. Strengthening international environmental protections during armed conflict is therefore essential to ensure ecological sustainability, humanitarian protection and long-term environmental recovery in conflict-affected regions.