Gaps in International Criminal Law on Third-Party Responsibility for AI-Enabled Drones and Targeted Ecocide

May 12, 2026

by

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in April 2026 Issue, Criminal law

Acknowledgement: The authors are thankful to ***Paarth Chhapolia, Mohammed Haris and Tanasvi Mittal*** *for their assistance with editing the piece.*

Ecocide refers to the extensive, enduring, and severe destruction of ecosystems by human activities, causing significant environmental harm and the infringement of fundamental human rights. This widespread devastation diminishes biodiversity, disrupts ecological balance, and jeopardizes the livelihoods of communities, especially those dependent on their natural surroundings for cultural, physical, and economic well-being. The term "ecocide," a blend of "ecosystem" and "genocide," was first introduced during the Vietnam War to describe the deliberate environmental destruction that occurred. Since then, its meaning has broadened to include various forms of environmental harm, whether intentional or stemming from negligence. Deforestation stands out as one of the most destructive forms of ecocide, particularly evident in the Amazon Rainforest, where extensive clearing has sparked habitat destruction, loss of biodiversity, and disruption of carbon cycles. The reduction in forest cover not only accelerates climate change but also displaces indigenous communities that depend on these ecosystems for their survival. Similarly, industrial pollution has wreaked havoc on the environment, as illustrated in the Niger Delta, where chronic oil spills have contaminated water sources, rendered agricultural lands unusable,

and led to ongoing health crises for local populations. Another notable example is the large-scale clearing of forests for palm oil plantations in Southeast Asia, which has resulted in habitat destruction, increased carbon emissions, and extensive pollution. This form of environmental exploitation frequently displaces local communities and aggravates air quality through widespread slash-and-burn practices. In conflict zones, ecocide takes on an even graver dimension. The deployment of chemical weapons and other environmental warfare tactics has rendered ecosystems uninhabitable for years. For instance, the Vietnam War's use of defoliants like Agent Orange devastated forests and agricultural lands, causing lasting ecological and human health repercussions. More recently, the destruction of the Nova Kakhovka Dam in Ukraine led to widespread flooding, habitat loss, and the contamination of farmlands with industrial waste and landmines, showcasing the severe environmental destruction linked to warfare.

Ecocide spans multiple fields, including environmental ethics, international law, humanitarian law, and human rights, highlighting the need for legal accountability for actions that threaten the planet's sustainability. It encompasses deforestation, industrial pollution, overexploitation of resources, and activities that exacerbate climate change, yet these crimes are not featured in the list of Article 7 of ICC Rome Statute as crimes against humanity. The degradation of ecosystems not only disrupts biodiversity but also jeopardises the survival of populations reliant on these natural resources for their livelihoods. The repercussions of these harms cascading effects on agriculture, water systems, and air quality, ultimately threatening global ecological stability. Ecocide is also intrinsically linked to the Sustainable Development Goals (SDGs), as its impacts directly undermine multiple global objectives. It has severe detrimental effects on climate action (SDG 13), biodiversity conservation on land and in oceans (SDGs 14 and 15), access to clean water (SDG 6), food security (SDG 2), public health (SDG 3), and sustainable consumption and production patterns (SDG 12). Consequently, mitigating ecocide is essential to the realization of the SDGs, as ecocidal practices fundamentally erode efforts to build an environmentally sustainable, resilient, and healthy future.

Since October 2023, Gaza has faced a systematic and deliberate annihilation of its environment which experts characterized as ecocide. Investigations by Forensic Architecture reveal that Israeli forces targeted orchards, greenhouses and farmlands, obliterating nearly one-third of Gaza's greenhouses by March, 2024. The Al Meezan Center for Human Rights reports multiple forms of environmental deterioration caused by Israeli forces which includes targeting of critical water sources, agricultural land and waste management systems which has led to widespread contamination and major public health risks critically thwarting the survival of Gaza's 2.3 million residents, military conflicts have further escalated ecocide, prompting calls for international recognition of it as a prosecutable crime. UNEP's press release on a preliminary assessment report published by it in June, 2024 highlights the destruction of nearly half the region's tree cover and farmlands. Furthermore, five of Gaza's water treatment plants have shut down, resulting in sewage contaminating water bodies with hazardous chemicals, pathogens, and microplastics making 90 per cent of Gaza's water undrinkable.

Even in the absence of formal recognition, legal precedents illustrate the potential to address ecocide through existing international frameworks. Article 8(2)(b)(iv) of the Rome Statute prohibits wartime environmental damage causing widespread and long-term harm. This leaves peacetime harm largely unregulated. Cases like oil spills in the Niger Delta and deforestation in Indonesia reveal how national laws often fail to address large-scale environmental harm, highlighting the urgent need for robust international legal frameworks. Some countries have begun to incorporate ecocide into their legal frameworks. Criminal

Procedures (N 2341-III), Criminal Code, as consolidated in 2010, particularly in response to environmental devastation resulting from the Russian invasion. Still, wider adoption faces resistance over sovereignty and enforcement difficulties. Ecocide extends beyond environmental degradation in International Humanitarian Law (IHL) and International Criminal Law (ICL), IHL is increasingly recognizing that protecting the environment is critical to ensuring human security. Article 55 of Geneva Convention and their Additional Protocol– explicitly prohibit excessive environmental damage, acknowledging that harm to the environment during warfare can lead to long-lasting humanitarian repercussions, leaving those responsible for significant environmental destruction largely unpunished. IHL mandates the protection of civilians and their surroundings, stressing the need to avoid unnecessary destruction. Part III, Section 1 of the Additional Protocols to the Geneva Conventions forbid warfare methods that result in widespread, long-lasting, and severe environmental harm.

Ecocide in the Age of Autonomous Warfare: Rethinking Responsibility under International Criminal Law

The rapid evolution of military technologies, particularly unmanned aerial vehicles (UAVs) and artificial intelligence (AI), has exposed profound gaps in the international criminal law (ICL) framework, especially regarding third-party responsibility for environmental destruction or potential ecocide. Although the Rome Statute identifies genocide, crimes against humanity, war crimes, and aggression as the four core international crimes, it does not explicitly include ecocide nor adequately address the complex liability issues introduced by autonomous or semi-autonomous warfare systems.

Modern conflict has been fundamentally reshaped by drones enhanced through machine learning, sensor fusion, and algorithmic decision-making. Originally developed for surveillance, UAVs now routinely perform targeted strikes and, increasingly, operate with minimal human supervision. This progression toward autonomy creates a *"responsibility vacuum,"* where accountability becomes fragmented across designers, operators, programmers, and corporate entities. Traditional ICL principles such as intent, knowledge, and direct participation are difficult to apply when decision-making is filtered or executed by opaque algorithms rather than identifiable human choices. The challenge becomes even more urgent when considering the liability of indirect contributors. Developers, software engineers, data analysts, private defence contractors, and corporate manufacturers now constitute integral parts of the drone warfare ecosystem. Yet current ICL doctrine largely focuses on state actors or direct participants in hostilities. Established modes of liability, including command responsibility and aiding and abetting, were developed for hierarchical, human-controlled warfare and do not map cleanly onto decentralized technological systems. For example, the requirement of proving "effective control" becomes highly problematic when autonomous systems operate based on machine-learning processes that are neither fully transparent nor fully predictable.

These accountability gaps become especially concerning in contexts involving large-scale environmental destruction. AI-enabled targeting systems could hypothetically direct attacks on ecologically sensitive areas, such as wetlands, forests, and critical water infrastructure, without a clear legal route for prosecution because the international system lacks codified protections specific to ecocide. Some states, however, have begun taking independent action.

Ukraine is a leading example. Article 441 of the Ukrainian Criminal Code explicitly criminalizes ecocide, defining it as *mass destruction of flora or fauna, poisoning of the atmosphere or water resources, or other actions capable of causing an environmental disaster.* This provision is detailed in the analysis by the Supreme Court of Ukraine, which outlines the crime's elements, *actus reus*, and *mens rea* requirements.

The relevance of this provision became especially pronounced following the destruction of the Nova Kakhovka Dam during the Russian invasion, described by Ukraine's Prosecutor General as one of the most severe ecological catastrophes in recent European history. Further legislative study, such as the Research Service of Ukraine's report on the legal grounds of liability for ecocide, has emphasized the need for clearer procedural mechanisms and improved definitional clarity. Despite these national advancements, expanding ecocide to the international level within the ICC faces political, legal, and definitional challenges. Policy research highlights persistent ambiguities around thresholds such as "mass destruction" or "environmental disaster," complicating efforts to create universally applicable standards.

As AI-enabled autonomous systems increasingly shape the conduct of war, the lack of adequate attribution mechanisms and the absence of ecocide as an international crime leave significant accountability gaps. Addressing these challenges will require legal innovation, both in expanding international criminal law to include ecocide and in modernizing doctrines of liability to reflect technological mediation and the distributed nature of contemporary warfare.

Conclusion

As the situation in Gaza demonstrates, environmental devastation is increasingly used as a method of warfare, directly undermining civilian survival, public health, and long-term ecological stability. Yet the absence of ecocide as a standalone international crime allows such destruction to persist within legal grey zones, particularly where harm occurs outside narrowly defined wartime provisions or through technologically mediated means.

The rapid integration of AI-enabled drones and autonomous systems further exposes the inadequacy of existing international criminal law frameworks. Traditional concepts of intent, control, and attribution are ill-equipped to address accountability where environmental harm results from algorithmic decision-making and dispersed third-party involvement. Without clear legal mechanisms to assign responsibility to states, commanders, and private actors who design, deploy, or profit from these technologies, accountability for ecocide remains largely symbolic.

Recognising ecocide as an international crime would bridge critical gaps between environmental protection, human rights, and humanitarian law. It would also enable the law to evolve alongside modern warfare, ensuring that environmental destruction whether deliberate, reckless, or technologically facilitated and no longer escapes legal consequence. Environmental lawyer Polly Higgins has been at the forefront of efforts to amend the Rome Statute, seeking to designate ecocide as the fifth international crime against peace, alongside genocide, war crimes, crimes against humanity, and aggression. The future of international justice must acknowledge that protecting ecosystems is inseparable from protecting humanity itself.

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