

International Cooperation in Achieving Environmental Security : Concepts, Mechanisms, and Governance

Ahmed Yousuf Al-Huraibi¹, Prof. Ahmed Qasim Al-Humaidi², Huda Mohammed
Ahmed Thabet³

Department of Public Law, Faculty of Law, Taiz University, Taiz, Yemen¹

Professor of Public International Law — Taiz University²

Department of English Language and Translation, Faculty of Administrative and humanities
Sciences, Al Janad University for Science and Technology, Taiz, Yemen³

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الملخص:

تتناول هذه الورقة البحثية التعاون الدولي في تحقيق الأمن البيئي، وهو موضوع بالغ الأهمية ومتزايد الإلحاح في النظام الدولي المعاصر. فقد جعلت التهديدات البيئية العابرة للحدود، بما في ذلك تغير المناخ وفقدان التنوع البيولوجي والتلوث المنهجي، الاستجابات الوطنية الأحادية غير كافية، ورفعت الأمن البيئي إلى صدارة الخطاب العالمي للحكومة. وبالاستناد إلى مراجعة شاملة للصكوك القانونية والأطر المؤسسية والأدبيات الأكاديمية، تُرسخ الورقة أساساً مفاهيمياً للتعاون الدولي والأمن البيئي، وتحلل الآليات القانونية الرئيسية على المستويين الدولي والإقليمي، وتقيم بشكل نقدي دور الآليات التنفيذية، بما في ذلك المؤتمرات العالمية الهامة والمنظمات الدولية المتخصصة. ويُخصّص اهتمام خاص لحالة اليمن، التي يُمثّل وضعها البيئي المتردي، والذي تفاقم بفعل عقد من النزاع المسلح، تحلياً صارخاً لإخفاقات الحكومة التي تسعى هذه الورقة إلى معالجتها. وتجادل الورقة بأن الحكومة الفعالة للأمن البيئي تتطلب تكاملاً معيارياً بين فروع القانون الدولي، وآليات مالية وتقنية متينة، وإرادة سياسية حقيقية، مدعومة ببنية مؤسسية عالمية متماسكة.

الكلمات المفتاحية: التعاون الدولي، تحقيق الأمن البيئي، المفاهيم، الآليات، الحكومة.

Abstract

This paper examines international cooperation in achieving environmental security — a subject of critical and growing urgency in the contemporary international order. Transboundary environmental threats, including climate change, biodiversity loss, and systemic pollution, have rendered unilateral national responses insufficient and have elevated environmental security to the forefront of global governance discourse. Drawing on a comprehensive review of legal instruments, institutional frameworks, and academic literature, the paper establishes a conceptual foundation for international cooperation and environmental security, analyses the principal legal mechanisms at both international and regional levels, and critically assesses the role of executive mechanisms including landmark global conferences and specialized international organizations. Particular attention is devoted to the case of Yemen, whose environmental predicament — compounded by a decade of armed conflict — represents an extreme manifestation of the governance failures this paper seeks to address. The paper argues that effective environmental security governance requires normative integration across branches of international law, robust financial and technical mechanisms, and genuine political will, underpinned by a coherent global institutional architecture.

Keywords: International cooperation, achieving environmental security, concepts, mechanisms, governance.

I. Introduction

The progressive deterioration of the global environment has fundamentally transformed the landscape of international relations. Environmental challenges — from anthropogenic climate change and transboundary air and water pollution to deforestation, desertification, and the collapse of biodiversity — have long since ceased to be domestically contained phenomena. They are, by their very nature, collective-action problems that demand coordinated international responses. As Keohane and Nye observed, complex interdependence has rendered the traditional state-centric model of international relations inadequate to address problems whose consequences do not respect territorial boundaries.¹

Yet despite more than five decades of international environmental diplomacy — initiated by the landmark 1972 Stockholm Conference on the Human Environment — the gap between normative commitments and actual environmental outcomes remains alarmingly wide. The atmospheric concentration of greenhouse gases continues to rise; biodiversity is being lost at rates comparable to geological mass-extinction events; and access to clean water and uncontaminated soil remains inequitably distributed across the globe.²

This paper situates itself within this problematique. It proceeds from the premise that environmental security — understood as the condition in which individuals, communities, and states are protected from environmentally induced threats to their well-being and survival — is not merely a subsidiary concern of global governance but a foundational precondition for sustainable peace and development.³ The paper's central questions are: (1) How has international cooperation in the environmental domain evolved in conceptual and institutional terms? (2) What are the most significant legal and executive mechanisms through which this cooperation is operationalized? And (3) Where do the principal governance gaps lie, and what reform directions are indicated?

A. Research Significance

The significance of this research is both theoretical and practical. Theoretically, it contributes to the burgeoning literature on environmental governance by integrating perspectives from international law, international relations theory, and comparative politics. Practically, it addresses an urgent policy imperative: the need to identify and strengthen the institutional pathways through which environmental security can be achieved, particularly for conflict-affected states such as Yemen whose environmental vulnerabilities have been dramatically amplified by armed conflict.

B. Methodology

The paper employs a pluralistic methodological approach, combining: (a) doctrinal legal analysis of key international environmental instruments; (b) historical-institutional analysis tracing the evolution of the international environmental governance architecture; (c) comparative analysis of regional environmental cooperation mechanisms; and (d) a case-study approach applied to Yemen. Primary sources include international treaty texts, conference declarations, and reports of international organizations. Secondary sources encompass a broad range of peer-reviewed scholarship in international environmental law, international relations, and political ecology.

C. Structure

The paper is structured as follows. Section II presents an extensive review of the prior literature. Section III sets out the theoretical framework. Sections IV and V address the conceptual dimensions of international cooperation and environmental security respectively. Sections VI and VII analyse legal and executive mechanisms. Section VIII considers Yemen as an illustrative case study. Section IX examines the role of non-state actors and global environmental governance. Section X concludes with findings and recommendations.

II. Review of Prior Literature

The literature on international cooperation and environmental security is rich, multidisciplinary, and continues to expand rapidly. For analytical clarity, this review is organized into four thematic clusters: foundational theoretical contributions, international environmental law scholarship, environmental security studies, and Yemen-specific environmental research.

A. Foundational Theoretical Works

The theoretical foundations of international environmental cooperation rest substantially on the liberal institutionalist tradition. *Keohane and Nye (1977)* in their seminal *Power and Interdependence* provided the analytical scaffold for understanding how states manage collective-action dilemmas through institutions when mutual vulnerability renders unilateral action suboptimal.¹ This framework was elaborated for environmental commons by *Young (1994)*, whose *International Governance: Protecting the Environment in a Stateless Society* argued that international regimes, despite the absence of supranational

authority, can achieve meaningful environmental governance through norm diffusion, monitoring, and iterative bargaining.²

Ostrom (1990) offered a corrective to both the Hardin's "tragedy of the commons" pessimism and the unwarranted faith in either privatization or centralization. Her polycentric governance framework, empirically grounded in case studies of self-governing commons, demonstrated that communities can devise durable institutional arrangements for collective resource management.⁴⁰ Ostrom's insights have been increasingly applied to global environmental governance, informing proposals for hybrid, multi-level governance architectures.

Haas (1992), in his foundational essay on epistemic communities, argued that knowledge-based transnational networks of experts play a crucial role in shaping state preferences and building the cognitive consensus necessary for international environmental cooperation.³⁹ This insight remains highly pertinent in the context of climate science and the Intergovernmental Panel on Climate Change (IPCC).

B. International Environmental Law Scholarship

The legal architecture of international environmental cooperation has been comprehensively surveyed in several authoritative treatises. **Sands et al. (2018)** in *Principles of International Environmental Law* (now in its fourth edition) provide the most exhaustive systematic account of the field, tracing the evolution of customary principles, treaty frameworks, and institutional mechanisms from Stockholm to Paris.²³

Bodansky (2010) in *The Art and Craft of International Environmental Law* offers a nuanced practitioner-scholar perspective on the processes, constraints, and innovations that characterize international environmental lawmaking. Bodansky emphasizes the importance of flexibility mechanisms, differentiation between developed and developing states, and the role of non-binding "soft law" in facilitating agreement.²²

Birnie, Boyle, and Redgwell (2009) in *International Law and the Environment* examine the interplay between general international law principles and sector-specific environmental regimes, paying particular attention to state responsibility, the precautionary principle, and common but differentiated responsibilities.⁵¹

Beyerlin and Marauhn (2011) in *International Environmental Law* offer a comparative treaty-by-treaty analysis, noting the fragmentation risk that arises when hundreds of multilateral environmental agreements (MEAs) operate in parallel without adequate coordination.⁵²

Litfin (1994) in *Ozone Discourses* provided a landmark constructivist account of the Montreal Protocol negotiations, demonstrating how scientific knowledge, discursive framing, and epistemic authority shaped the content and pace of international ozone protection cooperation.¹⁵ Her findings underscore that legal outcomes in international environmental negotiations are never merely technocratic: they are profoundly political.

C. Environmental Security Studies

The concept of environmental security has attracted sustained scholarly attention since the late 1980s and early 1990s. **Barnett (2001)** in *The Meaning of Environmental Security* critically interrogated the securitization of environmental issues, warning that framing environmental problems through a security lens risks militarizing responses and marginalizing the ecological and social dimensions of the problem.³

Dalby (2002) in *Environmental Security* offered a critical geopolitical perspective, arguing that the concept of environmental security is ideologically laden and that dominant framings tend to reproduce North-South power asymmetries. Dalby insists on the need to question who defines environmental threats and whose security is actually being protected.⁷

Homer-Dixon (1994) in his influential article "Environmental Scarcities and Violent Conflict" in *International Security* presented empirical evidence from case studies in Africa, Asia, and the Middle East linking resource scarcity — including freshwater depletion and agricultural land degradation — to increased risks of sub-national and international violent conflict.⁸ Homer-Dixon's findings have been extensively debated but have fundamentally shaped policymakers' understanding of the security-environment nexus.

Gleck (1993) pioneered the analysis of freshwater as a security resource, identifying the conditions under which water scarcity generates interstate tension and conflict — a finding with acute relevance for Yemen.⁹

Conca and Dabelko (2002) in *Environmental Peacemaking* offered the counter-narrative: that shared environmental challenges can serve as platforms for cooperative confidence-building between adversaries, providing empirical evidence from several conflict regions.¹⁰

Brauch (2008) in a comprehensive edited volume reconceptualized security for the 21st century, arguing for a fifth dimension of security — the environmental — alongside political, military, economic, and societal dimensions. Brauch's framework has been influential in academic and policy communities seeking to broaden the traditional security paradigm.⁵³

D. Global Environmental Governance

Biermann (2014) in *Earth System Governance: World Politics in the Anthropocene* develops an ambitious research framework for understanding how humanity can govern itself in an era of planetary-scale environmental transformation. Biermann argues for integrated earth system governance architecture capable of addressing systemic, non-linear environmental risks.³⁸

Bernstein (2002) characterized the dominant norm complex in global environmental governance as "liberal environmentalism" — a synthesis of environmental protection and market-oriented economic norms that has shaped every major multilateral environmental agreement since Rio 1992. While this norm complex has facilitated agreement, critics argue it has done so by systematically subordinating ecological limits to economic growth imperatives.⁴¹

Conca (2015) in *An Unfinished Foundation: The United Nations and Global Environmental Governance* provides a rigorous institutional history of the UN's environmental engagement, identifying structural weaknesses in the fragmented environmental governance architecture and calling for a more coherent global environmental organization.⁵⁴

Najam (2005) advanced the important argument that international environmental politics looks fundamentally different when viewed from the Global South, where countries — particularly small, poor, and conflict-affected states — face severe capacity constraints and often experience international environmental regimes as externally imposed obligations that may conflict with developmental priorities.⁴² This perspective is highly relevant to Yemen's situation.

Victor (2001) in *The Collapse of the Kyoto Protocol* provided an early but influential analysis of the implementation failures of the Kyoto Protocol, attributing them to structural flaws in the agreement's design — particularly the exclusion of major developing-country emitters and the inability to make binding commitments credible in domestic political systems.⁵⁰

E. Yemen-Specific Environmental and Conflict Literature

Lackner (2017) in *Yemen in Crisis* situates Yemen's environmental vulnerabilities — water scarcity, desertification, coastal degradation — within a broader analysis of state collapse, neo-liberal economic mismanagement, and the political economy of the conflict.

Lackner's account underscores that environmental crises in Yemen are deeply entangled with governance failures and political exclusion.⁴⁶

Salisbury (2015), writing for Chatham House, identified Yemen's environmental resource fragility — especially its water crisis — as one of several structural factors that, absent state capacity and political will to manage them, contributed to state fragility.⁴⁷

CARPO (2022) examined how environmental degradation and the absence of functional environmental governance institutions in Yemen have transformed environmental issues from long-term developmental challenges into acute humanitarian crises, while also exploring how environmental programming might contribute to confidence-building and peacemaking efforts.⁴⁸

III. Theoretical Framework

This paper is anchored in three complementary theoretical traditions that together provide the analytical tools needed to understand international environmental cooperation and its structural challenges.

A. Liberal Institutionalism and Regime Theory

Liberal institutionalism, as developed by Keohane, Nye, Ruggie, and others, holds that international institutions — including international organizations, treaty regimes, and informal norms — can shape state behaviour even in an anarchic international system by altering incentive structures, reducing information asymmetries, increasing the costs of defection, and lengthening the "shadow of the future". Applied to environmental cooperation, regime theory predicts that stable cooperation is achievable when states perceive sufficient common interests, and when institutional design addresses the specific collective-action failure at hand.¹

For environmental governance, however, liberal institutionalism faces the challenge that environmental cooperation often involves not merely coordination problems (where all parties prefer any agreed solution to no solution) but genuine distributional conflicts — particularly between developed states that have historically caused most pollution and developing states that bear its worst consequences. This is the political-economic context in which MEAs must be negotiated and implemented.

B. The Common Security Paradigm and Environmental Security

The Common Security Paradigm, which emerged from the Palme Commission's 1982 report and was extended by the Brundtland Commission's 1987 "Our Common Future", reconceptualized security as a shared, interdependent condition: no state can achieve

genuine security at the permanent expense of others. The Brundtland Commission explicitly linked environmental degradation to security threats, coining the concept of "sustainable development" — meeting present needs without compromising future generations' capacity to meet theirs.¹³

This framework generates a powerful normative argument for international environmental cooperation: because environmental degradation threatens the security of all, and because environmental systems are functionally integrated across national borders, security from environmental threats is by definition a collective good that can only be achieved through collective action. This argument underpins both the legal obligations embedded in multilateral environmental agreements and the institutional mandates of organizations such as UNEP.

C. Earth System Governance and Polycentric Governance

The emerging Earth System Governance framework, as elaborated by Biermann and colleagues, moves beyond the state-centric assumptions of both realism and classical liberalism to conceptualize governance as a multi-level, polycentric system encompassing not only states and international organizations but also transnational corporations, civil society organizations, scientific networks, and local communities.³⁸ This framework is particularly well-suited to understanding the complex, multi-actor character of environmental governance in practice, where effective outcomes typically require coherent action across multiple levels of governance simultaneously.

IV. International Cooperation in Environmental Governance: Conceptual Dimensions

A. Conceptual Evolution

International cooperation has evolved from a narrow diplomatic concept focused on the management of bilateral interstate relations into a broad, multi-level framework encompassing a vast range of collective challenges. In its environmental dimensions, international cooperation refers to all deliberate, coordinated activities undertaken by states, international organizations, sub-state actors, and non-governmental entities with the shared objective of protecting the environment, managing shared natural resources sustainably, and mitigating transboundary environmental threats.⁴

The normative foundation for environmental cooperation was established by the UN Charter (1945), which mandated international cooperation for solving "problems of an economic, social, cultural, or humanitarian character" (Article 1(3)).⁴ This foundation was

reinforced by the 1970 Declaration on Principles of International Law, which articulated cooperation as a legally binding principle governing inter-state relations.⁵ The establishment of UNEP in 1972 as the first dedicated international environmental institution marked the institutionalization of the environmental dimension of international cooperation.⁶

B. Rationale and Drivers of Environmental Cooperation

The imperatives driving international environmental cooperation can be grouped into three categories:

Three Imperatives for International Environmental Cooperation

Ecological Imperative: Environmental threats are transboundary by nature; atmospheric pollution, ocean acidification, migratory species loss, and climate change cannot be addressed within national borders.

Security Imperative: Resource scarcity and environmental degradation generate conflict risk. UNEP data suggests at least 40% of intrastate conflicts over 60 years have had natural resource dimensions.

Justice Imperative: The states least responsible for global environmental degradation are disproportionately its victims (e.g., small island states, least-developed countries, and conflict-affected states like Yemen).

The security argument for environmental cooperation is empirically grounded: a UNEP study examining conflicts over 60 years found that at least 40% of all intrastate conflicts had links to natural resources. The UN Security Council itself, in 2020, warned that climate change could exacerbate resource competition and fuel new conflicts.¹¹

C. The Principle of Common but Differentiated Responsibilities (CBDR)

A cornerstone of international environmental law — and arguably its most politically consequential innovation — is the principle of Common but Differentiated Responsibilities (CBDR), first formally articulated in Principle 7 of the Rio Declaration (1992). CBDR acknowledges that while all states share responsibility for global environmental protection (the "common" dimension), their respective obligations must be calibrated to their historical contribution to environmental damage and their current economic capacity (the "differentiated" dimension). This principle has been operationalized in the UNFCCC through the Annex system, and in the Paris Agreement through the nationally determined contributions (NDC) architecture.³⁶

CBDR has been both celebrated as a breakthrough in multilateral diplomacy and criticized for creating structural rigidities that impede the ratcheting-up of ambition as developing-country emissions grow. Its application to Yemen is particularly poignant: a state that has contributed negligibly to historical greenhouse gas emissions faces some of the world's most severe climate impacts.

V. Environmental Security: Concept, Dimensions, and Global Threats

A. Defining Environmental Security

Environmental security, as a concept, emerged at the intersection of environmental politics and security studies in the late 1980s. The Brundtland Commission's 1987 report is widely credited with introducing the concept into mainstream policy discourse by explicitly linking environmental degradation to threats to human security and social stability.¹³ The concept has since been elaborated by scholars and institutionalized in the mandates of numerous international bodies.

For the purposes of this paper, environmental security is defined as: the condition — achieved through coordinated domestic and international governance — in which individuals, communities, and states are protected from threats to their well-being arising from environmental degradation, resource scarcity, and ecosystem disruption, and in which natural systems are maintained in a condition sufficient to sustain present and future human flourishing. This definition encompasses both the anthropocentric dimension (protecting people from environmental threats) and the ecocentric dimension (protecting ecosystems from anthropogenic damage).¹⁴

B. Principal Global Environmental Threats

1. Climate Change and Global Warming

The scientific consensus, comprehensively synthesized in the IPCC's Sixth Assessment Report (AR6, 2022), establishes that human-induced climate change is unequivocal, its impacts are already widespread and severe, and further warming is locked in by historical emissions. Current policies place the world on a trajectory of approximately 2.5–3°C of warming above pre-industrial levels by 2100 — well above the 1.5°C and 2°C thresholds enshrined in the Paris Agreement.¹⁶ The UNEP Emissions Gap Report 2023 calculates that achieving the 2°C target requires global emissions reductions of at least 28% relative to current policy trajectories by 2030.¹⁸

2. Biodiversity Loss and Ecosystem Degradation

The Global Biodiversity Framework adopted at COP-15 in Montreal (2022) identified biodiversity loss as one of the three planetary crises facing humanity alongside climate

change and pollution. Current extinction rates are estimated to be between 100 and 1,000 times higher than background rates, with over 500 vertebrate species now critically endangered. The loss of ecosystem services — clean water, soil fertility, pollination, climate regulation — represents an existential threat to food security and human well-being that is increasingly quantified in economic terms.

3. Transboundary Pollution

Air pollution — including particulate matter (PM 2.5), ground-level ozone, and nitrogen dioxide from industrial, agricultural, and transport sources — kills an estimated 7 million people annually according to WHO data, making it the world's single largest environmental health risk.¹⁷ Ocean plastic pollution, chemical contamination of groundwater systems, and nuclear fallout represent further dimensions of transboundary pollution whose governance requires internationally coordinated responses.

C. Environmental Threats in Yemen

Yemen's environmental situation demands specific attention because it represents an acute confluence of pre-existing structural vulnerabilities and conflict-induced degradation that has overwhelmed whatever institutional capacity existed.

Yemen's Principal Environmental Vulnerabilities

Water scarcity: Yemen ranks 12th globally in water stress severity, with 80% of available supply already extracted. WRI projections indicate 100% water stress by 2050 if current trends continue. Approximately 18 million people lack reliable access to safe drinking water.

Desertification: Approximately 97% of Yemen's land area is affected by desertification to varying degrees, exacerbated by the conflict's destruction of agricultural infrastructure and widespread landmine contamination of farmland.

Waste crisis: UNDP assessed daily per-capita solid waste generation at 0.55–0.65 kg in urban areas (2015), with collection rates below 65% in major cities and as low as 5% in rural areas, generating acute public health risks.

Conflict-induced damage: A decade of armed conflict has destroyed water treatment infrastructure, contaminated soil and groundwater with unexploded ordnance and chemical residues, and produced over 39 million tonnes of rubble.

These vulnerabilities are compounded by Yemen's limited institutional capacity: a shortage of trained environmental professionals, the near-total suspension of international environmental financing following the outbreak of conflict in 2015, and the collapse of central state authority. Yemen ratified the UNCCD but has been unable to implement its

obligations; it has signed the Basel Convention but lacks the infrastructure for environmentally sound waste management; and it remains formally outside the Paris Agreement.¹¹¹²

VI. Legal Mechanisms of International Environmental Cooperation

The legal architecture of international environmental cooperation comprises hundreds of multilateral and bilateral treaties, customary international law principles, and "soft law" instruments. As Bodansky observes, international environmental law is one of the most productive fields of international lawmaking: since the early 1970s, states have concluded more than 500 MEAs addressing topics from climate change to biodiversity to hazardous waste management.²² This section analyses the most significant legal instruments grouped by environmental domain.

A. Atmospheric Protection Agreements

1. The Vienna Convention (1985) and the Montreal Protocol (1987)

The Vienna Convention for the Protection of the Ozone Layer (1985) established the international framework for ozone protection, creating a system of regular meetings, scientific assessment, and cooperative research. Its operational instrument — the Montreal Protocol (1987) — is universally ratified and is widely considered the most successful environmental treaty in history: under its auspices, the atmospheric concentration of ozone-depleting substances has been reduced by approximately 99%, and the ozone layer is projected to recover to pre-1980 levels by mid-century.²⁵ The Montreal Protocol's success is attributable to several design features: mandatory phase-out schedules backed by trade measures, a Multilateral Fund providing financial transfers to developing countries, and a non-confrontational compliance mechanism.

2. The UNFCCC (1992), Kyoto Protocol (1997), and Paris Agreement (2015)

The UNFCCC (1992) established the overarching framework for addressing climate change with the objective of stabilizing greenhouse gas concentrations "at a level that would prevent dangerous anthropogenic interference with the climate system".²⁶ The Kyoto Protocol (1997) operationalized this by imposing legally binding quantified emission-limitation commitments on developed states, though its effectiveness was undermined by the United States' non-participation and Canada's withdrawal.

The Paris Agreement (2015) — negotiated through a "bottom-up" nationally determined contribution (NDC) architecture — achieved near-universal participation (184 signatories) by sacrificing binding emission targets in favour of binding procedural requirements: each

party must submit an NDC, regularly update it with increased ambition, and report transparently on implementation.²⁸ The Agreement's fundamental challenge is the massive gap between stated NDCs and the emissions trajectories required to achieve its temperature goals.

B. Biodiversity and Land Degradation Instruments

1. The Convention on Biological Diversity (CBD, 1992)

The CBD (1992) established a comprehensive framework for biodiversity conservation, sustainable use, and equitable benefit-sharing from genetic resources. The Kunming-Montreal Global Biodiversity Framework (2022) extended the CBD's operational programme, adopting the "30x30" target (protecting 30% of land and ocean by 2030) and establishing a Global Biodiversity Fund.

2. The Basel Convention (1989)

The Basel Convention (1989) regulates transboundary movements of hazardous wastes, prohibiting their transfer to countries that have banned imports and requiring environmentally sound management in destination countries. The 2019 Basel Convention amendments extended coverage to plastic waste — a rapidly growing transboundary pollution concern.²⁹

3. The UNCCD (1994)

The UNCCD (1994) is the only binding international instrument addressing desertification and land degradation, establishing the framework within which Yemen — severely affected — has committed to national action programmes. Its provisions include obligations for developed parties to provide financial resources and technology transfer to affected developing countries.³¹

C. Marine Environmental Instruments

1. UNCLOS (1982)

The United Nations Convention on the Law of the Sea (UNCLOS, 1982) — described as "a constitution for the oceans" — establishes in Part XII a comprehensive framework for marine environmental protection. Article 192 imposes a general obligation on all states to protect and preserve the marine environment; Article 194 requires states to take all measures necessary to prevent, reduce, and control marine pollution from any source.³⁰ UNCLOS has been ratified by more than 167 states and the EU, giving it near-universal scope.

D. Regional Environmental Instruments

1. The Barcelona Convention System

The 1976 Barcelona Convention for the Protection of the Mediterranean Sea (amended 1995 as the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean) represents one of the most sophisticated regional environmental regimes, comprising the framework convention and seven protocols addressing pollution from ships, dumping, land-based sources, offshore activities, specially protected areas, transboundary movements of hazardous wastes, and emergency response.³²

2. The Kuwait Regional Convention (1978)

Particularly relevant to Yemen given its Arabian Sea coastline, the Kuwait Regional Convention established a cooperative framework for marine environmental protection in the Persian Gulf and Gulf of Oman. Its Regional Organization for the Protection of the Marine Environment (ROPME) coordinates scientific monitoring and emergency response.³³

3. Convention on LRTAP (1979)

The Convention on Long-range Transboundary Air Pollution (1979, under UNECE auspices) established the first international framework specifically addressing transboundary air pollution, with eight protocols progressively tightening limits on sulphur dioxide, nitrogen oxides, volatile organic compounds, persistent organic pollutants, heavy metals, and particulate matter (including black carbon, added by the 2012 amendment to the Gothenburg Protocol).³⁴

VII. Executive Mechanisms: Conferences and International Organizations

A. Landmark Global Environmental Conferences

1. Stockholm Conference on the Human Environment (1972)

The 1972 Stockholm Conference was the first occasion on which the international community convened at the level of heads of government to address environmental issues. Its Declaration — comprising 26 principles — established the foundational normative framework for international environmental law. Principle 21 is of particular significance: it affirms states' sovereign right to exploit their own resources while imposing the responsibility not to cause damage to the environment of other states or of areas beyond national jurisdiction — a formulation that has been accepted as customary international law.³⁵

2. Rio Earth Summit (1992)

The 1992 Rio Conference produced the most ambitious package of international environmental commitments ever achieved at a single event: the Rio Declaration (27 principles), Agenda 21 (an action plan for sustainable development), and the opening for signature of the UNFCCC and CBD. The Rio Declaration introduced or consolidated several key principles — precautionary approach, polluter pays, public participation, and CBDR — that have since become foundational to international environmental law.³⁶

3. Johannesburg World Summit on Sustainable Development (2002)

The 2002 Johannesburg Summit, attended by more than 20,000 participants, reaffirmed the Rio commitments and produced the Johannesburg Plan of Implementation establishing time-bound targets across water, energy, health, agriculture, and biodiversity. Its most significant conceptual contribution was the explicit integration of poverty eradication as an indispensable component of sustainable development — recognizing the political implausibility of environmental protection divorced from social development.³⁷

B. Principal International Environmental Organizations

1. United Nations Environment Programme (UNEP)

Established by the UN General Assembly following the Stockholm Conference, UNEP serves as the principal intergovernmental body responsible for coordinating UN environmental activities and providing leadership and encouraging partnership in caring for the environment. UNEP's functions include: scientific assessment and early warning through its flagship State of the Global Environment reporting; normative development through the convening and servicing of MEA negotiations; capacity-building for developing countries; and advocacy for environmental mainstreaming across the UN system.⁴³

UNEP's institutional limitations are widely acknowledged: its governing body (the UN Environment Assembly, upgraded from the Governing Council in 2013) has universal membership but no binding decision-making authority; its financial base is highly dependent on voluntary contributions; and its operational mandate does not extend to enforcement. These structural constraints have led to repeated calls — as yet unimplemented — for an upgrade to a specialized agency with a broader mandate and assessed budget contributions.

2. International Atomic Energy Agency (IAEA)

The IAEA (established 1957, based in Vienna, 178 member states) bears particular relevance for environmental security through its mandate to ensure that nuclear technology is used for peaceful purposes only, and that nuclear and radiological materials and installations are protected from environmental contamination. Yemen became an IAEA member state in 1994 and signed a Framework Programme Agreement in July 2024 focusing on peaceful nuclear applications in health and food security sectors.

3. Food and Agriculture Organization (FAO)

The FAO (established 1945, headquartered in Rome) contributes to environmental security through its work on sustainable agriculture, fisheries management, forestry conservation, and desertification combating. The FAO serves as the secretariat of the UNCCD's work programme related to land and soil, and in 2024 administered GEF-funded projects worth USD 2.9 billion targeting degraded land restoration, sustainable fisheries, and emissions reduction in food systems.

4. World Health Organization (WHO)

The WHO contributes to environmental security by linking environmental quality to public health outcomes — establishing international standards for ambient air quality, drinking water quality, and permissible exposure to hazardous substances — and by documenting the health burden of environmental degradation. WHO's Global Burden of Disease estimates attribute approximately 13 million deaths annually to preventable environmental causes.¹⁷

5. International Maritime Organization (IMO)

The IMO (established 1948, operational 1959, headquartered in London) is the UN specialized agency with responsibility for the safety and security of shipping and the prevention of marine pollution. The 2023 IMO Revised GHG Strategy commits the shipping sector to net-zero greenhouse gas emissions by or around 2050, with interim milestones of 40% emissions reduction by 2030 compared to 2008 levels.⁴⁴

C. Regional Organizations

1. European Union

The EU represents the most advanced example of regional environmental integration, combining binding environmental legislation (directives and regulations with direct effect in member states), a functioning market for carbon emissions (ETS), the European Green Deal as a framework for economy-wide decarbonization, and a common external environmental policy. The EU's Environmental Liability Directive operationalizes the

"polluter pays" principle at regional level, while its Taxonomy Regulation defines sustainable economic activities for investment purposes.

2. African Union

The AU has progressively strengthened its environmental engagement: the African Convention on the Conservation of Nature and Natural Resources (adopted 1968, revised 2003) provides the legal foundation; the AU's Climate Change and Resilient Development Strategy and Action Plan (2022-2032) translates AU climate commitments into an operational framework; and the African Ministerial Conference on the Environment (AMCEN) provides the political platform for regional coordination of positions in global environmental fora.

3. League of Arab States

The Arab States' Council of Ministers Responsible for the Environment (established 1987 following the adoption of the Arab Declaration on Environment and Development) provides a ministerial-level coordination mechanism for regional environmental policy. The Council's most recent sessions have focused on water security, desertification, the Middle East Green Initiative, and preparation for UNCCD COP16. For Yemen, the League's potential as a platform for mobilizing regional support for environmental recovery from the conflict remains underexplored.⁴⁹

VIII. Global Environmental Governance: Structural Dimensions

A. The Problem of Fragmentation

One of the most significant structural challenges confronting international environmental governance is fragmentation: the proliferation of separate, sectoral MEAs — each with its own conference of parties, secretariat, reporting requirements, and compliance mechanism — without adequate coordination or integration. The International Law Commission identified fragmentation as a systemic risk to international law in its 2006 report, noting that competing normative frameworks generate uncertainty about applicable obligations and can be manipulated by states to escape accountability.

The practical consequences of fragmentation in the environmental domain include: duplication of monitoring and reporting obligations that burden developing states' limited administrative capacity; inconsistency between the rules of different regimes (e.g., WTO trade rules vs. MEA trade measures); and the inability to generate synergies between related issues — for example, between climate change mitigation and biodiversity conservation — that are addressed in separate institutional silos.

B. Finance Gap and Equity

International environmental governance is characterized by a persistent and growing finance gap. UNEP's 2023 Adaptation Gap Report found that developing countries' adaptation finance needs exceed available public international finance flows by a factor of 10 to 18 — itself a 50% upward revision compared to previous estimates. Current bilateral and multilateral adaptation finance to developing countries stands at approximately USD 21 billion annually — against estimated needs of USD 215-387 billion. This gap has political as well as financial dimensions: it reflects the asymmetry between the distributions of responsibility for environmental damage and the capacity to address its consequences.¹⁸

C. The Role of Non-State Actors

Contemporary global environmental governance is no longer the exclusive preserve of states and intergovernmental organizations. Non-state actors — transnational corporations, civil society organizations, scientific networks, cities, subnational governments, and faith communities — play increasingly significant roles in shaping environmental outcomes, both positively (through innovation, advocacy, and voluntary commitments) and negatively (through lobbying against stringent regulation and enabling illegal environmental exploitation).³⁹

The Paris Agreement formally acknowledges the role of non-party stakeholders through the Global Climate Action (Marrakech Partnership) framework, under which thousands of non-state actors have registered voluntary commitments. Critical assessments of these commitments, however, note significant concerns about greenwashing, accountability gaps, and the absence of third-party verification — issues that parallel debates about corporate environmental social responsibility more broadly.

D. Corruption as a Governance Failure

Environmental governance is significantly undermined by corruption, which operates through multiple channels: bribery of regulatory officials to obtain permits for illegal resource extraction; capture of environmental agencies by regulated industries; embezzlement of environmental funds; and collusion between political elites and criminal networks engaged in wildlife trafficking, illegal logging, and waste dumping. The UN Convention Against Corruption (UNCAC) Conference of States Parties, in Decision 8/12 (2019), specifically addressed the relationship between corruption and environmental crime, calling on states to prevent, investigate, and prosecute corruption that facilitates

environmental offences. For Yemen, the near-total collapse of regulatory institutions has created conditions in which environmental exploitation — including unregulated groundwater extraction and uncontrolled waste disposal — proceeds without accountability.

IX. Findings and Conclusions

This paper has examined international cooperation in achieving environmental security across its conceptual, legal, and institutional dimensions. The following findings emerge from the analysis.

Finding 1: Necessity of International Cooperation

International cooperation for environmental security is not a diplomatic option but a structural necessity: the ecological, security, and justice rationales for cooperation converge to create an overwhelming imperative for coordinated multilateral action. States that attempt to manage transboundary environmental threats through unilateral measures systematically underperform, and the costs of non-cooperation — measured in lives lost, ecosystems degraded, and conflicts fuelled — continue to mount.

Finding 2: Incomplete Normative Integration

Despite the impressive breadth of the international legal architecture for environmental protection, its effectiveness is structurally compromised by normative fragmentation: the rules of international environmental law operate alongside — and are frequently subordinated to — the rules of international trade law, investment law, and customary law on state sovereignty, without adequate mechanisms for resolving conflicts in favour of environmental obligations. Normative integration — embedding environmental security within the framework of international peace and security — is the governance imperative most urgently requiring attention.

Finding 3: Implementation and Compliance Deficit

The most significant gap in international environmental governance is not the absence of legal rules but the failure to implement and comply with those that exist. Implementation deficits reflect: the absence of binding enforcement mechanisms in most MEAs; the structural unwillingness of major powers to accept binding compliance procedures; inadequate technical and financial support for developing-country implementation; and the corrosive effect of corruption on domestic regulatory systems. Bridging the gap between legal obligation and actual performance requires investment in monitoring systems, compliance facilitation, and — selectively — credible sanctions.

Finding 4: Yemen as a Case Study in Governance Failure

Yemen illustrates the catastrophic consequences of the intersection between pre-existing environmental vulnerability, conflict-induced governance collapse, and inadequate international support. A state that contributes minimally to global environmental problems faces some of their most severe consequences, without the institutional capacity to respond effectively or access the financial resources needed for adaptation. Yemen's environmental crisis — water depletion, desertification, waste accumulation, and conflict-induced contamination — demands a coordinated international response that treats environmental governance not as a post-conflict luxury but as an integral component of conflict resolution and state-building.⁴⁶⁴⁸

Finding 5: Finance Gap as Structural Injustice

The persistent gap between developed-country financial commitments to developing-country environmental adaptation and the actual financing flows represents not merely a technical shortfall but a structural injustice: it reflects the failure of the states most responsible for cumulative global environmental damage to meet their obligations under the CBDR principle. Closing the finance gap requires not only quantitative increases in climate and environmental finance but qualitative improvements in accessibility, conditionality reform, and governance of international financial mechanisms.

X. Policy Recommendations

A. Strengthening the International Legal Architecture

1. **Normative integration:** Amend WTO rules to create a safe harbour for bona fide MEA-mandated trade measures; negotiate a global environmental constitution that hierarchically subordinates economic law to ecological limits.
2. **Universal ratification:** Intensify diplomatic efforts to achieve universal ratification of key MEAs, particularly the Paris Agreement, the Kuming-Montreal GBF instruments, and the BBNJ Agreement (High Seas Treaty).
3. **Specialized environmental judiciary:** Establish a permanent International Environmental Court with compulsory jurisdiction, expert judges, and accelerated procedures for urgent environmental matters — building on the abandoned ITLOS Environmental Chamber model.
4. **Polluter pays operationalization:** Develop a legally binding framework operationalizing the polluter pays principle in cross-border contexts, including mandatory environmental liability insurance for high-risk industrial activities.

B. Institutional Reform

5. **UNEP reform:** Upgrade UNEP to a specialized agency with universal membership, an assessed budget, and expanded enforcement authority — the "World Environment Organization" model — while maintaining linkage to the broader UN system.
6. **MEA coordination:** Establish a treaty-wide coordination mechanism — a "cluster" approach — to rationalize reporting obligations, align compliance systems, and generate policy synergies across the biodiversity, climate, and chemicals MEA clusters.
7. **Non-state actor integration:** Develop internationally agreed standards for non-state actor environmental commitments, including third-party verification requirements and accountability frameworks to address greenwashing.

C. Finance and Capacity

8. **Closing the finance gap:** Developed countries must deliver on the USD 300 billion annual climate finance commitment made at COP29 (2024) and work toward a reformed, significantly scaled-up New Collective Quantified Goal for the post-2025 period.
9. **Access simplification:** Radically simplify the procedures for developing-country access to the GEF, GCF, and Adaptation Fund, including streamlined accreditation, direct access modalities, and targeted support for conflict-affected states.
10. **Green taxation:** Support the development of internationally harmonized carbon pricing mechanisms and green fiscal reform in developing countries, including revenue recycling toward environmental remediation and adaptation.

D. Yemen-Specific Recommendations

11. **Environmental peacebuilding:** Integrate environmental governance — particularly water management and desertification control — into Yemen peace negotiations and confidence-building processes, following the CARPO (2022) model.
12. **Legislative consolidation:** Upon stabilization, the Yemeni legislature should enact a comprehensive unified Environmental Protection Code, replacing the fragmented sectoral legislation currently in force, with strengthened enforcement mechanisms and penalties calibrated to the severity of violations.
13. **Institutional rebuilding:** Rebuild the General Authority for Environmental Protection with adequate budgetary resources, qualified staff, and operational independence — as a precondition for effective implementation of Yemen's MEA obligations.
14. **Regional engagement:** Utilize the Arab League's Council of Ministers Responsible for the Environment and the regional cooperation frameworks of the Kuwait Convention as platforms for mobilizing regional solidarity for Yemen's environmental recovery.

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