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Establishing a cause-and-effect relationship in military environmental crimes: Criminalistic aspect of protecting the right to life in practice of the European Court of Human Rights

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Abstract

The study aimed to conduct a comparative legal analysis of the tools and procedures for verifying the causal link between the destructive impact of armed conflicts on the environment and violations of the right to life. The research was based on an examination of the body of legislation and the practice of applying international human rights standards within the jurisdictions of Ukraine, the Netherlands and Azerbaijan. The research established that, as of April 2026, Ukraine had developed a precise model for the criminalisation of war-related environmental damage, with the total amount of recorded environmental damage reaching UAH 6.763 trillion. The study determined that the Dutch investigative system is based on the formation of integrated chains of evidence, where data on the toxicity of weapons allow large-scale pollution to be classified as a direct threat to public safety. The study established that, in the case law of the European Court of Human Rights, the environmental consequences of armed conflicts may be deemed a violation of the fundamental right to life, provided that a real and foreseeable risk to civilians is demonstrated. Large-scale destruction of ecosystems and climate-related damage pose a long-term threat to the population's safe existence. The study demonstrated that the use of innovative digital recording and open-source intelligence tools ensures the proper documentation of damage in cases where physical access to affected areas is restricted. The study established that environmental safety must be regarded as an integral prerequisite for the realisation of the right to life. Furthermore, the study noted that compensation and reparation mechanisms may be regarded as one of the avenues for restoring violated environmental and human rights safeguards. The practical significance of the study is determined by possible use of results by investigative bodies and forensic experts to develop effective procedures for documenting, proving and internationally verifying war-related environmental crimes in the context of protecting the right to life

Keywords: environmental damage; documentation of damage; ecocide; forensic examination; evidence gathering; investigation methodic; criminalistic innovations

Introduction

The period of global instability and large-scale armed conflicts has necessitated a re-evaluation of the legal protection of the environment, not merely as a natural resource, but as a prerequisite for the realisation of the right to life. As of early 2026, the environmental consequences of hostilities were no longer regarded as inevitable collateral damage but had acquired the status of independent objects of criminal infringement, requiring precise proof. Establishing a direct link between the destructive impact on ecosystems and the death or injury of a person is a central challenge in criminal proceedings and international humanitarian law. The complexity of investigating such acts stems from the long-term effects of pollution, the cross-border nature of the damage, and the need to integrate innovative forensic technologies into traditional evidence-gathering procedures. The development of effective methodologies for documenting environmental crimes within the context of Article 2 of the European Convention on Human Rights (ECHR) (1950) is a priority task,

transforming technical data on the condition of soil or water into legally significant arguments for the protection of human dignity.

The issue of the admissibility of innovative digital evidence – which serves as a key tool for documenting war-related environmental damage and substantiating threats to the right to life – was examined by V. Shevchuk *et al.* (2025a). Analysing the practice of using artificial intelligence in criminal proceedings, the authors found that, due to the lack of a specific regulatory framework governing algorithms, the defence moves to have such evidence ruled inadmissible in 73.5% of cases. The findings demonstrated that, without resolving the issue of forensic verification of digital traces (in particular OSINT data and satellite monitoring), the effective demonstration of a causal link between environmental destruction and its consequences for the population in international courts will remain procedurally vulnerable. The issues of forensic support for the investigation of war crimes and the integration of international standards of environmental justice into the national system of evidence were further examined by V. Shevchuk *et al.* (2025b). The researchers analysed European experience in documenting the consequences of armed conflict. Their research demonstrated that, to properly document war damage and substantiate international claims, Ukrainian investigative practice requires a thorough doctrinal overhaul and adaptation to state-of-the-art forensic examination methodologies.

The concept of "agroecocide" as a framework for interpreting the destruction of agriculture during the war in Ukraine was introduced by R. Kazak *et al.* (2026). The authors argued that existing legal doctrines regulate agricultural damage only in a piecemeal manner; they therefore proposed the introduction of Article 441-1 into the Criminal Code of Ukraine (2001) to strengthen preventive mechanisms and ensure soil restoration. S.O. Kharytonov *et al.* (2023) examined the national realities of criminal law protection of the environment and their compliance with international standards. The researchers demonstrated that, to improve the effectiveness of combating environmental offences, it is necessary to refine the system of sanctions and procedural rules, covering growing environmental awareness in society. D. Rawtani *et al.* (2022) analysed the prospect of environmental damage resulting from the war in Ukraine and its impact on human health and the planet. The researchers found that damage to industrial infrastructure leads to the contamination of water resources and the air, necessitating urgent reform of the International Criminal Court's mandate to include environmental crimes within its jurisdiction. G. Chiarini (2022) examined the procedural aspects of ecocide dating back to the Vietnam War. The author developed seven macro-amendments to the Rome Statute of the International Criminal Court (1998), focusing on standards of proof and the prosecutor's discretion. D.P. van Uhm & R.C.C. Nijman (2022) studied the convergence of environmental crimes with other types of serious offences, in particular organised crime. The researchers identified three types of criminal groups involved in the illegal trade in resources and demonstrated that the traditional boundaries between environmental and general criminal law are ineffective for interpretation of contemporary challenges. Kh. Marych & M. Pohorilets (2023) examined the specifics of establishing a legal framework for liability for war crimes against the environment. The authors investigated the constituent elements of the mechanism for punishment and compensation for damage caused to ecosystems in the context of armed aggression against Ukraine. Their findings established that the environmental damage caused has a long-term negative impact on people's lives and health, and that the effective enforcement of liability in national and international courts requires clear documentation of the facts of the

offences, with the mandatory involvement of specialist expert assessments. The environmental history of wars and mass violence was summarised by R.P. Tucker & J.R. McNeill (2025). The authors found that whilst pre-industrial weapons had a limited impact on the environment, modern preparations for war are a central aspect of the organisation of societies, making future cyberwars new environmental threats. R.J. Wenning & T.D. Tomasi (2023) proposed using the American Natural Resource Damage Assessment (NRDA) methodology to interpret the consequences of the war in Ukraine. The researchers demonstrated that remote preliminary assessment of damage during a conflict allows for the prioritisation of rehabilitation measures. Y.D. Wirtu & U. Abdela (2025) analysed the military consequences for the planet through the lens of ecocide and the mass degradation of biological forms. The scientists identified patterns of destruction in the wars in Vietnam, the Persian Gulf and Ukraine, calling for the creation of international treaties that would guarantee the absence of environmental degradation in post-war countries. The issue of animal and nature rights in the context of the "just war" theory was raised by C. Wanner (2025). The researcher argued that a shift in perspective in favour of ecosystems could radically alter the assessment of the legitimacy of military action.

Despite substantial research, there are gaps that require comprehensive study. In particular, there is a lack of analysis of practical approaches to establishing a causal link between specific tactical actions (the blowing up of dams, shelling of chemical depots) and violations of the right to life in the case law of the European Court of Human Rights (ECHR).

The study aimed to conduct a comparative legal analysis of the link between war-related environmental damage and the violation of the right to life. To achieve this aim, the following objectives were set: to analyse the case law of the ECHR regarding state obligations in the context of environmental and man-made threats, with a view to establishing criteria for proving a risk to life; to examine the legal frameworks of Ukraine, the Netherlands and Azerbaijan in the context of defining war-related environmental damage as a threat to the survival of the population; to assess the use of forensic methods and innovative recording technologies as an auxiliary tool for proving a causal link between military acts, the destruction of ecosystems and the consequences for human life.

Materials and Methods

The study was theoretical, legal and comparative in nature. The methodological framework of the study was developed through the integration of theoretical approaches, which facilitated a multi-level analysis of the algorithms used to establish a cause-and-effect relationship in military environmental offences. The sample of countries included Ukraine – as an example of war-related environmental damage and its impact on the realisation of the right to life in conflict situations; the Netherlands – as an example of internationally coordinated evidence-gathering regarding environmental threats to life; and Azerbaijan – as an example of the use of international legal mechanisms for environmental protection following an armed conflict. This approach facilitated the comparison of different legal models, ranging from the direct criminalisation of environmental damage to the protection of the right to life through the prism of environmental security.

Comparative legal analysis served as the main research method. The criteria for comparing Ukraine, the Netherlands and Azerbaijan were standardised according to the following parameters: 1) the key legal framework for the protection of the environment and life; 2) the existence of criminal liability for environmental damage or war crimes against the environment; 3) the link

between environmental damage and risks to life and health; 4) the state's obligations regarding the prevention of hazards and effective investigation; 5) the evidence required to establish a causal link; 6) sanctions or legal consequences; 7) the existence of international legal response mechanisms. The comparative legal method was applied to the following bodies of law – the Criminal Code of the Republic of Azerbaijan (1999), the Criminal Code of Ukraine (2001), and the Criminal Code of the Netherlands (1881) – to identify the elements of offences related to the destruction of ecosystems and threats to life. To examine the procedural aspects of gathering and assessing evidence during wartime, a dogmatic analysis was conducted of the legislative provisions of Ukraine (Criminal Procedure Code..., 2012), the Netherlands (International Crimes Act..., 2003) and Azerbaijan (Criminal Procedure Code..., 2000) was used to examine the procedural aspects of evidence collection and assessment during wartime; this facilitated an interpretation of the rules governing the admissibility of technical data in courts. Comparative method was used to identify differences in the interpretation of the "environmental basis of the right to life" between the national legislation of Ukraine, the Netherlands and Azerbaijan, and Directive (EU) No 2024/1203 of the European Parliament and of the Council "On the Protection of the Environment Through Criminal Law and Replacing Directives 2008/99/EC and 2009/123/EC" (2024). The case-study method was employed to analyse case law, specifically the judgments of the ECHR concerning environmental and man-made risks to life under Article 2 of the European Convention on Human Rights (1950). The following cases concerning Turkey were examined: Case of Öneryıldız v. Turkey (2004), Case of M. Özel and Others v. Turkey (2015), Case of Oruk v. Türkiye (2014). Furthermore, data from the Case of Brincat and Others v. Malta (2014) and the Case of Cannavacciuolo and Others v. Italy (2025) were examined. These materials were analysed to trace the evolution of the concept of the state's positive obligations regarding the prevention of danger and the effective investigation of environmental threats. To identify effective methods for establishing a causal link between the use of weapons and environmental consequences for human life, the court's decision in the MH17 case (The court's decision..., 2022) was examined.

Descriptive and analytical synthesis of secondary statistical data covering the period of active hostilities (2022 – April 2026) was used for a quantitative assessment of the extent of the damage. This method was used to objectively confirm the scale of environmental degradation. The analysis focused on official secondary data from international and national sources (Ministry of Environmental Protection and Natural Resources of Ukraine, n.d.; European Court of Human Rights and Council of Europe, 2026; De Klerk *et al.*, 2026). These documents were examined and compared in terms of the number of recorded environmental incidents, the amount of damage caused and the volume of climate-related emissions, which made it possible to verify the intensity of the war's impact on the basic conditions of human existence. A systemic-structural approach was used to analyse the activities of institutions such as the National Office for Serious Fraud, Environmental Crime and Asset Confiscation (n.d.), the Netherlands Forensic Institute (n.d.) and the Core International Crimes Evidence Database (CICED) (n.d.) (European Union Agency for Criminal Justice Cooperation, n.d.). The activities of these institutions were examined exclusively concerning the organisational mechanisms for the cross-border preservation of evidence of environmental damage.

The procedural algorithm for documenting the consequences of the bombing of the Kakhovka hydroelectric power station (HPP) and the shelling of industrial facilities was examined using the case-study method to detail the procedural

framework for the collection, preservation and secure transfer of environmental samples (Operational information on..., 2023). The research materials also included official numerical, technical, expert and administrative sources documenting military environmental damage. In particular, the following were considered as national documentation tools: the "EcoZagroza" (n.d.) platform, Order of the Ministry of Environmental Protection and Natural Resources of Ukraine No. z0406-22 "On Approval of the Methodology for Determining the Amount of Damage Caused to Land and Soils as a Result of Emergency Situations and/or Armed Aggression and Hostilities During Martial Law" (2022), as well as materials from the State Environmental Inspectorate of Ukraine (The environment of Chernihiv..., 2025). The international dimension of documenting the consequences was examined using data from the Register of Damages for Ukraine (11th council meeting, 2026) and official reports from the Europol Operational Taskforce (Europol sets up OSINT…, 2023). These materials were used as supporting tools to establish the fact of damage, its source, scale, dynamics and potential impact on human life and health. Information and analytical methods were applied to technical reports (Conflict and Environment Observatory and Norwegian People's Aid, 2025) and European initiatives (CyberEast+, CyberUA…, 2026). These documents examined the specific nature of the application of innovations, whilst the entire technical section concerning satellite imagery, artificial intelligence, open-source intelligence (OSINT) and digital platforms was considered solely as a supplementary evidential tool for verifying the toxicity of munitions. Combining these methods with analytical sources from the Supreme Court of Ukraine (Urkevych, 2025) and the Council of Europe (CyberUA: Strengthening capacity..., n.d.) ensured the scientific validity of the results obtained. Furthermore, the methodological difficulties stem from the complexity of establishing a causal link between military action, environmental damage and the risk to life, due to limited physical access to contaminated sites under martial law.

Results

As of April 2026, the Ukrainian legal system faced the need to link war-related environmental damage not only to ecocide or breaches of the laws and customs of war, but also to a risk to human life within the meaning of Article 2 of the European Convention on Human Rights (1950). Environmental damage caused by war poses a risk not only to environmental protection interests but also to human physical survival, as the destruction of water, soil, air, energy and industrial infrastructure is capable of directly or indirectly affecting the lives, health and basic conditions of existence of the civilian population. In this context, the environmental consequences of armed conflict may be assessed through the lens of Article 2 of the ECHR, provided that a real and foreseeable risk to life is established, the state was aware of such a risk, and there was a failure to take adequate preventive measures or a failure to conduct a proper subsequent investigation. The central finding of the study was a causal chain model: military action – damage to an environmentally hazardous facility – contamination of water, soil or air – exposure of the population – a real risk to life or death – the state's duty to prevent, investigate and ensure protection. This model addressed forensic methods of documentation as a tool for establishing a link between military-induced environmental damage and the right to life. Within the Ukrainian legal system, this approach requires the integration of criminal law provisions on ecocide and war crimes with the legislation and standards of the ECHR. The legal basis for classifying such acts in Ukraine is founded on the provisions of Section XX of the Criminal Code of Ukraine (2001). Article 441 ("Ecocide") defines this criminal offence as the mass destruction of

flora or fauna, the poisoning of the atmosphere or water resources, and the commission of other acts that may cause an environmental disaster. As noted in the Supreme Court of Ukraine's judicial interpretations (Urkevych, 2025), the defining feature of ecocide is its object – the ecological security of humanity, that is, a state of the environment that prevents the emergence of dangers to human life and health. In addition to Article 441, wartime environmental crimes are classified under Article 438 ("War Crimes") as cruel treatment of prisoners of war or the civilian population, which is prohibited under international law. The blanket nature of this provision requires reference to the provisions of international humanitarian law, in particular Article 35(3) and Article 55 of the Protocol Additional to the Geneva Conventions of 12 August 1949, and relating to the Protection of Victims of International Armed Conflicts (Protocol I) (1977), which prohibit methods or means of warfare intended to cause, or likely to cause, widespread, long-term and severe damage to the natural environment. In this context, the verification of damage is not a prohibited method of warfare, but a procedural means of proving the consequences of such a violation. The sanctions provisions of the Ukrainian model include Article 441 of the Criminal Code of Ukraine, which provides for a term of imprisonment of between eight and fifteen years for ecocide, as well as Article 438 of the Criminal Code of Ukraine, which provides for a term of imprisonment of between eight and twelve years, and, where combined with intentional murder, from ten to fifteen years or life imprisonment. A key aspect of this harmonisation is that, in the event of a person's death as a result of ecological terrorism, the act falls under Part 2 of Article 438 or Article 442-1 ("Crimes against humanity"), where extermination is defined as the creation of living conditions aimed at destroying part of the population, in particular by depriving them of access to water.

In contrast to the Ukrainian approach, which treats ecocide as a separate offence, the Dutch legal system integrates environmental protection within the framework of threats to public health and human life. Articles 173a and 173b of the Criminal Code of the Netherlands (1881) establish liability for the intentional or negligent release of substances into the soil, air or water. The key criterion for establishing a causal link is the "likelihood of danger to the life of another person". If such pollution results in death, penalty is up to fifteen years' imprisonment. This illustrates a model in which environmental harm is not an end for the purposes of classification, but a means of infringing upon the right to life. At the same time, the Netherlands has implemented international standards through the International Crimes Act of the Netherlands (2003), where Section 5(5)(b) explicitly classifies as a war crime an attack causing "widespread, long-term and severe damage to the natural environment", provided that such damage is disproportionate to the anticipated military advantage. This wording is consistent with the Rome Statute of the International Criminal Court (1998) and draws a parallel with Article 438 of the Criminal Code of Ukraine (2001); however, Dutch legislation stipulates liability of superiors for negligence in preventing such consequences in greater detail (Article 9 of the International Crimes Act of the Netherlands).

Azerbaijan's experience in this field has become relevant due to the armed conflict over Nagorno-Karabakh, where environmental factors have become a tool in the legal confrontation between states (Bern Convention Arbitration..., 2023). Azerbaijan's legal strategy is based on the use of international arbitration as a means of establishing liability for environmental damage. At the same time, this strategy is also underpinned by the national environmental legal framework. Article 39 of the Constitution of the Republic of Azerbaijan (1995) enshrines the right of every person to live in a

healthy environment, to receive information about the actual environmental situation, and to receive compensation for damage to health or property caused by a breach of environmental requirements. Law No. 678-IQ of the Republic of Azerbaijan "On the Protection of the Environment" (1999) defines the legal, economic and social foundations of environmental protection, and it aims to ensure environmental safety, prevent the harmful impact of human activities on natural ecosystems, conserve biodiversity and ensure the rational use of natural resources. In particular, in January 2023, the Republic of Azerbaijan initiated arbitration proceedings against Armenia under the Bern Convention Arbitration (The Republic of Azerbaijan v. The Republic of Armenia). The essence of the claims was to demonstrate that prolonged military activity had caused the mass destruction of forests, the pollution of water resources and the disruption of ecosystems on which the livelihoods of local communities depend. Deforestation can increase the risks of soil erosion, flooding, land degradation and the loss of natural barriers that protect the population; water pollution directly affects access to safe drinking water, sanitation, people's health and the ability to practise agriculture; whilst the destruction of ecosystems undermines a region's ability to provide its population with water, food, clean air and other basic resources (Petrov *et al*., 2025). In the context of Article 2 of the European Convention on Human Rights (1950), this case may be used as an illustrative example of how war-induced environmental damage can pose a risk to the life, health and basic conditions of existence of communities, however, independently, it does not automatically establish a violation of the right to life without proving jurisdiction, the foreseeability of the risk, a causal link and the effectiveness of the state's response (Bern Convention Arbitration..., 2023). It was appropriate to compare Ukraine, the Netherlands and Azerbaijan not only in terms of the form of criminalisation of environmental damage, but also in terms of how the relevant legal model links war-related environmental damage to risks to life, the state's positive obligations, evidence of a causal link and international legal response mechanisms. It is precisely according to these criteria that the comparative results have been systematised in Table 1.

Table 1. Comparative models of the relationship between war-related environmental damage and risk to life in Ukraine, the Netherlands and Azerbaijan

Comparison criteria	Ukraine	Netherlands	Azerbaijan
Key regulatory framework for the protection of the environment and life	Constitution of Ukraine (1996), Law of Ukraine No. 1264-XII "On Environmental Protection" (1991), Criminal Code of Ukraine (2001), Criminal Procedure Code of Ukraine (2012)	Constitution of Netherlands (1983), Criminal Code of Netherlands (1881), International Crimes Act of Netherlands (2003), Environment and Planning Act of the Netherlands (2024)	Constitution of the Republic of Azerbaijan (1995), Law of the Republic of Azerbaijan No. 678-IQ (1999), Criminal Code of the Republic of Azerbaijan (1999), Criminal-Procedure Code of the Republic of Azerbaijan (2000), Bern Convention Arbitration (The Republic of Azerbaijan v. The Republic of Armenia) (2023)
How is environmental damage linked to a risk to life	On grounds of environmental safety as a prerequisite for human life and health, on the grounds of Article 441 of the Criminal Code of Ukraine (ecocide) and Article 438 of the Criminal Code of Ukraine (violation of the laws and customs of war)	Due to risk to life posed by soil, water or air pollution, due to liability for the hazardous release of substances and war crimes against the environment	On grounds of the right to a healthy environment, compensation for damage, and the demonstration that deforestation, water pollution and the degradation of ecosystems are undermining the livelihoods of communities

Table 1. Continued

Comparison criteria	Ukraine	Netherlands	Azerbaijan
Positive obligations of the state	Prevention of environmentally harmful consequences of war, documentation of damage, and investigation of the link between environmental damage and risks to life	Prevention of hazardous pollution, investigation of man-made and environmental risks, and the use of specialist expertise	Environmental protection, access to environmental information, compensation for damage and an international response to the consequences of the conflict
Evidence to establish a causal link	Data from the "EcoZagroza" platform, materials from the State Environmental Inspection, satellite imagery, data from UAVs, OSINT, soil, water and air samples, toxicological and environmental assessments, medical data	Expert reports, toxicological studies, digital materials, telecommunications data, findings from specialist institutions, international coordination of investigations	Arbitration documents, environmental reports, data on deforestation, water pollution, land degradation and the impact on livelihoods
Relation to Article 2 of the ECHR (Right to life)	Article 2 of the European Convention on Human Rights (1950) may be invoked provided that a real and foreseeable risk to life is established, along with the State's knowledge of the danger, a causal link and the effectiveness of the investigation	The national legal framework is closely aligned with the standards of the ECHR regarding hazardous activities, man-made risks and the State's positive obligations	Article 2 of the ECHR may be used as a framework for assessing whether environmental damage poses a risk to the lives and basic conditions of existence of the population
Sanctions or legal consequences	Criminal liability under Articles 441 and 438 of the Criminal Code of Ukraine, the possibility of compensation mechanisms through the Register of Damages	Criminal liability for hazardous pollution and international crimes, penalties depend on the consequences (including death)	International legal liability, arbitration claims, compensation and environmental consequences
International legal response mechanism	ECHR, the International Criminal Court, the Register of Damages for Ukraine, international legal assistance	ECHR, Eurojust, JIT, ICC, specialised expert cooperation	Bern Convention, international arbitration, and the potential application of ECHR standards

Notes: DEI – State Environmental Inspectorate, UAV – unmanned aerial vehicle, OSINT – Open-Source Intelligence, ECHR – European Court of Human Rights, ICC – International Criminal Court, JIT – Joint Investigation Team
Source: compiled by the authors

The case law of the ECHR concerning Article 2 of the European Convention on Human Rights (1950) is of fundamental importance for the study of war-related environmental damage, as the Court regards the right to life not only as a prohibition on the arbitrary deprivation of life, but also as a source of positive obligations on the part of the state in situations involving hazardous activities, man-made disasters and environmental risks. In such cases, the assessment focuses not only on the fact of death, but also on whether the danger was real, foreseeable and known to the state authorities, and whether they could have taken reasonable measures to prevent or minimise it. In the case of Öneryıldız v. Turkey (2004), the Court established an approach whereby the state has a positive obligation to establish a legal and administrative system for the protection of

life in the context of hazardous activities. In the context of war-related environmental damage, this means that the destruction or inadequate control of environmentally hazardous facilities may be assessed not only as damage to the environment but also as a risk to the lives of the population, if the state was or should have been aware of the danger (Denissova *et al*., 2025). In the Case of M. Özel and Others v. Turkey (2015), the ECHR linked the state's liability to the foreseeability of natural or man-made hazards, the availability of information regarding the risk of infrastructure destruction, and the failure to take appropriate preventive measures. This standard for assessing the foreseeability of risk and the fulfilment of the state's positive obligations to protect life is relevant to war crimes against the environment, since, following damage to dams, industrial plants, chemical storage facilities, energy infrastructure or water supply systems, the key question becomes: was the risk to the population's lives foreseeable, and were measures taken to evacuate, warn the public, contain the pollution and conduct a subsequent investigation. In the Case of Oruk v. Türkiye (2014), the Court applied Article 2 of the ECHR to a situation where the civilian population suffered harm as a result of the abandonment of hazardous military materials (unexploded ordnance) and emphasised the significance of correlation between the operation of a hazardous facility, the actions or inaction of the authorities regarding its isolation, and the consequences for human life. In the context of the destruction of hydraulic structures during wartime, this approach allows for the construction of an evidential model centred not only on the fact of destruction itself, but also on the subsequent chain of events: flooding, pollution, exposure of the population, loss of life or a real risk to life. In the Case of Brincat and Others v. Malta (2014), the ECHR recognised the significance of the long-term impact of hazardous substances on human health and life. This approach is crucial in the context of war-related environmental damage, as toxic contamination of soil, water or air may have a delayed rather than an immediate effect. Consequently, a causal association in such cases may be established not only based on instantaneous death, but also based on the long-term exposure of the population to hazardous substances. In the Case of Cannavacciuolo and Others v. Italy (2025), the Court considered long-term environmental pollution and the ineffectiveness of the state's response to a known danger. This standard made it possible to establish that, for Article 2 of the ECHR, it is essential not only to establish the fact of environmental damage, but also to assess whether the state's response was sufficient, timely and capable of effectively protecting people from danger. A synthesis of this case law has formed a central model of causation for war-related environmental crimes: military action – damage to an environmentally hazardous site – pollution of water, soil or air – exposure of the population – a real risk to life or death – the state's duty to prevent, investigate and ensure protection.

Establishing a causal link in this category of cases requires proving that a specific military act led to contamination which was the direct or indirect cause of the loss of life. In the case law of the ECHR, notably in the case of Ukraine and the Netherlands v. Russia (2022), the existence of an "administrative practice" of systematic violations, including attacks on civilian infrastructure, was recognised. The inter-state cases Case of Ukraine and the Netherlands v. Russia (2022) and Case of Ukraine v. Russia (re Crimea) (2024) are of subsidiary importance for the application of aforementioned standards to military environmental damage. It is advisable to use them not as the primary source of environmental criteria, but as material for issues of jurisdiction, control, attribution of state actions, administrative practice and the assessment of evidence in the context of

armed conflict. This approach allows the standards established in the Case of Öneryıldız v. Turkey (2004) and the Case of M. Özel and Others v. Turkey (2015) to be applied to situations where military action causes environmentally hazardous consequences and poses a risk to the lives of the population. At the same time, as early as the admissibility stage in the Case of Ukraine and the Netherlands v. Russia, the ECHR established a framework for the examination of evidence in the subsequent consideration of inter-state complaints against Russia. The Court recognised that there were, prima facie, sufficient grounds to examine allegations concerning Russia's jurisdiction over the war in eastern Ukraine, in particular through its military, political and economic support for illegal armed groups, as well as its influence on their activities. The significance of this judgment for war crimes against the environment lies in the fact that it demonstrates the ECHR's approach to establishing a link between the actions of a state, the structures under its control, and violations of the European Convention on Human Rights (1950) in the context of an armed conflict. This approach may also be used to establish a causal link between military operations, the destruction of environmentally hazardous facilities, environmental pollution, and a threat to or violation of the right to life. To establish a possible breach of Article 2 of the ECHR in cases concerning war-related environmental damage, it must be shown that the state in question had jurisdiction or effective control over the territory, facility or actions that caused the harmful consequence. That the risk to life was real and foreseeable; that the state knew or ought to have known of such a danger; that it failed to take reasonable and feasible measures to prevent or minimise it; that there is a causal link between the environmental damage and the threat to life; and that, following the loss of life or a catastrophic event, no effective, independent and timely investigation was carried out. The Court emphasised the importance of establishing jurisdiction and attributing responsibility for the actions to the State, which, in conditions of martial law, requires a combination of environmental expert assessments with forensic analysis of the means of warfare. In particular, the judgment in the Case of Ukraine v. Russia (re Crimea) (2024) demonstrated the Court's approach to assessing evidence through the prism of "logical coherence", where the causal link between the occupation policy and the deterioration in the living conditions of the civilian population was regarded as a coherent practice. The development of the ECHR's case law in cases concerning Azerbaijan provides additional tools for establishing a causal link through the concept of interim measures. In the Interim measures in the case of Armenia v. Azerbaijan (No. 4) (2022), the Court applied Rule 39 concerning the Lachin Corridor (Rules of Court, 2006), emphasising the need to ensure safe passage for persons requiring medical assistance. Although the dispute had political undertones, the legal argument was based on Articles 2 and 8 of the European Convention on Human Rights (1950), under which restrictions on access to safe passage, medical care, water, energy and other resources necessary for the survival of the population were regarded as creating a real risk of irreparable harm to life. The application of Rule 39 in the context of the Lachin Corridor can serve as a supporting example of how access to basic resources, medical care and safe passage may be relevant to the assessment of risk under Articles 2 and 8 of the ECHR. For Ukraine and the Netherlands, who are joint applicants in the case against Russia, this precedent is key to demonstrating that even in the absence of direct shelling, the destruction of water treatment or power supply systems (environmental infrastructure) constitutes an act that threatens life (Case of Ukraine..., 2022). The ECHR's statistical overview for 2025 recorded an increase in inter-state cases

related to conflicts (12 cases out of a total of 15), in which Ukraine and Azerbaijan are key parties. The Court emphasised that in 2025, the right to life was found to have been violated in 42 cases, a significant proportion of which concerned the ineffectiveness of investigations into deaths in conflict zones (European Court of Human Rights and Council of Europe, 2026). The ECHR's criteria for assessing environmental and man-made risks are provided in Table 2.

Table 2. ECtHR's criteria for assessing environmental and man-made risks under Article 2 of the ECHR

ECHR criterion	Content of criterion	Basic cases	Use for military environmental damage
Actual and anticipated risk	Danger to life must be sufficiently specific, rather than abstract	Case of Öneryıldız v. Turkey (2004), Case of M. Özel and Others v. Turkey (2015)	Destruction of HPP, chemical storage facilities, industrial sites or water supply systems may pose a foreseeable risk to the population
State's awareness of the risk	The state was aware of, or ought to have been aware of, the danger	Case of Oruk v. Türkiye (2014), Case of M. Özel and Others v. Turkey (2015)	Control over the site must be demonstrated, as must the existence of prior data on its hazardous nature, reports to the authorities or expert warnings
Appropriate preventive measures	State was required to take reasonable measures to minimise the risk	Case of Öneryıldız v. Turkey (2004), Case of Brincat and Others v. Malta (2014)	Evacuation, public warnings, protection of high-risk facilities, and prevention of attacks on environmental infrastructure
Causal relationship	Correlation between dangerous acts or omissions and death or a risk to life is required	Case of Oruk v. Türkiye (2014), Case of Cannavacciuolo and Others v. Italy (2025)	Military action must be directly linked to damage to property, pollution, exposure of the population and harm to life or health
Effective investigation	Following a loss of life or a disaster, the state must conduct an independent and effective investigation	Case of Öneryıldız v. Turkey (2004), Case of M. Özel and Others v. Turkey (2015)	It is necessary to conduct examinations, take samples, collect satellite data, prepare medical documents, and identify the causative agent and the mechanism of infection

Source: compiled by the authors based on European Convention on Human Rights (1950); Case of Ukraine and the Netherlands v. Russia (2022); Interim measures in the case Armenia v. Azerbaijan (No. 4) (2022); Case of Ukraine v. Russia (re Crimea) (2024)

Consequently, establishment of a causal link in accordance with the standards of the ECHR requires the Ukrainian and Azerbaijani authorities not only to record the death, but also to prove that the environmental consequences of the war were foreseeable and that the aggressor state failed to take measures to minimise them. The forensic aspect of safeguarding the right to life in April 2026 is based on the use of innovative recording technologies. Article 84 of the Criminal Procedure Code of Ukraine (2012) (CPC) defines evidence as factual data obtained following the procedure stipulated by law. The circumstances subject to proof under Article 91 include the nature and extent of environmental damage. In this context, the recording of evidential information must be conducted not only following national requirements of the Code regarding the relevance, admissibility and reliability of evidence, but also considering international standards for handling electronic evidence. In particular, the Council of Europe's CyberUA project is specifically aimed at improving the handling of electronic evidence in criminal proceedings relating to war crimes and human rights violations in the context of Russia's aggression against Ukraine (CyberUA: Strengthening capacity..., n.d.).

In the context of evidence gathering (Article 93 of the Criminal Procedure Code of Ukraine (2012)), this is impossible without the use of remote sensing,

UAVs and artificial intelligence technologies for the analysis of satellite imagery. Such technologies established a chain of evidence in cases where access to the scene of the incident by investigators or environmental inspectors is difficult or dangerous (CyberEast+, CyberUA..., 2026). Remote sensing, satellite imagery, photographic and video evidence from UAVs, as well as OSINT analysis, make it possible to establish the time, location, scale and dynamics of environmental damage, and to link it to a specific military act. This approach is consistent with the Methodology for Determining the Extent of Damage Caused to Land and Soil as a Result of Armed Aggression, which explicitly permits the use of remote sensing data, soil sample analyses, expert reports, documents, materials, information from any sources and operational reports to establish the fact of land contamination or littering (Order of the Ministry of Environmental Protection and Natural Resources of Ukraine No. z0406-22, 2022). This makes it possible to document environmental damage in real time in areas where investigators' physical access is restricted. The main tool for the initial recording of war-related environmental damage and the creation of an electronic evidence base is the "EcoZagroza" (n.d.) platform, developed by the Ministry of Environmental Protection and Natural Resources of Ukraine (Ministry of the Environment), which automated collection of geolocated data on environmental risks. As of 2026, over 11,223 instances of environmental damage caused to Ukraine by Russia had been recorded, with the total amount of losses reaching UAH 6.763 trillion (Ministry of Environmental Protection and Natural Resources of Ukraine, n.d.). At the same time, the digital recording of environmental damage is not limited to domestic government platforms. A key international mechanism is the Register of Damages for Ukraine, which compiles claims regarding damage caused as a result of Russian aggression. As of early 2026, the Register's Council reported over 45,000 claims submitted, as well as the introduction of new categories for the State of Ukraine, legal entities, and regional and local authorities concerning the damage to or destruction of infrastructure and assets. This indicates a shift from simply documenting the environmental and infrastructural consequences of the war to formalising them within an international compensation mechanism (11th Council meeting, 2026). The forensic model for establishing a causal link in wartime conditions was exemplified by the Dutch case of MH17. In this case, the court established a "comprehensive evidential framework" in which photographs of the rocket's contrail were cross-referenced with satellite imagery of the launch site and data from mobile phone masts. This methodology is relevant to the investigation of war-related environmental crimes, as it allows a specific weapon (for example, a missile that struck a toxic waste storage facility) to be linked to the consequences for people through the following chain: military act – weapon – location – environmental release – death (The court's decision..., 2022). The Netherlands Forensic Institute (n.d.) has become a key centre ensuring the independence and objectivity of investigations, which is essential under ECHR standards. The NFI's mission is conducted through a combination of over forty areas of expertise, including the analysis of digital traces from encrypted devices and toxicological investigations. Compared with the Ukrainian "EcoZagroza" platform, the Dutch JIT model is based on the deep integration of international specialists, ensuring a "chain of custody" at the international level (The criminal investigation, n.d.). This makes it possible to identify those responsible for issuing orders that led to environmental disasters through the analysis of intercepted communications and OSINT data. In particular, the Dutch practice of critically assessing expert reports linked to interested parties (such as a court's refusal to accept reports from

"Almaz-Antey" due to their lack of transparency) is an approach that demonstrates the advisability of engaging independent EU environmental laboratories to verify the toxicity of munitions (The court's decision..., 2022).

One of the key examples for modelling cause-and-effect relationships is the destruction of the Kakhovka HPP on 6 June 2023. According to Ukrainian authorities, following the destruction of the facility, a spill of at least 150 tonnes of lubricant into the Dnipro River was recorded, along with the flooding of areas where 3,470 tonnes of liquid fertiliser (UAN) were stored (Operational information on..., 2023). In the context of Article 2 of the European Convention on Human Rights (1950), this incident may be used to argue that there was a risk to life, provided that control over the facility, the foreseeability of the danger, a causal link between the destruction and the consequences for the population, and an inadequate response by the responsible state can be established. In this context, the causal link has a multi-level structure: primary act (detonation) – mechanical flooding (loss of life) – secondary pollution (contamination of water resources) – long-term effect (destruction of ecosystems and risks to the health of future generations). This model of evidence is corroborated by the practice of the State Environmental Inspectorate, which, following military strikes, documents not only the fact of the attack but also the specific environmental consequences. For example, following a drone strike in the town of Nizhyn on 1 December 2025, inspectors surveyed the scene, identified damage to tanks containing a urea-ammonia mixture and ammonia water, recorded the spread of hazardous substances across the terrain, took soil samples for instrumental and laboratory analysis, and prepared materials for submission to law enforcement agencies to document environmental crimes (The environment of Chernihiv..., 2025). This example demonstrated a practical chain of evidence: a military strike – damage to a hazardous facility – a toxic substance leak – soil contamination – laboratory analysis – calculation of damage – transfer of materials to the criminal prosecution authorities. Article 100 of the Criminal Procedure Code of Ukraine (2012) requires a special procedure for the storage of such physical evidence, particularly where its long-term storage poses a danger to life or the environment. The Environmental Inspectorate has estimated the damage to water resources caused by the Russian terrorist attack at UAH 2 billion, whilst the overall loss of biodiversity continues to rise (Crispino *et al.*, 2022; Svitlana Grinchuk: Environmental..., 2025).

The establishment of a violation of the right to life in the case law of the ECHR in connection with the Kakhovka disaster is based on the concept of "inevitable risk". Russia, provided it has established control over the facility, may be regarded as a State whose actions or omissions are potentially subject to assessment under Article 2 of the European Convention on Human Rights (1950) in connection with the risk to the lives of the civilian population resulting from flooding, as well as the possible failure to take appropriate measures to evacuate the population and minimise the sanitary and epidemiological consequences. A legal analysis of the objects of legal protection under Article 5 of Law of Ukraine No. 1264-XII (1991) confirms that people's health and lives are subject to state protection against the negative effects of an adverse environmental situation. Article 50 of the Constitution of Ukraine (1996) explicitly guarantees the right to a safe environment and compensation for damage, which, in conjunction with Article 27, establishes a national framework for the protection of the right to life.

In this study, climate-related damage was one of the long-term consequences of war-induced environmental damage, which may affect safe

living conditions. According to the report "Climate damage caused by Russia's War in Ukraine" (De Klerk *et al.*, 2026), total greenhouse gas emissions resulting from the war are estimated at 311 million tonnes of CO_2 equivalent, whilst the calculated climate damage exceeds USD 57 billion. In the context of Article 2 of the European Convention on Human Rights (1950), these figures are of secondary importance: they confirm the long-term nature of war-related environmental damage, but do not replace an analysis of the specific causal link between a hazardous event, public exposure and the risk to life. Forensic expert reports are central in proving environmental damage to human health. Article 242 of the Criminal Procedure Code of Ukraine (2012) imposes a duty on the investigator to ensure that an expert examination is conducted to establish the causes of death and the extent of environmental damage. An innovative aspect is the conduct of comprehensive expert assessments that combine data from toxicological analyses of soil and water samples with medical indicators of morbidity among the population in affected areas (Pilecka *et al.*, 2017). Expert assessments relating to the toxicity of munitions and explosive weapon remnants are becoming increasingly relevant. A study by the Conflict and Environment Observatory (CEOBS) on southern Ukraine states that most munitions contain heavy metals and explosive chemicals, including arsenic, chromium, copper, trinitrotoluol, TNT, cyclotetramethylenetetranitramine (HMX) and cyclotrimethylenetrinitramine (RDX), which are toxic to humans, animals and ecosystems. The study also shows that documenting this type of damage requires a combination of remote analysis, field surveys, interviews with local communities, targeted soil and water sampling, and subsequent laboratory analysis (Conflict and Environment Observatory and Norwegian People's Aid, 2025). This interdisciplinary model makes it possible to prove not only the fact of contamination, but also its origin, intensity, toxicity and potential impact on human life and health. The use of blockchain technologies to record the chain of custody for digital materials and the results of sample analyses can support process of proving these claims (Bruno *et al.*, 2019). Such technologies do not in themselves ensure the admissibility of evidence in international or national courts, as admissibility depends on the lawfulness of collection, proper procedural documentation, preservation, verification of authenticity, the relevance of the evidence to the subject matter of the case, and its assessment by the court. At the same time, blockchain can help confirm the integrity of a digital record, the time of its creation, the absence of unauthorised alterations, and the transparency of the transfer of materials between the parties to the proceedings (Wójcik *et al.*, 2022). When combined with the requirements regarding the authenticity, proper preservation and admissibility of electronic evidence, this approach may enhance the evidential value of material obtained via OSINT, UAVs, satellite imagery or digital platforms, provided, however, that they are processed in accordance with the Criminal Procedure Code of Ukraine and international standards for electronic evidence (Convention on Cybercrime, 2001; CyberUA: Using OSINT..., 2026). Under Article 20-2 of Law of Ukraine No. 1264-XII (1991), state supervisory authorities may use photography, video recording and space technologies as auxiliary means of documenting the circumstances of an offence. The international legal dimension of environmental protection in Ukraine should be linked to Article 71 of Law of Ukraine No. 1264-XII, which provides for Ukraine's participation in international cooperation in the field of environmental protection and the application of the provisions of an international treaty where such a treaty establishes rules different from those in national environmental legislation. As a candidate for EU membership, Ukraine is adapting its

legislation to Directive (EU) No. 2024/1203 of the European Parliament and of the Council (2024), which requires the criminalisation of acts causing long-term and significant damage to ecosystems. In 2025, the Committee on Environmental Policy and Nature Management of the Verkhovna Rada of Ukraine established a working group on the implementation of the provisions of the Directive on the protection of the environment through criminal law (Working Group on the implementation…, 2025). The Research Service of the Verkhovna Rada of Ukraine has also prepared an analytical report on the key provisions of the Directive, which focuses on the criminalisation of environmental offences, the liability of natural and legal persons, sanctions, attempts to commit environmental crimes, the protection of whistleblowers and cooperation between states. This provides additional tools for protecting the right to life, as environmental degradation is recognised as a serious offence (Musayeva *et al*., 2026).

World Bank statistics (RDNA4) indicate that direct damage to the environment and infrastructure amounted to 176 billion USD, whilst reconstruction needs are estimated at USD 524 billion over the next decade (Updated assessment of Ukraine's..., 2025). A priority area is the demining of territories (almost 23% of Ukraine's land area as of 2025), which is a prerequisite for restoring a safe living environment (Svitlana Grinchuk: Environmental..., 2025).

The latest environmental legislation in the Netherlands, in particular the Environment and Planning Act of the Netherlands (2024), introduces a broader interpretation of the physical environment, including infrastructure, water, soil and air as a single object of protection. Article 1.2(4) of this Act expressly states that an impact on the environment is deemed to include an impact on people if they suffer harm as a result of natural elements. This provision is the legal embodiment of the concept of "environmental justice", whereby the right to life is protected through the maintenance of a "healthy physical environment" (Article 1.3 of the Environment and Planning Act of the Netherlands). For Ukraine and Azerbaijan, which face the problem of landmines and long-term pollution, this legal framework makes it possible to establish a causal link even when harm to health occurs years after the end of hostilities. Institutionally, the Netherlands has established a specialised National Office for Serious Fraud, Environmental Crime and Asset Confiscation (n.d.) (Functioneel Parket), which deals exclusively with environmental crimes. This body works in close collaboration with Eurojust, ensuring the coordination of cross-border investigations via the CICED database (European Union Agency for Criminal Justice Cooperation, n.d.). CICED was used to store and analyse hundreds of files containing satellite imagery and video evidence relating to war crimes in Ukraine, thereby creating a solid evidential foundation for future proceedings before the ECHR and the International Criminal Court. Netherlands' cooperation with Ukraine within the framework of the "Tallinn Mechanism" and demining projects has highlighted that restoring the ecological balance is a prerequisite for the realisation of the right to life. The Netherlands' contribution of USD 1 million to the International Centre for the Prosecution of the Crime of Aggression (ICPA) confirms its strategic approach to combating impunity for crimes whose consequences have a global climate impact (The Netherlands and Ukraine, n.d.).

A key element of a person's legal status as a subject of protection in relation to war-related environmental crimes is ensuring access to environmental information (Article 9 of Law of Ukraine No. 1264-XII (1991)). Soil contamination covering an area of over 1.4 million m^2 and land littering affecting 54.8 million m^2 pose a real threat to the development of minors (Ministry of Environmental Protection and Natural Resources of

Ukraine, n.d.). As part of the criminal proceedings initiated following the bombing of the Kakhovka HPP (case No. 22023230000000307), investigative authorities are employing OSINT methods to identify the units responsible for planting explosives on the dam, thereby linking the intent to destroy the ecosystem to a direct threat to the lives of thousands of people (Operational information on..., 2023). The international dimension of OSINT's use in documenting war crimes in Ukraine is confirmed by the establishment of the Europol Operational Taskforce (OTF), whose aim is to assist in the investigation of major international crimes committed following the full-scale invasion by Russian armed forces on 24 February 2022. The OTF's remit is to identify suspects and establish their involvement in war crimes, crimes against humanity or genocide by collecting and analysing intelligence from open sources. Europol has emphasised that, given the unprecedented volume of online material, particularly from the internet and social media, OSINT can assist investigators in verifying and documenting instances of war crimes. The task force is led by the international crimes' investigation units of the Dutch police and the German Federal Criminal Police Office, with support from Europol and its Analysis Project Core International Crimes; 14 countries have joined the OTF's work, including Belgium, France, Germany, Ireland, Italy, Lithuania, the Netherlands, Portugal, Slovakia, Slovenia, Spain, Norway, the United Kingdom and the United States (Europol sets up OSINT..., 2023). This demonstrates that the establishment of a causal link in military environmental crimes can be based not only on national evidence but also on internationally coordinated OSINT verification, which helps to link a specific military act, the perpetrator and the environmental consequences.

A comparative legal analysis of Ukraine, the Netherlands and Azerbaijan has shown that war-related environmental damage becomes relevant to Article 2 of the European Convention on Human Rights (1950) when it poses a real and foreseeable risk to life, is linked to the actions or inaction of the state, and is not accompanied by adequate preventive measures or an effective investigation. Ukraine presented a model of direct criminalisation of ecocide and the documentation of harm through criminal proceedings, environmental methodologies, official digital platforms and expert assessments. The Netherlands demonstrated a model combining criminal liability for hazardous pollution, international crimes and specialised institutional expertise. Azerbaijan's experience highlighted the significance of international arbitration and the right to a healthy environment in establishing the environmental consequences of conflict. Consequently, forensic techniques in such cases should be regarded as a supplementary tool for proving a causal link between military action, environmental damage and risk to life, rather than as the primary focus of the investigation.

Discussion

Study results showed that, as of April 2026, establishing a causal link in war-related environmental crimes can be regarded as a key element in safeguarding the right to life, with forensic tools supporting process of proving a case under Article 2 of the European Convention on Human Rights (1950). The discrepancy identified during the study between the direct criminalisation of ecocide in Ukraine and the integrated approach adopted by the Netherlands was significant for interpretation of the evolution of international criminal law. The findings confirmed that the Ukrainian model, based on Article 441 of the Criminal Code of Ukraine (2001), proposed an approach in which environmental security was regarded as a prerequisite for the physical survival of the population. This correlated directly with the arguments of V.V. Haltsova *et al.* (2024),

who noted that national approaches to the criminalisation of ecocide were characterised by historical determinism, and that the absence of a unified international mechanism precluded the possibility of full accountability in the context of global harm. The present study suggests that Ukraine's experience may contribute to a re-examination of the doctrinal foundations discussed by J. Rigo-García (2025). The author argued that, although the Rome Statute does not contain a separate offence of ecocide, but only a provision on a war crime involving an intentional attack with the intent to cause large-scale, long-lasting and serious damage to the natural environment, the full-fledged establishment of ecocide as an autonomous international crime requires clearer threshold criteria for damage, which is partly reflected in the operation of the Ukrainian platform "EcoZagroza".

A comparison of the findings regarding the use of innovative means of documentation (UAVs, AI) with the concept of the "evolutionary link" between ecocide and war, as proposed by R. Killean (2025), revealed common vectors of transformation. The researcher argued that contemporary advocacy had extended the scope of ecocide to peacetime, yet the principles of *lex specialis* still limited its applicability in conflicts. This study found that, as of early 2026, forensic verification using satellite imagery strengthens the evidence base for establishing a causal link between a specific military act and a long-term threat to life, although it does not replace legal classification. The importance of this link was emphasised by M.J. Kelly (2025) using the example of the mass death of cetaceans in the Black Sea. The author noted that Ukraine's choice of how to prosecute environmental crimes carried legal weight for the international community, creating a public record from which the aggressor cannot evade accountability. This study confirmed these arguments, demonstrating that proving intent to destroy ecosystems in cases concerning the sabotage of the Kakhovka HPP forms a potential legal basis for classifying the acts as crimes against humanity, provided the relevant elements are proven. One aspect of the discussion centred on the choice between anthropocentric and ecocentric approaches. The findings regarding the protection of the right to life through environmental safety in the Netherlands revealed a certain contradiction with the conclusions of K.J. Heller (2025). The researcher criticised the elite activism of the Vietnam War era for emphasis on protection of people from the consequences of environmental damage rather than on protecting nature, which, in his view, condemned the concept of ecocide to the status of a rhetorical device. However, this study demonstrated that it is precisely through the protection of human beings that, in early 2026, avenues for holding those responsible for war-related environmental destruction to account under the law are opening. This coincided with the experience of Colombia, analysed by J. Galindo & H. Herrera (2025). The authors noted a shift in transitional justice from anthropocentrism towards recognising non-human entities as victims of conflict. A discussion of the International Criminal Court's procedural capabilities through the lens of ecocide was reflected in the work of G. Lee (2026). The researcher argued that acts of ecocide could be prosecuted under the ICC's existing four core crimes, even without amending the Rome Statute. The findings of this study regarding the Dutch JIT model confirmed this possibility, as joint investigation teams began using environmental evidence as early as 2025 to substantiate charges of war crimes. At the same time, the link identified between environmental collapse and state failure, as illustrated by the example of Syria and described by M.L. Bremme & S.S. Regilme (2025), contributed to the analysis of the Azerbaijani case. The authors argued that ecocide acted as a "threat multiplier", leading to mass

population displacement. This study identified an identical pattern in Nagorno-Karabakh, where arbitration under the Berne Convention has become a means of establishing liability for the disruption of the living conditions of entire communities.

The findings of this study regarding the long-term effects of military pollution were consistent with the arguments put forward by P. Hough (2022). Study noted that military ecocide had a long history, but the stigmatisation of such practices by academics had helped to mitigate their worst manifestations through demands for reparations. The issue of reconciling ecocide with environmental law – which D. Robinson (2022) considered the most complex conundrum – was resolved in this study through the broadening of the concept of the "physical environment" in Dutch legislation of 2024. The role of comprehensive expert assessments in determining the toxicity of munitions, identified in this study, is consistent with the proposal by M. Gillett *et al.* (2025) regarding the integration of environmental science with international law. The authors argued for the need to transition from the binary "fact-value" distinction in favour of mixed assessments, which was used by the Netherlands Institute for Forensic Science. A key element of the scientific debate was the issue of legitimacy in the Anthropocene era. A. Branch & L. Minkova (2023) cautioned that prosecutions for ecocide at the International Criminal Court could lead to distorted outcomes for the environment due to the limitations of the political context. This study demonstrated that systematic OSINT verification and the theoretical potential for implementing the concept of blockchain-based custody chain recording can ensure adequate transparency, which will help to minimise political risks. This correlated with the call by R. Killean & D. Short (2025) for the development of robust definitions of crime based on flexibility and predictability. The dogmatic approach to criminalisation proposed by W. Hongwei (2024) served as the theoretical framework for the analysis of Article 441 of the Ukrainian Criminal Code. The author argued that the protection of environmental rights must be grounded in the right to life as a threshold, consistent with the practice of the ECHR regarding the state's positive obligations in the sphere of man-made and environmental risks. The criteria for criminal liability and the subjective element of the offence, as examined by F.V. Arias & A.-K. Reinefeld (2024), were reflected in the analysis of directors' liability for negligence under the Dutch International Crimes Act Lastly, A. Dumont's (2022) scepticism regarding the prospects of including ecocide in the Rome Statute due to the absence of corporate liability has been partially refuted by the findings of this study.

Consequently, as of April 2026, establishing a cause-and-effect relationship in the context of war-related environmental crimes is based on the convergence of scientific methods and legal standards for the protection of human beings. The findings of this study were consistent with the work of international authors regarding the importance of verifying the long-term consequences and destructive nature of military impact on biodiversity. The significance of the findings is determined by the revelation that environmental harm can be regarded as a threat to the right to life, which requires the ECHR to apply the concept of "inevitable risk", provided that the real and foreseeable nature of such a danger is proven. The analysis demonstrated that legal reasoning is evolving from merely noting the destruction to establishing effective mechanisms for its forensic and procedural documentation in the interests of future justice.

Conclusions

The study substantiated a model for establishing a causal link in war-related environmental crimes, whereby war-related environmental damage

should be assessed not merely as a criminal offence, but as a factor posing a real risk to life. The study demonstrated that environmental destruction may pose a real risk to the lives of the civilian population or form part of a broader mechanism for the violation of the right to life, provided that a causal link, the foreseeability of the risk and control over the hazardous facility can be established. The study found that, as of April 2026, Ukraine had established a regulatory framework for the direct criminalisation of ecocide, in which environmental safety is recognised as a material foundation of the right to life.

The scale of environmental damage was quantified by recorded environmental losses amounting to UAH 6.763 trillion and the registration of over 11,000 instances of environmental damage, which attests to the intensity of the war's impact on the environment. A comparison with the experience of the Netherlands has demonstrated the existence of institutional specialisation within investigative bodies and the application of "comprehensive evidential frameworks", where digital traces and the results of toxicological analyses of munitions can be used to establish a chain of attribution for the offence. The Azerbaijani case demonstrated the possibility of using international arbitration to formalise environmental claims in an inter-state dispute following an armed conflict. The study determined that, in the practice of the ECHR, the establishment of a causal link is based on the concept of "foreseeable risk". Accordingly, the destruction of environmental infrastructure, particularly in the case of the Kakhovka disaster, may be regarded as a potential breach of the state's obligation not to kill and its positive duty to protect the population from the consequences of the disaster, provided that the relevant elements are proven.

The forensic aspect of the study demonstrated that the use of UAVs, artificial intelligence technologies and blockchain-based chain-of-custody recording for soil samples serves as an auxiliary tool for gathering evidential information in cases where physical access to the contaminated area is blocked; however, the admissibility of this evidence depends on the procedural rules governing its collection, preservation and assessment by the court. The study established that the integration of OSINT methods helps to determine the time, place and source of the contamination, as well as potential perpetrators and the link between military action and environmental consequences; however, it cannot independently prove long-term effects on public health. Such a conclusion requires comprehensive environmental, toxicological and medical evidence. The findings indicate that the effectiveness of protecting the right to life in early 2026 depends directly on the ability of law enforcement systems to treat environmental data as fully valid evidence in court. Based on the study, it is recommended that national investigative authorities refine their methods for integrating digital and traditional evidence to build a robust case demonstrating causal links before international human rights bodies.

The limitations of this study stem from the absence, as of early 2026, of established case law from the ECHR specifically regarding the direct recognition of war-related environmental damage as a violation of Article 2 of the ECHR. Prospects for further research lie in examining the legal frameworks governing the use of satellite monitoring as a preliminary finding in cases concerning global environmental damage.

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Conflict of Interest

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Встановлення причинно-наслідкового зв'язку у воєнних екологічних злочинах: криміналістичний аспект захисту права на життя у практиці ЄСПЛ

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Анотація

Метою проведеного дослідження був порівняльно-правовий аналіз інструментів та процедур верифікації причинно-наслідкового зв'язку між деструктивним впливом збройних конфліктів на довкілля та порушенням права на життя. Процес наукового пізнання базувався на вивченні

нормативних масивів та практики застосування міжнародних правозахисних стандартів щодо юрисдикцій України, Нідерландів та Азербайджану. У ході роботи встановлено, що станом на квітень 2026 року в Україні сформовано прецизійну модель криміналізації воєнної екологічної шкоди, де загальна сума зафіксованих збитків довкіллю сягнула 6,763 трильйона гривень. Виявлено, що нідерландська система розслідування базується на формуванні інтегрованих доказових ланцюгів, де дані про токсичність зброї дозволяють кваліфікувати масштабне забруднення як безпосередню загрозу безпеці населення. З'ясовано, що у практиці Європейського суду з прав людини екологічні наслідки збройних конфліктів можуть визначатися посяганням на фундаментальне право на життя за умови доведення реального та передбачуваного ризику для цивільних осіб. Масштабні руйнування екосистем та кліматичні збитки становлять довготривалу загрозу для безпечного існування населення. Обґрунтовано, що застосування інноваційних засобів цифрової фіксації та розвідки з відкритих джерел забезпечує належне документування шкоди у випадках обмеженого фізичного доступу до уражених територій. Визначено, що екологічна безпека має сприйматися як невід'ємна умова реалізації права на життя. Додатково констатовано, що компенсаційні та репараційні механізми можуть розглядатися як один із напрямів відновлення порушених екологічних і правозахисних гарантій. Практична значимість дослідження полягає в тому, що його висновки можуть бути використані слідчими органами та судовими експертами для формування ефективних алгоритмів документування, доказування й міжнародної верифікації воєнних екологічних злочинів у контексті захисту права на життя

Ключові слова: шкода довкіллю; документування шкоди; екоцид; судова експертиза; збирання доказів; методика розслідування; криміналістичні інновації