

Biodiversity, health science, and the human right to a healthy environment

Liz Willetts, Lora E Fleming, Elisa Morgera



Planetary health agendas need a strong human rights focus. Both public health and the human right to a clean, healthy, and sustainable environment depend on biodiversity, ecosystems, and a healthy biosphere. Targeted transdisciplinary health research, action, and communication on biodiversity–health linkages can clarify and reinforce the human rights obligations of public authorities whose decisions might negatively affect the environment. However, our observations across law, policy, science, and advocacy show that there is a void of transdisciplinary guidance on how to apply the human right to a healthy environment to impact policy and law. We introduce a biodiversity–health roadmap to the UN *Framework Principles on Human Rights and the Environment*. This roadmap is only a starting point to co-develop and mobilise knowledge and policy-driven research and action agendas across the health–environment nexus, and among science, policy, and law professionals. In this Personal View, we invite knowledge co-development among health and environmental sciences, environmental law, human rights, and policy advisors to steer, mobilise, and focus the health–environment nexus on human rights to support more effective and coherent public decisions.

Introduction

“A critical factor in the global nature crisis is that States and businesses have repeatedly failed to fulfil their commitments and have not been held accountable because of the weak enforcement mechanisms in international environmental law. International and domestic human rights law offer treaty bodies, courts, commissions, and processes for ensuring accountability.”¹

A new approach to valuing biodiversity is needed. The planetary health field can strategically champion and mobilise implementation on the human right to a clean, healthy, and sustainable environment (human right to a healthy environment) to mainstream valuation of nature for human health. Recent planetary health agendas have focused on biodiversity–health interlinkages from a global health perspective.^{2–5} For instance, The Rockefeller–*Lancet* Commission on Planetary Health focused on the mechanisms of impact on health, data in the context of economic analysis and modelling risk indicators, and the practicality of policy scenarios.² Comparing this landmark 2015 planetary health agenda to one by the Royal Netherlands Academy of Arts in 2023⁴ shows that the gaps in biodiversity–health interlinkages are largely the same, with little progress in addressing them.

The planetary health field could greatly benefit from incorporating the right to a healthy environment as an overarching framework. A human rights framing of planetary health addresses some of the governance challenges identified by Keune and colleagues at the environment–health nexus: assessing environmental impacts holistically, in all their inter-relations with diverse dimensions of human wellbeing; engaging evidence on environmental drivers; co-developing solutions across diverse knowledge and value systems; and unifying practice to operationalise transdisciplinary action.⁶ This framing could also drive transformation in global health partnerships by developing authentic

allyship and encouraging broader culturally appropriate planetary-based and ecosystems-based lenses into health professional practice.⁵

Environmental law, human rights law, ecology and environmental sciences, and health sciences are contributing in distinct, yet siloed, ways to safeguard planetary health.^{7,8} The health sciences can play a more substantial and strategic role in ensuring countries take “deliberate, concrete, and targeted measures towards the progressive realisation”⁹ of the right to a healthy environment.¹⁰ Health science is increasingly called upon to support climate justice and human rights activism.^{11,12} But there remains a major gap in policy and legal action with regard to realising a transdisciplinary health approach and connecting biodiversity–health interlinkages.^{13–16} This gap is even more pronounced with regard to marine biodiversity linkages with human health.^{17,18}

The normalisation of biodiversity-related and nature-related terminology across the health sciences is an important precondition for the co-development of integrated knowledge and action agendas. Despite numerous high-level advisories to champion nature as critical to human wellbeing and survival from economic institutions,^{19–21} science institutes,^{22,23} Indigenous peoples’ bodies,²⁴ and religious leaders,²⁵ among other networks, coherence in the understanding of the definition and interpretation of biodiversity terminology continues to be debated.²⁶ Panel 1 provides the science-policy definition of biodiversity in use under international environmental law that serves as the starting point for interdisciplinary engagement. Figure 1 shows how elements of biodiversity and health interlinkages have been recognised in intergovernmental science-policy dialogue.

Now is a crucial time to enable and mobilise the co-creation of medical and public health evidence at national and subnational levels to protect the human right to a healthy environment. Momentum for addressing biodiversity loss continues to grow worldwide. Countries seek to implement the *Kunming-Montreal Global*

Lancet Planet Health 2025;
9: e553–65

Inter-American Institute for Global Change Research, Clayton, Panama (L Willetts MEM); European Centre for Environment and Human Health, University of Exeter Medical School, Penryn, UK (Prof L E Fleming MD); Strathclyde University Law School, Glasgow, UK (Prof E Morgera PhD)

Correspondence to:
Liz Willetts, Inter-American Institute for Global Change Research, Clayton 07144, Panama
lizwilletts@gmail.com

Biodiversity Framework adopted in 2022.³⁸ International businesses are planning for environmental instability from biodiversity loss and ecosystem collapse.¹⁹ Experts seek to strengthen the environmental dimension of One Health approaches.³⁹ UN institutions look to incorporate planetary boundaries and planetary health risks into their vision.⁴⁰ Advocacy movements work to recognise ecological limits and the human right to a healthy environment in national constitutions.^{40–42}

Panel 1: Defining biodiversity for science and policy

Biodiversity can be understood as the variability and interconnectedness of life on Earth and of ecosystems across terrestrial, aquatic, and marine environments.²⁷ Biodiversity underpins healthy ecosystem functioning, including basic environmental determinants of health (eg, water, food, air, soil, and healthy oceans),²⁸ and, therefore, underpins public health. The biosphere is the life-supporting system on our planet.²⁹ The various human interactions with nature (eg, biological and cultural diversity and the links between them) are also considered part of biodiversity.³⁰

Biodiversity–health interlinkages have a role in the direct state of human health and across the prerequisites³¹ or environmental determinants for health. Biodiversity–health interlinkages can be assessed across different value systems, and have been to varying extents,^{32–34} but the value of nature for health in decision making still predominantly focuses on market-based approaches.³⁵

In science-policy contexts, the operable definition of biodiversity adopted and used by 196 governments is, “the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems”.²⁷

Over the last 50 years, substantial growth in environmental laws worldwide has not been matched by more effective environmental protection.^{18,43,44} Deep, durable change in values and behaviour and a shared commitment to protect the landmark adoption of the human right to the environment are needed worldwide.⁴⁵ Our priority is to equip the health sector with structure and strategy to co-generate, jointly apply, and exchange knowledge across disciplines and sectors towards fulfilment of the right to a healthy environment.^{45,46} We target health, environment, science, policy, and law professionals, and also funders, communicators, and stakeholders working at the planetary health nexus. The gaps described are a common problem. We hope to catalyse transdisciplinarity at the nexus of science, policy, and law of planetary health, biodiversity, and human rights.⁴⁷

A human right to a healthy environment

The international recognition of everyone’s human right to a healthy environment by the UN General Assembly (UNGA) in 2022 earned worldwide media attention, although this right had already been incorporated into most national constitutions^{18,48,49,50} and protected under many international and regional human rights treaties.¹⁰ Since the UNGA adoption, this human right has been cited in multilateral environmental agreements on climate change,⁵¹ biodiversity,³⁸ and chemicals,⁵² and in specific guidance on children’s human rights.⁵³

This inclusion shows the explicit commitment of the international community to connect efforts to protect the environment and human rights. But will this commitment lead to more effective protection and true accountability? Implementation of the right to a healthy environment at any scale depends not only on legislation, budgeting, planning, monitoring, assessment, and

Environmental determinants of health	Direct state of health
• Air quality^{28,30,36} • Freshwater^{28,30,36} and coastal water quality³⁰ • Food and water security,^{28,36} soil quality,³⁶ fertility, and degradation or storage of pollutants³⁰ • Agricultural biodiversity,^{28,36} pollination and seed dispersal^{30,36} • Food and feed production from wild, managed, or domesticated organisms on land and in the ocean^{30,36} or nutrition^{28,36} • Habitat (ecological conditions necessary or favourable for human life)³⁰ • Learning (education, knowledge acquisition, and inspiration for art and technological design (eg, biomimicry)³⁰ • Regulation of planetary boundaries including climate,^{30,36} ocean acidification,^{30,36} hydrological cycles,³⁰ and synthetic chemical substances³⁶ • Sustainable development²⁸	• Disaster risk, hazards, and extreme events^{28,30,36} • Infectious diseases^{28,36} • Microbial diversity,²⁸ regulation of pests,³⁶ pathogens,³⁶ predators, competitors, parasites, and potentially harmful organisms³⁰ • Mental health,^{28,36} depression,³⁶ emotional wellbeing, stress,³⁶ healing*,³⁰ relaxation, recreation, leisure, and aesthetic enjoyment based on close contact with nature³⁰ • Intrinsic interconnection and supporting identities:³⁰ basis for religious, spiritual, and social cohesion experiences; sense of place, purpose, belonging, rootedness or connectedness, associated with different entities of the living world; narratives and myths, rituals and celebrations; satisfaction derived from knowing that a particular landscape, seascape, habitat or species exists; and cultural identities³⁶ • Biomedical and pharmaceutical discovery, traditional medicine,^{28,36} and medicinal,³⁶ biochemical, and genetic resources^{30,36}

Figure 1: Biodiversity–health interlinkages recognised by the UN

Here we aggregate specific biodiversity–health interlinkages recognised in UN intergovernmental processes, including those adopted by plenaries of the Intergovernmental Science Policy Platform on Biodiversity and Ecosystem Services in 2019³⁰ and 2024,³⁶ as well as those published in a joint report of WHO and the Convention on Biological Diversity in 2015,²⁸ commissioned by parties to the Convention in 2014.³⁷ Not all interlinkages were recognised in each policy document. The table identifies which biodiversity–health interlinkages were acknowledged in each process, highlighting areas of policy progress as well as inconsistencies and gaps. *The term healing was adopted in the plenary negotiation for the Intergovernmental Science Policy Platform for Biodiversity and Ecosystem Services in 2019 and refers to the idea that greenery—such as that found in hospitals—can support patient recovery and positive exposure to nature can improve mental wellbeing.

enforcement, but also on litigation in the case of insufficient efforts by public authorities or violations by private actors. Evidence on the interdependence of health and biodiversity is critical in both decision making and judicial processes.

The strong rule of law is positively associated with good environmental quality.⁴⁹ Through collaboration, the health sector can—and should—support stronger environmental rule of law. Extensive national and sub-national level investigations concluded that the right to a healthy environment is insufficiently integrated into the finance and health sectors.⁴⁹ This lack of integration is supported by varied analyses showing gaps in the health sector's role in biodiversity governance, including science,⁵⁴ policy,⁸ national implementation,^{55–57} and behaviour-change expertise.⁵⁸ There are significant gaps in mainstreaming the human right to a healthy environment into public health programmes, research agendas, dialogues, and policy decisions, and in general, in health sector awareness within health institutions, strategies, priorities, and normative frameworks. The scarcity of information compromises the accountability of states—to be understood as public authorities at all levels that are responsible for legislation, budgeting, planning, monitoring, assessment, enforcement, and access to justice—and businesses.¹⁸

Biodiversity is central to the human right to a healthy environment (panel 1).^{59,60} This is clear in how the 2022 *Kunming-Montreal Global Biodiversity Framework*³⁸ and the human right to the environment have a lot in common. The framework is an environmental blueprint that covers land, freshwater, and sea use, animal and plant species, climate change, food systems, pollution, and cultural diversity.³⁸ The framework emphasises that sound biodiversity strategies and policies contribute to the protection of everyone's human right to a healthy environment. The human right to a healthy environment includes the right to clean air, a safe climate, healthy ecosystems and biodiversity, safe and sufficient water, non-toxic environments, and healthy and sustainable food.⁵⁹ This human right also encompasses access to information, public participation in decision making, and access to justice.

However, the understanding in human rights law of biodiversity–health interlinkages lags behind other components (eg, air, climate, water, food, and a non-toxic environment) of the human right to a healthy environment. Two foundational UN reports on human rights and the environment did not elaborate on biodiversity–health interlinkages, from the microbial to planetary level and across ecosystems.^{61,62} As might be expected, evidence of the effects of biodiversity loss on human health is used in a limited way to support more effective decisions on the environment and human rights.^{63,64} This evidence is also used, to a limited extent, to hold public authorities accountable for not sufficiently protecting human rights when decisions that negatively affect the environment are made.⁶⁵

When the health of the environment is undermined, it can affect other human rights, such as the rights to health, life, food, water, livelihoods, culture, security, and dignity.^{60,62} Infringement of the right to a healthy environment can also have distinctive impacts on Indigenous peoples' rights and on the human rights of other communities due to their historical and continued connections to places and direct reliance on natural resources.⁶⁶ In addition, more severe effects continue to be documented on the human rights of women, children, older people, people with disabilities, and displaced people. In this way, implementing the right to the environment plays a role in determining health equity.

By co-developing strategies across public health, environmental sciences, and environment and human rights, legal experts can ensure mutual understanding of current barriers to implementing this right. States have human rights obligations to protect the human right to the environment. One obligation is ensuring due process procedures, such as identifying which rights-holders and knowledge-holders should be included in decisions that could affect the implementation of the right. For instance, states must identify relevant rights-holders who might be negatively impacted by public authorities' decisions on the environment and identify relevant knowledge-holders who can contribute to clarifying how to protect a clean, healthy, and sustainable environment.

A second obligation of states is ensuring protection, substantively, by identifying and addressing specific risks. This obligation includes identifying: what feature or area of an ecosystem is at risk; which harm should be prevented (eg, disease avoided or human risk reduced from a healthy environment, or loss of benefit obtained from conservation or ecological restoration); and who is vulnerable to environmental degradation. Mobilising transdisciplinary health knowledge around these two obligations would ensure the planetary health field is policy-relevant at any level and oriented to support public authorities in making decisions that are good for the environment and human health. Although sharing terminologies might be difficult and time consuming, it builds the foundation for transdisciplinary research, communication, action, and exchange across professions.

A report by the UN Special Rapporteur on Human Rights and the Environment, the 2018 *Framework Principles on Human Rights and the Environment*,⁶⁷ serves as a guidance document for governments on their human rights obligations related to a healthy environment. The framework principles summarise various sources of international human rights law on the duties of public authorities. These duties include providing information to citizens, assessing effects on the environment before making decisions, and regulating potentially harmful activities. They also outline the responsibility of business sectors to respect the human right to a healthy

For more on sustainable development goals see <https://sdgs.un.org/goals>

environment. Overall, the framework principles are intended to guide the development of legislation, budgeting, planning, monitoring, assessment, enforcement, and access to justice. However, the framework principles have not been formally integrated into the health sector or scientific community practices, limiting coordinated research, action, and communication among professionals.

Global governance of the biodiversity–health nexus

The state of global governance at the biodiversity–health nexus shows gaps and opportunities for stronger coordination across disciplines, policy bodies, and in implementation. A common issue is that existing frameworks are underused, or that key actors, institutions, and in the case of health, entire sectors, remain unaware of opportunities. Fragmentation in governance indicates inconsistent awareness and valuation of biodiversity for health.

Health and environmental sciences

Worldwide, communities of practice in environment and health have varying levels of awareness of the concepts and importance of biodiversity–health interlinkages, although both fields show limited integration. The mobilisation of knowledge across fields on biodiversity and health is also limited in policy, education, and training, among other areas.^{6,8,54,68} Human rights advocates engage less with biodiversity and ocean-related governance and these policy processes have been less robustly tracked by civil society health organisations.⁵⁵

Although some credit can be given to the various frameworks of ecological public health, One Health, planetary health, and even ecosystem services (ie, nature's contributions to people), currently biodiversity–health interlinkages remain underdeveloped and under-recognised.^{69–73} This neglect results in clear gaps in integrated governance and implementation. Planetary health is still considered an emerging field⁴ and the environmental dimension of One Health is not yet clear or operable in research,⁷⁴ frameworks,⁷⁵ networks,⁷⁶ or governance.⁷⁷ One underlying reason for this absence of progress is likely to be that most higher education institutions in public health and the medical sciences do not provide programmes or degrees on the social science aspects of biodiversity.⁷⁸

Moreover, leading global health institutions continue to leave out the state of the natural environment, including ecosystems and biodiversity, in central aspects of their guidance. This omission is the case for WHO's *Global Strategy on Health, Environment, and Climate Change*,⁷⁹ and *The Lancet Commission on Global Mental Health*.⁸⁰ Both the strategy and commission leave out the UN sustainable development goal (SDG) 14 (marine ecosystems) and 15 (terrestrial ecosystems) when identifying synergies with the SDGs.

Although the body of literature continues to grow, there is a tendency to orient around specific health elements linked to a geographical location (eg, urban green space³⁸) or individual species (eg, wildlife, microbe, tree, or crop). This zoom-in approach is also apparent with the use of the Intergovernmental Science Policy Platform for Biodiversity and Ecosystem Services' (IPBES) framing of “nature's contributions to people”⁷³ that are typically interpreted (similar to ecosystem services) as a list rather than a cohesive whole. This interpretation is problematic because it avoids the broader consideration of biodiversity as a holistic concept involving an inseparable range of health–environment interlinkages, as defined by the Convention on Biological Diversity (CBD; ie, to consider ecosystem integrity, diversity of interspecies and intraspecies relationships, and biocultural diversity; panel 1).

The biodiversity conservation community has also tended to describe ecosystem services without translating them into specific human health outcomes, such as the incidence and potential prevention of chronic diseases.⁸¹ It is more common to find analyses of biodiversity and health on individual elements, and this means some benefits or costs are overlooked when decisions are considered. More attention is needed to ensure that knowledge-holders, rights-holders, and decision makers consider the range of known interconnections between ecosystem integrity and access to positive experiences of nature. These interconnections include: their impacts on health status (communicable and non-communicable diseases) and wellbeing; health determinants, social cohesion, and health equity;^{2,28,30,37,69,82–84} acute and chronic physical conditions; and psychological, cognitive, and developmental health.^{70,85,86}

Several science-policy reports and resources can be taken up more broadly to advance integrated learning. The state of knowledge review on biodiversity and human health,²⁸ commissioned by parties to the CBD in 2014, continues to serve as the authoritative UN guide to the field and could be used by more institutions.²⁸ A new database of science-policy tools and resources on biodiversity and health, published by the CBD in 2024, could serve as a foundation for transdisciplinary efforts.⁸⁷ Several intergovernmentally adopted IPBES reports could be better acknowledged in the health sciences and environmental law. The IPBES 2019 *Global Assessment Report* recognises systems-regulating, material, and non-material functions of biodiversity for health, unequal access to these functions, and unequal effects of the state of these functions on different social groups, including on disability-adjusted life years (figure 1).^{30,81} A 2024 report adopted by IPBES on the nexus of biodiversity, water, food, and health has potential for more inter-institutional policy impact.³⁶ However, this potential impact will also depend on whether the IPBES assessment is incorporated into building national public health capacity, an aspect

generally neglected in outreach of previous IPBES reports.

Stronger policy architecture is needed to drive this work. Permanent institutional structures (eg, long-term and staff positions for integrated expertise) under the CBD and WHO have yet to materialise. An inaugural World Health Assembly resolution on biodiversity and a decision to commit to implementation, monitoring, and evaluation of CBD health decisions would catalyse the field.⁸⁸ Lamentably, despite strong institutional support in the past,⁸⁹ the WHO *14th General Programme of Work 2025–28* adopted in May, 2024, does not explicitly recognise the independent role of biodiversity or the human right to a healthy environment.⁹⁰

Environmental law

There is poor understanding in environmental law of the full spectrum of biodiversity–health interlinkages, and rare engagement in biodiversity litigation to hold authorities accountable.^{60,91,92} Most legal attention has focused on the role of biodiversity for medical innovation⁹³ or infectious disease and pandemic prevention.⁹⁴ The crucial links between marine biodiversity, climate change, and human rights have recently become clearer in international environmental law, human rights, and the law of the sea.¹⁸ However, the human health implications of marine biodiversity compared with those of terrestrial biodiversity are generally under-recognised across different international policy processes.^{95,96}

This pattern of overlooking biodiversity–health interlinkages in policy and law continues despite biodiversity being recognised for its social impact across UN institutions. For instance, the UN Office for Disaster Risk Reduction recognises nature's role in supporting community and population resilience;⁹⁷ the CBD's *Kunming-Montreal Global Biodiversity Framework* acknowledges nature as a determinant of health;³⁸ and the UN framework convention on climate change recognises the role of nature in human adaptation.⁹⁸ These conclusions have not mobilised broad uptake, action, research, or funding on biodiversity–health interlinkages. Thus, it is widely observed that decisions leading to biodiversity degradation are often made with weak consideration of the knock-on effects on human health and related human rights.⁹⁹

Unchecked powers across industries limit due diligence on biodiversity–health interlinkages across supply chains.¹⁰⁰ At the same time, states need more support to strengthen the awareness of, and obligations to, the human right to a healthy environment within the private sector.¹⁰⁰ There is also room to improve the reporting of business performance, lobbying, donations, and commercial determinants of health that impact biodiversity–health interlinkages^{100,101} and to raise greater awareness of good business practices.¹⁰²

The *Global Action Plan on Biodiversity and Health*, adopted by 196 parties to the CBD in November, 2024, is

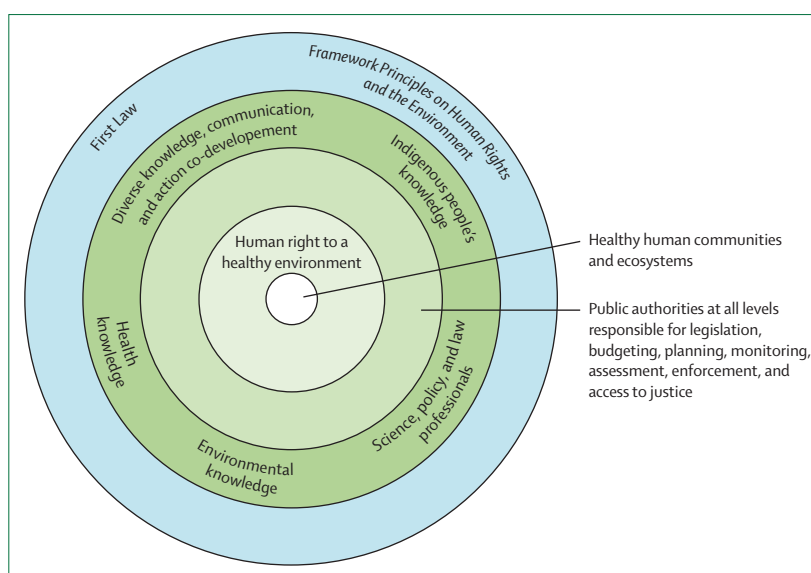


Figure 2: Unifying human rights and transdisciplinary knowledge-holders to support public authorities for stronger outcomes in healthy communities and ecosystems

Adapted with permission from Redvers and colleagues.¹¹¹ This figure is not intended to replace or update the graphic by Redvers and colleagues,¹¹¹ but rather to illustrate the procedural and substantive coordination needed to achieve the UN human right to the environment, with emphasis on co-development.

hoped to invigorate engagement across science, policy, and law related to biodiversity–health interlinkages.¹⁰³ The plan recognises the right to health and the right to the environment, but it will be up to countries to implement these rights jointly. Consideration of human health under the CBD has developed in breadth and depth over the past two decades, but overarching and national commitments have stalled for years.^{8,72,104} At the national level, biodiversity strategies and action plans largely fall short of incorporating human health elements.^{55,105,106} This shortfall could be explained by the fact that major reviews of CBD implementation have shown limited consideration or involvement of the health sector.^{56,57,105}

Worldwide, broad uptake of co-developed knowledge on biodiversity–health interlinkages can inform the governance of planetary health at any scale. Various initiatives are emerging to advance the concept of ecocide.¹⁰⁷ However, these efforts are still behind when it comes to incorporating the science of planetary boundaries into climate and environmental laws or policies.⁴⁹ For example, efforts to bring ecological limits into one European national constitution in 2025 proved unsuccessful.⁴¹ There are increasing calls to apply planetary boundaries as a means to strengthen human rights law and to clarify the duties of states to protect the human right to a healthy environment in this context.¹⁰⁸ In addition, the UN Special Rapporteur on the Human Right to a Healthy Environment has called for further mainstreaming of this right, and for it to encompass planetary boundaries and planetary crises.¹⁰⁹

Improved coordination among health, environment, science, policy, human rights, and law professionals

builds the capacity to take biodiversity–health interlinkages into account in the valuation of nature. In addition, it advances knowledge mobilisation in decision making across fields and institutions. Although transdisciplinary experts recognise that knowledge generation needs to be driven by societal need and demand,¹¹⁰ guidance on how to do so while encompassing a planetary health perspective is lacking. In this context, we propose that a human rights framing should gauge and guide shared understanding of societal need and demand regarding biodiversity–health interlinkages across science, policy, law, academia, and among stakeholders and rights-holders (figure 2).

A human rights backbone for planetary health

To achieve a stronger human rights approach to its scope, we suggest planetary health research and action agendas—along with their underlying theories of change and the outputs they generate or catalyse—should aim to respond to the needs identified in human rights advisories, such as those issued by the UN High Commissioner for Human Rights and the independent UN Special Rapporteurs on Human Rights and Water, Food, Toxics, Climate Change, and the Environment and through their periodic calls for inputs. These agendas should also be informed by the proceedings and outcomes of multiple intergovernmental environmental forums—for example, those on biodiversity, ocean, land, climate change, chemicals, and disaster risk—particularly where the human right to the environment is recognised.⁸

At the same time, planetary health agendas should consider the risks as well as the benefits and opportunities that biodiversity offers for building a sustainable, equitable, and healthy environment that supports human health and wellbeing. They should also embrace different knowledge systems, including diverse legal knowledge systems such as Indigenous First Law, and include diverse knowledge-holders (eg, Indigenous peoples and social scientists) to encompass a wider range of understandings of human–nature connections, to broaden the information base on health, and to support inclusive decision making (procedural justice) and equitable sharing of benefits of nature (distributive justice).^{5,9,34,35,85} Finally, they should incorporate human and intrinsic values of biodiversity,^{5,32–35,112,113} including marine biodiversity,^{17,114} recognising that these values underpin effects to mental and physical health of different sectors of the human population and have implications for the application of the human right to the environment.

Many countries face difficulties meeting the existing needs of traditional public health agendas. Our proposal is to efficiently broaden public health to include awareness of the human right to the environment, focusing on practical synergies across ministries, disciplines, and institutions in any country. Strategic dialogue should support the realisation of co-benefits across respective mandates. While remaining cognisant

of capacity limitations, particularly in low-income countries, we seek to address that the projected ecosystem collapse worldwide poses severe and irreversible risks to the environment, built environment, economic systems, human security, and human health.

Our observations across law, policy, science, and advocacy show that there is a void of transdisciplinary guidance on how to apply the human right to the environment to make broader impacts in policy and law. To create a human rights backbone to guide planetary health knowledge generation and use, we propose mapping the environmental obligations of public authorities to transdisciplinary health science. This approach will help to orient what biodiversity–health knowledge needs to be produced, identify who should be informed, and provide a direction for overall coordination of transdisciplinary planetary health work (figure 3).

Figure 3 serves as a translation protocol between health and law professionals. This biodiversity–health roadmap for the *Framework Principles on Human Rights and the Environment* provides a guide for planetary health professionals and serves as a foundation for research, action, and communication co-development across professions and disciplines. Public authorities are responsible for fulfilling the human right to a healthy environment. Public authorities include governments at the local, municipal, and national scales; other recognised governing entities; and parliament, enforcement, and courts. Health science and transdisciplinary health knowledge can be more effective if it directly fulfils the obligations and responds to the responsibilities of public authorities who make decisions. As environmental changes occur, this decision making needs to be a dynamic exchange process.

The *Framework Principles on Human Rights and the Environment* guide governments and other public authorities on their responsibilities.⁶⁷ However, the framework's legal and regulatory language and terminology are difficult to understand and imprecise by design. It is not the language of the health sector, but it is the language to which public authorities should respond and interpret based on differing contexts. The health sector can play a meaningful and critical role in identifying the scope of public authorities' duties regarding biodiversity–health interlinkages. Transdisciplinary health actors also are important stakeholders and rights-holders in identifying, recognising, and communicating on the bounds of accountability when these obligations are unmet or infringed upon. Scale, scope, and discrimination should be shaped by transdisciplinary health teams.

A health professional can also understand the potential impact of their work on environmental and human rights policies and law by identifying the framework principle to which their work most closely aligns. In the biodiversity–health roadmap, environmental harm needs to be understood in terms of its human rights impacts. A negative health outcome arising from

A biodiversity–health roadmap for the Framework Principles on Human Rights and the Environment: a tool for transdisciplinary work			
Human rights lawyers and human rights holders; environmental lawyers and managers; Indigenous peoples; health science and diverse knowledge-holders; and policy advisors			
	Prioritise and inform	Assess environmental problems and biodiversity–health interlinkages	Mobilise, generate, or align
	Duties of public authorities*	Environmental knowledge community	Transdisciplinary health science community
	Protect the right to a healthy environment	Implement the duties	Inform the scope of the duties
Principle 3	Prohibit discrimination and ensure equal and effective protection	Understand underlying environmental conditions that perpetuate discrimination; and provide additional measures to protect those most vulnerable to environmental harm	Define in terms of health: who or what needs to be protected; and what evidence is available to clarify known or anticipated harms
Principle 8	Avoid undertaking or authorising actions with environmental impacts; require assessment of possible environmental impacts of proposed projects and policies in advance	Identify transboundary and cumulative effects due to biodiversity–health interactions; and avoid possible effects of environmental impacts of proposed projects and policies on the enjoyment of the rights to life, health, water, food, housing, and cultural rights	Define in terms of health: which harms are to be prevented; and whose human rights are at stake
Principle 11	Establish and maintain substantive environmental standards	Ensure environmental laws and regulations are consistent with all relevant international health and safety standards and evidence; take precautionary measures to protect against environmental harm; and apply indicators and benchmarks to assess implementation of environmental laws and regulations	Identify evidence for impacts across the life course or intergenerationally, or both, on the state of health and the determinants of health (non-medical)
Principle 14	Take additional measures to protect the rights of those who are most vulnerable from environmental harm	Make data available on environmental harm on different segments of the population; and monitor and report on environmental issues affecting the most vulnerable populations	Identify and address health inequities: vulnerability† to environmental harm; disproportionate negative exposures to environmental harms; barriers to access for positive exposures to nature or local food environments; improvements to health equity from robust environmental management, restoration, or regenerative practices; and protection of current and future generations from harm
Principle 6	Provide education and public awareness on environmental matters	Share basic information on the state of ecosystem health, functional integrity, and diversity; specific risks related to environmental degradation and how individuals might protect themselves from those risks; and information on cumulative and transboundary impacts	Identify how human health depends on the state of the local environment and local environmental stewardship
Principle 7	Provide public access to environmental information by collecting and disseminating information and by providing affordable, effective, and timely access to information to any person upon request	Enable individuals to understand how environmental harm might undermine their rights and how access to information supports their ability to exercise other rights, including expression, association, participation and remedy; and ensure that all information that would enable the public to take protective measures is disseminated immediately to all affected people when there is imminent threat of harm to human health or the environment	Identify and communicate how environmental harm undermines the right to health and the right to life; identify protective measures including health measures and environmental management measures at the household and community level that prevent, limit, or address imminent threats of harm or access to biodiversity

Figure 3: A biodiversity–health roadmap

The principles were selected based on their relevance to health information and grouped so that the education principles (principles 6 and 7) could be visualised together. *Public authorities refer to government, whether local, municipal, national, or other recognised governing entity, and parliament, enforcement, and courts. †Vulnerability is defined according to the UN Environment Programme's 2019 Global Environment Outlook as the interface between exposure to the physical threats to human wellbeing and the capacity of people and communities to cope with those threats.¹¹⁵

a decision that leads to environmental degradation (such as the licensing of unsustainable fishing practices or the authorisation to replace a wetland with a golf course) can infringe on human rights. Importantly, the fact that biodiversity–health relationships are longitudinal and complex, influencing individual, community, global,²⁸ and intergenerational health¹¹⁶ across the life course—including the ability to be born, develop, grow, learn, thrive, reproduce, and maintain mental, emotional, and spiritual wellbeing—should be

considered.^{5,9,28,49,85} This range of harms can, and should, inform the duties of public authorities and be communicated coherently.

Decision makers also need to easily understand actual or reasonably foreseeable environmental harm and human rights impacts,^{53,61} as do the courts, to hold public authorities and private companies accountable for failing to appropriately consider and prevent harm. The relationship between the environment and human health should be researched, acted upon, and

Panel 2: Case study 1**Policy—deep-seabed mining, human health, and human rights***Biodiversity–health interlinkage*

The disruption of the marine seabed inhibits future marine biomedical discovery, the buffering effect of the ocean to absorb heat and carbon dioxide, and the ocean's potential to contribute to climate change mitigation or release carbon dioxide stored in the deep seabed.

Environmental science

Deep seabed minerals are located hundreds of kilometres from shore, and at depths of hundreds of metres below sea level. Findings that deep-sea mining could lead to an irreversible loss of marine ecosystem functions and species extinction highlight concerns about long-lasting harms from seafloor destruction, light, noise, and sediment plumes.

Among other impacts to people, seabed disruption negatively limits the potential of marine ecosystems to serve as a source for biomedical discovery. For instance, the tests used to diagnose COVID-19 were based on a microbial enzyme found in marine hydrothermal vents.¹¹⁹

In addition, although deep-seabed mining could contribute to humanity's climate change mitigation efforts by contributing minerals that are needed for electric car batteries (replacing fossil fuel consumption), damage to deep-sea biodiversity could have a negative effect on the ocean's natural

contributions to climate change mitigation and its ability to buffer the excess heat arising from climate change.

Current limitations to international policy

There is no consideration of the links between deep-sea ecosystem services and human health or human rights in the context of climate change in the negotiations for the regulations of deep-seabed mining by the International Seabed Mining Authority. Although these intergovernmental negotiations are scheduled to be completed in 2025, there is a growing movement to take a precautionary pause or establish a moratorium on deep-seabed mining.^{120,121} The UN Special Rapporteur on the Human Right to a Healthy Environment has indicated that such a moratorium is essential to protect human rights.¹⁸

How can health evidence can inform the scope of public authority duties?

Health evidence could be used to support the growing demands for a moratorium on deep-seabed mining under the International Seabed Mining Authority. The possibility of irreversible marine ecosystem damage from deep-seabed mining is relevant to human health and climate change. Health evidence could be generated and mobilised to support public access to information and public awareness, and to avoid undertaking or authorising actions with negative environmental effects that interfere with the full enjoyment of human rights.

communicated within the context of the decision-making processes. Health science could improve the communication of statistical measures, such as probabilities and confidence intervals, by translating them into policy and legal terms such as harm and foreseeable harm.

Quantified health evidence, such as positive exposure to biodiversity leading to fewer days of recuperation from surgery or improved therapeutic medical management,^{117,118} can also have an effect at various points in policy and legal practice. Such evidence can be used to determine whether actions to protect biodiversity are inefficient or negligible, particularly in the case of business activities that contribute to biodiversity loss.¹⁴

Co-development among health, science, law, and policy is key to figuring out environmental problems and solutions, including through collaboration in investigating and learning from poor judicial decisions (panel 2). The biodiversity–health roadmap is a starting point for understanding and coordinating knowledge, as well as its use and communication. Moreover, it is not only lawyers who interpret and implement environmental law. A range of natural resource planners, managers, and analysts—often subdivided and working in isolation across fisheries, forestry, agriculture, and mining—have not been trained to relate their work to the needs of human rights holders and could be more effectively engaged.

Although environmental education curriculums are prevalent, it is likely less known that they also contribute to fulfilling public authorities' duties regarding the human right to a healthy environment (Principles 6 and 7, figure 3). Transdisciplinary coordination can strengthen this work by incorporating biodiversity–health interlinkages (figure 1) into curriculums or ensuring they are embedded in national human rights institutions and their networks.¹²² Co-development and coordinated delivery of education programmes by both the environmental and health sectors will expand the reach of education, support public authorities, promote environmental stewardship for public health, and inform environmental management practices to prevent disease and promote wellbeing. An important part of environmental and planetary health education going forward is introducing the human right to a healthy environment as a core component of teaching and training.

Although individual aspects of health science (case studies, causal pathways, associations, etc) are fundamental to informing each element of the biodiversity–health roadmap, isolated science will have limited impact on the ability of a public authority to fulfil its duty or on strengthening a case under litigation. A stronger focus on packaging and mobilising the roadmap's information into one collective body of work could bridge disciplines in new and more effective

Panel 3: Case study 2**Law—terrestrial gold mining, pollution, and explaining vicinity***Biodiversity–health interlinkage*

Terrestrial mining introduces a range of direct and indirect negative health exposures and risks such as from water quality and access, air quality, and food security (including from wild species).

Environmental science

There are broad negative effects on ecosystems and their functions and services from the extraction of gold at a mine using cyanide leaching. These extractions can lead to poisonings, organ damage or organ failure, and displacements, among other long-term effects.

Current limitations to environmental or human rights law

In *Cangi and others v Türkiye*,¹²³ the judges only considered negative effects on the human rights to those living in close proximity to the gold mine, which was defined by the court as the vicinity of the mine. Those within the court-defined vicinity were considered personally and directly affected by absence of a healthy environment.

The judges did not consider the situation of other people living outside the court-defined vicinity of the mine; therefore, the judges did not consider the more diffuse, indirect, or chronic negative effects on human health and the social determinants

of health from the mine that were not dependent on immediate proximity. Ultimately, this ruling narrowed the consideration of mining impacts, and thus also the scope of public authority duties to protect the population more broadly and over the long term.

The absence of clarity for how vicinity of exposure is relevant for some, but irrelevant to other, adverse health effects of environmental degradation was critical to the outcome. Using the relationship between vicinity and adverse health effects to degradation, and how this holds and does not hold for types of degradation, pollutants, demographic groups, and exposure duration could change the course of an environmental decision.

How can health evidence inform the scope of public authority duties?

Health evidence of actual, foreseeable, and potential impacts to the health of children or other individuals not in proximity to the mine would allow authorities to take additional measures to protect the rights of those who are most vulnerable (Principle 14) and avoid undertaking or authorising actions with environmental effects that interfere with the full enjoyment of human rights (Principle 8). Transdisciplinary health science is needed to clarify the relevance of vicinity for the harms of exposure and the scope of actual and foreseeable harms arising out of the environmental impact.

ways to support public authorities' obligations. Several countries have begun producing national and regional tools—such as websites, data repositories, reporting tools, and public databases on the human right to the environment—which can serve as inspiration or starting points for co-development of health knowledge at the biodiversity–health nexus.⁴⁹

Applying the biodiversity–health roadmap: policy and law

Health information can serve to shift decision makers away from focusing on the near-term, also called policy short-termism, which negatively impacts the environment and human rights (panel 3). Advancing and normalising biodiversity–health interlinkages across professions enhances support for legal experts in advising public authorities on the public health information that can help prevent infringement of the right to a healthy environment. For example, biodiversity–health evidence on specific risks to children's human right to a healthy environment could clarify how environmental actions that seem reasonable on a shorter scale can become unreasonable when considering the full extent of harm they will cause to children throughout their childhoods and their lives.⁵³ Finding ways to link obligations related to the human right to the environment and the human right to health will further support the precautionary principle.

Knowledge of human health harms from altered planetary or local ecosystem states can also support legal experts in environmental litigation and inform litigation at different levels (panel 2). In *Sharma v Minister for the Environment* local environmental degradation was found to affect local community health.¹²⁴ In this case, environmental protection from the Ministry of the Environment was ruled to include a duty to avoid personal injury to children.¹²⁴ In *Rikki Held v State of Montana* local adverse effects were identified as arising from encroaching or transgressing planetary boundaries.¹¹ Health evidence arising from local ecosystem disruption due to global environmental change served in this case to show distinguishable, severe, irreversible, and cognisable injuries to mental health (such as loss, despair, and anxiety).¹¹ The judges recognised these injuries as human rights violations resulting from global environmental change.¹¹

Conclusion

No single framework and no single discipline is going to address the planetary health agenda or save our planet. However, greater clarity and more tools are needed to equip the health sector to promote environmental actions that are more effective in influencing decision makers and in contributing to the protection of human rights.⁴⁸ Finding new ways to value

biodiversity and mobilise knowledge on biodiversity–health interlinkages is a fundamental part of this work. Nine planetary boundaries are now well recognised as indicators of planetary resilience.¹²⁵ Six of these nine planetary boundaries relate to biodiversity science and also fall under global governance of biodiversity (novel entities, biogeochemical flows, biosphere integrity, land use change, freshwater change, and ocean acidification).¹²⁵ All but ocean acidification have already been transgressed, posing potential ecological tipping points of irreversible environmental systems change. It is unwise for the health sector to remain disengaged from this space or to merely react to urgent events.

The biodiversity–health roadmap for the *Framework Principles on Human Rights and the Environment* steers transdisciplinary action and can accelerate the co-production and strategic use of knowledge.

Humanity is experiencing biodiversity loss in all its forms at an unprecedented rate. The planetary health theory of change needs to expand and orient towards mobilising health and environmental sciences to protect biodiversity on land and in the ocean, across value systems and scales. Mutual learning and collaboration across biodiversity, legal, and health professions are essential for creating a community of practice among individuals, institutions, and countries to protect and fulfil the human right to a healthy environment.¹¹⁷ Tying planetary health agendas to the needs of environmental law and human rights professions could lead to broader positive impacts on public and global health.

Contributors

Conceptualisation: LW and EM. Writing the original draft: LW and EM. Writing, review, and editing: LW, LEF, and EM. Analysis: LEF. Visualisation: LW, LEF, and EM.

Declaration of interests

We declare no competing interests.

Acknowledgments

EM received funding from the University of Strathclyde Law School for open access fees. EM serves as the United Nations Special Rapporteur on Climate Change and Human Rights.

References

- Boyd D. Executive summary of the Special Rapporteur on Human Rights and the Environment (A/75/161): human rights depend on a healthy biosphere. <https://www.ohchr.org/sites/default/files/2022-02/BiosphereSummary.pdf> (accessed May 6, 2025).
- Whitmee S, Haines A, Beyrer C, et al. Safeguarding human health in the Anthropocene epoch: report of The Rockefeller Foundation–Lancet Commission on planetary health. *Lancet* 2015; **386**: 1973–2028.
- Health Environment Research Agenda for Europe Consortium. EU research agenda for the environment, climate, and health 2021–2030. <https://spheraresearch.org/storage/2024/02/HERAFullagenda31.1.2022.pdf> (accessed May 6, 2025).
- Royal Netherlands Academy of Arts and Sciences. Longlist of knowledge gaps in planetary health. 2023. <https://storage.knaw.nl/2023-05/Longlist-of-knowledge-gaps-in-Planetary-Health.pdf> (accessed May 6, 2025).
- Ibarra AS, LaBeaud AD. Transforming global health partnerships. 2024. <https://link.springer.com/book/10.1007/978-3-031-53793-6> (accessed May 6, 2025).
- Keune H, Payyappallimana U, Morand S, Rüegg SR. One Health and biodiversity. In: Visseren-Hamakers IJ, Kok MTJ, eds. *Transforming biodiversity governance*. Cambridge University Press, 2022: 93–114.
- Morin JF, Blouin C. How environmental treaties contribute to global health governance. *Global Health* 2019; **15**: 1–8.
- Willets E, Grant L, Bansard J, et al. Health in the global environmental agenda: a policy guide. Jan 20, 2022. <https://www.iisd.org/publications/health-global-environment-agenda-policy-guide> (accessed May 6, 2025).
- Knox JH. Report of the Special Rapporteur on the issue of human rights obligations relating to the enjoyment of a safe, clean, healthy and sustainable environment (A/HRC/37/59). Jan 24, 2018. <https://documents.un.org/doc/undoc/gen/g18/017/42/pdf/g1801742.pdf> (accessed May 6, 2025).
- UN General Assembly. Resolution 76/300: the human right to a clean, healthy and sustainable environment. July 28, 2022. <https://www.un.org/en/ga/76/resolutions.shtml> (accessed May 6, 2025).
- Held v State of Montana. CDV-2020-307. Montana First Judicial District Court; Lewis and Clark County, USA; Aug 14, 2023.
- UN Environment Programme. Global climate litigation report: 2023 status review. July, 2023. <https://wedocs.unep.org/20.500.11822/43008> (accessed May 6, 2025).
- Knox JH, Morgera E. Human rights and the environment: the interdependence of human rights and a healthy environment in the context of national legislation on natural resources. 2022. <https://openknowledge.fao.org/handle/20.500.14283/cb9664en> (accessed May 6, 2025).
- Maljean-Dubois S, Morgera E. International biodiversity litigation: the increasing emphasis on biodiversity law before international courts and tribunals. In: Futhaar G, Maljean-Dubois S, Razzaque J, eds. *Biodiversity litigation*. Oxford University Press, 2022: 331–58.
- Rocque RJ, Beaudoin C, Ndjaboue R, et al. Health effects of climate change: an overview of systematic reviews. *BMJ Open* 2021; **11**: e046333.
- Lajaunie C, Morand S. Biodiversity targets, SDGs and health: a new turn after the coronavirus pandemic? *Sustainability* 2021; **13**: 4353.
- Bennett NJ, Morgera E, Boyd D. The human right to a clean, healthy and sustainable ocean. *NPJ Ocean Sustain* 2024; **3**: 1–8.
- Puentes Riaño A. Report of the Special Rapporteur on the human right to a clean, healthy, and sustainable environment: the ocean and human rights (A/HRC/58/59). Dec 31, 2024. <https://documents.un.org/doc/undoc/gen/g24/230/82/pdf/g2423082.pdf> (accessed May 6, 2025).
- World Economic Forum. Global risks report 2024. Jan 10, 2024. <https://www.weforum.org/publications/global-risks-report-2024/> (accessed May 6, 2025).
- Dasgupta P. The economics of biodiversity: the Dasgupta review—abridged version. 2021. <https://www.gov.uk/government/publications/final-report-the-economics-of-biodiversity-the-dasgupta-review> (accessed May 6, 2025).
- UN Development Programme. Planetary pressures-adjusted Human Development Index. <https://hdr.undp.org/planetary-pressure-adjusted-human-development-index#/indices/PHDI> (accessed Feb 20, 2025).
- Caesar LB, Sakschewski LS, Andersen T, et al. Planetary Health Check Report. 2024. https://publications.pik-potsdam.de/pubman/item/item_30275 (accessed May 6, 2025).
- World Wildlife Fund. Living planet report 2024—a system in peril. 2024. <https://www.worldwildlife.org/publications/2024-living-planet-report> (accessed May 6, 2025).
- UN Economic and Social Council. Indigenous determinants of health in the 2030 agenda for sustainable development. Jan 31, 2023. <https://docs.un.org/en/E/C.19/2023/5> (accessed May 6, 2025).
- Pope Francis. Encyclical Letter Laudato Si' of the Holy Father Francis on care for our common home. May 24, 2015. https://www.vatican.va/content/francesco/en/encyclicals/documents/papa-francesco_20150524_enciclica-laudato-si.html (accessed May 6, 2025).
- Ducarme F, Couvet D. What does 'nature' mean? *Palgrave Commun* 2020; **6**: 1–8.
- UN Environment Programme. Convention on Biological Diversity. 1992. <https://www.cbd.int/doc/legal/cbd-en.pdf> (accessed May 6, 2025).
- WHO. Connecting global priorities: biodiversity and human health. A state of knowledge review. June 3, 2015. https://iris.who.int/bitstream/handle/10665/174012/9789241508537_eng.pdf (accessed May 6, 2025).

- 29 Chivian E, Bernstein A. Sustaining life: how human health depends on biodiversity. June 2, 2008. <https://doi.org/10.1093/oso/9780195175097.001.0001> (accessed May 6, 2025).
- 30 Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). The global assessment report on biodiversity and ecosystem services: summary for policymakers. 2019. <https://doi.org/10.5281/zenodo.3553579> (accessed May 6, 2025).
- 31 WHO. Ottawa charter on health promotion. June 16, 2012. <https://www.who.int/publications/i/item/WH-1987> (accessed May 6, 2025).
- 32 Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). The methodological assessment report on the diverse values and valuation of nature: summary for policymakers, version 1.2. July 9, 2022. <https://doi.org/10.5281/zenodo.6522392> (accessed May 6, 2025).
- 33 Convention on Biological Diversity. Decision adopted by the Conference of the Parties to the Convention on Biological Diversity. 15/22: nature and culture. Dec 19, 2022. <https://www.cbd.int/doc/decisions/cop-15/cop-15-dec-22-en.pdf> (accessed May 6, 2025).
- 34 Convention on Biological Diversity. Decision adopted by the Conference of the Parties to the Convention on Biological Diversity. 16/14: review of findings from the methodological assessment report on the diverse values and valuation of nature of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services and their implications for the work undertaken under the convention (CBD/COP/DEC/16/14). Nov 1, 2024. <https://www.cbd.int/doc/decisions/cop-16/cop-16-dec-14-en.pdf> (accessed May 6, 2025).
- 35 Pascual U, Balvanera P, Anderson CB, et al. Diverse values of nature for sustainability. *Nature* 2023; **620**: 813–23.
- 36 Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). The thematic assessment report on interlinkages among biodiversity, water, food, and health: summary for policymakers. Dec 16, 2024. <https://doi.org/10.5281/zenodo.13850290> (accessed May 6, 2025).
- 37 Convention on Biological Diversity. Decision adopted by the Conference of the Parties to the Convention on Biological Diversity. XII/21: biodiversity and human health. Oct 14, 2014. <https://www.cbd.int/meetings/COP-12> (accessed May 27 2025).
- 38 Convention on Biological Diversity. Decision adopted by the Conference of the Parties to the Convention on Biological Diversity. 15/4: Kunming-Montreal Global Biodiversity Framework. Dec 19, 2024. <https://www.cbd.int/doc/decisions/cop-15/cop-15-dec-04-en.pdf> (accessed May 6, 2025).
- 39 The Lancet. One Health: a call for ecological equity. *Lancet* 2023; **401**: 169. [https://doi.org/10.1016/S0140-6736\(23\)00090-9](https://doi.org/10.1016/S0140-6736(23)00090-9).
- 40 UN Environment Programme, International Science Council. Navigating new horizons: a global foresight report on planetary health and human wellbeing. July, 2024. <https://wedocs.unep.org/handle/20.500.11822/45890> (accessed May 6, 2025).
- 41 Federal Council of Switzerland. Environmental responsibility initiative popular vote. Feb 9, 2025. <https://www.admin.ch/gov/en/start/documentation/votes/20250209/environmental-responsibility-initiative.html> (accessed May 6, 2025).
- 42 Council of Europe. Protecting the environment using human rights law. <https://www.coe.int/en/web/portal/human-rights-environment> (accessed May 6, 2025).
- 43 UN Environment Programme. Environmental rule of law: first global report. 2019. <https://www.unep.org/resources/assessment/environmental-rule-law-first-global-report> (accessed May 6, 2025).
- 44 UN Environment Programme. Environmental rule of law: tracking progress and charting future directions. November, 2023. <https://doi.org/10.59117/20.500.11822/43943> (accessed May 6, 2025).
- 45 Jodoin S. Should we be so positive about environmental rights? Review of David R Boyd: The Environmental Rights Revolution. *McGill Int J Sustain Dev Law Pol* 2012; **8**: 131–41.
- 46 Marselle MR, Golding SE. Applying the behaviour change wheel to mitigate the biodiversity crisis. In: Murtagh N, Gatersleben B, eds. Handbook on pro-environmental behaviour change. Elgar, 2023: 353–71. <https://doi.org/10.4337/9781800882133.00034>.
- 47 Lang DJ, Wiek A, Bergmann M, et al. Transdisciplinary research in sustainability science: practice, principles, and challenges. *Sustain Sci* 2012; **7**: 25–43.
- 48 Boyd D. The right to a healthy and sustainable environment. In: Aguila Y, Vinuales JE, eds. A global pact for the environment—legal foundations. University of Cambridge, 2019: 30–36.
- 49 Boyd DR. The right to a healthy environment: a user's guide. 2024. <https://www.ohchr.org/sites/default/files/documents/issues/environment/srenvironment/activities/2024-04-22-stm-earth-day-srenv.pdf> (accessed May 6, 2025).
- 50 Puentes Riaño A. Overview of the implementation of the human right to a clean, healthy and sustainable environment (A/79/270). Aug 2, 2024. <https://docs.un.org/en/A/79/270> (accessed May 6, 2025).
- 51 UN Framework Convention on Climate Change. Draft decision CP.27 Sharm el-Sheikh Implementation Plan. Nov 20, 2022. <https://unfccc.int/documents/621914> (accessed May 6, 2025).
- 52 International Conference on Chemicals Management (ICCM5). Global framework on chemicals: for a planet free of harm from chemicals and waste. Sept 30, 2023. <https://www.unep.org/resources/global-framework-chemicals-planet-free-harm-chemicals-and-waste> (accessed May 6, 2025).
- 53 UN Committee on the Rights of the Child. CRC/C/GC/26: General comment No. 26 (2023) on children's rights and the environment with a special focus on climate change. Aug 22, 2023. <https://www.ohchr.org/en/documents/general-comments-and-recommendations/general-comment-no-26-2023-childrens-rights-and> (accessed May 6, 2025).
- 54 Fleming LE, Depledge M, Bouley T, et al. The ocean decade: opportunities for oceans and human health programs to contribute to public health. *Am J Public Health* 2021; **111**: 808–11.
- 55 Willetts L, Siegel C, Stewart-Ibarra AM, et al. Advancing integrated governance for health through national biodiversity strategies and action plans. *Lancet* 2023; **402**: 753–56.
- 56 Whitehorn PR, Navarro LM, Schröter M, Fernandez M, Rotllan-Puig X, Marques A. Mainstreaming biodiversity: a review of national strategies. *Biol Conserv* 2019; **235**: 157–63.
- 57 Convention on Biological Diversity. Update on progress on revising/updating and implementing national biodiversity strategies and action plans, including national targets. Sept 25, 2018. <https://www.cbd.int/doc/c/3d50/c310/2e8a0f5f3b44fd8c0df5f7f3/cop-14-05-add1-en.pdf> (accessed May 6, 2025).
- 58 Rode J, Moreno Soares T, Colléony A, Turbe A, Chadwick P, Marselle M. National biodiversity strategies under-utilize the potential for individual behavior change. *Environ Sci Policy* 2024; **162**: 103916.
- 59 UN General Assembly. The human right to a clean, healthy, and sustainable environment (A/RES/76/300). Aug 1, 2022. <https://documents.un.org/doc/undoc/gen/n22/442/77/pdf/n2244277.pdf> (accessed May 6, 2025).
- 60 UN General Assembly. Resolution adopted by the Human Rights Council. 57/28: biodiversity and human rights (A/HRC/RES/57/28). Oct 11, 2024. <https://documents.un.org/doc/undoc/gen/g24/191/20/pdf/g2419120.pdf> (accessed May 6, 2025).
- 61 Knox, JH. Report of the Special Rapporteur on the issue of human rights obligations relating to the enjoyment of a safe, clean, healthy and sustainable environment (A/HRC/34/49). Jan 19, 2017. <https://digitallibrary.un.org/record/861173?ln=en> (accessed May 6, 2025).
- 62 Boyd DR. Human rights depend on a healthy biosphere (A/75/161). July 15, 2020. <https://digitallibrary.un.org/record/3878846?v=pdf> (accessed May 6, 2025).
- 63 Webster E, Morgera E. Transformative capacity building around a right to a healthy environment: what role for dignity as a human rights value? *Griffith J Law & Human Dignity* 2021; **9**: 55–86.
- 64 Morgera E. Report of the Special Rapporteur on the promotion and protection of human rights in the context of climate change: access to information on climate change and human rights (A/79/176). July 18, 2024. <https://www.ohchr.org/en/documents/thematic-reports/a79176-access-information-climate-change-and-human-rights-report-special> (accessed May 6, 2025).
- 65 Morgera E. Biodiversity as a human right and its implications for the EU's external action. April, 2020. <https://data.europa.eu/doi/10.2861/60672> (accessed May 6, 2025).
- 66 Parker E, Tanana H. Indigenizing the right to a healthy environment. *Pace Envtl L Rev* 2024; **41**: 221–58.

- 67 Knox JH. Framework principles on human rights and the environment. 2018. <https://www.ohchr.org/en/special-procedures/sr-environment/framework-principles-human-rights-and-environment-2018> (accessed May 6, 2025).
- 68 Konijnendijk C, Devkota D, Mansourian S, Wildburger C. Forests and trees for human health: pathways, impacts, challenges and response options. 2023. <https://www.iufro.org/publications/world-series-vol-41-forests-and-trees-for-human-health-pathways-impacts-challenges-and-response-options> (accessed May 6, 2025).
- 69 World Resources Institute. Millennium Ecosystem Assessment: ecosystems and human wellbeing. 2005. <https://www.wri.org/research/millennium-ecosystem-assessment-ecosystems-and-human-well-being> (accessed May 6, 2025).
- 70 Robinson JM, Breed AC, Camargo A, Redvers N, Breed MF. Biodiversity and human health: a scoping review and examples of underrepresented linkages. *Environ Res* 2024; **246**: 118115.
- 71 Fleming LE, Maycock B, White MP, Depledge MH. Fostering human health through ocean sustainability in the 21st century. *People Nat* 2019; **1**: 276–83.
- 72 Willetts L, Comeau L, Vora N, et al. Health in global biodiversity governance: what is next? *Lancet* 2023; **401**: 533–36.
- 73 Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). Nature's contributions to people (NCP). <https://www.ipbes.net/node/41543> (accessed Feb 20, 2025).
- 74 Zinsstag J, Kaiser-Grolimund A, Heitz-Tokpa K, et al. Advancing One human–animal–environment Health for global health security: what does the evidence say? *Lancet* 2023; **401**: 591–604.
- 75 Traore T, Shanks S, Haider N, et al. How prepared is the world? Identifying weaknesses in existing assessment frameworks for global health security through a One Health approach. *Lancet* 2023; **401**: 673–87.
- 76 Mwatondo A, Rahman-Shepherd A, Hollmann L, et al. A global analysis of One Health Networks and the proliferation of One Health collaborations. *Lancet* 2023; **401**: 605–16.
- 77 Elnaïem A, Mohamed-Ahmed O, Zumla A, et al. Global and regional governance of One Health and implications for global health security. *Lancet* 2023; **401**: 688–704.
- 78 Cianfagna M, Bolon I, Babo Martins S, et al. Biodiversity and human health interlinkages in higher education offerings: a first global overview. *Front Public Health* 2021; **9**: 637901.
- 79 WHO. Global strategy on health, environment, and climate change: the transformation needed to improve lives and wellbeing sustainably through healthy environments. Feb 9, 2020. <https://www.who.int/publications/i/item/9789240000377> (accessed May 6, 2025).
- 80 Patel V, Saxena S, Lund C, et al. The Lancet Commission on global mental health and sustainable development. *Lancet* 2018; **392**: 1553–98.
- 81 Brauman KA, Garibaldi LA, Polasky S, et al. Status and trends—nature's contributions to people (NCP). In: Brondizio ES, Settele J, Díaz S, Ngo HT, eds. Global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. IPBES secretariat, 2019: 310–84.
- 82 Steffen W, Richardson K, Rockström J, et al. Planetary boundaries: guiding human development on a changing planet. *Science* 2015; **347**: 1259855.
- 83 Persson L, Carney Almroth BM, Collins CD, et al. Outside the safe operating space of the planetary boundary for novel entities. *Environ Sci Technol* 2022; **56**: 1510–21.
- 84 Rockström J, Gupta J, Qin D, et al. Safe and just Earth system boundaries. *Nature* 2023; **619**: 102–11.
- 85 UN Human Rights Office of the High Commissioner. Analytical study on the relationship between climate and the full and effective enjoyment of the rights of the child (A/HRC/35/13). May 4, 2017. https://ap.ohchr.org/documents/dpage_e.aspx?si=A/HRC/35/13 (accessed May 6, 2025).
- 86 Marselle MR, Hartig T, Cox DTC, et al. Pathways linking biodiversity to human health: A conceptual framework. *Environ Int* 2021; **150**: 106420.
- 87 Convention on Biological Diversity. Resources to support the implementation of the Global Action Plan. <https://www.cbd.int/health/Resources.shtml> (accessed Feb 20, 2025).
- 88 Convention on Biological Diversity. COP decisions. <https://www.cbd.int/health/decisions.shtml> (accessed Feb 20, 2025).
- 89 WHO. Health, environment and climate change: human health and biodiversity (A/71/11). March 29, 2018. https://apps.who.int/gb/ebwha/pdf_files/WHA71/A71_11-en.pdf (accessed May 6, 2025).
- 90 WHO. A global health strategy for 2025–2028—advancing equity and resilience in a turbulent world: fourteenth General Programme of Work. 2025. https://cdn.who.int/media/docs/default-source/documents/about-us/general-programme-of-work/global-health-strategy-2025-2028.pdf?sfvrsn=237faceb_3 (accessed May 6, 2025).
- 91 Morgera E, Razzaque J. Biodiversity and nature protection law. 2017. https://www.e-elgar.com/shop/gbp/biodiversity-and-nature-protection-law-9781783474240.html?srsltid=AfmBOordX8IMLpnLgimMFKgku73GX_YS8Q_ZrgHD4uTLASrcGtzRAOo (accessed May 6, 2025).
- 92 Maljean-Dubois S. International biodiversity law. Brill, 2024.
- 93 Wilkie M. A healthy look at the Nagoya Protocol—implications for global health governance. In: Morgera E, Buck M, Tsoumani E, eds. The 2010 Nagoya Protocol on access and benefit-sharing in perspective: implications for international law and national implementation. Brill, 2013: 123–48.
- 94 Switzer S, Morgera E, Tsoumani E, Burci GL. Biodiversity, pathogen sharing and international law. In: Negri S, ed. Environmental health in international and EU law: current challenges and legal responses. Routledge, 2019: 271–90.
- 95 Morgera E, McQuaid K, La Bianca G, et al. Addressing the ocean-climate nexus in the BBN agreement: strategic environmental assessments, human rights and equity in ocean science. *Int J Mar Coast Law* 2023; **38**: 447–79.
- 96 Hamley GJ. The implications of seabed mining in the area for the human right to health. *Rev Eur Comp Int Environ Law* 2022; **31**: 389–98.
- 97 UN Disaster Risk Reduction Asia-Pacific. Ecosystem-based disaster risk reduction: implementing nature-based solutions for resilience. 2020. <https://www.undrr.org/publication/ecosystem-based-disaster-risk-reduction-implementing-nature-based-solutions-0> (accessed May 6, 2025).
- 98 UN Framework Convention on Climate Change. Decision 2/ CMA.5 Global goal on adaptation (FCCC/PA/CMA/2023/16/Add.1). March 15, 2024. <https://unfccc.int/documents/637073> (accessed May 6, 2025).
- 99 Niner HJ, Morgera E, Longo, A, et al. Connecting ecosystem services research and human rights to revamp the application of the precautionary principle. *NPJ Ocean Sustain* 2024; **3**: 1–3. <https://doi.org/10.1038/s44183-024-00072-8> (accessed May 6, 2025).
- 100 Boyd DR. Business, planetary boundaries, and the right to a clean, healthy and sustainable environment (A/HRC/55/43). Jan 2, 2024. <https://docs.un.org/en/A/HRC/55/43> (accessed May 6, 2025).
- 101 Pitt H, McCarthy S, Arnot G. Children, young people and the commercial determinants of health. *Health Promot Int* 2024; **39**: daad185. <https://doi.org/10.1093/heapro/daad185> (accessed May 6, 2025).
- 102 UN Special Rapporteur on human rights and the environment. Good practices (Annex 2 to A/HRC/55/43). Feb 19, 2024. https://www.ohchr.org/sites/default/files/documents/issues/environment/srenvironment/reports-annex/Annex2_to_A_HRC_55_43.docx (accessed May 6, 2025).
- 103 Convention on Biological Diversity. Decision adopted by the Conference of the Parties to the Convention on Biological Diversity. 16/19: biodiversity and health (CBD/COP/DEC/16/19). Nov 1, 2024. <https://www.cbd.int/health/GAP.shtml> (accessed May 6, 2025).
- 104 Willetts L. Nature negotiations: sharing responsibility for global health. *Lancet Planet Health* 2022; **6**: e554–56.
- 105 UN Economic and Social Commission for Asia Pacific, International Institute for Sustainable Development. Operationalizing the environment-health nexus in Asia and the Pacific: a policy guide on opportunities for enhancing health, biodiversity, food system and climate action. Nov 11, 2022. <https://www.unescap.org/kp/2022/operationalizing-environment-health-nexus-asia-and-pacific-policy-guide-opportunities> (accessed May 6, 2025).
- 106 Rosenthal A, Simpson M, Wahono A. Biodiversity and nutrition strategies: evaluating national biodiversity strategies and action plans for integration. 2024. <https://www.gainhealth.org/sites/default/files/publications/documents/i-can-report-on-biodiversity-and-nutrition-synergies.pdf> (accessed May 6, 2025).

- 107 Fleming S. What is ecocide and which countries recognize it in law? Aug 30, 2021. <https://www.weforum.org/stories/2021/08/ecocide-environmental-harm-international-crime/> (accessed Feb 20, 2025).
- 108 Lähdenmäki-Uutela A, Ituarte-Lima C, Turunen T, et al. Planetary boundaries nurturing the grand narrative of the right to a healthy environment? *Environ Policy Law* 2024; **54**: 15–26.
- 109 Puentes Riaño A. Overview of the implementation of the human right to a clean, healthy and sustainable environment (A/79/270). Aug 2, 2024. <https://documents.un.org/doc/undoc/gen/n24/228/44/pdf/n2422844.pdf> (accessed May 6, 2025).
- 110 Grandjean P. Science for precautionary decision-making. Jan 22, 2013. <https://www.eea.europa.eu/en/analysis/publications/late-lessons-2/late-lessons-chapters/late-lessons-ii-chapter-26/> (accessed May 6, 2025).
- 111 Redvers N, Poelina A, Schultz C, et al. Indigenous natural and First Law in planetary health. *Challenges* 2020; **11**: 29.
- 112 Boyd F, Allen C, Robinson JM, Redvers N. The past, present, and future of nature and place-based interventions for human health. *Landsc Res* 2023; **49**: 129–45. <https://doi.org/10.1080/01426397.2023.2244430> (accessed May 6, 2025).
- 113 Ekins P, Simon S, Deutsch L, et al. A framework for the practical application of the concepts of critical natural capital and strong sustainability. *Ecol Econ* 2003; **44**: 165–85.
- 114 Jenkins AP, Lancaster AMSN, Capon A, Soapi K, Fleming LE, Jupiter SD. Human health depends on thriving oceans. *Lancet* 2023; **402**: 9–11.
- 115 UN Environment. Global environment outlook–GEO-6: healthy planet, healthy people. May, 2019. <https://doi.org/10.1017/9781108627146> (accessed May 6, 2025).
- 116 Lamoreaux J. “Passing down pollution”: (inter)generational toxicology and (epi)genetic environmental health. *Med Anthropol Q* 2021; **35**: 529–46.
- 117 White MP, Hartig T, Martin L, et al. Nature-based biopsychosocial resilience: an integrative theoretical framework for research on nature and health. *Environ Int* 2023; **181**: 108234.
- 118 Haywood A, Dayson C, Garside R, et al. National evaluation of the Preventing and Tackling Mental III Health through Green Social Prescribing Project: final report. January, 2024. <https://randd.defra.gov.uk/ProjectDetails?ProjectId=20772> (accessed May 6, 2025).
- 119 Hugus E. Finding answers in the ocean. Nov 10, 2020. <https://www.whoi.edu/oceanus/feature/finding-answers-in-the-ocean/> (accessed May 6, 2025).
- 120 Morgera E, Lily H. Public participation at the International Seabed Authority: an international human rights law analysis. *Rev Eur Comp Int Environ Law* 2022; **31**: 374–88.
- 121 Atwood T, Romanou A, DeVries T, et al. Atmospheric CO₂ emissions and ocean acidification from bottom-trawling. *Front Mar Sci* 2023; **10**: 1–11. <https://doi.org/10.3389/fmars.2023.1125137> (accessed May 6, 2025).
- 122 UN Office of the High Commissioner. UN human rights and NHRIs. <https://www.ohchr.org/en/countries/nhri> (accessed Feb 20, 2025).
- 123 Cangi and others v Türkiye. 48173/18. European Court of Human Rights; Strasbourg, France; Nov 23, 2023.
- 124 Peel W, Markey-Towler R. A duty to care: the case of Sharma v Minister for the Environment [2021] FCA 560. *J Environ Law* 2021; **33**: 727–36.
- 125 Stockholm Resilience Center. Planetary boundaries. <https://www.stockholmresilience.org/research/planetary-boundaries.html> (accessed Feb 20, 2025).

Copyright © 2025 The Author(s). Published by Elsevier Ltd. This is an Open Access article under the CC BY-NC-ND 4.0 license.