Program on International
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The International Law of Armed Conflict and the Natural Environment

An Analytical Resource for States

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Executive Summary

Environmental harm associated with armed conflict is becoming more severe, complex, and far-reaching. International humanitarian law (IHL), or the law of armed conflict (LOAC), provides certain protections for the natural environment in armed conflict. In the context of accelerating climate change, ecological degradation, and biodiversity loss, recent work on the topic evinces a need to highlight and analyze these protections, together with issues of interpretation and application, to further enhance respect for the underlying obligations.

While these safeguards remain vital, many foundational IHL/LOAC obligations were developed prior to the emergence of modern ecological science, accompanying technological advances, the growing recognition of climate-related and other systemic environmental risks, and the development of international environmental law (IEL). It is therefore also arguably warranted to critically examine whether, even if fully complied with, those obligations are capable of addressing the scope and character of environmental harm anticipated in connection with current and future armed conflicts.

This paper aims to contribute to recent and ongoing efforts by States, the International Law Commission, the International Committee of the Red Cross, and other actors to uphold and clarify legal protections for the environment in armed conflict. In particular, the paper seeks: to help keep this issue on the agenda of States and other relevant legal and policy communities; to examine certain key areas of IHL/LOAC with a view to enhancing respect for existing legal obligations and curbing environmental harm in war; and to provide a principled basis for reflecting on whether those obligations — as indispensable as they are — are adequate, in their current form and application, to respond to existing and emerging environmental threats. In doing so, the paper aims to support strengthened implementation and enhanced protection without undermining the integrity of extant legal frameworks.

To those ends, the paper examines a select set of IHL/LOAC obligations of particular salience to environmental protection in relation to armed conflict, specifically those pertaining to:

- widespread, long-term, and severe damage to the natural environment;
- distinction, proportionality, and precautions in attack;
- objects indispensable to the survival of the civilian population;
- works and installations containing dangerous forces; and
- usufruct in situations of belligerent occupation.

Each of these areas is analyzed through a structured legal approach encompassing the following aspects: addressing the relations between treaty-based and customary IHL/LOAC; incorporating relevant IEL through the principle of systemic integration; and taking into account current scientific understanding, particularly concerning ecological and climate-related processes.

The paper distills legal questions that emerge from the analysis and outlines measures that might be taken toward implementing the obligations in practice. The paper also sets out some potential structural reflections intended to offer a legally and scientifically grounded conceptual vocabulary through which to configure a principled space for reflection on the adequacy of the existing legal framework in light of accelerating climate-related hazards and the growing body of scientific evidence on environmental risks associated with armed conflict. These and related considerations may be particularly relevant to legal advisers seeking: to reconcile military necessity with environmental protection; to assess whether existing IHL/LOAC principles and rules offer sufficient clarity for operational planning; or to determine how best to reflect ecological vulnerability in doctrinal development, military manuals, or multilateral dialogue.

Credits

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List of Abbreviations

AP I	1977 Protocol Additional to the Geneva Conventions of 12 August 1949, and relating to the Protection of Victims of International Armed Conflicts (Protocol I)
AP II	1977 Protocol Additional to the Geneva Conventions of 12 August 1949, and relating to the Protection of Victims of Non-International Armed Conflicts (Protocol II)
CBD	1992 Convention on Biological Diversity
ENMOD	1977 Convention on the Prohibition of Military of Any Other Hostile Use of Environmental Modification Techniques
GC IV	1949 Convention (IV) relative to the Protection of Civilian Persons in Time of War
Hague Regulations	Regulations concerning the Laws and Customs of War on Land, annexed to the 1907 Convention (IV) respecting the Laws and Customs of War on Land
IAC	International armed conflict
ICJ	International Court of Justice
ICL	International criminal law
ICRC	International Committee of the Red Cross
IEL	International environmental law
IHL/LOAC	International humanitarian law/the law of armed conflict
IHRL	International human rights law
ILC	International Law Commission
ITLOS	International Tribunal for the Law of the Sea
NIAC	Non-international armed conflict
UNCLOS	1982 United Nations Convention on the Law of the Sea
UNEP	United Nations Environment Programme
UNFCCC	1992 United Nations Framework Convention on Climate Change
VCLT	1969 Vienna Convention on the Law of Treaties
WHC	1972 Convention Concerning the Protection of the World Cultural and Natural Heritage

CONTENTS

1. Introduction

The protection of the natural environment in relation to armed conflict has become the focus of growing legal, policy, and scholarly attention. In recent years, efforts by States, the International Law Commission (ILC), the International Committee of the Red Cross (ICRC), and others have helped bring renewed visibility and urgency to this area of international law. That work builds on earlier normative foundations while responding to intensifying concerns about the character and consequences of environmental harm during war. At the same time, developments in ecological science and international environmental law (IEL) are reshaping how such harm is understood — not only as a collateral effect of armed conflict but also as a factor that may itself aggravate humanitarian crises, undermine civilian protection, and accelerate global ecological degradation.

International humanitarian law (IHL), also known as the law of armed conflict (LOAC), contains an array of principles and rules that constrain environmental harm in war. These binding safeguards remain vital. Yet many of the relevant obligations were initially developed in an earlier era — prior to a widespread recognition of climate change and biodiversity loss as systemic threats, prior to the rise of IEL as a legal regime, and prior to the scientific understanding of the interdependence and vulnerability of ecological systems. Rising concerns about the cumulative and cascading effects of environmental harm associated with armed conflict arguably warrant additional attention to how existing IHL/LOAC obligations are interpreted, implemented, and evaluated.

1.1. Objectives, Orientation, and Target Audiences

This paper seeks to contribute to recent and ongoing efforts to uphold and clarify legal protections concerning the natural environment in relation to armed conflict. It aims to assist a wide range of actors engaged in the interpretation and application of IHL/LOAC by offering a structured legal analysis of select issues at the intersection of the legal framework, environmental harm, and armed conflict. That said, it is directed principally to States' legal advisers whose work concerns IHL/LOAC obligations related to the natural environment, whether serving in the armed forces, in ministries of defense or

foreign affairs, or elsewhere.

The paper has three principal objectives. First, it seeks to support sustained legal and policy engagement on the environmental dimensions of armed conflict, including by helping to keep the issue on the agenda of States and other relevant professional and institutional communities. Second, the paper aims to bolster respect for the underlying protections by raising interpretive and implementation considerations regarding a select set of IHL/LOAC obligations. And third, the paper seeks to provide a principled basis for reflecting on whether those obligations suffice, in their current form and application, to meet the nature, scale, and complexity of environmental risks associated with contemporary and future armed conflicts.

Raising the question of the sufficiency of existing IHL/LOAC obligations is not meant to cast doubt on their binding force. Given the best available scientific evidence, it is arguably a question that warrants careful and principled engagement. Indeed, developments in such fields as climate science and environmental-systems modeling have yielded increasingly extensive findings about the cumulative, cross-border, and, in many cases, irreversible effects of environmental harm associated with armed conflict, including indirect and delayed harms to civilian populations.[1] These findings may arguably pose fundamental challenges not only to existing practices and policies concerning environmental safeguards and civilian protection but also to how the purposes and limits of IHL/LOAC can and should be understood and operationalized. In that context, engaging the question of whether current IHL/LOAC obligations — even if fully complied with — are comprehensively availing is not only warranted but, in light of the foreseeable consequences of insufficient action, arguably essential to ensuring that legal interpretation and implementation remain responsive to evolving risk.

It is also recognized that debates on the sufficiency of existing principles and rules of IHL/LOAC — and those who initiate them — are regarded with suspicion in certain quarters. Many avoid such debates largely out of a concern for potentially jeopardizing consensus on the existing law. Moreover, there is sometimes a perception that those who raise these debates do so either in an attempt to undermine existing obligations or out of a naivety oblivious to the geopolitical realities of development and codification of international

[1] *See, e.g.*, Conflict & Env't Observatory, How Does War Damage the Environment (Jun. 4, 2020), https://ceobs.org/how-does-war-damage-the-environment/#:~:text=Weapons%20and%20military%20materiel%20used,metals%20and%20toxic%20energetic%20materials.

norms. An objective of this paper, in creating space for principled reflection on the sufficiency of the IHL/LOAC framework to address existential environmental concerns, is to contribute to global attention on these issues and to build on the momentum created by the work of States, the ILC, the ICRC, and other actors on this topic. Advancements in scientific knowledge of ecological and climate-related crises — taken together with the acceleration of environmental risks — arguably warrant reflection on the sufficiency of select IHL/LOAC obligations. Such reflection may be most productive when grounded in legal and scientific concepts that can provide an accessible framework for those considering these questions.

This paper is situated within the broader interpretation-and-implementation ecosystem of IHL/LOAC — a dynamic normative and operational space shaped by an array of actors, including policy-makers, armed forces, humanitarian organizations, courts, international organizations, civil society, academics, and specialists from a range of disciplines. Within this ecosystem exist overlapping but distinct epistemic and practice communities, informed by varying legal traditions and institutional priorities. While these communities share a general commitment to the regulation of armed conflict through IHL/LOAC, they often diverge — sometimes significantly — in their assessments of the law's scope, content, and application in respect of a particular situation or incident. These communities may also differ in what they understand the IHL/LOAC framework to be capable of achieving — including with respect to its purposes and functions — as well as in how they conceive of its proper scope: whether, for example, as a tool for addressing relatively bounded operational or protective challenges or for addressing broader structural or ecological risks.

Attempting to speak across that diversity requires navigating several interpretive and methodological challenges. Some stem from structural features of the IHL/LOAC framework, including variations in treaty participation, questions of the formation of customary law and the role of persistent objectors, and disagreement over the significance of purported silence or inaction by States.[2] Others relate specifically to the subject at hand. These include

[2] Of the 193 Member States of the United Nations, 23 expressed their views to the ILC on the Draft Principles on Protection of the Environment in Relation to Armed Conflicts adopted at first reading in 2022 (19 States submitted written comments and observations, with Sweden doing so on behalf of several Nordic countries). International Law Commission, *Protection of the Environment in Relation to Armed Conflicts, Comments and Observations Received from Governments, International Organizations and Others,* U.N. Doc. A/CN.4/749 (Jan. [Footnote continued on next page]

divergent views on the co-application of IHL/LOAC and IEL during armed conflict and on the practical relevance of certain developments in international jurisprudence, such as the call of the International Court of Justice (ICJ) in *Gabčíkovo-Nagymaros* to take into account new norms and standards in light of evolving scientific insights.[3]

This paper does not seek to resolve those debates or to prescribe specific interpretations or implementation measures. Rather, it aims to support principled and practical engagement with interpretive and implementation questions, including by actors whose legal assessments, operational responsibilities, or institutional mandates may differ. It is anticipated that the implications of engaging with the legal aspects presented here will vary depending on one's role and position within the IHL/LOAC ecosystem. For some, they may support further clarification or refinement of existing obligations. For others, they may reinforce prevailing interpretations while informing assessments of feasibility and risk. For still others, the analysis may prompt principled reconsideration of whether the current IHL/LOAC framework — even if maximally upheld — is adequate to meet the environmental challenges of contemporary and future armed conflicts.

This contribution is offered in recognition of — and, it is hoped, as a complement to — the foundational work undertaken by States, the ILC, the ICRC, and others. Rather than restating those efforts, the paper aims to add value by framing and engaging certain legal issues that may warrant further consideration.

17, 2022) [hereinafter Comments and Observations on PERAC], ¶ 3. Additionally, three other States submitted information to the ILC in 2016, in response to the request in its report on the work of its 67th session, but did not subsequently submit written comments and observations on the draft principles. *See* Marie Jacobsson (Special Rapporteur on the Protection of the Environment in Relation to Armed Conflict), *Third Rep. on the Protection of the Environment in Relation to Armed Conflicts*, ¶ 54, U.N. Doc. A/CN.4/700 (June 3, 2016).

[3] Gabčíkovo-Nagymaros Project (Hungary/Slovakia), Judgment, 1997 I.C.J. 7, ¶ 140 (Sept. 25) ("Throughout the ages, mankind has, for economic and other reasons, constantly interfered with nature. In the past, this was often done without consideration of the effects upon the environment. Owing to new scientific insights and to a growing awareness of the risks for mankind — for present and future generations — of pursuit of such interventions at an unconsidered and unabated pace, new norms and standards have been developed, set forth in a great number of instruments during the last two decades. Such new norms have to be taken into consideration, and such new standards given proper weight, not only when States contemplate new activities but also when continuing with activities begun in the past."). The Court's discussion in this Judgment directly concerned the environmental effects of peacetime activities and did not expressly refer to military activities.

1.2. Methodology

1.2.1. Sources

This paper draws on traditional sources of public international law, including treaties, customary law, and general principles. The treaty-based and customary law in this paper pertains principally to IHL/LOAC, to IEL, and to the law of treaties. In addition, this paper refers to certain general principles of treaty interpretation and of IEL. The paper cites statements of States in multilateral fora, judicial decisions of international courts and tribunals, and the (Draft) Principles on the Protection of the Environment in Relation to Armed Conflicts and commentary thereto by the ILC,[4] as well as the 2020 Guidelines on the Protection of the Natural Environment in Armed Conflicts by the ICRC.[5] The paper also builds on military documents, such as manuals, as well as academic research and publications relating to IHL/LOAC, to IEL, and to climate and ecological sciences. This paper has been developed on the basis of a non-comprehensive review of publicly available primary and secondary sources published in English or French, as well as through informal consultations with experts.

1.2.2. Scope

This paper engages with five sets of IHL/LOAC obligations relating to the conduct of hostilities and to belligerent occupation, selected as some of the most relevant principles and rules with respect to protecting the natural environment in relation to armed conflict.[6] The paper then examines the select

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[4] G.A. Res. 77/104, annex, Principles on the Protection of the Environment in Relation to Armed Conflict (Dec. 7, 2022) [hereinafter PERAC]. The ILC adopted the draft principles, together with commentaries, at its 73rd session, in 2022. Subsequently, the UN General Assembly adopted (without a vote) resolution 77/104, in which it "[*t*]*akes note* of the principles . . . , brings them to the attention of States, international organizations and all who may be called upon to deal with the subject, and encourages their widest possible dissemination." *Id.* ¶ 4 (emphasis in original). While the completion of the ILC's work might suggest that they are no longer in draft form, they are yet to be adopted as a formally binding instrument, notwithstanding whatever persuasive authority they may be ascribed. In this paper, this ILC document is referred to as the "(Draft) Principles", in an attempt to give a shorthand that takes into account these aspects concerning its status.

[5] International Committee of the Red Cross, *Guidelines on the Protection of the Natural Environment in Armed Conflict: Rules and Recommendations Relating to the Protection of the Natural Environment under International Humanitarian Law, with Commentary* (2020) [hereinafter ICRC Guidelines].

[6] Those seeking more detailed treatment of IHL/LOAC and the environment are encouraged to consult the (Draft) Principles on Protection of the Environment in Relation to Armed Conflicts, PERAC, *supra* note 4, and [Footnote continued on next page]

sets of IHL/LOAC obligations alongside principles and rules of IEL, as well as scientific research on ecology and climate. IEL was selected for the purposes of this paper as its principles and rules relate directly to protection of the natural environment, and many of them are particularly susceptible to scientific appreciations of the risks that armed conflict poses thereto. This paper does not address obligations pertaining to armed conflict and the natural environment arising in other fields, such as international human rights law (IHRL) and international criminal law (ICL).[7]

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commentary thereto, Int'l L. Comm'n, Rep. on the Work of Its Seventy-Third Session, at 96–186, U.N. Doc. A/77/10 (2022) [hereinafter PERAC Commentary], adopted by the ILC and the 2020 Guidelines on the Protection of the Natural Environment in Armed Conflict published by the ICRC, ICRC Guidelines, *supra* note 5.

[7] Many relevant issues arising under IHRL and ICL are addressed in relation to the protection of the natural environment in armed conflict by the ILC in its commentary on the (Draft) Principles on the Protection of the Environment in Relation to Armed Conflicts, PERAC Commentary, *supra* note 6, and by the ICRC in its Guidelines on the Protection of the Natural Environment in Armed Conflict, ICRC Guidelines, *supra* note 5. There remain ongoing developments in these areas with potential implications for States' obligations in relation to armed conflict, not only with respect to the content of obligations but also regarding fora of potential legal proceedings. *See, e.g.*, International Criminal Court, Office of the Prosecutor, *Draft Policy on Environmental Crimes under the Rome Statute* (Dec. 18, 2024) [hereinafter ICC OTP Draft Policy on Environmental Crimes], https://www.icc-cpi.int/sites/default/files/2024-12/2024-12-18-OTP-Policy-Environmental-Crime.pdf. While it is not possible to comprehensively set out potentially relevant IHRL and ICL aspects, the following are some pertinent considerations.

Several IHRL instruments implicitly recognize the right to a clean and healthy natural environment, arguably applicable in relation to armed conflict. Examples of relevant non-derogable rights include — but are not limited to — the right to life under Article 6 of the International Covenant on Civil and Political Rights, Dec. 16, 1966, 999 U.N.T.S. 171; *see also id.* art. 4(2) ("No derogation from articles 6, 7, 8 (paragraphs I and 2), 11, 15, 16 and 18 may be made under this provision."); *cf.* Human Rights Committee, General Comment No. 36, U.N. Doc. CCPR/C/GC/36 (Sept. 3, 2019), ¶ 65 ("Environmental degradation, climate change and non-sustainable development constitute some of the most pressing and serious threats to the ability of present and future generations to enjoy the right to life. Obligations of States parties under international environmental law should thus inform the contents of article 6 of the Covenant, and the obligation of States parties to respect and ensure the right to life must reinforce their relevant obligations under international environmental law. The ability of individuals to enjoy the right to life, and in particular life with dignity, depends on measures taken by States parties to protect the environment against harm and pollution. In this respect, States parties should engage in sustainable utilization of natural resources, conduct environmental impact assessments for activities likely to have a significant impact on the environment, provide notification to other States of natural disasters and emergencies, and take due note of the precautionary principle."), the right to health under Article 12 of the International Covenant on Economic, Social and Cultural Rights art. 12, Dec. 16, 1966, 993 U.N.T.S. 3; *see also* Committee on Economic, Social and Cultural Rights, General Comment No. 14, U.N. Doc. E/C.12/2000/4 (Aug. 11, 2000), ¶ 47 ("It should be stressed, however, that a State party cannot, under any circumstances whatsoever, justify its non-compliance with the core obligations set out in paragraph 43 above, which are non-derogable."); *cf. id.* ¶¶ 4, 11, 15, 16, and the rights of children to life and health under Articles 6 and 24 respectively of the Convention on the Rights of the Child arts. 6, 24, Nov. 20, 1989, 1577 U.N.T.S. 3; *see also* Committee on the Rights of the Child, Rep. on Second Session, ¶ 64, U.N. Doc. CRC/C/10 (Oct. 19, 1992) ("When basing the consideration of the question of children in armed conflicts on the Convention itself, it was recalled that States parties have undertaken to respect and ensure all the rights set forth therein to all children within their jurisdiction (art. 2). States parties have also made a commitment to adopt all appropriate measures in [Footnote continued on next page]

There are many other important aspects regarding the natural environment and armed conflict that are not addressed in this paper. The paper does not, for example, treat the issue of harm to the natural environment by military activities outside the context of the conduct of hostilities or belligerent occupation, such as damage caused by deployment, troop movement, or military engineering. Nor does this paper address the harm to the environment caused by general mobilization and maintenance of armed forces, including the immense carbon emissions and waste byproducts of, for example, manufacturing arms, ammunition, and vehicles, or moving armies, aircraft, and naval vessels. These phenomena have been examined elsewhere.[8] They contribute to the overall erosion of environmental health and to the acceleration of climate change.[9]

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order to achieve such a purpose (art. 4) and that, in all actions taken, the best interests of the child shall be a primary consideration (art. 3). None of these general provisions admit a derogation in time of war or emergency."). *See also* Obligations of States in Respect of Climate Change, Advisory Opinion, ¶¶ 388–393 (July 23, 2025), https://www.icj-cij.org/sites/default/files/case-related/187/187-20250723-adv-01-00-en.pdf ("The human right to a clean, healthy and sustainable environment is therefore inherent in the enjoyment of other human rights. The Court thus concludes that, under international law, the human right to a clean, healthy and sustainable environment is essential for the enjoyment of other human rights."); G.A. Res. 76/300 (July 28, 2022) (recognizing "the right to a clean, healthy and sustainable environment as a human right"); Human Rights Council Res. 48/13, U.N. Doc. A/HRC/RES/48/13 (Oct. 8, 2022) (recognizing "the right to a clean, healthy and sustainable environment as a human right that is important for the enjoyment of human rights").

As for ICL, certain enumerated war crimes directly concern the natural environment. *E.g.* Rome Statute of the International Criminal Court art. 8(2)(b)(iv), July 17, 1998, 2187 U.N.T.S. 3 ("Intentionally launching an attack in the knowledge that such attack will cause . . . widespread, long-term and severe damage to the natural environment which would be clearly excessive in relation to the concrete and direct overall military advantage anticipated"). Other war crimes may indirectly concern the natural environment, in ways analogous to those explored in this paper. *E.g. id.* art. 8(2)(b)(xxv) ("Intentionally using starvation of civilians as a method of warfare by depriving them of objects indispensable to their survival . . . ."). As covered later in this paper, if an object that is indispensable to the survival of the civilian population is also a part of the natural environment, then such a provision provides direct protection to the natural environment. Indirect protection is also accorded to the natural environment where an object indispensable to the survival of the civilian population is not in itself a part of the natural environment but when destruction would nevertheless adversely affect the natural environment. *See infra* 2.3.1. *See also* ICRC Guidelines, *supra* note 5, at 109–110.

[8] *See, e.g.*, Neta C. Crawford, *Pentagon Fuel Use, Climate Change, and the Costs of War*, at 2, COSTS OF WAR (Nov. 13, 2019), https://watson.brown.edu/costsofwar/files/cow/imce/papers/Pentagon%20Fuel%20Use%2C%20Climate%20Change%20and%20the%20Costs%20of%20War%20Revised%20November%202019%20Crawford.pdf; CONFLICT & ENV'T OBSERVATORY, HOW INCREASING GLOBAL MILITARY EXPENDITURE THREATENS SDG 13 ON CLIMATE ACTION (May 2025), https://ceobs.org/how-increasing-global-military-expenditure-threatens-sdg-13-on-climate-action/.

[9] *See, e.g.*, CONFLICT & ENV'T OBSERVATORY, HOW DOES WAR DAMAGE THE ENVIRONMENT (Jun. 4, 2020), https://ceobs.org/how-does-war-damage-the-environment/#:~:text=Weapons%20and%20military%20materiel%20used,metals%20and%20toxic%20energetic%20materials.

1.2.3. Methods

1.2.3.1. Select Obligations

This paper selects five sets of IHL/LOAC obligations concerning the natural environment in armed conflict: (1) protections against widespread, long-term, and severe damage; (2) distinction, proportionality, and precautions in attack; (3) protection of objects indispensable to the survival of the civilian population; (4) protection of works and installations containing dangerous forces; and (5) obligations concerning usufruct in the context of belligerent occupation. These have been selected as they represent some of the most fundamental, directly relevant, and broadly applicable principles and rules of IHL/LOAC to offer protection to the natural environment. In this respect, they also seem to be among the most salient IHL/LOAC obligations in light of scientific assessments of ecological and climate-related concerns.

1.2.3.2. Legal Aspects

This paper examines each of the select sets of IHL/LOAC obligations by way of three legal aspects: an outline and comparison of treaty-based and customary rules of IHL/LOAC; an approach of systemic integration, taking into account relevant rules of IEL; and an evaluation of IHL/LOAC obligations in light of current scientific knowledge. When assessing their understanding of the extant IHL/LOAC framework, States' legal advisers and other concerned actors may consider each of these aspects individually or in combination. While some overlap exists among them, each may reinforce the others or lead to convergent interpretive outcomes.

These three aspects are not the only legal considerations relevant to environmental protection in relation to armed conflict. They have been selected with a view to further clarifying and enhancing respect for existing IHL/LOAC obligations in this area — in particular, by assisting States and other relevant actors in refining their interpretations of applicable principles and rules, in further developing and executing appropriate implementation measures, and in reflecting, in a principled and structured manner, on the sufficiency of existing binding IHL/LOAC obligations to address the nature, scale, and complexity of environmental harm associated with contemporary and future armed conflicts.

1.2.3.2.1. Treaty-Based and Customary IHL/LOAC

The analysis of this aspect sketches the principles and rules of IHL/LOAC pertaining to protection of the natural environment in relation to armed conflict and compares the relevant IHL/LOAC treaty-based and customary principles and rules. The work of determining the content of an obligation differs depending on its source. For treaties, the 1969 Vienna Convention on the Law of Treaties (VCLT) provides methods for interpreting the text of provisions.[10] The existence and content of rules of customary international law, on the other hand, are identified through State practice and *opinio juris*.[11]

The treaty-based IHL/LOAC obligations applicable to the protection of the natural environment in armed conflict derive from various instruments. As a starting point, this paper considers the Fourth 1949 Geneva Convention (GC IV)[12] and particularly the 1977 First Additional Protocol (AP I).[13] Additional attention is paid to other IHL/LOAC treaties as relevant, such as the Regulations Respecting the Laws and Customs of War on Land (Hague Regulations) annexed to the Fourth Hague Convention of 1907,[14] the 1977 Second Additional Protocol (AP II),[15] the 1977 Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques

[10] Vienna Convention on the Law of Treaties arts. 31–33, May 23, 1969, 1155 U.N.T.S. 331 [hereinafter VCLT]. Though the VCLT is itself a treaty and therefore binds only those States that are party to it, many of its provisions have been said to reflect the customary international law of treaties. For the purposes of treaty interpretation, Articles 31 and 32 are the most relevant and have generally been accepted as having customary status. *See, e.g.*, Avena and Other Mexican Nationals (Mexico v. United States of America), Judgment, 2004 I.C.J. Reports 12, ¶ 83 (Mar. 31) (referring to "the customary rules of treaty interpretation reflected in Articles 31 and 32 of the Vienna Convention on the Law of Treaties"); Sovereignty over Pulau Ligitan and Pulau Sipadan (Indonesia/Malaysia), Judgment, 2002 I.C.J. 625, ¶ 37 (Dec. 17) (referring to "customary international law, reflected in Articles 31 and 32 of that Convention"); Arbitral Award of 31 July 1989 (Guinea-Bissau v. Senegal), Judgment, 1991 I.C.J. 53, ¶ 48 (Nov. 12) ("These principles are reflected in Articles 31 and 32 of the Vienna Convention on the Law of Treaties, which may in many respects be considered as a codification of existing customary international law on the point.").

[11] *E.g.*, Int'l L. Comm'n, Rep. on the Work of Its Seventieth Session, at 90, U.N. Doc. A/CN.4/SER.A/2018/Add.1 (Part 2) (2018).

[12] Geneva Convention (IV) Relative to the Protection of Civilian Persons in Time of War, Aug. 12, 1949, 75 U.N.T.S. 287 [hereinafter GC IV].

[13] Protocol Additional to the Geneva Conventions of 12 August 1949, and relating to the Protection of Victims of International Armed Conflicts (Protocol I), June 8, 1977, 1125 U.N.T.S. 3 [hereinafter AP I].

[14] Convention (IV) Respecting the Laws and Customs of War on Land annex, Oct. 18, 1907, 36 Stat. 2295 [hereinafter Hague Regulations].

[15] Protocol Additional to the Geneva Conventions of 12 August 1949 and relating to the Protection of Victims of Non-International Armed Conflicts (Protocol II), June 8, 1977, 1125 U.N.T.S. 609 [hereinafter AP II].

(ENMOD),[16] and others.

Many of the principles and rules laid down in those instruments have their customary analogues. A State that is not a party to a treaty containing a principle or rule of IHL/LOAC may therefore nonetheless have the same or a similar obligation, binding as a matter of customary international law. The precise content of the obligation as set out in the provision of a treaty may differ in certain respects to that of the customary-law obligation. It is necessary for States, therefore, to further consider the scope, content and practical application of their and others' obligations with respect to the same or similar rules under customary international law. Moreover, by persistently objecting to the development of a customary-law rule, States may seek to set themselves outside of its purview.[17]

1.2.3.2.2. Systemic Integration of International Environmental Law

Systemic integration refers to an interpretive mode that factors in applicable rules of international law that derive from sources beyond that which is primarily being interpreted. Under the general rules of treaty interpretation, as reflected in the VCLT, interpretation must take into account — in the words of Article 31(3)(c) — "any relevant rules of international law applicable in the relations between the parties."[18] When interpreting a treaty provision, that provision cannot be considered as operating wholly independently from other relevant rules of international law. Those other relevant rules form the legal background to — and must be taken into consideration when interpreting — a given treaty provision.[19]

Because systemic integration is a form of treaty interpretation, it is applicable only when interpreting the text of a treaty provision. In this paper, therefore, systemic integration will be applied only to provisions of IHL/LOAC

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[16] Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques, Dec. 10, 1976, 1108 U.N.T.S. 151 [hereinafter ENMOD].

[17] *E.g.*, Int'l L. Comm'n, Rep. on the Work of Its Seventieth Session, at 91, U.N. Doc. A/CN.4/SER.A/2018/Add.1 (Part 2) (2018).

[18] VCLT, *supra* note 10, art. 31(3)(c).

[19] *See generally, e.g.,* Campbell McLachlan, *The Principle of Systemic Integration and Article 31(3)(c) of the Vienna Convention*, 54 INT'L & COMP. L. Q. 279–320 (2005). *See also* Oil Platforms (Islamic Republic of Iran v. United States of America), Judgment, 2003 I.C.J. 161, ¶ 41 (Nov. 6); Legal Consequences for States of the Continued Presence of South Africa in Namibia (South West Africa) notwithstanding Security Council Resolution 276 (1970), Advisory Opinion, 1971 I.C.J. 16, ¶ 53 (June 21).

treaties and not to customary rules of IHL/LOAC. Interpreting a provision in a treaty, however, need not take into account only other treaty-based rules. The words "any relevant rules of international law applicable" in Article 31(3)(c) of the VCLT invite the contemplation of customary rules of international law as well, so long as they are relevant and applicable. Therefore, systemic integration — when examining a treaty-based rule of IHL/LOAC — calls for taking customary rules of other relevant fields into account. While the first legal aspect identified above seeks to compare the contours of treaty-based and customary IHL/LOAC side by side, systemic integration isolates one particular mode of interpreting treaty provisions, which in turn may rely on any other relevant treaty-based or customary rules of international law.

This paper draws on rules of IEL for this systemic-integration approach to interpreting treaty-based IHL/LOAC obligations.[20] These derive from treaties such as the 1992 Convention on Biological Diversity (CBD),[21] the 1972 Convention Concerning the Protection of the World Cultural and Natural Heritage (WHC),[22] and others.[23] There are also relevant principles of customary international law, such as the precautionary principle and the principle on transboundary harm. This paper does not take a position on the question of whether the rules and principles of IEL are broadly co-applicable with those of IHL/LOAC in respect of a situation of armed conflict. Nor whether, where a conflict between specific norms exists, IHL/LOAC displaces IEL as the *lex specialis* pertaining to armed conflict.[24] Irrespective of any position on those

[20] While limited in this paper to IHL/LOAC and IEL, systemic integration as an interpretive mode may be used in relation to understanding IHL/LOAC provisions in light of applicable rules of other areas of international law also, such as IHRL and ICL. Moreover, IEL rules are themselves in turn susceptible to interpretation that takes into account other applicable rules of international law.

[21] Convention on Biological Diversity, Jan. 6, 1992, 1760 U.N.T.S. 79 [hereinafter CBD].

[22] Convention Concerning the Protection of the World Cultural and Natural Heritage, Nov. 16, 1972, 1037 U.N.T.S. 151 [hereinafter WHC].

[23] There is a multiplicity of regional environmental treaties to which States may also have recourse when interpreting provisions of IHL/LOAC by way of systemic integration in respect of specific geographical contexts.

[24] Notably, the ILC included a number of IEL instruments in "[a]n indicative list of treaties the subject-matter of which involves an implication that they continue in operation, in whole or in part, during armed conflict". Int'l L. Comm'n, Rep. on the Work of Its Sixty-Third Session, at 108–130, U.N. Doc. A/CN.4/SER.A/2011/Add.1 (Part 2) (2011). The ILC has also indicated that during armed conflict, "other rules of international law providing environmental protection, such as international environmental law and international human rights law, retain their relevance." PERAC Commentary, *supra* note 6, (draft) principle 13, at 113–114, ¶ 4. *See also* Raphaël van Steenberghe, *International Environmental Law as a Means for Enhancing the Protection of the Environment in Warfare: A Critical Assessment of Scholarly Theoretical Frameworks*, 105 Int'l Rev. Red Cross 1568, 1575 (2023). For an overview of select States' views on the question, *see* Conflict & Env't Observatory, State Positions on the Draft Principles on the Protection of the Environment in Relation to Armed Conflicts After First Reading, § 2.3 (2022).

questions, systemic integration would take rules of IEL that are relevant and applicable into account when interpreting treaty-based rules of IHL/LOAC. The integration of rules of IEL into interpretations of IHL/LOAC may in some cases lead to a (potentially far) more restrictive approach to the conduct of hostilities in ways that would arguably constitute a marked departure from how many States are currently interpreting and applying the law.

1.2.3.2.3. Current Scientific Knowledge

An approach that seeks to interpret IHL/LOAC principles and rules in light of new scientific knowledge and evidence concerning the natural environment is an evolutive one. It is one that may draw on the object and purpose of a given treaty — such as to limit human suffering resulting from war — and interpret its provisions and the content of the obligations that flow therefrom accordingly: for example, by noting that environmental degradation at a certain rate or scale in warfare leads to excessive human suffering. It may attach significance to certain IHL/LOAC terms — such as "widespread, long-term and severe damage to the natural environment" — in light of what is now known from a scientific understanding about the adverse impacts concerning the environment. It may similarly seek to refine customary-law obligations — such as drawing on new scientific insights to conduct more robust environmental impact assessments.

The relatively limited number of treaty-based IHL/LOAC provisions that directly address the natural environment might suggest, at first glance, that environmental protection has not figured prominently within the field. Most of the foundational IHL/LOAC instruments were developed before environmental science emerged as a widely accepted field of international relevance. At the same time, it would be a mistake to assume that the drafters lacked certain relevant insights; within the intellectual and political contours of their era, they responded to the concerns then available to them. For example, the inclusion of language in AP I regarding "widespread, long-term and severe damage" to the natural environment[25] reflects the influence of contemporary events and debates, such as the environmental devastation wrought during the Vietnam War and the concerns that catalyzed the 1972 Stockholm

[25] AP I, *supra* note 13, arts. 35(3), 55(1).

Declaration.[26] Similarly, the contemporaneous negotiation of ENMOD reflected an emerging awareness among States of the risks that human activity, including military operations, posed to the environment. These developments indicate that the drafters were operating with a growing sensitivity to environmental vulnerability. Nevertheless, those treaty texts were drafted without the benefit of the vast body of ecological, climatological, and systems-science knowledge that has since emerged.

Insights gained in the intervening decades — perhaps especially concerning the cumulative and interdependent nature of environmental systems — may have significant implications for how the existing law is understood and applied. In this light, the relative absence of more detailed environmental provisions in IHL/LOAC treaties should arguably not be read as an intentional exclusion of such concerns but, rather, as a reflection of the epistemic limitations of the time. Accordingly, these instruments remain susceptible not only to traditional textualist readings but also to interpretations that take seriously the evolving landscape of environmental science and its relevance to the conduct and effects of armed conflict. By drawing upon scientific developments to revisit and deepen understandings of IHL/LOAC obligations, States may enhance protections for the natural environment in relation to armed conflict.

1.2.3.3. Distilled Legal Questions, Implementation Measures, and Structural Reflections

At the end of the discussion of each of the select sets of IHL/LOAC obligations, the paper distills legal questions that emerge from the analysis and outlines measures that might be taken toward implementing the obligations in practice. These contributions are not prescriptive: they do not purport to identify questions that must be answered, nor measures that must be adopted. Rather, they are offered to assist those tasked with interpreting and applying the relevant principles and rules. Measures that might be taken include, for example, revising military manuals, issuing interpretive guidance, exchanging best practices, strengthening accountability mechanisms, integrating environmental and scientific expertise into command structures and decision-making processes, issuing unilateral declarations, contributing to

[26] *See, e.g.*, Official Records of the Diplomatic Conference on the Reaffirmation and Development of International Humanitarian Law Applicable in Armed Conflicts, vol. XIV, CDDH/III/SR.26 (1978), at 237; ICRC Guidelines, *supra* note 5, at 12–13.

multilateral engagements.

These sections also set out some potential structural reflections concerning whether the selected sets of IHL/LOAC obligations, even if fully carried out, suffice to meet the purposes or functions that States or other relevant actors may ascribe to the legal framework. These considerations are not meant to call into question the binding force of extant legal obligations that form vital parts of the IHL/LOAC framework. Rather, that final dimension of the analysis is intended to offer a legally and scientifically grounded conceptual vocabulary through which to configure a principled space for reflection on the adequacy of the existing legal framework in light of accelerating climate-related hazards and the growing body of scientific evidence on environmental risks associated with armed conflict. These and related questions may be particularly relevant to legal advisers seeking: to reconcile military necessity with environmental protection; to assess whether existing IHL/LOAC principles and rules offer sufficient clarity for operational planning; or to consider how best to reflect ecological vulnerability in doctrinal development, military manuals, or multilateral dialogue.

2. Select IHL/LOAC Obligations

This section sets out an analysis of five sets of IHL/LOAC obligations pertaining to the natural environment in relation to armed conflict: (1) protections against widespread, long-term, and severe damage; (2) distinction, proportionality, and precautions in attack; (3) protection of objects indispensable to the survival of the civilian population; (4) protection of works and installations containing dangerous forces; and (5) obligations concerning usufruct in the context of belligerent occupation. While there are many other principles and rules of IHL/LOAC that offer legal protections for the natural environment in armed conflict, these select sets of obligations are among the most widely applicable and the most salient for concerns regarding accelerating ecological and climate-related degradation. Each set of obligations is examined by way of three legal aspects: an outline and comparison of treaty-based and customary IHL/LOAC; an approach of systemic integration, taking into account relevant rules of IEL; and an evaluation of IHL/LOAC obligations in light of current scientific knowledge. For each set of obligations, the paper offers key questions and practical measures that may be considered in light of the corresponding analysis, as well as certain structural considerations

designed to provide a conceptual vocabulary through which to reflect on whether those obligations — even if fully implemented — suffice to meet the purposes and functions that relevant actors may assign to IHL/LOAC.

2.1. Widespread, Long-Term, and Severe Damage

Article 35(3) of AP I provides that "[i]t is prohibited to employ methods or means of warfare which are intended, or may be expected, to cause widespread, long-term and severe damage to the natural environment."[27]

Article 55(1) of AP I provides that:

> Care shall be taken in warfare to protect the natural environment against widespread, long-term and severe damage. This protection includes a prohibition of the use of methods or means of warfare which are intended or may be expected to cause such damage to the natural environment and thereby to prejudice the health or survival of the population.[28]

2.1.1. Treaty-Based and Customary IHL/LOAC

Articles 35(3) and 55(1) of AP I both employ the same formulation of "widespread, long-term and severe damage" concerning the natural environment. The former appears in Part III, Section 1 of AP I on methods and means of warfare. It concerns a general prohibition on the methods and means available to belligerents, alongside the prohibition of methods and means that are of a nature to cause "superfluous injury or unnecessary suffering".[29] In this way, paragraph 3 protects not only civilians and combatants but also the natural environment itself.[30] The purpose of Article 55(1), appearing in Chapter III on civilian objects, is more closely related to the protection of the environment in so far as it concerns civilian objects and populations. Both provisions are binding on parties to AP I and as such apply in respect of international armed conflict (IAC).

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[27] AP I, *supra* note 13, art. 35(3).

[28] *Id.* art. 55(1).

[29] *Id.* art. 35(2).

[30] *See* Claude Pilloud, Yves Sandoz, Christophe Swinarski & Bruno Zimmerman, International Committee of the Red Cross, Commentary on the Additional Protocols of 8 June 1977 to the Geneva Conventions of 12 August 1949 ¶ 1441 (1987) [hereinafter AP I Commentary].

The language of these provisions indicates that they do not prohibit widespread, long-term, and severe damage itself — though, under Article 55(1), States must take care to protect against it[31] (an obligation of conduct rather than of result[32]). Instead, the text of both articles expressly prohibits methods or means that are intended or may be expected to cause such damage. The word "intended" arguably indicates that a deliberate causation of widespread, long-term, and severe damage to the natural environment is prohibited.[33] The word "expected" imposes the same prohibition if such damage, including incidental damage, is a likely or reasonably foreseeable outcome of a given means or method.[34] These provisions operate independently from any balancing against military necessity and therefore provide an absolute protection to the natural environment that takes effect even when the environment may be seen as a lawful object of attack or where incidental damage to it is otherwise not unlawful under other IHL/LOAC obligations.

The terms "widespread", "long-term", and "severe" are not defined in the treaty. The *travaux préparatoires* reveal that, at least with respect to Article 55(1), "long-term" was "considered by some to be measured in decades" but do not otherwise provide much guidance.[35] In the context of Article 55(1), these terms could be understood in relation to a threshold of prejudice to "the

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[31] The ILC regards the words "care shall be taken" as imposing a "duty on the parties to an armed conflict to be vigilant of the potential impact that military activities can have on the environment. The considerations to be taken into account for this purpose are related both to the foreseeable effect of the methods and means of warfare used, and to the characteristics of the terrain in which military activities take place, such as the importance of ecologically rich environmental areas, or vulnerable or fragile ecosystems. The duty of care is also related to the obligation to take 'constant care . . . to spare . . . civilians and civilian objects' and the principle of precautions." PERAC Commentary, *supra* note 6, (draft) principle 13, at 142, ¶ 7. *See also* ICRC Guidelines, ¶¶ 44–46.

[32] *See* Karen Hulme, *Taking Care to Protect the Environment Against Damage: A Meaningless Obligation?*, 92 INT'L REV. RED CROSS 675, 679 (2010).

[33] *See* AP I Commentary, *supra* note 30, ¶¶ 1440, 1458, 1462.

[34] *See* ICRC Guidelines, *supra* note 5, ¶¶ 52, 57, 70.

[35] Official Records of the Diplomatic Conference on the Reaffirmation and Development of International Humanitarian Law Applicable in Armed Conflicts, vol. XV, CDDH/215/Rev. I (1978), at 268–269 ("References to twenty or thirty years were made by some representatives as being a minimum. Others referred to battlefield destruction in France in the First World War as being outside the scope of the prohibition. The Biotope report states that 'Acts of warfare which cause short-term damage to the natural environment, such as artillery bombardment, are not intended to be prohibited by the article,' and continues by stating that the period might be perhaps for ten years or more. However, it is impossible to say with certainty what period of time might be involved. It appeared to be a widely shared assumption that battlefield damage incidental to conventional warfare would not normally be proscribed by this provision. What the article is primarily directed to is thus such damage as would be likely to prejudice, over a long term, the continued survival of the civilian population or would risk causing it major health problems.") (citation omitted). *See also* AP I Commentary, *supra* note 30, ¶ 1455.

health or survival of the population".[36] In any event, the terms' ordinary meaning and their cumulativeness (indicated by the word "and") contemplate a relatively high threshold of permissible damage to the natural environment.[37] The term "natural environment" is also undefined in AP I. The 1987 ICRC Commentary on AP I suggests that it "should be understood in the widest sense to cover the biological environment in which a population is living."[38]

Many States maintain that these provisions reflect analogous rules of customary IHL/LOAC.[39] Under this appreciation, all parties to an armed conflict are prohibited from causing widespread, long-term, and severe damage to the environment in IACs and, arguably, in non-international armed conflicts (NIACs) as well.[40] Some States have objected to the notion that these provisions have customary status. At least one State not party to AP I has argued that

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[36] The terms as used in Article 35(3), however, may be understood in relation to a different, albeit undefined, threshold. The *travaux préparatoires* indicate that the inclusion of both provisions was debated with the conclusion that they are not duplicative but rather have different aims. *See* AP I Commentary, *supra* note 30, ¶¶ 1441, 1449, 1451, 1453(c), 1455, 1462. *See also, e.g.*, ICRC Guidelines, *supra* note 5, ¶¶ 69, 73–75; UNITED KINGDOM MINISTRY OF DEFENCE, JOINT SERVICE MANUAL OF THE LAW OF ARMED CONFLICT ¶ 5.29.1 (2004) ("Article 35 deals with direct protection of the environment whereas Article 55 tends more towards protecting the environment from the incidental effects of warfare, especially if it prejudices the health or survival of the civilian population").

[37] PERAC Commentary, *supra* note 6, (draft) principle 13, at 142, ¶ 8 ("It is also obvious that, by opting for the conjunctive 'and' instead of the disjunctive 'or' used in the Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques, the States participating in the negotiations on Additional Protocol I wished to set a high threshold."); Michael Bothe et al., *International Law Protecting the Environment During Armed Conflict: Gaps and Opportunities*, 92 INT'L REV. RED CROSS 569, 575 (2010).

[38] AP I Commentary, *supra* note 30, ¶ 2126. *See also* ICRC Guidelines, *supra* note 5, ¶¶ 16–17 ("The present Guidelines understand 'the natural environment' to constitute the natural world together with the system of inextricable interrelations between living organisms and their inanimate environment, in the widest sense possible."). *Cf.* ICC OTP Draft Policy on Environmental Crimes, *supra* note 7, ¶ 21–22 ("'Natural environment' refers to the earth's biosphere, cryosphere, lithosphere, hydrosphere, and atmosphere, including outer space. This definition draws upon scientific recognition of the interactions that make up the environment. In general, the term 'natural environment' should be 'understood in the widest possible sense, in line with the meaning States have given it in the context of IHL,' because the concept of the environment 'may evolve over time as knowledge about it increases' and because 'the environment itself is constantly changing.'").

[39] *See* JEAN-MARIE HENCKAERTS & LOUISE DOSWALD-BECK, INTERNATIONAL COMMITTEE OF THE RED CROSS, CUSTOMARY INTERNATIONAL HUMANITARIAN LAW, vol. I, Rule 45, 151–158 (2005) [hereinafter ICRC CUSTOMARY IHL]; Comments and Observations on PERAC, *supra* note 2, at 76 ("Switzerland would welcome an explicit reference to the customary prohibition to employ methods or means of warfare which are intended, or may be expected, to cause widespread, long-term and severe damage to the natural environment.").

[40] The PERAC Commentary clarifies that "[d]raft principle 13 comprises three paragraphs which broadly provide for the protection of the environment during armed conflict, whether international or non-international". PERAC Commentary, *supra* note 6, (draft) principle 13, at 141, ¶ 1. *See also* ICRC CUSTOMARY IHL, *supra* note 39, at 151–158. For a discussion on the "lack of transparency" of the inclusion of NIACs in the ILC's commentary pertaining to the (draft) principle, *see* Marja Lehto, *Throughout the Conflict Cycle: International Law Commission Principles on Protection of the Environment in Relation to Armed Conflicts*, 2024 MAX PLANCK Y.B. INT'L L. 279–280.

there are no such rules of customary international law.[41] The same position is held by certain States that are party to AP I.[42] Separately, some States have maintained that customary rules of this nature do not apply in relation to the use of nuclear weapons.[43]

2.1.2. Systemic Integration of International Environmental Law

States may interpret certain terms in Articles 35(3) and 55(1) of AP I in light of other relevant rules of international law. With respect to the term "natural environment", States may have recourse to definitions in treaties to which they are party. There are no agreed definitions of the terms "environment" or "natural environment" in international law.[44] While the term "natural

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[41] U.S. ARMY, THE COMMANDER'S HANDBOOK ON THE LAW OF LAND WARFARE [FM 6–27] ¶¶ 2–143 (2019) ("The United States has not accepted these provisions and repeatedly expressed the view that they are overly broad and ambiguous and do not constitute customary international law."); Comments and Observations on PERAC, *supra* note 2, at 77 ("[T]he United States has expressed the view that certain treaty provisions directed expressly at the protection of the natural environment — such as provisions of Additional Protocol I to the 1949 Geneva Conventions that prohibit 'methods or means of warfare intended or expected to cause widespread, long-term and severe damage to the environment' — are too broad and ambiguous and not part of customary international law."); U.N. GAOR, 77th Sess., 6th Committee, 25th mtg. at 13–14, U.N. Doc. A/C.6/70/SR.25 (Nov. 11, 2015) (Statement of Israel). Although the position has been said to appear to be that of a persistent objector, ICRC Guidelines, *supra* note 5, at 31, it may arguably be more accurate, from the wording of relevant statements, to characterize the position as maintaining that there is no such customary rule binding on any State.

[42] Comments and Observations on PERAC, *supra* note 2, at 68 (". . . article 55 of Additional Protocol I, to which Canada is party. This treaty obligation has not obtained customary status."); *id.* at 70 ("France recalls that it does not consider articles 35 and 55 of Additional Protocol I to the Geneva Conventions . . . to have customary value.").

[43] ICRC CUSTOMARY IHL, *supra* note 39, at 151.

[44] These terms are not universally defined in IEL, and IEL treaties typically refer to the environment in broad terms or within the specific context of a particular instrument. *See generally* Marja Lehto (Special Rapporteur on Protection of the Environment in Relation to Armed Conflicts), *Second Rep. on Protection of the Environment in Relation to Armed Conflicts*, at 82–86, U.N. Doc. A/CN.4/728 (Mar. 27, 2019). For the statements of States on this point, *see, e.g.*, U.N. GAOR, 69th Sess., Sixth Committee, agenda item 78 (Nov. 3, 2014) (Statement of Austria); U.N. GAOR, 71st sess., 6th Committee, agenda item 78 (Oct. 28, 2016) (Statement of Malaysia); U.N. GAOR 73d sess., 6th Committee, agenda item 82 (Oct. 31, 2018) (Statement of Malaysia); U.N. GAOR, 71st sess., 6th Committee, agenda item 78 (Nov. 1, 2016) (Statement of Micronesia); U.N. GAOR, 69th sess., 6th Committee, agenda item 78 (Nov. 3, 2014) (Statement of New Zealand). Generally speaking, the concept of the environment in IEL encompasses "both the features and the products of the natural world and those of human civilization", PHILIPPE SANDS ET AL., PRINCIPLES OF INTERNATIONAL ENVIRONMENTAL LAW 14 (4th ed. 2018). *See also* Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion, 1996 I.C.J. 226, ¶ 29 (July 8) (observing that "the environment is not an abstraction but represents the living space, the quality of life and the very health of human beings, including generations unborn"); NORTH ATLANTIC TREATY ORGANIZATION, NATO GLOSSARY OF TERMS AND DEFINITIONS, AAP-06, 49 (2019) ("The surroundings in which an organization operates, including air, water, land, natural resources, flora, fauna, humans, and their [Footnote continued on next page]

environment" as such does not appear in the CBD, for example, the definition it gives to "ecosystem"[45] may shed light on certain integral aspects of the natural environment as it appears in AP I. Similarly, although the WHC uses the term "natural environment" without defining it, it does provide a definition of "natural heritage"[46]. These definitions are arguably not strictly transposable onto the meaning of "natural environment" in AP I, but States may nonetheless find such definitions useful in formulating their positions on the precise meaning of the term. States may also refer to specific definitions of particular natural environments, such as the clarification by the International Tribunal for the Law of the Sea (ITLOS) of the meaning of "marine environment" as used in the United Nations Convention on the Law of the Sea (UNCLOS).[47] This may afford actors more clarity when assessing the lawfulness of certain attacks during armed conflict in naval theatres or that otherwise might have an effect on the sea or coastal areas.

There are, however, limitations to systemic integration in this area. For example, Article I(1) of ENMOD uses the terms "widespread, long-lasting or severe".[48] In full, it reads as follows: "Each State Party to this Convention

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interrelations."); EUROPEAN UNION, EUROPEAN UNION MILITARY CONCEPT ON ENVIRONMENTAL PROTECTION AND ENERGY EFFICIENCY FOR EU-LED MILITARY OPERATIONS, EEAS 01574/12, 8 (2012) ("The surroundings in which an organization operates, including air, water, land, natural resources, flora, fauna, humans, and their interrelation."). For its part, the ILC considers that the notion of the environment "represents a complex system of interconnections where the factors involved (such as humans and the natural environment) interact with each other in different ways that 'do not permit them to be treated as discrete'." Marja Lehto (Special Rapporteur on Protection of the Environment in Relation to Armed Conflicts), *Second Rep. on Protection of the Environment in Relation to Armed Conflicts*, ¶ 196, U.N. Doc. A/CN.4/728 (Mar. 27, 2019).

[45] CBD, *supra* note 21, art. 2 ("'Ecosystem' means a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit.").

[46] WHC, *supra* note 22, art. 2 ("For the purposes of this Convention, the following shall be considered as 'natural heritage': natural features consisting of physical and biological formations or groups of such formations, which are of outstanding universal value from the aesthetic or scientific point of view; geological and physiographical formations and precisely delineated areas which constitute the habitat of threatened species of animals and plants of outstanding universal value from the point of view of science or conservation; natural sites or precisely delineated natural areas of outstanding universal value from the point of view of science, conservation or natural beauty.").

[47] Request for an Advisory Opinion submitted by the Commission of Small Island States on Climate Change and International Law, Advisory Opinion, ¶¶ 166–171 (May 21, 2024), https://www.itlos.org/fileadmin/itlos/documents/cases/31/Advisory_Opinion/C31_Adv_Op_21.05.2024_orig.pdf.

[48] While ENMOD is not an IEL treaty, it is considered here in the subsection on systemic integration, rather than the preceding subsection on treaty-based and customary IHL/LOAC, owing to its separateness from the AP I provisions under consideration and, in particular, in view of the stipulation that the terms in ENMOD are defined precisely for the purposes of that convention alone. Considered by way of systemic integration, the terms as employed in ENMOD may nevertheless inform an interpretation of obligations in other IHL/LOAC treaties, such as AP I.

undertakes not to engage in military or any other hostile use of environmental modification techniques having widespread, long-lasting or severe effects as the means of destruction, damage or injury to any other State Party."[49] The terms "widespread, long-lasting or severe" are defined in one of the Understandings attached to the convention.[50] The term "widespread" is defined as "encompassing an area on the scale of several hundred square kilometres";[51] "long-lasting" as "lasting for a period of months, or approximately a season";[52] and "severe" as "involving serious or significant disruption or harm to human life, natural and economic resources or other assets."[53] However, the text of that Understanding expressly provides that "the interpretation set forth above is intended exclusively for this Convention and is not intended to prejudice the interpretation of the same or similar terms if used in connexion with any other international agreement."[54] Though these terms are defined precisely for the purposes of ENMOD, it has been argued that they may be relied upon in part to inform contemporary understandings of the same or similar terms in AP I.[55] States might elect to interpret terms similarly across both instruments,[56] as some have done.[57]

Customary rules of IEL may also be of use to States and other actors interpreting these provisions. While customary law does not provide precise definitions for these terms, it may shed light on how to interpret and apply

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[49] ENMOD, *supra* note 16, art. I(1).

[50] Conference of the Committee on Disarmament, *Report of the Conference of the Committee on Disarmament*, 91–92, U.N. Doc. A/31/27/[Vol.I](Supp) (Vol. I) (1976).

[51] *Id.*

[52] *Id.*

[53] *Id*.

[54] *Id.*

[55] *See* ICRC Guidelines, *supra* note 5, ¶¶ 52, 60, 64, 72; UN ENVIRONMENT PROGRAMME, PROTECTING THE ENVIRONMENT DURING ARMED CONFLICT 52 (2009), https://wedocs.unep.org/bitstream/handle/20.500.11822/7813/-Protecting%20the%20Environment%20During%20Armed%20Conflict_An%20Inventory%20and%20Analysis%20of%20International%20Law-2009891.pdf?sequence=3&amp%3BisAllowed=.

[56] *Cf.* ANNE DIENELT, ARMED CONFLICTS AND THE ENVIRONMENT: COMPLEMENTING THE LAWS OF ARMED CONFLICT WITH HUMAN RIGHTS LAW AND INTERNATIONAL ENVIRONMENTAL LAW 319 (2022) ("It is . . . proposed that in cases of treaties that deal with similar objects or the same legal situation, a quasi-universal or universal membership of states indicates a common understanding of terminology across these texts. The quasi-universal or universal treaties concerned are hence the common ground, and an interpretation in order to clarify ambiguous terminology across regimes is possible irrespective of identical contracting state parties.").

[57] *See, e.g.*, Michael Schmitt, *Green War: An Assessment of the Environmental Law of International Armed Conflict*, 22 YALE J. INT'L. L. 1, 107 (1997) ("Since there is no indication of what was meant by the term 'widespread' in the Protocol I drafting process, it makes sense to defer to its sole legal definition, that of ENMOD. Though ENMOD definitions were specifically said not to bind other agreements, this does not negate the logic of using them to minimize confusion if doing so makes sense contextually.").

the AP I provisions as a whole. Consider the precautionary principle in customary IEL, for example, as encapsulated in Principle 15 of the Rio Declaration: "Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."[58] This principle emphasizes anticipation in the face of scientific uncertainty about future environmental damage and calls for adopting measures to prevent future harm even in the absence of conclusive evidence about the likely extent of the harm.[59] Put into the context of armed conflict, it could be argued that where a State is uncertain of the extent, longevity, or severity of damage that may be caused to the environment by a given method or means of warfare, it may not rely on the urgency and exigency of a concrete military necessity to employ such a method or means. Reading a customary IEL principle into States' obligations under AP I, or the customary analogue, in this way may present a path for States and other actors to enhance protection with respect to the natural environment in the context of armed conflict.

2.1.3. Current Scientific Knowledge

The ILC, in its commentary to (draft) principle 13 — which incorporates parts of Articles 35(3) and 55(1) of AP I — noted that "interpretation of this standard should not rely solely on how the concept of 'environmental damage' was understood in the 1970s but must take into account current scientific knowledge of ecological processes."[60] Similarly, the ICRC maintains that "in assessing the degree to which damage is widespread, long-term and severe, contemporary (i.e. current) knowledge about the effects of harm on the

[58] United Nations Conference on Environment and Development, *Rio Declaration on Environment and Development*, U.N. Doc. A/CONF.151/26/Rev.1 (Vol. I), annex I (Aug. 12, 1992) [hereinafter Rio Declaration], principle 15. *Cf.* ICRC CUSTOMARY IHL, *supra* note 39, at 147, 150.

[59] Relatedly, the United Nations Framework Convention on Climate Change obliges parties to "take precautionary measures to anticipate, prevent or minimize the causes of climate change and mitigate its adverse effects. Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing such measures, taking into account that policies and measures to deal with climate change should be cost-effective so as to ensure global benefits at the lowest possible cost." United Nations Framework Convention on Climate Change art. 3(3), May 9, 1992, 1771 U.N.T.S. 107 [hereinafter UNFCCC].

[60] PERAC Commentary, *supra* note 6, (draft) principle 13, at 142, ¶ 9 ("In this regard, risk of damage should not be conceptualized only in terms of harm to a specific object but should also take into account the possibility of affecting a fragile interdependent system of both living and non-living components.").

natural environment must be taken into account."[61] The terms "widespread", "long-term" and "severe" may thereby now bear contemporary interpretations with respect to space, time and degree. While the area of effect of an attack might in 1977 have been understood as being only an area that is directly damaged by a chosen method or means of warfare, it is possible for States today to anticipate that damage in one area of the natural environment may likely have repercussive environmental effects beyond the immediate vicinity.[62] With respect to "long-term" damage, much has been made in commentaries on Articles 35(3) and 55(1) of the notion that drafters had in mind, for example, the effects of the use of napalm and Agent Orange in the Vietnam War.[63] With the passage of more time the effects of these means of warfare have lingered even through today.[64] Beyond that example, moreover, current scientific knowledge has developed a deeper understanding of the long-term effects of warfare on environmental processes.[65] Some States and international bodies have suggested interpreting these terms in light of scientific and academic findings with regard to ecosystem processes.[66]

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[61] ICRC Guidelines, *supra* note 5, ¶ 54 (citing Michael Bothe, *The Protection of the Environment in Times of Armed Conflict: Legal Rules, Uncertainty, Deficiencies and Possible Developments*, 34 GER. Y.B. INT'L L. 54, 60–61 (1991); Cordula Droege & Marie-Louise Tougas, *The Protection of the Natural Environment in Armed Conflict – Existing Rules and Need for Further Legal Protection*, 82 NORDIC J. INT'L L. 21, 33 (2013)).

[62] ICRC Guidelines, *supra* note 5, ¶¶ 57–58.

[63] Official Records of the Diplomatic Conference on the Reaffirmation and Development of International Humanitarian Law Applicable in Armed Conflicts, vol. XIV, CDDH/III/SR.26 (1978), at 237. See also KAREN HULME, WAR TORN ENVIRONMENT: INTERPRETING THE LEGAL THRESHOLD 92 (2004). *See also, e.g.*, Schmitt, *supra* note 57, 9–11 ("For the first time, the environmental impact of military operations drew domestic and international attention . . . . Not only did the conflict spotlight the fact of environmental damage, but it also raised questions of its legality.").

[64] *See, e.g.*, Kenneth Olson & Lois Morton, *Long-Term Fate of Agent Orange and Dioxin TCDD Contaminated Soils and Sediments in Vietnam Hotspots*, 9 OPEN J. SOIL SCI. 1 (2019); Thi Nam Tuyet Le & Annika Johansson, *Impact of Chemical Warfare with Agent Orange on Women's Reproductive Lives in Vietnam: A Pilot Study*, 9 REPROD. HEALTH MATTERS 156 (2001); Jeanne Stellman & Steven Stellman, *Agent Orange During the Vietnam War: The Lingering Issue of Its Civilian and Military Health Impact*, 108 AM. J. PUB. HEALTH 726 (2018). This knowledge has been supplemented by a similar understanding (still underway) of the effects of, for example, the environmental devastation caused by the Gulf War. *See, e.g.*, G.A. Res. 47/37, at 2 (Feb. 9, 1993) ("Expressing its deep concern about environmental damage and depletion of natural resources, including the destruction of hundreds of oil-well heads and the release and waste of crude oil into the sea, during recent conflicts . . . .") (underlining in original).

[65] *See, e.g.*, UN ENVIRONMENT PROGRAMME, *supra* note 55, at 4; UN ENVIRONMENT PROGRAMME, SUDAN POST-CONFLICT ENVIRONMENTAL ASSESSMENT (2007), https://www.unep.org/resources/assessment/sudan-post-conflict-environmental-assessment; UN ENVIRONMENT PROGRAMME, DESK STUDY ON THE ENVIRONMENT IN IRAQ (2003), https://www.unep.org/resources/report/desk-study-environment-iraq.

[66] *E.g.*, Comments and Observations on PERAC, *supra* note 2, at 74 ("[T]he Kingdom of the Netherlands notes that, in 2009, the United Nations Environment Programme requested the development of a more specific [Footnote continued on next page]

At the same time, while we now know more about how certain methods and means of warfare have reverberating environmental effects, it may not be possible to predict in every instance what the precise extent, longevity, and severity of each use of a method or means of warfare will be. This has led the ICRC to posit that there is a need to limit environmental damage as far as possible.[67]

2.1.4. Distilled Legal Questions, Implementation Measures, and Structural Reflections

Those reviewing or formulating a position on the IHL/LOAC obligations discussed in this section might consider the following legal questions:

- What degree of certainty of expected widespread, long-term, and severe damage to the natural environment is required to forgo an attack or the use of a particular method or means of warfare?
- What are the most salient means of measuring the area of environmental damage in relation to the term "widespread"? For example, ought this to be thought of in terms of a geographical area measured in kilometers, in terms of States and territories, or in terms of the range of biomes and interlinked ecosystems adversely affected?
- What units of measurement, and on what scale, should time be measured in relation to the term "long-term"?
- What are the most salient criteria to inform whether damage is of such a severity as to meet the meaning of the term "severe"? For example, how does severity of damage relate to the natural environment in and of itself, and how does it relate to the health or survival of the civilian

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definition of the phrase 'widespread, long-term and severe'. The commentaries to the draft principles merely refer to Additional Protocol I to the Geneva Conventions of 1949. The Kingdom of the Netherlands would like to suggest interpreting the standard of 'widespread, long-term and severe' in light of the most recent academic discourse with regard to the different functions of ecosystems, taking into account recent case law. For example, the commentary could refer to the need to interpret this phrase in accordance with the latest scientific insights into the various functions of ecosystems, as the International Court of Justice did in *Certain Activities Carried Out by Nicaragua in the Border Area* (Costa Rica v. Nicaragua, Compensation Judgment).").

[67] ICRC Guidelines, *supra* note 5, ¶ 55 ("Considering the difficulty of knowing in advance what the scope of effects of acts will be, there is a need to limit environmental damage as far as possible, even in cases where it is not certain to meet a strict interpretation of the criteria of 'widespread, long-term and severe'. To comply with this rule, those employing methods or means of warfare must inform themselves of the potential detrimental effects of their planned actions and refrain from those intended or expected to cause widespread, long-term and severe damage."). *See also* ICRC CUSTOMARY IHL, *supra* note 39, at 158.

population? In what respects might these differ?

- To what extent, if at all, do — and should — these obligations differ with respect to IACs compared to NIACs?

Those seeking to implement the IHL/LOAC obligations discussed in this section by way of policy or other practical measures might consider the following:

- creating a definition of the natural environment that allows commanders to readily assess whether an object constitutes a part of the environment protected by these obligations;
- establishing practicable parameters by which to measure whether a potential attack or other use of a method or means of warfare would meet the threshold of widespread, long-term, and severe;
- indicating the standard of certainty required for an expectation that a potential attack or other use of a method or means of warfare would cause such damage as to require the military action to be called off;
- educating commanders on the geographical extent, longevity, and severity of damage potentially caused to the natural environment by their own armed forces' respective weapons and other methods and means of warfare; and
- integrating at the concept-of-operations and operations-planning phases an assessment of the susceptibility of a theater's or other battlespace's natural environment to damage as a result of the use of methods and means of warfare expected to be at commanders' disposal.

The following questions offer legal and scientific concepts and considerations to guide principled reflection on the structural sufficiency of the IHL/LOAC obligations discussed in this section for addressing risks posed to the natural environment in relation to armed conflict:

- Whether the threshold of widespread, long-term, and severe is conceptually appropriate in light of knowledge that localized or moderate ecological damage may contribute to irreversible ecosystem collapse or climate disruption due to cumulative systemic effects?
- Whether the legal reliance on intent or expectation of harm as a condition for the prohibitions overly limits their capacity to address scientifically foreseeable but indirect or spatially or temporally distant harms?

2.2. Distinction, Proportionality, and Precautions in Attack

Article 48 of AP I provides: "In order to ensure respect for and protection of the civilian population and civilian objects, the Parties to the conflict shall at all times distinguish between the civilian population and combatants and between civilian objects and military objectives and accordingly shall direct their operations only against military objectives."[68]

Article 52 of AP I provides, in relevant part:

> 1. Civilian objects shall not be the object of attack or of reprisals. Civilian objects are all objects which are not military objectives as defined in paragraph 2.
> 2. Attacks shall be limited strictly to military objectives. In so far as objects are concerned, military objectives are limited to those objects which by their nature, location, purpose or use make an effective contribution to military action and whose total or partial destruction, capture or neutralization, in the circumstances ruling at the time, offers a definite military advantage.[69]

Article 51(5)(b) of AP I provides that, among the types of attacks that are to be considered as indiscriminate, is "an attack which may be expected to cause incidental loss of civilian life, injury to civilians, damage to civilian objects, or a combination thereof, which would be excessive in relation to the concrete and direct military advantage anticipated."[70]

Article 57 of AP I provides, in relevant part:

> 1. In the conduct of military operations, constant care shall be taken to spare the civilian population, civilians and civilian objects.
> 2. With respect to attacks, the following precautions shall be taken:
> (a) those who plan or decide upon an attack shall: . . .
> (ii) take all feasible precautions in the choice of means and methods of attack with a view to avoiding, and in any event to minimizing, incidental loss of civilian life, injury to

[68] AP I, *supra* note 13, art. 48.

[69] *Id.* arts. 52(1), 52(2).

[70] *Id.* art. 51(5)(b).

> civilians and damage to civilian objects;
> (iii) refrain from deciding to launch any attack which may be expected to cause incidental loss of civilian life, injury to civilians, damage to civilian objects, or a combination thereof, which would be excessive in relation to the concrete and direct military advantage anticipated;
> (b) an attack shall be cancelled or suspended if it becomes apparent that the objective is not a military one or is subject to special protection or that the attack may be expected to cause incidental loss of civilian life, injury to civilians, damage to civilian objects, or a combination thereof, which would be excessive in relation to the concrete and direct military advantage anticipated; . . .
> 3. When a choice is possible between several military objectives for obtaining a similar military advantage, the objective to be selected shall be that the attack on which may be expected to cause the least danger to civilian lives and to civilian objects.[71]

2.2.1. Treaty-Based and Customary IHL/LOAC

The ILC's (draft) principle 14 states that "[t]he law of armed conflict, including the principles and rules on distinction, proportionality and precautions shall be applied to the environment, with a view to its protection."[72] Under the requirement of distinction, parties to an armed conflict may direct attacks only against military objectives and may not make civilians or civilian objects the object of an attack. Per Article 52(1) of AP I, all objects are civilian unless they meet the criteria of a military objective.[73] In the view of the ICRC, this provision has been established as a rule of customary IHL/LOAC.[74] In line with that position, at a minimum for all States, a specific part of the natural environment may become a military objective and may be a lawful target of attack only if it makes an effective contribution to military action by virtue of

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[71] *Id.* arts. 57(1), 57(2)(a)(ii), 57(3).

[72] PERAC, *supra* note 4, (draft) principle 14.

[73] AP I, *supra* note 13, art. 52(1).

[74] *See, e.g.*, PERAC Commentary, *supra* note 6, (draft) principle 14, at 144, ¶ 3; ICRC CUSTOMARY IHL, *supra* note 39, at 25 ("The parties to the conflict must at all times distinguish between civilian objects and military objectives. Attacks may only be directed against military objectives. Attacks must not be directed against civilian objects."); *id.* at 143 ("No part of the natural environment may be attacked, unless it is a military objective.").

its location, purpose, or use[75] and if its total or partial destruction, capture, or neutralization offers a definite military advantage[76] under the prevailing circumstances.[77] By default, the natural environment is civilian in character and generally not targetable.[78] Conversely, some actors regard certain parts of the natural environment as simply a background against which armed conflict

[75] Definitionally, the natural environment likely cannot be a military objective merely by virtue of its nature. *See* ICRC Guidelines, *supra* note 5, ¶ 101 ("With regard to the first prong of this definition, a distinct part of the natural environment will never by its 'nature' make an effective contribution to military action. This is because the term 'nature' refers to the intrinsic character of an object, and the intrinsic character of the natural environment is civilian. A distinct part of the natural environment may, however, make an effective contribution to military action owing to its location, purpose or use."). *See also* YORAM DINSTEIN & ARNE DAHL, OSLO MANUAL ON SELECT TOPICS OF THE LAW OF ARMED CONFLICT: RULES AND COMMENTARY 136 (2020) [hereinafter OSLO MANUAL] ("Although parts of the natural environment constitute civilian objects other parts may be regarded as military objectives by location, purpose or use (e.g., camouflage).").

[76] Regarding the meaning of "definite military advantage", *see* ICRC Guidelines, *supra* note 5, ¶ 103 ("The term 'definite' requires that the advantage be concrete and perceptible, and thus that those ordering or executing the attack have concrete information as to what the advantage offered by attacking the distinct component of the natural environment will be. The term 'military' clarifies that the anticipated advantage cannot be merely political, social, psychological, moral, economic or financial in nature. For example, where a celebrated national park occupies a cherished place in a State's history and identity, attacking such a park may undermine national morale and political resilience. However, as undermining national morale and political resilience is not a military advantage, the national park cannot fulfill the definition of a military objective by this metric."). *See also* AP I Commentary, *supra* note 30, ¶ 2024 ("Finally, destruction, capture or neutralization must offer a 'definite military advantage' in the circumstances ruling at the time. In other words, it is not legitimate to launch an attack which only offers potential or indeterminate advantages. Those ordering or executing the attack must have sufficient information available to take this requirement into account; in case of doubt, the safety of the civilian population, which is the aim of the Protocol, must be taken into consideration.").

[77] *See* AP I, *supra* note 13, art. 52(2).

[78] *See* PERAC, *supra* note 4, (draft) principle 13(3) ("No part of the environment may be attacked, unless it has become a military objective."); ICRC CUSTOMARY IHL, *supra* note 39, at 143 ("No part of the natural environment may be attacked, unless it is a military objective."); ICRC Guidelines, *supra* note 5, ¶ 18 ("It is generally recognized today that, by default, the natural environment is civilian in character".). *See also* Comments and Observations on PERAC, *supra* note 2, at 17–18; Bothe, *supra* note 61, at 55 (maintaining that the natural environment "is protected as being part of the civilian world. Anything which is not a military objective is a civilian object and enjoys the corresponding protection."); Karen Hulme, *Using International Environmental Law to Enhance Biodiversity and Nature Conservation During Armed Conflict*, 20 J. INT'L CRIM. JUST. 1155, 1161 (2022) ("[T]he last fifty years have witnessed many efforts to interpret or influence a greener path for existing IHL/LOAC obligations. Principal among these was the fundamental recognition in the 1980s and 1990s that the environment is *prima facie* a civilian object for application of the principles of distinction, proportionality and precautions."); Helen Obregón Gieseken & Vanessa Murphy, *The Protection of the Natural Environment under International Humanitarian Law: The ICRC's 2020 Guidelines,* 105 INT'L REV. RED CROSS 1180, 1187 (2023) ("By virtue of its civilian character, the natural environment is protected by the general IHL/LOAC rules governing the conduct of hostilities, and the interpretive guidance on these rules lies at the heart of the Guidelines' objective of better restraining the worst excesses of war wrought on the environment. Most quotidian and influential for contemporary conflicts are the protections provided to all parts of the natural environment as civilian objects by the IHL/LOAC principles of distinction, proportionality and precaution."). For a collection of State practice on the default civilian character of the natural environment, *see* ICRC Guidelines, *supra* note 5, at 19 n.33.

occurs and in that sense as neither military nor civilian in character.[79] In armed conflict, it may transpire that a belligerent uses the natural environment in a way that renders its destruction a definite military advantage for the adversary — for example, by concealing armed forces in dense forests.[80] While, in such a case, the parts of a forest directly contributing to military action may be lawfully targeted[81] — such as where forces are suspected to be hiding (notwithstanding the requirement to take feasible precautions in attack, as explained below) — the wholesale destruction of an entire forest would likely not be lawful, even if it would mean that the belligerent could no longer use any of it as camouflage.[82]

With respect to proportionality, under Article 51(5)(b) of AP I and the analogous customary rule, parties to an armed conflict are prohibited from conducting attacks that may be expected to cause incidental civilian harm, including damage to civilian objects, that would be excessive in relation to the concrete and direct military advantage anticipated.[83] Given its default civilian character, the natural environment — unless a part of it has become a military

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[79] For assertions that the natural environment is not an "object" in the meaning of AP I or that only parts of it can be "objects", *see id.*, at 20 nn.40–42. *See also* Obregón Gieseken & Murphy, *supra* note 78, at 1190.

[80] Such reliance on trees for cover could likely constitute "purpose" or "use" in the meaning of Article 52(2) of AP I. AP I Commentary, *supra* note 30, ¶ 2022 ("The criterion of 'purpose' is concerned with the intended future use of an object, while that of 'use' is concerned with its present function."). It should also be noted that Protocol III of the Convention on Certain Conventional Weapons prohibits belligerents from "mak[ing] forests or other kinds of plant cover the object of attack by incendiary weapons except when such natural elements are used to cover, conceal or camouflage combatants or other military objectives, or are themselves military objectives." Convention on Certain Conventional Weapons, Protocol on Prohibitions or Restrictions on the Use of Incendiary Weapons (Protocol III) art. 2(4), Oct. 10, 1980, 1342 U.N.T.S. 171.

[81] *See* ICRC CUSTOMARY IHL, *supra* note 39, at 223–228 (providing examples of States' views on whether — and, if so, under what circumstances — an area of land can constitute a military objective).

[82] *Cf.* Droege & Tougas, *supra* note 61, at 28 (noting that "[a] forest can become a military objective by use, if troops are hiding in or under its cover" while citing "large forest[s]" as an example of objects that would "not become military objectives simply because combatants are located therein"). *See also, e.g.*, Yoram Dinstein, *Legitimate Military Objectives under the Current Jus in Bello*, 78 INT'L L. STUD. 150 (2002); Stefan Oeter, *Methods and Means of Combat*, *in* THE HANDBOOK OF HUMANITARIAN LAW IN ARMED CONFLICTS 192–193 (Dieter Fleck ed., 3d ed. 2013).

[83] AP I, *supra* note 13, art. 51(5)(b); PERAC, *supra* note 4, (draft) principle 14; PERAC Commentary, *supra* note 6, at 145, ¶ 4; ICRC CUSTOMARY IHL, *supra* note 39, at 46 ("Launching an attack which may be expected to cause incidental loss of civilian life, injury to civilians, damage to civilian objects, or a combination thereof, which would be excessive in relation to the concrete and direct military advantage anticipated, is prohibited."); *id.* at 143 ("Launching an attack against a military objective which may be expected to cause incidental damage to the environment which would be excessive in relation to the concrete and direct military advantage anticipated is prohibited."); OSLO MANUAL, *supra* note 75, at 137 ("It is prohibited to launch an attack against a lawful target, which may be expected to cause incidental damage to those parts of the natural environment that constitute civilian objects, expected to be excessive in relation to the concrete and direct overall military advantage anticipated.").

objective — and any damage thereto must be weighed against the military advantage anticipated. To continue the example used in the preceding paragraph, a belligerent would need to assess whether destroying an entire forest would be excessive in relation to the military advantage anticipated from denying its use to the enemy for concealing its armed forces. The military advantage derived from destroying the whole forest — as opposed to the portion actually being used by the adversary for concealment — would not relate to the circumstances at the time of attack but rather to an anticipated, future advantage, likely making such a potential attack disproportionate. In such an instance, the parts of the forest not being used by the adversary for concealment would not directly contribute to military advantage until actually used for that purpose. At the time of its use for concealment, the destruction of that part of the forest actually being used would lend itself to the anticipation of a military advantage that may be both concrete and direct.

One issue that arises here, as with any consideration of IHL/LOAC proportionality in attack, is the lack of any clearly defined calculus for determining whether an attack is proportional.[84] Another key issue for proportionality in the environmental context relates to the question of an attack's indirect or reverberating effects, in the sense of the proximate causation of deleterious environmental effects caused by an attack.[85] For example, when a given strike might destroy the habitat of a certain species, should that form part of the calculus? Should the same calculus extend to consider the effects of the disappearance of that species on the other species of the same ecosystem that rely on it? To the civilians who may rely on those latter species for their own

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[84] *See, e.g.*, AP I Commentary, *supra* note 30, ¶¶ 2213, 2215 (noting that Article 51 "allows for a fairly broad margin of judgment"); Emanuela-Chiara Gillard, *Proportionality in the Conduct of Hostilities: The Incidental Harm Side of the Assessment*, Chatham House (2018) at 21 ("Determining whether the incidental harm expected to be caused by an attack would be excessive in relation to the concrete and direct military advantage anticipated is probably the most challenging aspect of the application of the rule of proportionality in practice. It requires valuing and comparing two incommensurable factors: military advantage and incidental harm.").

[85] Droege & Tougas, *supra* note 61, at 30 ("The principle of proportionality is thus particularly relevant when the destruction of or damage to military objectives is likely to have indirect adverse effects on the natural environment. This is particularly clear for facilities that are military objectives and contain chemical substances whose release could damage the natural environment. However, frequently even more remote damage will be foreseeable and will have to be taken into account in the proportionality assessment. For example, if an electricity network is targeted because it is being used by the adversary as a military objective, past experience has shown that the destruction of electricity networks can lead to serious disruption of sewage or waste water treatment systems, and, in turn, very seriously harm the quality of the water and soil. This should certainly be taken into account in the proportionality assessment."). For a discussion of types of incidental damage to be taken into account and different weights that may be afforded to various kinds of possible effects of attacks, *see* ICRC Guidelines, *supra* note 5, ¶¶ 117–119, 121.

subsistence? What weight should be ascribed to different effects, such as potential damage to species under different levels of threat of extinction? These issues may benefit from further clarification by States expressing views or positions thereon.[86] In any event, commanders "making reasonable use of the information available"[87] must take into consideration any expectations of excessive environmental harm when planning or ordering an attack and must arguably take into consideration the foreseeability of such harm in light of causal connections between the attack and the harm for purposes of proportionality.[88] Such an assessment necessitates that parties proactively seek out and collect reasonably available information.[89]

As for precautions, under Article 57 of AP I, parties to an armed conflict must, in the conduct of military operations, take constant care to spare civilians, the civilian population, and civilian objects.[90] Such parties are obliged to take all feasible precautions when choosing the means and methods of attack

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[86] At a 2023 conference of State experts on IHL/LOAC and the protection of the environment, participants articulated a number of challenges and good practices. Those challenges included: "damage to the environment may not be immediately apparent to the eye in the manner that loss of civilian life, injury or building destruction can be" and may require "technical analysis to assess"; "environmental damage may flow from a chain of events — or a combination of factors — rather than a single act, and this can be a challenge to commanders who must consider damage that is reasonably foreseeable in the application of relevant IHL/LOAC"; and "assessing environmental damage in peacetime would typically depart from a baseline study against which environmental change is measured. This baseline tends to be less available in conduct of hostility scenarios." Int'l Comm. Red Cross, *State Expert Meeting on International Humanitarian Law: Protecting the Environment in Armed Conflicts (Chair's Summary)*, 8–9 (Aug. 8, 2023) [hereinafter State Expert Meeting]. Good practices shared by participants included: "conducting collateral damage assessments to assess reasonably foreseeable expected damage", formulating "doctrine that includes the natural environment as an element to factor" into assessments, and "involving experts in the decision-making chain to systematically integrate environmental considerations during military operations, including to advise against certain attacks." *Id.* at 9–11.

[87] Prosecutor v. Galić, IT-98-29-T, Judgment, ICTY, ¶ 58 (Dec. 5, 2003).

[88] *See* Gillard, *supra* note 84, at 18 ("Provided that the harm falls into one of the categories identified in Additional Protocol I, the geographic or temporal proximity of the harm to the attack is not determinative. Nor is the number of causal steps between the attack and the harm. There is nothing in the formulation of the rule of proportionality to suggest that these factors are determinative. While the anticipated military advantage to be considered in proportionality assessments must be 'direct', there is no such requirement for incidental harm. Instead, as discussed above, what matters is that the harm meets the criteria of causation and foreseeability.").

[89] *See* INTERNATIONAL COMMITTEE OF THE RED CROSS, THE PRINCIPLE OF PROPORTIONALITY IN THE RULES GOVERNING THE CONDUCT OF HOSTILITIES UNDER INTERNATIONAL HUMANITARIAN LAW 48 (Laurent Gisel ed., 2018); International Criminal Tribunal for the Former Yugoslavia, *Final Report to the Prosecutor by the Committee Established to Review the NATO Bombing Campaign Against the Federal Republic of Yugoslavia*, ¶ 29 (June 8, 2000), https://www.icty.org/en/press/final-report-prosecutor-committee-established-review-nato-bombing-campaign-against-federal; RUSSIAN FEDERATION MINISTRY OF DEFENCE, APPLICATION OF IHL: MANUAL ON INTERNATIONAL HUMANITARIAN LAW FOR THE ARMED FORCES OF THE RUSSIAN FEDERATION ¶ 131 (2001).

[90] AP I, *supra* note 13, art. 57(1); ICRC CUSTOMARY IHL, *supra* note 39, at 51 ("In the conduct of military operations, constant care must be taken to spare the civilian population, civilians and civilian objects.").

to avoid, and in any event to minimize incidental loss of civilian life, injury to civilians, and damage to civilian objects.[91] They are also required, when a choice is available, to select a military objective that may be expected to cause the least danger to civilian lives and to civilian objects when attacked.[92] According to the ICRC, State practice establishes these rules as customary IHL/LOAC applicable with respect to the natural environment, unless a part thereof has become a military objective, given its default civilian status.[93] Many States have interpreted "feasible precautions" as being limited to those that are practically possible, taking into account all circumstances ruling at the time; this is a highly fact specific assessment and may vary depending on several factors.[94] States might conclude that those charged with taking precautions may be obliged to regard such factors as the environmental fragility or vulnerability of the relevant area, as well as the expected severity and duration of damage in light of the state of the environment and the potential impact of weaponry thereon.[95]

At a 2023 conference of State experts on IHL/LOAC, participants highlighted obstacles related to feasibility in assessing the effects of military operations on the natural environment, such as the lack of "new technologies or tools to measure the impact of military operations on the environment," the absence of specialized staff, and the fact that "environmental impact assessments developed for peacetime projects are not always well-adapted for military operations" and may be difficult to carry out "in the vicinity of military positions of the adversary."[96] Participants also shared good practices, including conducting environmental risk analysis processes at different stages in the operational cycle, establishing staff or units with specific environmental

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[91] AP I, *supra* note 13, art. 57(2)(a)(ii); ICRC CUSTOMARY IHL, *supra* note 39, at 51 ("All feasible precautions must be taken to avoid, and in any event to minimize, incidental loss of civilian life, injury to civilians and damage to civilian objects.").

[92] AP I, *supra* note 13, art. 57(3).

[93] *See* ICRC CUSTOMARY IHL, *supra* note 39, at 147 ("Methods and means of warfare must be employed with due regard to the protection and preservation of the natural environment. In the conduct of military operations, all feasible precautions must be taken to avoid, and in any event to minimize, incidental damage to the environment. Lack of scientific certainty as to the effects on the environment of certain military operations does not absolve a party to the conflict from taking such precautions."). For the general principle of precautions and other obligations that flow from it, *see also id.* at 147–149.

[94] *See id.* at 54; INTERNATIONAL LAW ASSOCIATION STUDY GROUP ON THE CONDUCT OF HOSTILITIES IN THE 21ST CENTURY, THE CONDUCT OF HOSTILITIES AND INTERNATIONAL HUMANITARIAN LAW: CHALLENGES OF 21ST CENTURY WARFARE 374 (2017).

[95] *See* ICRC Guidelines, *supra* note 5, ¶ 129.

[96] State Expert Meeting, *supra* note 86, at 8–9.

expertise, coordinating between armed forces and national agencies with environmental responsibilities, and carrying out legal reviews of new weapons, means, and methods of warfare.[97]

2.2.2. Systemic Integration of International Environmental Law

The notion that the natural environment is by default civilian in character is consistent with systemic integration of rules of IEL into treaty-based IHL/LOAC. The WHC, for example, enshrines a duty for States Parties to "ensur[e] the identification, protection, conservation, presentation and transmission to future generations of . . . natural heritage".[98] Moreover, under Article 6(3) of the WHC, States Parties "undertake[] not to take any deliberate measures which might damage directly or indirectly . . . natural heritage . . . situated on the territory of other States Parties".[99] When interpreted through the lens of systemic integration, such obligations may inform IHL/LOAC obligations concerning distinction by affirming that natural-heritage sites are presumptively civilian in character and must not be targeted unless and until parts thereof meet the strict criteria of a military objective. Although the WHC focuses on formally designated sites, its provisions and underlying principles — such as conservation, intergenerational equity, and the prohibition of transboundary harm — suggest a broader approach through which the natural environment as a whole is a protected interest, particularly where it sustains civilian populations, endangered species, or ecosystems of global concern.

In terms of proportionality in attack, when weighing potential incidental damage to the natural environment against an anticipated direct and concrete military advantage, States may consider certain IEL protections.[100] For example,

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[97] *Id.* at 9–12.

[98] WHC, *supra* note 22, art. 4. Note also the establishment of the list of World Heritage in Danger, which includes property forming part of cultural and natural heritage that is threatened by serious and specific dangers, such as, among other possibilities, the outbreak or the threat of an armed conflict. *Id.* art. 11(4). The WHC is considered by the ILC, UNEP, and several experts to remain applicable during armed conflicts. *See, e.g.*, Int'l L. Comm'n, Rep. on the Work of Its Sixty-Third Session, annex E, at 361–362, U.N. Doc. A/CN.4/SER.A/2011 (Aug. 12, 2011); UN ENVIRONMENT PROGRAMME, *supra* note 55, at 37; Bothe et al., *supra* note 37, at 582.

[99] WHC, *supra* note 22, art. 6(3).

[100] The ICJ has held that "States must take environmental considerations into account when assessing what is necessary and proportionate in the pursuit of legitimate military objectives." Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion, 1996 I.C.J. 226, ¶ 30 (July 8). Opinions differ on whether the Court here was limiting its observation to the right of self-defense and therefore the principle of proportionality in the *jus*

[Footnote continued on next page]

Article 14(1)(d) of the CBD provides that each Contracting Party shall:

> In the case of imminent or grave danger or damage, originating under its jurisdiction or control, to biological diversity within the area under jurisdiction of other States or in areas beyond the limits of national jurisdiction, notify immediately the potentially affected States of such danger or damage, as well as initiate action to prevent or minimize such danger or damage.[101]

Where such a principle or rule is applicable, States occupying — and, potentially, States otherwise conducting military operations in — foreign territory would be under an IEL obligation to prevent or minimize danger or damage to biodiversity,[102] which in turn could arguably inform their analyses concerning proportionality in attack. Although notifying an adversary State in whose territory a Contracting Party's armed forces are present of danger or damage to biodiversity may seem counterintuitive, belligerents committed to protection of the natural environment could communicate with respect to certain parts of the environment that would be especially vulnerable in the context of armed conflict, coming to terms that might provide, for example, special protections to these areas or marking them as demilitarized zones while hostilities continue.[103] In this vein, the ILC's (draft)

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ad bellum or whether the same extends to proportionality in the context of attacks in the conduct of hostilities. *See, e.g.*, PERAC Commentary, *supra* note 6, at 99, ¶ 6.

[101] CBD, *supra* note 21, art. 14(1)(d). *See also id.* art. 8(a) ("Each Contracting Party shall, as far as possible and as appropriate: Establish a system of protected areas or areas where special measures need to be taken to conserve biological diversity . . . ."). The WHC also provides a mechanism for world heritage sites to be included on the "list of World Heritage in Danger", which "may include only such property forming part of the cultural and natural heritage as is threatened by serious and specific dangers, such as . . . the outbreak or the threat of an armed conflict". *Id.* art. 11(4).

[102] Principle 21 of the Stockholm Declaration and Principle 2 of the Rio Declaration express the duty of States "to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction". U.N. Conference on the Human Environment, *Stockholm Declaration on the Human Environment*, principle 21, U.N. Doc. A/CONF.48/14/Rev.1 (June 16, 1973) [hereinafter Stockholm Declaration]; Rio Declaration, *supra* note 58, principle 2. *See also* 1996 I.C.J. 226, ¶ 29 ("The existence of the general obligation of States to ensure that activities within their jurisdiction and control respect the environment of other States or of areas beyond national control is now part of the corpus of international law relating to the environment."); Obligations of States in Respect of Climate Change, Advisory Opinion, ¶ 134 (July 23, 2025), https://www.icj-cij.org/sites/default/files/case-related/187/187-20250723-adv-01-00-en.pdf ("This jurisprudence affirms that the duty to prevent significant harm to the environment is not confined to instances of direct cross-border harm and that it applies to global environmental concerns.").

[103] UNEP has recommended a new legal instrument "for place-based protection of critical natural resources and areas of ecological importance during armed conflicts". UN ENVIRONMENT PROGRAMME, *supra* note 55, at

[Footnote continued on next page]

principle 4 provides that "States should designate, by agreement or otherwise, areas of environmental importance as protected zones in the event of an armed conflict".[104] The San Remo Manual on International Law Applicable to Armed Conflicts at Sea likewise encourages parties to an armed conflict "to agree that no hostile actions will be conducted in marine areas containing: (*a*) rare or fragile ecosystems; or (*b*) the habitat of depleted, threatened or endangered species or other forms of marine life."[105]

With regard to precautions in attack, States could use the customary IEL precautionary principle as an interpretive tool to reinforce environmental protections under IHL/LOAC. As expressed in the Rio Declaration, that principle entails the following: "Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."[106] Measures that ought not to be postponed under such a reading might include peacetime preparations in the form of environmental training for commanders, incorporating scientists and other experts into the armed forces, or conducting environmental-impact assessments at the planning stage of military operations. As mentioned above, States have expressed that the feasibility of certain environmental precautions poses challenges in

54. *See also* Jérôme de Hemptinne, *Increasing the Safeguarding of Protected Areas Threatened by Warfare through International Environmental Law*, 105 INT'L REV. RED CROSS 1392, 1395–1398 (2023); State Expert Meeting, *supra* note 86, at 8–9; International Committee of the Red Cross, *International Humanitarian Law and the Challenges of Contemporary Armed Conflicts* (2024) [hereinafter ICRC Challenges] at 51–52; ICRC Guidelines, *supra* note 5, ¶¶ 205–210; Obregón Gieseken & Murphy, *supra* note 78, at 1197–1201.

[104] PERAC, *supra* note 4, (draft) principle 4. The commentary on this (draft) principle clarifies that "Part Two ('Principles of general application'), where this provision is placed, deals with the pre-conflict stage, when peace is prevailing, but also contains principles of a more general nature that are relevant to more than one temporal phase. While the designation of protected zones could take place at any time, it should preferably be done before or at least at the outset of an armed conflict. The phrase 'in the event of an armed conflict' indicates that the designation of an area as a protected zone may be made with a possible future event of an armed conflict in mind." PERAC Commentary, *supra* note 6, at 105, ¶ 1. The commentary also notes that "[t]he areas referred to in draft principle 4 may be designated by agreement or otherwise. The types of situations foreseen may include, *inter alia*, an agreement concluded verbally or in writing, or through reciprocal and concordant declarations, as well as those created through a unilateral declaration or designation through an international organization. It should be noted that the word 'State' does not preclude the possibility of agreements being concluded with non-State actors." *Id.* ¶ 2. *See also* PERAC, *supra* note 4, (draft) principle 18; U.N. Secretary-General, *Protection of Civilians in Armed Conflict*, 19, U.N. Doc. S/2022/381 (May 10, 2022).

[105] INTERNATIONAL INSTITUTE OF HUMANITARIAN LAW, SAN REMO MANUAL ON INTERNATIONAL LAW APPLICABLE TO ARMED CONFLICTS AT SEA ¶ 11 (Louise Doswald-Beck ed., 1995). *But see* JAMES KRASKA ET AL., NEWPORT MANUAL ON THE LAW OF NAVAL WARFARE 102 (2023) (contending that the San Remo Manual's assertion of this rule is "aspirational and do[es] not reflect treaty or customary international law").

[106] Rio Declaration, *supra* note 58, principle 15.

armed conflict.[107] However, it could be argued, in light of the precautionary principle, that a lack of full scientific certainty in the context of armed conflict does not obviate the obligation to take constant care to spare the natural environment, by virtue of its civilian character, and from taking proper precautionary measures to prevent undue environmental damage.[108] In this way, the precautionary principle could be marshalled to heighten the burden on parties to an armed conflict to assess, anticipate, and mitigate potential environmental harms as part of their legal obligation to take feasible precautions. For its part, Article 6(a) of the CBD requires each Contracting Party to "[d]evelop national strategies, plans or programmes for the conservation and sustainable use of biological diversity".[109] States that are bound by this provision could interpret their IHL/LOAC obligations to take feasible precautions as requiring strategies, plans, or programs to be developed that would better prepare their armed forces for assessing and mitigating environmental damage in case of a possible armed conflict.

States taking this approach further might conclude that the obligations of constant care and of feasible precautions may significantly affect the proportionality calculus or the manner in which precautions are to be employed. Incidental damage to a particular part of the natural environment — for example, a part containing an endangered species — could carry implications not only for that species but for all other species that are connected to it within that ecosystem, which might in turn potentially cause or otherwise contribute to consequent effects in other States. This might lead to a view that certain parts of the natural environment are not only civilian objects susceptible, in an attack, to balancing against a military objective but, in addition, that those parts of the natural environment should constitute specially protected civilian objects benefiting from a (new) kind of special status with enhanced protection akin potentially, for example, to cultural objects under IHL/LOAC. States

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[107] State Expert Meeting, *supra* note 86, at 8–9. States have also shared good practices in this regard. *Id.* at 9–12.

[108] *See* ICRC CUSTOMARY IHL, *supra* note 39, at 147 ("Lack of scientific certainty as to the effects on the environment of certain military operations does not absolve a party to the conflict from taking such precautions."); *id.* at 150 ("There is practice to the effect that lack of scientific certainty as to the effects on the environment of certain military operations does not absolve parties to a conflict from taking proper precautionary measures to prevent undue damage. As the potential effect on the environment will need to be assessed during the planning of an attack, the fact that there is bound to be some uncertainty as to its full impact on the environment means that the 'precautionary principle' is of particular relevance to such an attack. The precautionary principle in environmental law has been gaining increasing recognition. There is, furthermore, practice to the effect that this environmental law principle applies in armed conflict."). *See also* ICRC Guidelines, *supra* note 5, ¶ 124.

[109] CBD, *supra* note 21, art. 6(a).

might also conclude that current IHL/LOAC obligations relating to distinction, proportionality, and precautions in attack are ill-suited with respect to certain parts of the natural environment that, when damaged or destroyed, would bear consequences beyond the immediate area and adversely affect populations and States far from the theater of operations.

2.2.3. Current Scientific Knowledge

In its commentary on (draft) principle 14 concerning the applicability of the IHL/LOAC principles and rules of distinction, proportionality, and precautions to the natural environment, the ILC posited that "[s]ince knowledge of the environment and its ecosystems is constantly increasing, better understood and more widely accessible, environmental considerations cannot remain static over time but should develop as understanding of the environment develops."[110]

Although, as outlined above, the default civilian character of the natural environment under IHL/LOAC obligations relating to distinction already appears to be well established (recognizing the "intrinsic" value of the environment), there persists a minority "anthropocentric" view that maintains that only parts of the natural environment are civilian objects and only when they affect the civilian population.[111] Irrespective of the position adopted, fresh scientific insights have shed light on the interconnectedness of ecosystems to demonstrate that parts of the environment previously thought to exist in isolation from human wellbeing are actually linked to the sustainment of civilian populations.[112] Contemporary ecological knowledge increasingly reinforces that much, if not most or indeed all, of the natural environment is integral to human existence.[113]

Emerging scientific understanding of ecosystem services (the benefits

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[110] PERAC Commentary, *supra* note 6, at 145.

[111] *See* ICRC Guidelines, *supra* note 5, ¶ 19. This is in contradistinction to the "intrinsic" approach, according to which the environment has value worthy of IHL/LOAC protections in and of itself, as well as due to its interconnectedness and inherent links with the wellbeing and survival of the civilian population.

[112] *See generally, e.g.*, INTERGOVERNMENTAL SCIENCE-POLICY PLATFORM ON BIODIVERSITY AND ECOSYSTEM SERVICES, GLOBAL ASSESSMENT REPORT ON BIODIVERSITY AND ECOSYSTEM SERVICES (Eduardo Brondizio et al. eds., 2019), https://www.ipbes.net/global-assessment.

[113] *See generally, e.g.*, UN ENVIRONMENT PROGRAMME, *supra* note 55; MILLENNIUM ECOSYSTEM ASSESSMENT, ECOSYSTEMS AND HUMAN WELL-BEING (2005), https://www.millenniumassessment.org/documents/document.356.aspx.pdf.

derived from healthy, functioning ecosystems)[114] and environmental feedback loops (the cyclical processes that sustain ecosystems)[115] can help clarify what constitutes "excessive" damage to the natural environment for the purposes of IHL/LOAC proportionality assessments. Traditionally, proportionality analyses have in practice focused on immediate or clearly foreseeable civilian harms, often limited to human life and infrastructure. However, environmental science now makes it increasingly possible to also forecast longer-term and indirect effects on the environment, such as through the collapse of food systems, contamination of water sources, or disruption to ecosystem processes.[116] These insights may support an evolutive reading of proportionality that accounts not only for immediate environmental destruction but also for reasonably foreseeable repercussive effects, including on civilians. The destruction of wetlands, forests, or coral reefs, for example, may not initially appear excessive in relation to anticipated military advantage but could so prove in light of downstream harms, particularly with increased vulnerability to climate-change-related issues.[117] Contemporary science therefore might expand the scope of what is to be considered "reasonably foreseeable" in respect of proportionality analyses.

Scientific advancements might also be incorporated into the planning and execution of military operations under IHL/LOAC obligations concerning precautions in attack. As ecological data becomes more granular and accessible, commanders have a greater ability to assess the likely environmental impact of their operations.[118] It could be argued that this increased feasibility entails a greater responsibility to do so. Modern science also sheds light on the fragility of certain ecosystems and species to disruption, enabling more

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[114] *See, e.g.*, *id.*; Robert Costanza et al., *The Value of the World's Ecosystem Services and Natural Capital*, 387 NATURE 253 (1997). *See also, e.g.*, Robert Watson, *The Science-Policy Interface: The Role of Scientific Assessments*, 468 PROCS. ROYAL SOC'Y 2147 (2012).

[115] *See, e.g.*, Michael van Breugel et al., *Feedback Loops Drive Ecological Succession: Towards a Unified Conceptual Framework*, 99 BIOLOGICAL REVS. 928 (2024); Paul Maxwell et al., *The Fundamental Role of Ecological Feedback Mechanisms for the Adaptive Management of Seagrass Ecosystems*, 92 BIOLOGICAL REVS. 1521 (2017); Ian Ware et al., *Feedbacks Link Ecosystem Ecology and Evolution Across Spatial and Temporal Scales: Empirical Evidence and Future Directions*, 33 FUNCTIONAL ECOLOGY 31 (2019).

[116] *See, e.g.*, MILLENNIUM ECOSYSTEM ASSESSMENT, *supra* note 113.

[117] *See, e.g.*, Evan Grimes, Marissa Kneer & Jacob Berkowitz, *Military Activity and Wetland-Dependent Wildlife: A Warfare Ecology Perspective*, 20 INTEGRATED ENV'T ASSESSMENT & MGMT. 2153 (2023), https://pubmed.ncbi.nlm.nih.gov/36942452/.

[118] *See, e.g.*, Wim Zwijnenburg, *Burning Borderlands: Open-Source Monitoring of Conflict-caused Wildfires in Iraq*, BELLINGCAT (Sept. 11, 2018), https://www.bellingcat.com/news/mena/2018/09/11/burning-borderlands-open-source-monitoring-conflict-caused-wildfires-iraq/.

informed decision-making including about the likely severity and irreversibility of harm.[119] Moreover, as climate change intensifies environmental fragility, the need to consider ecological thresholds and tipping points — points beyond which changes to the environment become irreversible — arguably becomes more urgent.[120]

Pursued to its fullest extent, this interpretive approach could entail a significant shift in how certain IHL/LOAC obligations in this area — particularly regarding proportionality and precautions — are operationalized. If a State were to take seriously the scientific insights regarding ecological interdependence and environmental thresholds, it may come to view existing decision-making structures as insufficient. In such a frame, determinations about what constitutes excessive harm or feasible precautions might no longer be viewed as matters that can be entrusted solely to the reasonable judgment of a commander acting without specialized environmental input. Indeed, this line of reasoning could lead to the view that certain means and methods of warfare, while currently considered lawful and widely used, may be incompatible with the fragility of specific ecosystems or the presence of endangered species. For States inclined to interpret IHL/LOAC in ways that reflect the evolving scientific understanding of environmental harm, the implications could be not only operational but structural.

2.2.4. Distilled Legal Questions, Implementation Measures, and Structural Reflections

Those reviewing or formulating a position on the IHL/LOAC obligations discussed in this section might consider the following legal questions:

- What criteria are sufficient to reverse a presumption of the civilian character of a part of the natural environment?
- What weight should be given in proportionality analyses to the vulnerability of a part of the natural environment? How should such weighting factor the potential effects of eradicating critical habitats or species? To what extent should the calculus consider the effects of the

[119] *See* Thor Hanson, *Biodiversity Conservation and Armed Conflict: A Warfare Ecology Perspective*, 1429 ANNALS N.Y. ACAD. SCI. 50, 51 (2018), https://pubmed.ncbi.nlm.nih.gov/29683517/.

[120] *See, e.g.*, Timothy M. Lenton, *Tipping Elements in the Earth's Climate System*, 105 PROCS. NAT'L ACAD. SCI. U.S. AM. 1786 (2008), https://www.pnas.org/doi/pdf/10.1073/pnas.0705414105; Ignacio Amigo, *When Will the Amazon Hit a Tipping Point,* NATURE (Feb. 25, 2020), https://www.nature.com/articles/d41586-020-00508-4.

disappearance of that species on other species in the same ecosystem or to interlinked ecosystems further afield?

- How should the feasibility of possible precautions be considered in light of scientific evidence regarding the repercussive effects and irreversibility of certain forms of damage to ecosystems and the natural environment more generally?

Those seeking to implement the IHL/LOAC obligations discussed in this section by way of policy or other practical measures might consider the following:

- indicating the criteria to be taken into consideration when assessing the vulnerability of a part of the natural environment in proportionality analyses in connection with an attack;
- demilitarizing areas of the natural environment of particular importance or fragility, or both, within national territory and concluding agreements with others regarding the demilitarized status of such parts of the natural environment in other States; and, relatedly, according special civilian protections to specific parts of the natural environment containing endangered species or ecological nodes;
- assessing the compatibility of means and methods of warfare with the above IHL/LOAC obligations in light of the fragility of specific ecosystems and species within a theater or battlespace at the concept-of-operations and operations-planning stages;
- instituting training on ecological processes for commanders to assist with operational decisions, including by enhancing foreseeability of detrimental effects of environmental damage and with improving ability to acquire knowledge of circumstances before and during an attack to assist with feasibility of precautions; and
- incorporating scientific expertise and reviews in "targeting cycles" and command structures at various phases of operations, including pre-planning, planning, execution, and after-action assessments.

The following questions offer legal and scientific concepts and considerations to guide principled reflection on the structural sufficiency of the IHL/LOAC obligations discussed in this section for addressing risks posed to the natural environment in relation to armed conflict:

- Whether an IHL/LOAC targeting framework that is primarily structured around discrete attacks, bounded temporal frames, and

proximate causal relationships can adequately account for distributed, cumulative, and delayed forms of environmental harm that arise from warfare?

- Whether IHL/LOAC proportionality obligations are conceptually capable of integrating scientifically credible but probabilistic projections of environmental degradation — such as biodiversity loss, soil collapse, or carbon release — that may not manifest within the temporal or spatial bounds traditionally considered in targeting assessments?
- Whether IHL/LOAC precautionary obligations are normatively and practically structured to ensure meaningful mitigation of long-term environmental effects?
- Whether these IHL/LOAC obligations are structurally adequate to address risks shaped by systemic ecological fragility, intergenerational harm, and climate-amplified hazards that threaten not only civilian populations but the long-term habitability of affected regions?

2.3. Objects Indispensable to the Survival of the Civilian Population

Article 54 of AP I provides:

> 1. Starvation of civilians as a method of warfare is prohibited.
> 2. It is prohibited to attack, destroy, remove or render useless objects indispensable to the survival of the civilian population, such as foodstuffs, agricultural areas for the production of foodstuffs, crops, livestock, drinking water installations and supplies and irrigation works, for the specific purpose of denying them for their sustenance value to the civilian population or to the adverse Party, whatever the motive, whether in order to starve out civilians, to cause them to move away, or for any other motive.
> 3. The prohibitions in paragraph 2 shall not apply to such of the objects covered by it as are used by an adverse Party:
>
> (a) as sustenance solely for the members of its armed forces; or
> (b) if not as sustenance, then in direct support of military action, provided, however, that in no event shall actions against these objects be taken which may be expected to

> leave the civilian population with such inadequate food or water as to cause its starvation or force its movement.
> 4. These objects shall not be made the object of reprisals.
> 5. In recognition of the vital requirements of any Party to the conflict in the defence of its national territory against invasion, derogation from the prohibitions contained in paragraph 2 may be made by a Party to the conflict within such territory under its own control where required by imperative military necessity.[121]

Article 14 of the AP II provides:

> Starvation of civilians as a method of combat is prohibited. It is therefore prohibited to attack, destroy, remove or render useless, for that purpose, objects indispensable to the survival of the civilian population, such as foodstuffs, agricultural areas for the production of foodstuffs, crops, livestock, drinking water installations and supplies and irrigation works.[122]

2.3.1. Treaty-Based and Customary IHL/LOAC

Article 54 of AP I is principally aimed at protecting civilian populations from deliberate starvation as a method of warfare, clearly expressed in paragraph 1 thereof.[123] Paragraph 2 of Article 54 of AP I develops this by describing ways in which starvation might be caused[124] and thereby provides direct and indirect protection to the natural environment.[125] If an object that is indispensable to the survival of the civilian population is also a part of the natural environment, then it enjoys direct protection under this provision. The provision itself enumerates "foodstuffs, agricultural areas for the production of foodstuffs, crops, livestock, drinking water installations and supplies and irrigation works".[126] In light of the observation in the 1987 ICRC Commentary on

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[121] AP I, *supra* note 13, art. 54.

[122] AP II, *supra* note 15, art. 14.

[123] AP I Commentary, *supra* note 30, ¶¶ 2083–2091, 2098.

[124] *Id.* ¶ 2098. *See also* Tom Dannenbaum, *Legal Frameworks for Assessing the Use of Starvation in Ukraine*, JUST SECURITY (Apr. 22, 2022), https://www.justsecurity.org/81209/legal-frameworks-for-assessing-the-use-of-starvation-in-ukraine/; Tom Dannenbaum, *Siege Starvation: A War Crime of Societal Torture*, 22 CHICAGO J. INT'L L. 2 (2021).

[125] *See* ICRC Guidelines, *supra* note 5, ¶¶ 149–152.

[126] AP I, *supra* note 13, art. 54(2).

AP I that the natural environment "should be understood in the widest sense to cover the biological environment in which a population is living"[127] and the ICJ's recognition that "the environment is not an abstraction but represents the living space, the quality of life and the very health of human beings, including generations unborn",[128] many of the objects enumerated in paragraph 2 are, or arguably qualify as, parts of the natural environment.[129] In particular, the paragraph seems to capture such parts of the natural environment as vegetation used for foraging, land used for agriculture, waters used for drinking, fishing, or irrigation, and habitats of animals used for sustenance. Importantly, the list contained in paragraph 2 is illustrative, not exhaustive.[130] This provision also indirectly protects the natural environment where an object indispensable to the survival of the civilian population is not in itself a part of the natural environment but when attacking, destroying, removing, or rendering useless an object indispensable to the survival of the civilian population would nevertheless adversely affect the natural environment. For example, a desalination plant is not part of the natural environment but its capacity to provide drinking water to a civilian population would entail its protection under this provision, while its destruction could release dangerous waste and toxic chemicals into the surrounding area.

Paragraph 2 prohibits parties to an armed conflict from attacking, destroying, removing, or rendering useless the objects described above, including relevant parts of the natural environment.[131] This prohibition, however, is qualified. It comes into effect when the "specific purpose" of such action would be to deny the civilian population the "sustenance value" of the object.[132] Moreover, under paragraph 3(a), the prohibition does not apply when

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[127] AP I Commentary, *supra* note 30, ¶ 2126.

[128] Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion, 1996 I.C.J. 226, ¶ 29 (July 8).

[129] AP I Commentary, *supra* note 30, ¶ 2102. *See also* ICRC Guidelines, *supra* note 5, at 65 n.359 (quoting Jean-Marie Henckaerts & Dana Constantin, *Protection of the Natural Environment*, *in* OXFORD HANDBOOK OF INTERNATIONAL LAW IN ARMED CONFLICT 476 (Andrew Clapham & Paola Gaeta eds., 2014) ("The relevance of these rules for the natural environment is self-evident, as they protect agricultural areas, drinking water supplies, and livestock, which are constituent elements of the natural environment.")).

[130] AP I Commentary, *supra* note 30, ¶ 2103. The illustrative, non-exhaustive nature of this list is indicated by the words "such as". According to the ICRC Commentary on AP I, this provision "should be interpreted in the widest sense, in order to cover the infinite variety of needs of populations in all geographical areas." *Id.* ¶ 2102.

[131] AP I, *supra* note 13, art. 54(2).

[132] *Id.* Upon ratification of AP I, at least two States indicated their view that this provision does not apply to attacks that lack the specific purpose of denying a civilian population the sustenance value of an object indispensable to its survival. ICRC CUSTOMARY IHL, *supra* note 39, at 190. *See also* ICRC Guidelines, *supra* note 5, ¶ 153.

the object is used solely for the sustenance of armed forces.[133] A further exception to the prohibition, under paragraph 3(b), arises when the object is used in direct support of military action; however, it would still be prohibited to take action against the object if doing so would be expected to cause starvation or force the movement of the civilian population.[134] Paragraph 5 includes an exception allowing a party to a conflict to attack, destroy, remove, or render useless an object indispensable to the survival of the civilian population under its control within its national territory, when required by imperative military necessity, such as to deprive the adversary of its use.[135] Notably, none of these exceptions is present in the analogous Article 14 of AP II, indicating that they do not apply in NIACs which that instrument regulates, which instead are subject to a blanket prohibition of attack with respect to objects indispensable to the survival of the civilian population for the purpose of starving civilians.[136]

At least according to the ICRC, customary international law prohibits attacking, destroying, removing, or rendering useless objects indispensable to the survival of the civilian population in both IACs and NIACs.[137] In the commentary on Rule 54 of its Customary IHL/LOAC Study, the ICRC notes that this prohibition has been included in military manuals of States that are not or were not parties to AP I and in military manuals applied in NIACs, without countervailing State practice.[138] According to the ICRC's assessment, while several military manuals refer to the "specific purpose" requirement, most military manuals and much national legislation prohibit attacks against objects indispensable to the survival of the civilian population as such.[139] Two exceptions arguably apply to the customary rule in IACs: first, when an object is used solely by armed forces,[140] and, second, when applied in defense of national territory against invasion, as reflected in Article 54(5) of AP I.[141]

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[133] AP I, *supra* note 13, art. 54(3)(a).

[134] *Id.* art. 54(3)(b).

[135] *Id.* art. 54(5).

[136] AP II, *supra* note 15, art. 14. This provision contains a purpose requirement for the prohibition to apply, but it is construed more broadly as "[s]tarvation of civilians". *Id.*

[137] ICRC CUSTOMARY IHL, *supra* note 39, at 190.

[138] *Id.*

[139] *Id.*

[140] *Id.*

[141] *Id.* Notably, the Basic Military Manual for the armed forces of Colombia states that this exception does not apply to any armed conflict. COLOMBIAN NATIONAL MINISTRY OF DEFENSE, INTERNATIONAL HUMANITARIAN LAW: BASIC MILITARY MANUAL FOR THE ARMED FORCES OF COLOMBIA § 339 (1995).

2.3.2. Systemic Integration of International Environmental Law

Much of IEL places emphasis on the interdependence of human life and the natural environment. The Stockholm and Rio Declarations articulate the principle that environmental protection is an essential component of sustainable development and human dignity. Principle 1 of the Stockholm Declaration declares that "man bears a solemn responsibility to protect and improve the environment for present and future generations,"[142] while Principle 1 of the Rio Declaration recognizes that human beings "are entitled to a healthy and productive life in harmony with nature."[143] Interpreting Article 54 of AP I through the lens of such principles may lead to the view that environmental destruction is not only a threat to current populations but also to the life-sustaining ecological systems upon which future civilian populations depend. This interpretation supports a broader understanding of "survival", one that includes continuity of access to clean air, arable soil, potable water, and stable climatic conditions.

Article 192 of UNCLOS, for example, provides that "States have the obligation to protect and preserve the marine environment."[144] The breadth of this obligation could be read — in light of the dependence of many civilian populations on resources and ecosystems present in the marine environment — into IHL/LOAC obligations to spare objects indispensable to the civilian population. Where civilian populations rely on marine ecosystems — such as coral reefs, seagrass beds, and coastal wetlands — for food security, water filtration, or storm protection, these systems arguably fall within the scope of objects indispensable to the survival of the civilian population. For instance, the systemic integration of UNCLOS with IHL/LOAC may reinforce an interpretation that belligerents must consider not only the direct effects of an attack but also the indirect and potentially irreversible damage to ecosystems supporting subsistence fishing and other related activities.

IEL also accords specific protections for conservation and sustainability in relation to indigenous and local peoples. Article 8(j) of the CBD, for example, requires Contracting Parties to "respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities

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[142] Stockholm Declaration, *supra* note 102, principle 1.

[143] Rio Declaration, *supra* note 58, principle 1.

[144] U.N. Convention on the Law of the Sea art. 192, Dec. 10, 1982, 1833 U.N.T.S. 397.

embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity".[145] States bound by this provision may interpret their IHL/LOAC obligations with respect to objects indispensable to the survival of the civilian population in light of conservation and sustainability considerations, including as relates to the knowledge, innovation, and practices of the indigenous and local communities in the area in which they conduct military operations. Commitment to conservation and sustainability of biodiversity may be of particular relevance to armed forces operating in areas that, for example, differ from the natural environment in the territory to which they are most accustomed or where sustenance is derived from the natural environment in ways that are unfamiliar and not immediately obvious.[146]

States that pursue this legal interpretive approach to its fuller implications may find that it points toward a significantly reconfigured understanding of IHL/LOAC principles and rules that may relate to the protection of ecosystems critical to civilian survival. Building on the insights of IEL, such States might conclude that, in certain ecologically sensitive contexts, the legal obligation to spare objects indispensable to the survival of the civilian population could require advance identification and preservation of specific environmental zones.[147] In this view, areas such as coral reefs, coastal wetlands, or biodiversity corridors — perhaps especially those sustaining endemic or vulnerable species — might be designated, in peacetime, as excluded from the theater of operations altogether.[148] This would mark a meaningful departure from certain prevailing operational assumptions and may entail new forms of military restraint and planning, grounded in a recognition of ecological fragility and long-term civilian dependence on environmental systems. While such an approach would constitute a substantial shift, it arguably remains within the scope of interpretive evolution available to States committed to aligning IHL/LOAC with other normative commitments concerning environmental harm.

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[145] CBD, *supra* note 21, art. 8(j). *Cf.* PERAC, *supra* note 4, (draft) principle 5.

[146] Article 29(1) of the UN Declaration on the Rights of Indigenous Peoples, for example, recognizes the right of indigenous peoples to "the conservation and protection of the environment and the productive capacity of their lands or territories and resources". G.A. Res. 61/295, annex (Sept. 13, 2007). Note also Article 30(1): "Military activities shall not take place in the lands or territories of indigenous peoples, unless justified by a relevant public interest or otherwise freely agreed with or requested by the indigenous peoples concerned." *Id.*

[147] *See* PERAC, *supra* note 4, (draft) principles 4, 17; ICRC Guidelines, *supra* note 5, ¶ 14.

[148] *See* UN Environment Programme, *supra* note 55, at 54. *See also* de Hemptinne, *supra* note 103, at 1395–1398; State Expert Meeting, *supra* note 86, at 8–9; ICRC Challenges, *supra* note 103, at 51–52; ICRC Guidelines, *supra* note 5, ¶¶ 144–146, 205–210; Obregón Gieseken & Murphy, *supra* note 78, at 1197–1201.

2.3.3. Current Scientific Knowledge

As discussed above, AP I and customary IHL/LOAC, the latter as compiled by the ICRC, provide for certain exceptions in IACs to the prohibition on attacking, destroying, removing, or rendering useless objects indispensable to the survival of the civilian population. For example, in such conflicts the prohibition does not apply to objects used solely by members of armed forces for sustenance nor to "scorched-earth" approaches within a belligerent's own territory in furtherance of national defense against invasion. Intervening scientific knowledge might inform a refined interpretation of these prohibitions and exceptions as applied to the natural environment. As the ICJ observed in *Gabčíkovo-Nagymaros*, albeit outside the context of armed conflict, "vigilance and prevention are required on account of the often irreversible character of damage to the environment and of the limitations inherent in the very mechanism of reparation".[149] In that light, the exceptions to the prohibition on attacking objects indispensable to the survival of the civilian population might be understood more narrowly — for example, where such objects, though currently used solely by the military, could again become essential to the civilian population upon their return during or after hostilities.

Similarly, the understanding of what constitutes an object indispensable to the survival of the civilian population may benefit from new scientific understandings of the interrelatedness of ecosystems. For example, wetland areas that serve as natural water filters and buffers against flooding may not be directly used for drinking water but could be critical to ensuring the long-term availability and quality of water resources for civilian populations.[150] Likewise, pollinator habitats — such as hedgerows or forest margins — may appear to be of limited utility to a civilian population, but their destruction can undermine agricultural systems by disrupting crop pollination and thereby reducing food security.[151]

Scientific research also underscores the concept of ecological thresholds and tipping points, as mentioned above, whereby seemingly minor or localized environmental damage can trigger larger-scale ecosystem collapse,

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[149] Gabčíkovo-Nagymaros Project (Hungary/Slovakia), Judgment, 1997 I.C.J. 7, ¶ 140 (Sept. 25).

[150] *See, e.g.*, Evan Grimes, Marissa Kneer & Jacob Berkowitz, *supra* note 117, at 2153–2161.

[151] *See, e.g.*, Birgit Kimmerling, Conrad Schetter & Lars Wirkus, *The Logics of War and Food (In)security*, 33 GLOB. FOOD SEC. (2022) 1, https://www.sciencedirect.com/science/article/pii/S2211912422000256#bib5. *Cf.* U.S. DEPARTMENT OF DEFENSE, DOD POLLINATOR CONSERVATION REFERENCE GUIDE (2018), https://www.acq.osd.mil/eie/afpmb/docs/techguides/tg9.pdf.

particularly in already fragile or degraded regions.[152] For example, the destruction of a single area (such as a forested hillside that replenishes groundwater) or habitat (such as coastal vegetation that supports fish species) may irreversibly alter water or nutrient cycles that sustain broader ecological processes and thereby human survival.[153] In light of this knowledge, military actions that impair such critical ecological nodes could be subject to heightened scrutiny under Article 54 of AP I. A refined interpretation grounded in contemporary scientific evidence might therefore instantiate a more precautionary effort at performing the obligation, anticipating indirect harm to civilians through disruption of vital ecosystems.

For States engaging seriously with these scientific insights, this legal aspect may entail substantial operational consequences. Such States might, for example, determine that, under certain conditions, decisions regarding whether a given object is indispensable to civilian survival — or whether attacking it would produce indirect or long-term harm — cannot reliably be made by current command structures in the absence of scientific expertise. In response, such States might elect to integrate environmental advisers into operational planning processes, alongside legal advisers, to help assess ecological vulnerability and anticipate downstream risks. Doing so would reflect a view that precautionary obligations under IHL/LOAC, when interpreted in light of contemporary environmental knowledge, may require new forms of institutional capability and planning — perhaps especially in ecologically fragile areas or protracted armed conflicts where civilian dependence on environmental systems is particularly acute and complex. Still other States might conclude that current IHL/LOAC frameworks, no matter how expansively interpreted and assiduously applied, ought to be strengthened by considering the development of new norms.

2.3.4. Distilled Legal Questions, Implementation Measures, and Structural Reflections

Those reviewing or formulating a position on the IHL/LOAC obligations discussed in this section might consider the following legal questions:

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[152] *See, e.g.*, INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, SIXTH ASSESSMENT REPORT (2023); Seth Munson et al., *Ecosystem Thresholds, Tipping Points, and Critical Transitions*, 218 NEW PHYTOLOGIST 1315 (2018).

[153] *See, e.g.*, GLOBAL TIPPING POINTS (Timothy Lenton et al. eds., 2023), https://report-2023.global-tipping-points.org/download/4608/. *See also* International Union for Conservation of Nature, Red List of Ecosystems Database, https://assessments.iucnrle.org (last visited July 2025).

- What criteria should be considered as qualifying a part of the natural environment as indispensable for the survival of the civilian population?
- To what extent should assessments of the "survival" of civilian populations take into account civilian populations removed in time and space from those immediately present in a particular theater of an armed conflict?
- Should — and, if so, how can — specific considerations regarding particular populations (for example, those subsisting on a given ecosystem) be incorporated into understandings and interpretations of these IHL/LOAC obligations?

Those seeking to implement the IHL/LOAC obligations discussed in this section by way of policy or other practical measures might consider the following:

- identifying, and preserving in advance, specific environmental zones recognized as indispensable to the survival of a particular part of the civilian population;
- designating critical biodiversity areas and ecosystems as excluded from theaters of military operations in advance of armed conflict; and
- incorporating scientific expertise and reviews into "targeting cycles" and command structures at various phases of operations, including pre-planning, planning, execution, and after-action assessments.

The following questions offer legal and scientific concepts and considerations to guide principled reflection on the structural sufficiency of the IHL/LOAC obligations discussed in this section for addressing risks posed to the natural environment in relation to armed conflict:

- Whether a legal framework built on identifying "objects indispensable to survival" is sufficiently responsive to the distributed and interdependent nature of ecological systems that sustain civilian life?
- Whether the existing IHL/LOAC obligations adequately address forms of environmental degradation that are cumulative, gradual, or collateral but that, taken together, may severely impair access to food, water, and essential ecological services over the course of an armed conflict?
- Whether these IHL/LOAC obligations sufficiently address the broader structural drivers of deprivation resulting from ecologically harmful conduct, even when not motivated by an intent to target civilian sustenance?

- Whether these IHL/LOAC obligations are sufficient in contexts where environmental resilience is already critically weakened and where even minor ecological disruptions may lead to displacement, famine, or the collapse of sustenance systems?

2.4. Works and Installations Containing Dangerous Forces

Article 56 of AP I provides, in relevant part:

> 1. Works or installations containing dangerous forces, namely dams, dykes and nuclear electrical generating stations, shall not be made the object of attack, even where these objects are military objectives, if such attack may cause the release of dangerous forces and consequent severe losses among the civilian population. Other military objectives located at or in the vicinity of these works or installations shall not be made the object of attack if such attack may cause the release of dangerous forces from the works or installations and consequent severe losses among the civilian population.
> 2. The special protection against attack provided by paragraph 1 shall cease:
>
> (a) for a dam or a dyke only if it is used for other than its normal function and in regular, significant and direct support of military operations and if such attack is the only feasible way to terminate such support;
>
> (b) for a nuclear electrical generating station only if it provides electric power in regular, significant and direct support of military operations and if such attack is the only feasible way to terminate such support;
>
> (c) for other military objectives located at or in the vicinity of these works or installations only if they are used in regular, significant and direct support of military operations and if such attack is the only feasible way to terminate such support.
>
> 3. In all cases, the civilian population and individual civilians shall remain entitled to all the protection accorded them by international law, including the protection of the precautionary measures provided for in Article 57. If the protection ceases and any of the works, installations or military objectives mentioned

> in paragraph 1 is attacked, all practical precautions shall be taken to avoid the release of the dangerous forces.
> 4. It is prohibited to make any of the works, installations or military objectives mentioned in paragraph 1 the object of reprisals.
> 5. The Parties to the conflict shall endeavour to avoid locating any military objectives in the vicinity of the works or installations mentioned in paragraph 1. Nevertheless, installations erected for the sole purpose of defending the protected works or installations from attack are permissible and shall not themselves be made the object of attack, provided that they are not used in hostilities except for defensive actions necessary to respond to attacks against the protected works or installations and that their armament is limited to weapons capable only of repelling hostile action against the protected works or installations.[154]

Article 15 of AP II provides:

> Works or installations containing dangerous forces, namely dams, dykes and nuclear electrical generating stations, shall not be made the object of attack, even where these objects are military objectives, if such attack may cause the release of dangerous forces and consequent severe losses among the civilian population.[155]

2.4.1. Treaty-Based and Customary IHL/LOAC

Under Article 56(1) of AP I, States are prohibited from making "works or installations containing dangerous forces, namely dams, dykes and nuclear electrical generating stations" the "object of attack, even where these objects are military objectives, if such attack may cause the release of dangerous forces and consequent severe losses among the civilian population."[156] Given the potentially catastrophic environmental impacts of attacks on these objects, this provision offers important protections to the natural environment.[157] But there are

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[154] AP I, *supra* note 13, art. 56.

[155] AP II, *supra* note 15, art. 15.

[156] AP I, *supra* note 13, art. 56(1).

[157] *See* ICRC Guidelines, *supra* note 5, ¶¶ 164–165. Some States have expressly identified the protection of the natural environment as one of the purposes of limiting attacks against works and installations containing dangerous forces, alongside the purpose of protecting the civilian population. *See, e.g.*, CRIMINAL CODE art. 337 (Lith.); Council of Europe, Parliamentary Assembly, Committee on the Environment, Regional Planning and Local Authorities, *Report on the Environmental Impact of the War in Yugoslavia on South-East Europe*, Doc. 8925, ¶ 2 (Jan. 24, 2001).

some limitations. The enumerated objects are limited to dams, dykes, nuclear electrical generating stations, and "other military objectives located at or in the vicinity" of these objects — the provision would not apply, for instance, to attacks against a petrochemical factory located far from one of the objects in question.[158] Additionally, in IACs there are exceptions to the prohibitions on directing attacks at the enumerated objects. The protection for a dam or a dyke, for example, terminates if two conditions are met: namely, if the dam or dyke in question is "used for other than its normal function and in regular, significant and direct support of military operations" and "if such attack is the only feasible way to terminate such support."[159] This is a substantially higher standard than allowing for attacks directed at other "military objectives" in the sense of Article 52(2) of AP I. As noted in the ICRC's Commentary on AP I, "[i]t is clear that the termination of special protection can occur only in the event that a number of very restrictive conditions are all met at the same time."[160] Article 15 of AP II, applicable in NIACs regulated by that instrument, features a version of the rule without the exceptions provided for in AP I.[161]

According to the ICRC Customary IHL/LOAC Study, a corresponding rule exists in customary IHL/LOAC, applicable in both IACs and NIACs, requiring "particular care . . . if works and installations contain dangerous forces, namely dams, dykes and nuclear electrical generating stations, and other installations located at or in their vicinity are attacked, in order to avoid the release of dangerous forces and consequent severe losses among the civilian population."[162] The ICRC commentary notes that this corresponding rule is reflected in numerous military manuals and in the domestic legislation of a number of States, with some prohibiting attacks against such works and installations altogether.[163] It further notes that, while the Additional Protocols

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[158] AP I Commentary, *supra* note 30, ¶¶ 2149–2150 ("Several delegations wished to include other installations in the list, in particular oil production installations and storage facilities for oil products. . . . It appears that the consultations were not successful, as the sponsors of the proposals in this field finally withdrew them."). Such objects may be protected under other rules of IHL/LOAC, depending on whether they are civilian objects or military objectives. For example, an attack against other types of works and installations that have become military objectives are covered by IHL/LOAC obligations concerning proportionality and precautions in attack. *See* ICRC Guidelines, *supra* note 5, ¶ 162.

[159] AP I, *supra* note 13, art. 56(2)(a). Even in such cases, however, parties to an IAC regulated by AP I would be obliged to take "all practical precautions . . . to avoid the release of the dangerous forces." *Id.* art. 56(3).

[160] AP I Commentary, *supra* note 30, ¶ 2162.

[161] AP II, *supra* note 15, art. 15. *See* AP I Commentary, *supra* note 30, ¶ 2154.

[162] ICRC CUSTOMARY IHL, *supra* note 39, at 139. *See also* ICRC Guidelines, *supra* note 5, ¶ 160.

[163] *Id.*

have limited the conventional provisions to dams, dykes, and nuclear electrical generating stations, the customary rule "should equally apply to other installations, such as chemical plants and petroleum refineries."[164]

2.4.2. *Systemic Integration of International Environmental Law*

With respect to the release of dangerous forces, the IEL customary principle of transboundary harm is of primary relevance. Reflected in Principle 21 of the Stockholm Declaration[165] and Principle 2 of the Rio Declaration[166] and affirmed in the ICJ's Advisory Opinion on the *Legality of the Threat or Use of Nuclear Weapons*,[167] this principle requires States to ensure that activities in their territory or otherwise under their jurisdiction or control respect the environment of other States or of areas beyond national control, including to prevent significant environmental harm in such areas.[168] This principle could inform the obligation under Article 56 of AP I beyond the enumerated works and installations in that provision to other works and installations that could potentially release dangerous forces that would cause harm to the natural environment.

2.4.3. *Current Scientific Knowledge*

These obligations are primarily directed at protecting the civilian population from "severe losses". This may be principally understood as referring to the loss of civilian life. In this vein, the 1987 ICRC Commentary on AP I notes that if an attack "cannot cause severe losses it is legitimate, provided that the works or installation which is attacked has clearly become a military objective

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[164] *Id.*

[165] Stockholm Declaration, *supra* note 102, principle 21.

[166] Rio Declaration, *supra* note 58, principle 2.

[167] Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion, 1996 I.C.J. 226, ¶ 29 (July 8). *See also* Pulp Mills on the River Uruguay (Argentina v. Uruguay), Judgment, 2010 I.C.J. 14, ¶ 101 (Apr. 20) ("A State is . . . obliged to use all the means at its disposal in order to avoid activities which take place in its territory, or in any area under its jurisdiction, causing significant damage to the environment of another State . . . ."); Obligations of States in Respect of Climate Change, Advisory Opinion, ¶¶ 132–139 (July 23, 2025), https://www.icj-cij.org/sites/default/files/case-related/187/187-20250723-adv-01-00-en.pdf.

[168] *E.g.*, 1996 I.C.J. 226, ¶ 29. *See also* Int'l L. Comm'n, Draft Articles on Prevention of Transboundary Harm from Hazardous Activities, Y.B. INT'L L. COMM'N, vol. II, Part Two, art. 2(c) (2001). *See also* PERAC Commentary, *supra* note 6, (draft) principle 21, at 169, ¶¶ 1–2.

in the sense of Article 52".[169] In light, however, of current scientific knowledge, the notion of severe losses to civilians can arguably be considered as encapsulating such damage to the natural environment that could in turn cause severe losses among the civilian population. For example, when the destruction of a dam would release water and toxic sediments into an area without a civilian population, it may still cause severe losses to nearby civilian populations by virtue of the deprivation of that water being used for drinking or sanitation or by dint of flooding land used for agriculture or habitats of animals used for sustenance.[170] Modern scientific understandings of ecosystem processes could further reveal how the release of dangerous forces into the natural environment might affect civilian populations in ways that rise to the level of severe losses within the meaning of the IHL/LOAC obligations treated above. Thus, in assessing the severity of the impact, it is also necessary to consider whether the release of such forces would damage the natural environment's capacity to sustain human life.

Current scientific knowledge could also shed light on the deleterious effects of dangerous forces released by works and installations that are not expressly enumerated in the rules.[171] This might arguably include, among others:

- oil rigs, refineries, and storage depots, where attacks could trigger massive fires or spills that pollute air, groundwater, or marine environments, affecting civilian health and livelihoods;
- chemical plants, attacking which could contaminate air, water, or soil, causing severe harm to human health and ecosystems;
- biological research laboratories, where attacks could lead to the release of dangerous pathogens or toxins harmful to flora or fauna, or the civilian population itself;
- industrial wastewater treatment facilities where a breach might result

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[169] AP I Commentary, *supra* note 30, ¶ 2153.

[170] *See, e.g.*, Oleksandra Shumilova et al., *Environmental Effects of the Kakhovka Dam Destruction by Warfare in Ukraine*, 387 SCIENCE 1181 (2025); Jennifer Littlejohn, Raffi Balian & Luke Simmons, *The Ukraine War Is an Environmental Catastrophe with Global Consequences*, SCIENTIFIC AMERICAN (Aug. 1, 2023), https://www.scientificamerican.com/article/the-ukraine-war-is-an-environmental-catastrophe-with-global-consequences/.

[171] *See, e.g.*, Blanca Begert, *Putin's Assault on Ukraine Has Been an Environmental Catastrophe*, GRIST (Mar. 6, 2023), https://grist.org/health/one-year-in-the-toxic-legacy-of-war-in-ukraine-comes-into-view/; CONFLICT & ENV'T OBSERVATORY, DOWNSTREAM IMPACT: ANALYSING THE ENVIRONMENTAL CONSEQUENCES OF THE KAKHOVKA DAM COLLAPSE (2023), https://ceobs.org/analysing-the-environmental-consequences-of-the-kakhovka-dam-collapse/; NADA AL-DUAIJ, ENVIRONMENTAL LAW OF ARMED CONFLICT 25–43 (2004).

in widespread pollution of rivers or coastal zones crucial for civilian use and food supply; and

- mining sites, which can contain toxic heavy metals and arsenic the release of which could devastate ecosystems.

2.4.4. Distilled Legal Questions, Implementation Measures, and Structural Reflections

Those reviewing or formulating a position on the IHL/LOAC obligations discussed in this section might consider the following legal questions:

- What criteria or factors should be used to determine whether precautions are feasible with respect to preventing or mitigating the release of dangerous forces? How could those criteria or factors inform whether, for example, to avoid works and installations becoming the object of attack or to protect civilians from the effects of dangerous forces if released?
- What are the criteria relevant to assessing the severity of the impact of the potential release of dangerous forces from works and installations?

Those seeking to implement the IHL/LOAC obligations discussed in this section by way of policy or other practical measures might consider the following:

- identifying, designating, and marking works and installations as containing dangerous forces in advance of armed conflict, as well as locating military objectives far from the vicinity of such works and installations;
- preparing armed forces and civilian populations for emergency response to mitigate and protect against the environmental effects of release of dangerous forces if released;
- working with other States and actors to conclude special agreements designating and protecting works and installations not expressly enumerated in the rules but nonetheless containing dangerous forces or areas of ecological significance that would be particularly fragile in the event of release of dangerous forces; and
- drawing on scientific or environmental expertise at the national or international level in advance of armed conflict to model risks and other potentialities with respect to works and installations containing dangerous forces.

The following questions offer legal and scientific concepts and considerations to guide principled reflection on the structural sufficiency of the IHL/LOAC obligations discussed in this section for addressing risks posed to the natural environment in relation to armed conflict:

- Whether the works and installations containing dangerous forces already enumerated in IHL/LOAC capture the range of potential sources of dangerous forces at risk of release if made the object of attack in armed conflict?
- Whether current obligations are capable of addressing the environmental and humanitarian consequences of harm to infrastructure that may cause diffuse, delayed, or cumulative damage to ecosystems and public health (for example, long-term contamination of water systems or soil degradation)?
- Whether current obligations adequately account for how climate change has heightened risks associated with infrastructure and heightened vulnerability in armed conflict?
- Whether obligations not to attack works and installations containing dangerous forces or to locate military objectives in their vicinity sufficiently capture the systemic and often transboundary ecological harms that can follow from even indirect damage to certain climate-sensitive infrastructure?
- Whether these obligations offer a sufficiently integrated normative framework for protecting not just specific installations but the broader environmental and civilian systems they support?

2.5. Usufruct in the Context of Belligerent Occupation

Article 55 of the Hague Regulations provides that "[t]he occupying State shall be regarded only as administrator and usufructuary of public buildings, real estate, forests, and agricultural estates belonging to the hostile State, and situated in the occupied country. It must safeguard the capital of these properties, and administer them in accordance with the rules of usufruct."[172]

[172] Hague Regulations, *supra* note 14, art. 55.

Article 53 of GC IV provides: "Any destruction by the Occupying Power of real or personal property belonging individually or collectively to private persons, or to the State, or to other public authorities, or to social or co-operative organizations, is prohibited, except where such destruction is rendered absolutely necessary by military operations."[173]

2.5.1. Treaty-Based and Customary IHL/LOAC

Article 55 of the Hague Regulations confers on an occupying Power only the status of an administrator and usufructuary of, *inter alia*, the forests and agricultural estates belonging to the adversary State and situated within the occupied territory.[174] As such, the occupying Power must safeguard their capital and administer them in accordance with the "rules of usufruct".[175] This entails, according to the ICJ, "that the occupying Power bears the duty to administer public property for the benefit of the local population or, exceptionally, to meet the needs of the army of occupation."[176] In its discussion of Article 55 of the Hague Regulations in *Legal Consequences Arising from the Policies and Practices of Israel in the Occupied Palestinian Territory, Including East Jerusalem*, the ICJ observed that "the use by the occupying Power of natural resources must not exceed what is necessary for the purposes of the occupation. . . . Moreover, the use of natural resources in the occupied territory must be sustainable, and it must avoid environmental harm."[177] Additionally, in the view of the ICJ, the exploitation of natural resources in foreign territory may be inconsistent with the right of the State or people of that territory to permanent sovereignty over natural resources.[178]

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[173] GC IV, *supra* note 12, art. 53.

[174] Hague Regulations, *supra* note 14, art. 55. The ICJ, for its part, omitted the language "belonging to the hostile State" in setting out this rule. Legal Consequences arising from the Policies and Practices of Israel in the Occupied Palestinian Territory, including East Jerusalem, Advisory Opinion, ¶ 106 (July 19, 2024), https://www.icj-cij.org/sites/default/files/case-related/186/186-20240719-adv-01-00-en.pdf ("[T]he rule set out in Article 55 of the Hague Regulations confers on the occupying Power only the status of administrator and usufructuary of public buildings, real estate, forests and agricultural estates in the occupied territory.").

[175] Hague Regulations, *supra* note 14, art. 55.

[176] Legal Consequences arising from the Policies and Practices of Israel in the Occupied Palestinian Territory, including East Jerusalem, ¶ 122.

[177] *Id.* ¶ 124.

[178] *See id.* ¶ 133. *See also* ICRC Guidelines, *supra* note 5, ¶ 194; Canadian Chief of Defence Staff, Law of Armed Conflict at the Operational and Tactical Levels ¶ 1243 (2001); 4 New Zealand Defence Force, Manual of Armed Forces Law: Law of Armed Conflict 9–6 (2017); United Kingdom Ministry of Defence, Joint Service Manual of the Law of Armed Conflict ¶ 11.86 (2004); Office of General Counsel, U.S. Department of Defence, Law of War Manual (2015, updated 2023) ¶ 11.18.5.2.

Article 53 of GC IV prohibits, in the context of belligerent occupation, the destruction of property belonging individually or collectively to private persons, to the State or to other public authorities, or to social or co-operative organizations, except where such destruction is rendered absolutely necessary by military operations.[179] The natural environment would be directly protected by this rule, as parts of it — such as natural resources, farmlands, and livestock — may be privately owned and any other parts of the natural environment are likely owned by the State, other public authorities, or by social or co-operative organizations. Furthermore, the "extensive destruction and appropriation of property, not justified by military necessity and carried out unlawfully and wantonly" is listed in GC IV as a grave breach.[180] Taken together, the provisions above require the occupying Power in a belligerent occupation to safeguard the natural environment and not to abuse it for their own ends but to hold it in trust for the sovereign of the occupied territory.

The ICJ has held that Article 55 of the Hague Regulations reflects a principle of customary international law.[181] In this respect, the ICJ also drew on Principle 23 of the Rio Declaration,[182] which provides that "[t]he environment and natural resources of people under . . . occupation shall be protected",[183] and cited the ILC's (draft) principle 20, which provides that:

> To the extent that an Occupying Power is permitted to administer and use the natural resources in an occupied territory, for the benefit of the protected population of the occupied territory and for other lawful purposes under the law of armed conflict, it shall do so in a way that ensures their sustainable use and minimizes harm to the environment.[184]

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[179] GC IV, *supra* note 12, art. 53. *See also* PERAC Commentary, *supra* note 6, (draft) principle 19, at 160, ¶ 4.

[180] GC IV, *supra* note 12, art. 147.

[181] Legal Consequences arising from the Policies and Practices of Israel in the Occupied Palestinian Territory, including East Jerusalem, ¶ 124 ("The Court recalls that, under the principle of customary international law contained in Article 55 of the Hague Regulations, the occupying Power shall be regarded only as administrator and usufructuary of natural resources in the occupied territory, including but not limited to forests and agricultural estates, and it shall 'safeguard the capital' of these resources. Therefore, the use by the occupying Power of natural resources must not exceed what is necessary for the purposes of the occupation.").

[182] *Id.* ("Moreover, the use of natural resources in the occupied territory must be sustainable, and it must avoid environmental harm.").

[183] Rio Declaration, *supra* note 58, principle 23.

[184] PERAC, *supra* note 4, (draft) principle 20.

2.5.2. Systemic Integration of International Environmental Law

Under the transboundary-harm principle, States are required to ensure that activities occurring in their territory or in territory under their jurisdiction or control do not cause significant environmental harm to other territory or States.[185] An occupying Power, given its control of occupied territory, must therefore ensure that activities occurring within the occupied territory do not cause significant transboundary harm to the environment of other States or areas beyond national jurisdiction, including any unoccupied areas beyond the occupied territory.[186] Moreover, as the ICJ observed in *Pulp Mills on the River Uruguay*, "it may now be considered a requirement under general international law to undertake an environmental impact assessment where there is a risk that the proposed industrial activity may have a significant adverse impact in a transboundary context".[187] Furthermore, in the context of belligerent occupation, the ICJ has underlined that "[p]hysical control of a territory, and not sovereignty or legitimacy of title, is the basis of State liability for acts affecting other States".[188] Therefore, where there is a risk of significant transboundary harm originating in an occupied territory, the occupying Power is arguably obliged to conduct an environmental-impact assessment in line with the duty of environmental due diligence.

Systemic integration applied to the rules above could shed light on the responsibility that an occupying Power would bear to future generations in the occupied territory. The United Nations Framework Convention on Climate Change emphasizes sustainable development;[189] the CBD refers repeatedly to

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[185] *See* Stockholm Declaration, *supra* note 102, principle 21; Rio Declaration, *supra* note 58, principle 2; Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion, 1996 I.C.J. 226, ¶ 29 (July 8). *See also* PERAC, *supra* note 4, (draft) principle 21.

[186] *See* Int'l L. Comm'n, Draft Articles on Prevention of Transboundary Harm from Hazardous Activities, Y.B. INT'L L. COMM'N, vol. II, Part Two, art. 2(c) (2001). *See also* PERAC, *supra* note 4, (draft) principle 21. *See also* Ivon Mingashang & Christian Banungana, *The International Responsibility of a Belligerent State in the Event of Transboundary Environmental Damage*, 106 INT'L REV. RED CROSS 469 (2024).

[187] Pulp Mills on the River Uruguay (Argentina v. Uruguay), Judgment, 2010 I.C.J. 14, ¶ 204 (Apr. 20).

[188] Legal Consequences for States of the Continued Presence of South Africa in Namibia (South West Africa) notwithstanding Security Council Resolution 276 (1970), Advisory Opinion, 1971 I.C.J. 16, ¶ 118 (June 21). *See also* PERAC Commentary, *supra* note 6, (draft) principle 21, at 170, ¶ 4.

[189] *See, e.g.*, UNFCCC, *supra* note 59, art. 3(4) ("The Parties have a right to, and should, promote sustainable development. Policies and measures to protect the climate system against human-induced change should be appropriate for the specific conditions of each Party and should be integrated with national development programmes, taking into account that economic development is essential for adopting measures to address climate change.").

the sustainable use of biodiversity;[190] the Rio Declaration warns that "[w]arfare is inherently destructive of sustainable development";[191] and the preamble to the ILC's (Draft) Principles recalls "the urgent need and common objectives to reinforce and advance the conservation, restoration and sustainable use of the environment for present and future generations".[192] Although they are arguably not yet customary-international-law norms in themselves, emerging principles pertaining to sustainable development may be interpreted as further reinforcing the duty of the administrator and usufructuary in an occupied territory to preserve the natural environment for the civilian population, present and future.[193] Such a reading may further be understood in light of the principle of permanent sovereignty over natural resources, held as customary by the ICJ.[194] This interpretation can be read into the requirement that an occupying Power must, under the rules of usufruct, "safeguard the capital" of natural resources. Under this part of the rules of usufruct, the occupying Power must not diminish or destroy the underlying value of natural resources.[195] In this respect, States may interpret best practices in sustainability and conservation as part of the obligations inherent to the rules of usufruct.

2.5.3. Current Scientific Knowledge

Current scientific knowledge underscores the need to treat ecosystems as interconnected systems rather than as isolated sites of indefinite resource extraction. This may be particularly relevant in belligerent occupation, where

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[190] *See, e.g.*, CBD, *supra* note 21, art. 1 ("The objectives of this Convention, to be pursued in accordance with its relevant provisions, are the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources.").

[191] Rio Declaration, *supra* note 58, principle 24. *See also, e.g.*, *id.* principle 27 ("States and people shall cooperate in good faith and in a spirit of partnership in the fulfilment of the principles embodied in this Declaration and in the further development of international law in the field of sustainable development.").

[192] PERAC, *supra* note 4, pmbl.

[193] As observed by Judge Weeramantry in his separate opinion to the Judgment in *Gabčíkovo-Nagymaros*: "As modern environmental law develops, it can, with profit to itself, take account of the perspectives and principles of traditional systems, not merely in a general way, but with reference to specific principles, concepts, and aspirational standards. Among those which may be extracted from the systems already referred to are such far-reaching principles as the principle of trusteeship of earth resources, the principle of intergenerational rights, and the principle that development and environmental conservation must go hand in hand." Gabčíkovo-Nagymaros Project (Hungary/Slovakia), Judgment, 1997 I.C.J. 7, 107 (Sept. 25) (separate opinion by Weeramantry, J.).

[194] *See* Armed Activities on the Territory of the Congo (Democratic Republic of the Congo v. Uganda), Judgment, 2005 I.C.J. 168, ¶ 244 (Dec. 19). *See also* PERAC Commentary, *supra* note 6, (draft) principle 20, at 167–169, ¶¶ 5, 7–8.

[195] *See, e.g.*, Marco Longobardo, *State Responsibility for International Humanitarian Law Violations by Private Actors in Occupied Territories and the Exploitation of Natural Resources*, 3 NETH. INT'L L. REV. 251 (2016).

an occupying Power, as usufructuary, is permitted to use natural resources in the occupied territory only to the extent necessary for the purposes of the occupation. Current knowledge of ecology reveals that such exploitation can trigger irreversible degradation of soil, water sources, and biodiversity, undermining not only the natural environment per se but also the long-term livelihood and resilience of the local population. For example, deforestation in occupied territories can lead to desertification, reduced agricultural productivity, and water insecurity, all of which impose lasting burdens on civilians that may persist long after the end of occupation.[196]

Moreover, climate science reinforces the need for heightened environmental stewardship in times of armed conflict, including occupations. Many ecosystems are approaching or have passed critical tipping points, particularly in regions already under stress from resource scarcity. Environmental degradation caused during occupation can exacerbate vulnerabilities to climate shocks and undermine adaptation capacity.[197] It could be argued that the occupying Power should therefore integrate climate resilience into its administration of natural resources, consistent with emerging good practices in environmental governance and in fulfilment of responsibilities typical of a temporarily displaced government or sovereign.

An occupying Power is under an obligation to maintain local laws, unless absolutely prevented,[198] including with respect to local environmental laws in force. There may be certain circumstances where States might argue that an occupying Power, in its role as administrator and usufructuary, could bring its administration of activities having environmental effects in line with contemporaneous scientific insight. Consider two sets of examples:

- First, emergent scientific knowledge might reveal that the environmental laws in force at the outset of an occupation are inadequate to

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[196] *See, e.g.*, Tara Najim et al., Axed & Burned: How Conflict-caused Deforestation Impacts Environmental, Socio-economic and Climate Resilience in Syria 5 (2023).

[197] *See, e.g.*, International Committee of the Red Cross, *When Rain Turns to Dust: Understanding and Responding to the Combined Impact of Armed Conflicts and the Climate and Environmental Crisis on People's Lives* (2020) at 44.

[198] Hague Regulations, *supra* note 14, art. 43 ("The authority of the legitimate power having in fact passed into the hands of the occupant, the latter shall take all the measures in his power to restore, and ensure, as far as possible, public order and safety, while respecting, unless absolutely prevented, the laws in force in the country."). The French text, which is the only authentic version, reads: "L'autorité du pouvoir légal ayant passé de fait entre les mains de l'occupant, celui-ci prendra toutes les mesures qui dépendent de lui en vue de rétablir et d'assurer, autant qu'il est possible, l'ordre et la vie publics en respectant, sauf empêchement absolu, les lois en vigueur dans le pays."

address the risk of significant harm emanating from activities in the occupied territory. This might raise the question, for instance, of whether, if an occupying Power discovers previously unknown risks associated with deforestation in the occupied territory, it would be permitted or even obliged to tighten legal requirements for logging licenses and other foresting activities, in order to safeguard the capital of natural resources.

- Second, activities reliant on as-yet-unregulated technologies and associated industrial practices might arise during the course of an occupation that would require new oversight to protect the environment of the occupied territory and beyond. This might raise the question, for instance, of whether, if the population in an occupied territory began using a new kind of fertilizer or pesticide for agriculture, the occupying Power would be permitted or even obliged to adjust or issue environmental regulations, in order to administer the environment for the benefit of the local population.

Considerations of this kind may also support the interpretation of the obligations of usufruct as encompassing not just the safeguarding of "capital" but also the preservation of ecosystem services essential for the sustainment of the natural environment and the wellbeing of civilians.

2.5.4. Distilled Legal Questions, Implementation Measures, and Structural Reflections

Those reviewing or formulating a position on the IHL/LOAC obligations discussed in this section might consider the following legal questions:

- What are the most salient criteria by which to measure risk of significant transboundary harm arising from activities carried out in occupied territory?
- What is the extent of the obligation that an occupying Power bears to future generations of the population of an occupied territory with respect to the natural environment?
- What is the scope of the term "rendered absolutely necessary by military operations" in light of extant IEL obligations and emerging scientific awareness of ecological and climate-related effects of belligerent occupation on the natural environment?

Those seeking to implement the IHL/LOAC obligations discussed in this section by way of policy or other practical measures might consider the following:

- reviewing and clarifying the criteria by which military operations are considered as rendering destruction of parts of the natural environment absolutely necessary;
- conducting environmental-impact assessments for activities carried out in occupied territory bearing risks of significant harm; and
- indicating good practices for the sustainable use of natural resources in such a way as to safeguard their capital and comply with the above obligations, including consistency with the principle of permanent sovereignty over resources.

The following questions offer legal and scientific concepts and considerations to guide principled reflection on the structural sufficiency of the IHL/LOAC obligations discussed in this section for addressing risks posed to the natural environment in relation to armed conflict:

- Whether IHL/LOAC obligations that permit temporary use of renewable natural resources are adequate in an era when climate change, biodiversity collapse, and resource depletion may mean that even modest extraction or alteration could trigger irreversible ecological tipping points?
- Whether usufruct obligations offer the legal bases necessary to confront the ecological dimensions of systemic risk, including the occupation's contribution to global environmental decline, with the demands of environmental stewardship, precaution, and intergenerational justice in a climate-disrupted world?
- Whether usufruct obligations permit an occupying Power — in order to safeguard the capital of certain properties and to administer them for the benefit of the local population — to adjust environmental laws and regulations in force in the occupied territory?

3. Conclusion

The legal framework of IHL/LOAC contains a range of obligations that afford protection to the natural environment in relation to armed conflict. This paper has analyzed five select sets of those obligations in light of IEL principles

and rules and current scientific knowledge of environmental risk. Building on the work of States, the ILC, the ICRC, and others, the analysis here has sought to help further clarify these obligations and consider their application. In addition, the paper has sought to invite reflection on their sufficiency in the context of converging ecological and legal challenges.

Raising the question of whether these obligations are sufficient to meet the purposes that States or other relevant actors may ascribe to IHL/LOAC is not without risk. At the same time, scientific consensus underscores the accelerating consequences of environmental degradation, climate instability, and ecological fragility, including cumulative, transboundary, and potentially irreversible harms to civilian populations and ecosystems, many of which are intensified by armed conflict. Against that backdrop, IHL/LOAC obligations that were developed under different environmental, technological, and strategic conditions may face conceptual or operational constraints in preventing or mitigating the full range of risks that now arise.

The IHL/LOAC obligations analyzed in this paper retain binding force and continue to serve as vital normative constraints on environmentally harmful conduct in war. Nevertheless, the shifting landscapes of scientific knowledge and environmental risk in which these obligations now operate call for renewed attention. At stake is not only the responsiveness of the IHL/LOAC framework to accelerating environmental risk but also the cumulative and cascading consequences of harm to the natural environment from armed conflict.

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