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THE IMPACT OF RUSSIAN AGGRESSION ON ECOLOGICAL LOSSES OF UKRAINE

ABSTRACT: The ongoing Russian military aggression against Ukraine has resulted in consequences that extend far beyond the immediate humanitarian catastrophe, inflicting profound and enduring harm on the natural environment.

This study undertakes a comprehensive analysis of the conflict’s ecological repercussions, with a particular focus on both intentional and incidental destruction of natural ecosystems, the erosion of biodiversity, and the degradation of essential environmental components such as soil, air, and water resources.

Within this framework, the paper examines the notion of ecocide as a distinct legal category under international criminal law, assessing its applicability and relevance in the context of Ukraine. Particular emphasis is placed on the transboundary ramifications of environmental harm, notably the contamination of the Black Sea basin, the deterioration of wetlands of international importance, and the emerging threats to food security and climate stability.

KEYWORDS: ecocide, ecological losses, military aggression, environmental damages, reparation, environmental security

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1. INTRODUCTION

The Russian Federation's large-scale invasion of Ukraine in 2022 has produced consequences that extend far beyond the humanitarian and political spheres, reaching deeply into the ecological balance of the region. While the destruction of infrastructure, the displacement of millions of people, and the disruption of economic stability have been widely documented, the environmental dimension of the war has only recently begun to attract the level of attention it deserves. Military operations inevitably result in environmental degradation, but the intensity and duration of this conflict have generated unprecedented ecological losses, raising concerns not only for Ukraine's sustainable development but also for the broader environmental security of Eastern Europe.¹

Since the earliest stages of civilization, human beings have sought both to adapt to nature and to shape it according to their needs, while remaining dependent on its immutable laws for survival. However, beginning in the nineteenth century and intensifying throughout the last two centuries, a profound shift occurred: human attitudes toward the environment came to be dominated by an urge to control and exploit natural resources for short-term gains. This evolution has deepened the conflict between the cyclical equilibrium of the biosphere and the linear, accelerating dynamics of technological development, giving rise to what is now commonly referred to as an ecological crisis.

The origins of this crisis lie in the industrial revolution and the subsequent consolidation of industrial society, which initiated rapid and far-reaching transformations of the natural environment. The exploitation of natural resources intensified dramatically: agricultural land expanded, farming systems were restructured, forests were cleared on a massive scale for both timber and farmland, pastures were degraded through overuse, and mineral resources were extracted at unprecedented levels. At the same time, industrial growth encouraged demographic expansion and mass urbanization, leading to the concentration of large populations in limited geographic areas and creating fundamentally new social and ecological conditions.

As humanity's capacity to alter nature increased, the need to preserve balanced and sustainable living conditions was largely ignored. Only gradually did people begin to recognize their dual status as both creators of environmental change and products of ecological systems upon which biological survival and intellectual progress depend. Nevertheless, the excessive and irrational use of both renewable resources (forests, wildlife, flora) and non-renewable resources (particularly minerals) has aggravated the degradation of natural systems.

Within this broader context, ecocide has emerged as one of the most severe forms of environmental crime. It encompasses deliberate or large-scale destruction of ecosystems, whether at the global or regional level, with consequences that are often irreversible for both nature and

¹ Hryhorczuk, D., Levy, B.S., Prodanchuk, M. et al. The environmental health impacts of Russia's war on Ukraine. *J Occup Med Toxicol* 19, 1 (2024). <https://doi.org/10.1186/s12995-023-00398-y>. Available: https://occup-med.biomedcentral.com/articles/10.1186/s12995-023-00398-y?utm_source=chatgpt.com

society. Because such acts directly undermine human security, they occupy a critical place in the legal mechanisms aimed at safeguarding the environment.

A central paradox of human existence lies in the fact that, although humanity forms part of nature, it has simultaneously become its greatest threat. The once widespread assumption that the environment is limitless and indestructible has proven illusory: natural systems inevitably record and accumulate the destructive consequences of human activity on a planetary scale. Unlike political or territorial boundaries, the essential components of the environment – air, water, flora, and fauna – transcend national frontiers.

Against this background, the present study examines the historical evolution of ecocide as a legal category, the process through which it has gained recognition, and the ways in which contemporary armed conflicts accelerate ecological destruction. Russia's ongoing military aggression against Ukraine demonstrates this reality with clarity. Beyond the tragic loss of human life and the devastation of infrastructure, the war has produced profound and lasting ecological damage. The destruction of ecosystems, pollution of soil and water, and the eradication of species underscore the irreversibility of such harm. Establishing the causal connection between military operations and these environmental consequences confirms that the effects extend far beyond Ukraine's borders, generating cross-border repercussions that directly endanger the ecological security of neighboring states and, ultimately, Europe as a whole.

2. ECOCIDE AS AN INTERNATIONAL CRIME: CONCEPTUAL PERSPECTIVES FROM ENVIRONMENTAL PROTECTION NORMS

Researchers in the domain of environmental legal studies increasingly argue that the sustainability of the future global order depends on its ecological foundation, warning that its absence may precipitate systemic collapse. This view is reinforced by contemporary media debates, which consistently emphasize the imminence of an unprecedented ecological crisis. The underlying causes of this crisis are multifaceted and interdependent: accelerated industrial development, reliance on obsolete technologies, inadequate systems for water purification and waste management, and the uncontrolled emission of greenhouse gases.

The deterioration of ecological balance is compounded by the progressive loss of green spaces, the adverse implications of certain technological innovations for food security, depletion of the ozone layer, declining soil fertility, and the transformation of productive farmland into degraded landscapes. Equally concerning is the rapid extinction of numerous species of flora and fauna, all of which heighten environmental vulnerability. Considered together, these processes demonstrate that effective environmental protection and sustainable management – conceived as the legal object of environmental law – cannot be ensured without decisive interventions at both the national and international levels.

Within the corpus of legal mechanisms for environmental protection, criminal law plays a particularly significant role. Among environmental offenses, ecocide stands out as the gravest due to the existential threat it poses not only to ecosystems but to the security of humankind itself.

For this reason, ecocide has gradually come to be recognized as a transnational crime, the consequences of which are irreversible and extend beyond national territories, undermining both ecological stability and the foundations of human survival.

The conceptual development of ecocide within international criminal law can be traced back to the Vietnam War, where large-scale use of herbicides and toxic chemicals by U.S. forces resulted in the destruction of living organisms across vast areas. This case illustrated the intrinsic danger of ecocide: the destabilization of ecological balance within one territory generates consequences that extend far beyond its borders, a fact later tragically reaffirmed by the Chernobyl nuclear catastrophe.

In response to such transboundary threats, European legal institutions have undertaken efforts to establish coherent standards for the criminal prosecution of ecocide, emphasizing the need to hold perpetrators accountable within both international and regional legal systems.

It should be noted, however, that the legal protection of nature is not exclusively a modern phenomenon. Since ancient times, communities have relied on customary norms to regulate their relationship with the natural environment, which gradually evolved into formal prohibitions.

The sources underpinning the criminalization of environmental offenses, from which the concept of ecocide has evolved as an aggravated manifestation of their severity, can be traced to the following normative acts:

- Convention on the Preservation of Wild Animals, Birds, and Fish in Africa, the first multilateral international environmental agreement concluded in 1900;
- Paris Convention for the Protection of Useful Birds in Agriculture, dated March 19, 1902;
- Convention for the Preservation and Protection of Fur Seals, signed in Washington on July 7, 1911;
- Convention on the Conservation of Flora and Fauna in their Natural State, signed in London on November 8, 1933;
- Convention for the Protection of Flora, Fauna, and Natural Beauty of the Countries of the Americas (Washington, October 12, 1940);
- Protocol between Belgium and France concerning the establishment of a permanent commission for polluting waters (April 8, 1950);
- International Convention for the Protection of Plants, dated December 6, 1951;
- International Convention for the Protection of New Varieties of Plants, dated December 2, 1961.
- London Convention for the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (1972);
- Convention on Environmental Impact Assessment in a Transboundary Context, dated February 25, 1991;

- Agreement on Cooperation in the Field of Ecology and Protection of the Natural Environment, dated February 8, 1992;
- Convention on the Protection and Use of Transboundary Watercourses and International Lakes, dated March 17, 1992.

In 1977, the International Convention for the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques was signed. This document serves as the primary framework against the crime of ecocide, although it does not explicitly use this term.

The role of law in this domain is of paramount importance. Repeated environmental offenses, when tolerated or inadequately sanctioned, risk becoming entrenched practices, thereby transforming into a distinct category of wrongdoing – namely, the gradual destruction of the environment, which may be construed as a deliberate strategy of human existence.

At the international level, institutions such as the Council of Europe, the United Nations, and other global organizations have elaborated a range of legal instruments that enshrine and guarantee the fundamental human right to a healthy and ecologically balanced environment. The provisions embedded within these instruments are designed to ensure an equitable balance between the imperatives of environmental protection and the needs of human development. They are directed toward the preservation, management, and rational utilization of the natural environment, encompassing the principles of planning, sustainable development, and conservation.

For the purposes of legal and ecological clarity, the concept of habitat is understood as the specific geographical environment in which a human population, plant communities, or animal species subsist under relatively homogeneous conditions.

Through the adoption of international legal instruments, the global community has clearly expressed its concern regarding the urgent need to protect humankind from the grave crisis of environmental pollution.

Nevertheless, such aspirations cannot remain confined to abstract declarations that are detached from practical realities. Rather, they must be underpinned by the most effective systems of judicial protection at the national, regional, and international levels, ensuring that environmental rights are not only proclaimed but also enforced through robust legal mechanisms.

This warning may also be interpreted as a manifestation of the relativization of knowledge, whereby contemporary society is confronted with projects and programs – such as genetic mutations, organ transplants, cloning, and large-scale planetary interventions – that have surpassed traditional moral boundaries and eluded rational control. Within this context, certain initiatives are presented as opportunities to redefine humanity's relationship with the natural world on a cosmic and universal scale, thereby exceeding the classical boundaries of modern ecology and often generating ambiguous or counterproductive theoretical constructs.

Against this backdrop, the more recent concept of “ecocide” has emerged to designate the destructive impact of human activity on the natural environment. As a collective of complex organisms, humankind engages in the relentless exploitation of planetary resources, thereby shaping the very geological epoch in which we live – commonly referred to as the Anthropocene. This term underscores the unprecedented influence of human activity on the Earth’s systems, as reflected most visibly in phenomena such as atmospheric pollution caused by emissions of greenhouse gases, including carbon dioxide and methane.

Environmental scholars and activists, such as Patrick Hossay, argue that through the cumulative effects of industrial civilization, humanity is effectively committing ecocide, thereby endangering the ecological foundations upon which both nature and human survival depend.²

The term „ecocide” was coined by the American biologist and bioethicist Arthur W. Galston (1920–2008) at the Conference on War and National Responsibility in Washington (1970). He proposed to use this term to describe the catastrophic consequences of the application of the herbicide Agent Orange during the war in Vietnam when the American military spread about 200 mln gallons of this defoliant during the period from 1962 to 1970. It was used for the destruction of forests to reveal the positions and routes of the Vietnamese army. Arthur W. Galston argued that the wide-scale spread of the defoliant destroys the important ecological niches of the region.

In 1972, at the Stockholm Conference on the Human Environment, Olaf Palme, in his opening speech, referred to the Vietnam War as an ecocide.³

According to Article 8, Section 2, point b (IV) of the Rome Statute and Article 35(3) of the first Additional Protocol Additional to the Geneva Conventions of 8 June 1977 consider ecocide, namely the intentional launch of an attack in the knowledge that it will cause „widespread, long-term and severe damage to the natural environment which would be excessive in relation to the concrete and direct overall military advantage anticipated”, a war crime.

In 1978, various draft articles discussing state responsibility and international criminality included ecocide as an international crime, capable of resulting in serious breaches of international obligations crucial for the protection and conservation of the natural environment, such as through massive pollution of the atmosphere or seas.⁴

In 1985, ecocide continued to be addressed as an international crime. Consequently, the Sub-Commission on the Promotion and Protection of Human Rights commissioned a Special Report addressing the prevention and punishment of ecocide, prepared by Benjamin Whitaker.⁵

² Patrick Hossay. *Unsustainable: A Primer for Global Environmental and Social Justice*. ZED Books, 2005.

³ Tord Bjork. *The Emergence of Popular Participation in Global Politics, United Nations Conference on the Human Environment, 1972*.

⁴ Sub-Commission on Prevention of Discrimination and Protection of Minorities. *Study on the Prevention and Punishment of the Crime of Ecocide*. July 4, 1978. E/CN.4/Sub.2/416, p.124 and p.130.

⁵ Whitaker Benjamin C.G. UN. *Special Rapporteur on Prevention and Punishment of the Crime of Ecocide* E/CN.4/Sub.2/1985/6. [https://digitallibrary.un.org/search?ln=en&as=0&p=subjectheading:\[REPORT+PREPARATION\]](https://digitallibrary.un.org/search?ln=en&as=0&p=subjectheading:[REPORT+PREPARATION])

In 1987, discussions on international crimes persisted at the International Law Commission (ILC), where ecocide was proposed for inclusion in the list of international crimes, reflecting the need to protect and conserve the environment.⁶

The 1991 ILC „Draft Code of Crimes against the Peace and Security of Mankind” included 12 offenses, one of which was „intentional environmental degradation” (Article 26).

By March 29, 1993, the Secretary-General had received responses from 23 member states and one non-member state: Australia, Austria, Belarus, Belgium, Brazil, Bulgaria, Costa Rica, Ecuador, Greece, the Netherlands, the Nordic countries (Denmark, Finland, Iceland, Norway, Sweden), Paraguay, Poland, Senegal, Sudan, Turkey, the United Kingdom, the United States of America, Uruguay, and Switzerland. Only three countries – the Netherlands, the United Kingdom, and the United States of America – opposed the inclusion of an environmental offense. The issue of incorporating a high intent requirement was of interest; Austria commented, „Since perpetrators of this offense typically act for profit motives, intent should not be a condition for liability to punishment”. Belgium and Uruguay also took the position that no intent element was necessary for the crime of serious environmental damage (Article 26).⁷

In 1996, Canadian lawyer Mark Gray published his proposal for an international crime of ecocide, based on establishing international law in the fields of human rights and the environment. He argued that states, and undoubtedly individuals and organizations, causing or permitting harm to the natural environment constitute a massive violation. Gray proposed that such violations, when identified as deliberate, reckless, or negligent, resulting in severe, widespread, or long-term ecological damage, should attract international consequences and liabilities.⁸

In 2010, the proposal for an ecocide crime was presented at a private event at the United Nations. Subsequently, in 2011, a mock ecocide trial was conducted in the UK Supreme Court through a simulation organized by the Hamilton Group.

In the years 2013 and 2014, a citizens’ initiative was developed to criminalize ecocide, aimed at prohibiting the market access of products causing significant environmental damage through ecosystem destruction. Three Members of Parliament publicly supported the initiative by signing it. Although the initiative aimed to gather 1 million signatures, it did not reach this goal; however, the issue was discussed in the European Parliament.⁹

However, the precision of such a definition is still being discussed internationally. At the latest report, the European Law Institute (ELI) published its final report on ecocide.¹⁰ The report not only defines ecocide, it also contains Model Rules for an EU Directive and a Council Decision that

⁶ Yearbook of the International Law Commission, p. 56 para.1 38. A/CN.4/SER.A/1987. UNITED NATIONS PUBLICATION. ISBN 92-1-133312-1 https://legal.un.org/ilc/publications/yearbooks/english/ilc_1987_v1.pdf

⁷ http://legal.un.org/ilc/publications/yearbooks/english/ilc_1993_v2_p1.pdf

⁸ Mark Allan Gray. *International Crime of Ecocide*. 1996.

⁹ <https://en.wikipedia.org/wiki/Ecocide>

¹⁰ *ELI Report on Ecocide Model Rules for an EU Directive and a Council Decision*. Available: https://www.europeanlawinstitute.eu/fileadmin/user_upload/p_eli/Publications/ELI_Report_on_Ecocide.pdf

ELI hopes will both „contribute to the inter-institutional negotiations in the EU on the Proposal for a Directive of the European Parliament and of the Council on the protection of the environment through criminal law” and will „inspire legislative developments beyond the EU”; worth to mention that the definition of ecocide proposed by ELI faced a certain criticism, in particular, for the „overly narrow”¹¹ definition.

The most recent definition of ecocide, elaborated by the Independent Experts Panel „Stop Ecocide International”, was presented to the international community in 2021 to have it adopted and introduced into the Rome Statute.¹² The panel proposed an entirely new article, „art. 8 ter”, which may be directly adopted and incorporated into the Rome Statute. The proposed article reads as follows:

„1) For the purpose of this Statute, ecocide means unlawful or wanton acts committed with the knowledge that there is a substantial likelihood of severe and either widespread or long-term damage to the environment being caused by those acts.

2) For the purpose of paragraph 1. „Wanton” means with reckless disregard for damage which would be clearly excessive in relation to the social and economic benefits anticipated; 2. „Severe” means damage which involves very serious adverse changes, disruption, or harm to any element of the environment, including grave impacts on human life or natural, cultural, or economic resources; 3. „Widespread” means damage that extends beyond a limited geographic area, crosses state boundaries or is suffered by an entire ecosystem or species or a large number of human beings; 4. „Long-term” means damage that is irreversible or which cannot be redressed through natural recovery within a reasonable period of time; 5. „Environment” means the earth, its biosphere, cryosphere, lithosphere, hydrosphere, and atmosphere, as well as outer space.¹³

According to the commentary published by the Panel, the first threshold requires that „there must exist a substantial likelihood that the conduct (act or omission) will cause severe and either widespread or long-term damage to the environment”, while the second threshold requires „proof that the acts are unlawful or wanton.”¹⁴

Concurrently, the question of criminal liability for offenses against the natural environment was brought to the forefront within the framework of the Council of Europe. In 1998, the Committee of Ministers adopted the Convention on the Protection of the Environment through Criminal Law, a landmark instrument designed to harmonize the criminalization of environmental offenses among Member States.

¹¹ Kevin Jon Heller, *ELI's Overly Narrow Definition of Ecocide*, *Opinio Juris*, February, 23, 2023. Available: <https://opiniojuris.org/2023/02/23/elis-overly-narrow-definition-of-ecocide/>

¹² Ihor Kozak, *Crime of ecocide in Ukraine – environmental consequences of Russian military aggression*. *STUDIA PRAWNICZE KUL 4 (96) 2023*. p.104-106. ISSN: 1897-7146; eISSN: 2719-4264

¹³ The text of the definition is available on the following website: <https://www.stopecocide.earth/legal-definition> [access: 12.07.2025].

¹⁴ Stop Ecocide Foundation, *Independent Expert Panel for the Legal Definition of Ecocide. Commentary and Core Text*, Amsterdam 2021. <https://ecocidelaw.com/definition/>

Article 2 of the Convention expressly provides that “each Party shall adopt such appropriate measures as may be necessary to establish as criminal offences under its domestic law”. This provision obliges States to transpose the Convention’s standards into their national legal systems, thereby ensuring the effective penal protection of the environment.

As a Member State of the Council of Europe, Ukraine is obliged to uphold the commitments and guiding principles established under this Convention. In particular, Article 2 provides a detailed enumeration of environmental offenses, identifying specific forms of conduct that must be treated as punishable under national criminal legislation. In doing so, it lays the normative foundation for building an international consensus regarding the recognition, classification, and sanctioning of crimes directed against the environment: „(a) the discharge, emission or introduction of a quantity of substances or ionizing radiation into air, soil or water which: (i) causes death or serious injury to any person, or (ii) creates a significant risk of causing death or serious injury to any person; (b) the unlawful discharge, emission or introduction of a quantity of substances or ionizing radiation into air, soil or water which causes or is likely to cause their lasting deterioration or death or serious injury to any person or substantial damage to protected monuments, other protected objects, property, animals or plants; (c) the unlawful disposal, treatment, storage, transport, export or import of hazardous waste which causes or is likely to cause death or serious injury to any person or substantial damage to the quality of air, soil, water, animals or plants; (d) the unlawful operation of a plant in which a dangerous activity is carried out and which causes or is likely to cause death or serious injury to any person or substantial damage to the quality of air, soil, water, animals or plants; (e) the unlawful manufacture, treatment, storage, use, transport, export or import of nuclear materials or other hazardous radioactive substances which causes or is likely to cause death or serious injury to any person or substantial damage to the quality of air, soil, water, animals or plants, when committed intentionally”.¹⁵

Even if the Convention is not universally binding and does not introduce individual criminal liability at the international level, it identifies actions that may cause severe environmental damage and establishes fundamental standards for environmental protection.

3. ANALYSIS OF ECOLOGICAL LOSSES ON UKRAINIAN TERRITORY CAUSED BY RUSSIA’S MILITARY AGGRESSION

Russia’s military aggression against Ukraine constitutes not only an assault on the sovereignty and security of its people but also a grave attack on the natural environment. Reports increasingly document the use of toxic and environmentally harmful weapons by Russian forces, resulting in severe ecological degradation. In cities subjected to heavy bombardment, levels of biotic components pollution have reached critical thresholds, posing direct threats to public health and ecological stability. The environmental consequences of the conflict are not limited to immediate damage; rather, they carry profound, long-term implications for the quality of Ukraine’s environmental systems, with effects that may persist for decades, if not generations.

¹⁵ Article 2 of the Convention on the Protection of the Environment. <https://huespedes.cica.es/gimadus/06/THE%20CONVENTION%20ON%20THE%20PROTECTION%20OF%20THE%20ENVIRONMENT%20THROUGH%20CRIMINAL%20LAW.htm>

Since the outbreak of Russia's military aggression against Ukraine, public authorities, private institutions, and civil society organizations engaged in monitoring the ecological consequences of warfare have reported more than 2,900 instances of what has been characterized as "ecocide." These environmental crimes, systematically documented, are expected to be presented before international judicial bodies accompanied by claims for reparations and accountability.

The repercussions of such actions transcend Ukraine's national borders, producing measurable transboundary ecological impacts. This is already evidenced in Bulgaria and Romania, where the Black Sea has carried ashore visible indicators of imminent environmental disaster.

3.1 Impact of Military Aggression on Air Quality

The transboundary nature of atmospheric pollution underscores the reality that contaminated air recognizes no state borders. Emissions released into the atmosphere as a direct consequence of the Russian Federation's military aggression in Ukraine are carried by prevailing winds, dispersed across vast distances, and deposited on the territories of neighboring and distant states, in some cases thousands of kilometers away. The resulting contamination of European soils with heavy metals exemplifies the cross-border dimension of this ecological crisis. In Ukraine itself, approximately two million square meters of agricultural fields were rendered unusable within the first twelve months of the large-scale invasion.

Ukraine is home to more than 20,000 industrial facilities and approximately 3,000 hazardous waste storage sites, many of which have been deliberately targeted by the aggressor. Catastrophic damage ensued from attacks such as the destruction of the Kremenchug oil refinery and fuel depots, which released hundreds of tons of toxic combustion by-products into the environment. Similarly, the damage inflicted on the oil refining capacities of Odesa and Luhansk exacerbated the ecological devastation. According to data from Ukraine's State Environmental Inspectorate, by the summer of 2023, damages inflicted upon soil, aquatic ecosystems, and the atmosphere had already exceeded \$52 billion.

Environmental experts warn that the long-term harm to ecosystems will surpass even the destruction of infrastructure, with consequences that will reverberate throughout the European ecological system for decades. Vast stretches of arable land remain poisoned, the atmosphere continues to be heavily polluted, and large forested areas have been reduced to ashes. The acts of "ecocide" committed by the Russian Federation also threaten the survival of rare species of flora and fauna inscribed in the Red Book of Ukraine, thereby compounding the scale of biodiversity loss and undermining regional and global environmental security.

3.2 Greenhouse Gas Emissions from the War in Ukraine – A Transboundary Ecological Risk

The extensive use of military vehicles during Russia's aggression against Ukraine – each consuming several times more fuel than civilian cars – has significantly intensified atmospheric pollution through greenhouse gas emissions. According to updated estimates presented by the War-related Greenhouse Gas Accounting Initiative and supported by research led by Dutch climate expert Lennard de Klerk at the Bonn Climate Summit, the first twelve months of warfare

generated approximately 120 million tons of CO₂. This staggering amount is equivalent to the total annual greenhouse gas emissions of an entire industrialized country, such as Belgium.

Such emissions represent not only a direct ecological loss for Ukraine but also a transboundary environmental threat, extending their impact far beyond the region. The atmospheric dispersion of greenhouse gases exacerbates global climate change, disproportionately affecting countries of the Global South and particularly the least developed states, which remain most vulnerable to the adverse consequences of rising temperatures, food insecurity, and environmental instability. In this respect, Russian military actions against Ukraine contribute to global ecological degradation, reinforcing the classification of this war as not only a humanitarian and geopolitical crisis but also an unprecedented environmental catastrophe.

The ecological consequences of Russia's military aggression against Ukraine extend beyond immediate environmental degradation, generating long-term global risks associated with climate change intensification. Such impacts manifest in two critical dimensions. First, they directly contribute to the amplification of catastrophic climate-related phenomena, including rising global temperatures, extreme heatwaves, droughts, floods, biodiversity loss, and other natural disasters. Second, they indirectly increase vulnerabilities by diverting financial and political resources from climate change mitigation and adaptation efforts toward heightened militarization and security expenditures.

While states and corporations worldwide undertake substantial efforts to reduce greenhouse gas emissions in line with international climate commitments, Russia's war machinery continues to release millions of tons of CO₂ monthly. The deliberate or collateral destruction of energy infrastructure has further exacerbated the crisis. For instance, the bombardment of gas facilities has led to uncontrolled releases of pressurized gas, triggering numerous fires, particularly in the Odesa region, while the Kyiv region has also suffered extensive environmental damage due to recurrent fires. Notably, in 2022, Kyiv was ranked the most polluted city in the world, underscoring the unprecedented ecological consequences of the ongoing conflict.

The transboundary nature of environmental degradation underscores that polluted air and water recognize no state borders. While industrial activity in Ukraine has decreased due to the war, the combined effects of military operations, widespread forest fires, and damage to energy infrastructure have driven a dramatic increase in greenhouse gas emissions. According to recent estimation, the conflict has generated nearly 230 million tons of CO₂ equivalent since 2022, including approximately 55 million tons in 2024 alone – an amount equivalent to the annual emissions of Austria, Hungary, the Czech Republic, and Slovakia combined.¹⁶

One of the most catastrophic ecological events was the destruction of the Kakhovka Dam in June 2023. This collapse liberated over 90,000 tons of toxic heavy metals – such as arsenic, nickel,

¹⁶ *Forest fires push up greenhouse gas emissions from war in Ukraine*. Available: <https://www.theguardian.com/world/2025/feb/24/forest-fires-push-up-greenhouse-gas-emissions-from-war-in-ukraine>

and lead – from the reservoir sediments. Continued erosion now poses an ongoing threat to soil and water systems, with serious implications for public health and agriculture.¹⁷

Paradoxically, the drained reservoir fostered spontaneous rewilding – forming a floodplain forest known as Velykyi Luh, spanning over 2,100 km². While this phenomenon symbolizes ecological resilience, it also constitutes a “toxic time bomb” if pollutants within the soil are mobilized without proper management.¹⁸

The ecological repercussions extend well beyond Ukraine. Airborne pollutants are transported over long distances, while contaminated water flows downstream into the Danube Delta, the Gulf of Odesa, and the Sea of Azov. These ecologically sensitive zones—many of international significance – face long-term risks to biodiversity, fisheries, and climatic stability, though comprehensive assessments are still pending (IGB Berlin, 2025) (Wikipedia, Environment of Invasion).¹⁹

3.3 Impact of Russian Military Actions on Nesting Colonies and Biodiversity in Ukraine

Persistent military activity in Ukraine has inflicted severe harm on avian nesting colonies across multiple ecosystems. Recent research using open-source intelligence demonstrates that even highly mobile bird species – such as eagles, owls, pelicans, flamingos, and avocets – have suffered dramatic declines in breeding populations, despite their migratory adaptability.²⁰

Intensive shelling, rocket strikes, and fires in wetlands, particularly along the Azov-Black Sea coastal ecosystems, have destroyed entire nesting sites of colonial birds, including white pelicans, shelducks, gulls, and terns.²¹ These species are particularly vulnerable because their reproductive success depends on intact colonies, which are easily disrupted by noise, fire, and physical habitat destruction.

Furthermore, the cumulative stress of warfare is reshaping migratory routes. A 2024 study revealed that greater spotted eagles are now actively detouring around conflict zones, extending migration paths by up to 85 km and delaying arrival at breeding grounds, with potential consequences for reproductive timing and chick survival.²²

¹⁷ <https://www.washingtonpost.com/world/2025/03/13/kakhovka-dam-environment-heavy-metals-science-study/>

¹⁸ In Ukraine’s bombed out reservoir a huge forest has grown – is it a return to life or a toxic timebomb? Available: <https://www.theguardian.com/environment/2025/jul/22/in-a-bombed-out-reservoir-ukraine-huge-forest-grown-a-return-to-life-or-toxic-timebomb>

¹⁹ Kakhovka Dam in Ukraine. Available: <https://www.igb-berlin.de/en/news/water-war-long-term-environmental-consequences-destruction-kakhovka-dam-ukraine>

²⁰ Audubon. *How the War in Ukraine Takes a Devastating Toll on Nature*. Audubon Magazine. 2023. Available at: <https://www.audubon.org/magazine/how-war-ukraine-takes-devastating-toll-nature>

²¹ BirdLife International (2022). *The Impact of the Russian Invasion of Ukraine on Wild Birds and Habitats*. BirdLife News. Available at: <https://www.birdlife.org/news/2022/08/23/impact-russian-invasion-ukraine-wild-birds-habitats/>

²² Carrington, D. *Eagles Shifting Flight Paths to Avoid Ukraine Conflict*, Scientists Find. The Guardian. 2024. Available at: <https://www.theguardian.com/environment/article/2024/may/20/eagles-shifting-flight-paths-to-avoid-ukraine-conflict-scientists-find>

3.4 Environmental Consequences of Russian Aggression on Internationally Protected Areas

The catastrophic collapse of the Kakhovka Dam in June 2023 inflicted devastating effects on multiple internationally protected natural areas within Ukraine, many of which form critical biodiversity reservoirs under European and global conservation frameworks.

Nine Emerald Network sites were either fully or partially inundated by the floodwaters, undermining Ukraine's commitment to preserve these ecologically valuable territories for Europe's collective heritage.²³

Most notably, over 90% of the Lower Dniester Delta – a Ramsar-designated wetland and essential Emerald Network area—was submerged by the waters released.²⁴

The Grand Meadow National Nature Park, which includes the sensitive Sim Maiakiv Floodplain, suffered severe degradation after the draining of the reservoir, raising concerns about irreversible habitat loss.²⁵

Consequently, vast tracts of protected steppe, wetland, and riparian ecosystems have been converted into degraded landscapes or, in some cases, new successional habitats—prompting a reevaluation of restoration strategies. These environmental repercussions not only threaten local biodiversity and Ramsar objectives but also constitute a significant breach of international environmental commitments.

3.5 Statistical Assessment of Environmental Damage Arising from Russian Military Crimes in Ukraine

According to monitoring by the Ministry of Environmental Protection and Natural Resources of Ukraine, the following environmental crimes have been reported so far²⁶:

- damage to nuclear facilities and the potential threat of radiation and nuclear danger;
- destruction and damage to infrastructure and industrial facilities, which led to significant pollution;
- the emergence of so-called „military waste” and chemical pollution as a result of hostilities;
- destruction of reserves and other explicitly protected areas;
- mining and pollution of waterways.

²³ *The consequences of the Russian terrorist attack on the Kakhovka Hydroelectric Power Plant (HPP) for wildlife*. Available: <https://uncg.org.ua/en/the-consequences-of-the-russian-terrorist-attack-on-the-kakhovka-hydroelectric-power-station-hps-for-wildlife/>

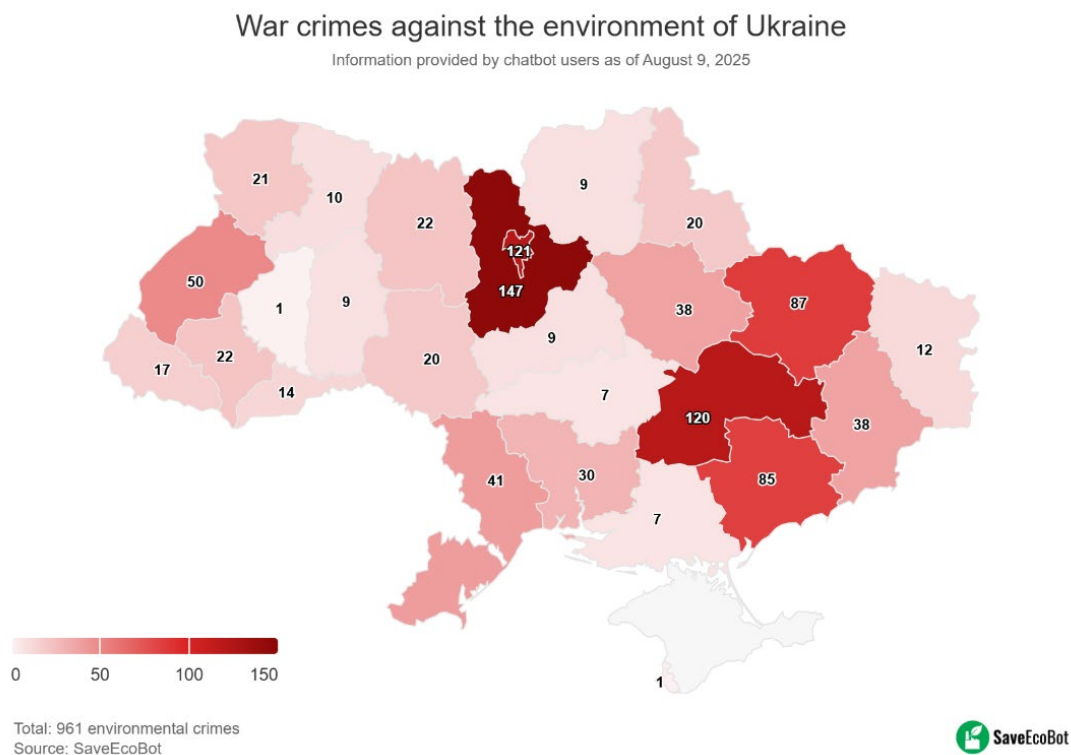
²⁴ *Downstream impact: Analysing the environmental consequences of the Kakhovka dam collapse*. Available: <https://reliefweb.int/report/ukraine/downstream-impact-analysing-environmental-consequences-kakhovka-dam-collapse>

²⁵ Grand Meadow National Nature Park. Available: https://en.wikipedia.org/wiki/Grand_Meadow_National_Nature_Park

²⁶ H. Bazhenova, *The War in Ukraine: Crimes against the Environment (Part 1)*, Instytut Europy Środkowej – IEŚ Commentaries 2022, no. 605 (117). ISSN 2657-6996. Available: <https://ies.lublin.pl/wp-content/uploads/2022/06/ies-commentaries-605-117-2022.pdf>

In this study, we provide current statistical data on the commission of military crimes („ecocide”) affecting Ukraine’s environment up to August 9, 2025.²⁷

Table No. 1 Military crimes against environment in Ukraine, status as at August 9, 2025



Analyzing Table No. 1, we can deduce that the most affected areas by military offenses are:

- - Kiev – 147 offenses;
- - Dnepropetrovsk – 120 offenses;
- - Kharkhov – 87 offenses;
- - Zaporizhia – 85 offenses;
- - Lviv – 50 offenses;
- - Poltava – 46 offenses;
- - Odessa – 41 offenses;
- - Donetsk – 38 offenses;
- - Poltava – 38 offenses, etc.

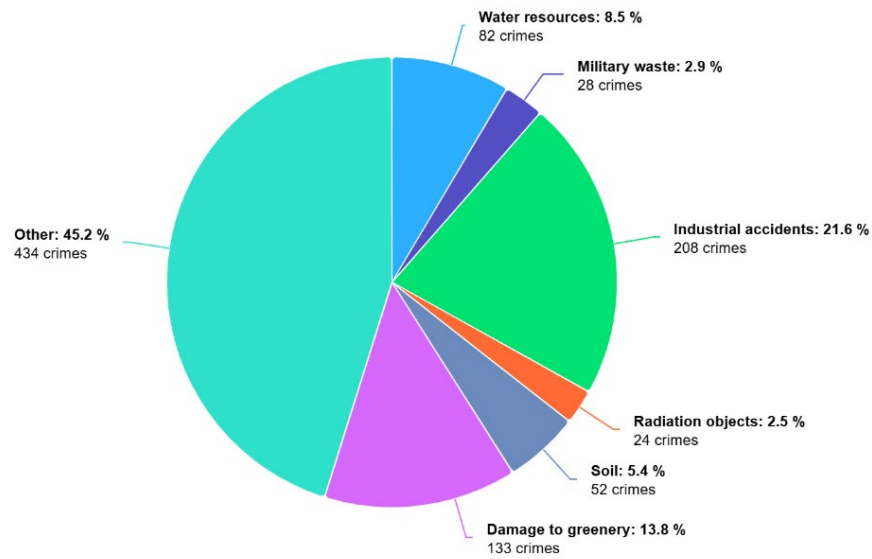
In the context of recovering the damages caused to Ukraine by the military actions of the Russian aggressor, it is necessary to take into consideration the evidence base and proper documentation of the competent authorities. Environmental crimes have the characteristic of not manifesting immediately but over a long period, with consequences felt over years, decades, and even centuries.

²⁷ <https://www.saveecobot.com/en/features/environmental-crimes>

Table No. 2 Military crimes against environment in Ukraine, status as at August 9, 2025

Environmental crimes in Ukraine

Information provided by chatbot users as of August 9, 2025



Total: 961 environmental crimes
Source: SaveEcoBot



From Table No. 2, it can be inferred that military crimes against the environment have been committed, targeting the following:

- Water contamination – 82 offenses – 8.5%;
- Military waste – 28 offenses – 2.9%;
- Industrial object impairment – 208 offenses – 21.6%;
- Damage to radiological facilities – 24 offenses – 2.5%;
- Soil contamination – 52 offenses – 5.4%;
- Damage to greenery – 133 offenses – 13.8%.
- Other – 434 offenses – 45.2%.

4. Conclusions

The military aggression of the Russian Federation against Ukraine has caused unprecedented ecological damage, with repercussions that extend beyond the national level and affect the regional and global environment. Forest and agricultural land fires, water and soil pollution, biodiversity loss, and the destruction of industrial infrastructure have created long-term consequences, many of which are irreversible.

Ecocide emerges as a central legal concept in the assessment of such destruction, requiring its explicit recognition within international criminal law. The current provisions of international humanitarian and environmental law – such as the 1977 Additional Protocol I to the Geneva Conventions, the 1998 Rome Statute of the International Criminal Court, and the 1998 Convention

on the Protection of the Environment through Criminal Law adopted by the Council of Europe – remain insufficient to adequately sanction these acts.

The transboundary dimension of ecological harm – confirmed by the pollution of the Black Sea, contamination of soils in neighboring states, and the spread of greenhouse gases – demonstrates the global nature of ecocide. This reality calls for collective responses from the European Union, the Council of Europe, and the United Nations through effective mechanisms for monitoring, sanctioning, and reparations.

The security dimension of ecocide is evident. In this line, environmental degradation directly affects food security, public health, climate stability, and the balance of ecosystems. Consequently, environmental protection must be treated not only as an ecological imperative but also as an essential component of international security and global sustainability.

Russia, as the aggressor state, must be held accountable not only for violations of international humanitarian law and human rights but also for the ecological damage inflicted upon Ukraine and the broader international community.

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