

Responding to Global Environmental Crises

As trustees, or stewards, of the planet's vast resources and biological diversity, humanity must learn to make use of the earth's natural resources, both renewable and non-renewable, in a manner that ensures sustainability and equity into the distant reaches of time . . . Therefore, sustainable environmental management must come to be seen not as a discretionary commitment mankind can weigh against other competing interests, but rather as a fundamental responsibility that must be shouldered.¹

Bahá'í International Community, 1998

In this chapter, we review the contemporary imperative of global environmental governance that did not exist when the United Nations was founded. After a brief historical summary, we confirm the need for a reinforced global environmental organization,² consider the existential challenges of climate change and threats to global biodiversity, make a case for global regulation of dangerous chemicals, and for equitable management of natural resources.

Our planet functions as a single global system, a biosphere with many interacting components and cycles of materials in the atmosphere, on land and in the oceans, that pay no attention to national boundaries, but instead define planetary boundaries

¹ Bahá'í International Community. 1998. *Valuing Spirituality in Development: Initial Considerations Regarding the Creation of Spiritually Based Indicators for Development*. A concept paper written for the World Faiths and Development Dialogue, Lambeth Palace, London, February 18–19.

² For example, the Secretary-General proposed in 1997 that the Trusteeship Council “be reconstituted as the Forum through which Member States exercise their collective trusteeship for the integrity of the global environment and common areas such as the oceans, atmosphere and outer space. At the same time, it should serve to link the United Nations and civil society in addressing these areas of global concern, which require the active contribution of public, private and voluntary sectors.” UN General Assembly. 1997. “*Renewing the United Nations: A Programme for Reform*,” 14 July, A/51/950, New York, United Nations, para. 85.

that we must respect to maintain an environment suitable for human life and well-being.³ Through our actions and consumption patterns, we have already overshoot some of these planetary boundaries, threatening the future human carrying capacity of the planet. Many dimensions of this system can only be managed at the global level through close cooperation of all countries, first through reducing damaging activities to a sustainable level, and then through collaboration to restore and eventually extend that carrying capacity in an ever-advancing civilization. The reform of the UN system should incorporate the necessary dimensions of environmental governance, particularly as they concern climate change and biodiversity resilience, as a central rather than peripheral responsibility.

While the conservation of nature has been a concern for well over a century, and the International Union for the Conservation of Nature (IUCN), with both state and non-state members, was founded in 1948, it was only in the 1960s, in light of warnings such as Rachel Carson's *Silent Spring* and the Torrey Canyon oil spill in 1967, that the environment became a political issue and governments began to create agencies and ministries for environmental protection.⁴ It was already obvious that environmental problems often escaped from national control, and that environmental cooperation was needed at the international level. In 1972 the US National Academy of Sciences prepared a report for the US Department of State on *Institutional Arrangements for International Environmental Cooperation*,⁵ recommending a new environmental unit within the UN supported by an intergovernmental advisory body, a science advisory and research board, a monitoring and surveillance network and an environment fund.

The 1972 United Nations Conference on the Human Environment in Stockholm, Sweden, adopted a Declaration and Action Plan for the Human Environment,⁶ which created the UN Environment Programme (UNEP) with an environmental assessment (Earthwatch) component including a Global Environment Monitoring System (GEMS),⁷ an environmental management component and an Environment Fund, intended to catalyze environmental action across the UN system.

³ Rockström, Johan et al. 2009. "A Safe Operating Space for Humanity." *Nature*, Vol. 461, pp. 472–475. DOI: 10.1038/461472a; Steffen, Will et al. 2015. "Planetary Boundaries: Guiding Human Development on a Changing Planet." *Science*, Vol. 347, No. 6223. DOI: 10.1126/science.1259855.

⁴ Carson, Rachel. 1962. *Silent Spring*. Boston, Houghton Mifflin.

⁵ National Academy of Sciences. 1972. *Institutional Arrangements for International Environmental Cooperation*. A report to the Department of State by the Committee for International Environmental Programs, Environmental Studies Board, Washington, DC, National Academy of Sciences.

⁶ United Nations. 1972. *Report of the United Nations Conference on the Human Environment*, held at Stockholm, June 5–16, 1972. A/CONF.48/14. New York, United Nations.

⁷ Gosovic, Branislav. 1992. *The Quest for World Environmental Cooperation: The Case of the UN Global Environment Monitoring System*, London and New York, Routledge.

Since the Stockholm Conference, there has been considerable progress in elements of international governance of specific environmental problems ranging from conservation of species and biodiversity, managing chemical pollution, depletion of the ozone layer and climate change, to transboundary air pollution, shared river basins and regional seas. The result has been hundreds of multilateral environmental agreements, both global and regional, usually with separate secretariats, some within the United Nations system and many outside of it. While some subsidiarity is appropriate for specific geographic realities or shared resources, the overall patchwork, with gaps and overlaps, has become increasingly unwieldy and has placed an increasing burden on governments to participate in, apply and report to all these separate mechanisms.

The next major step forward in international environmental governance occurred 20 years later in 1992, at the UN Conference on Environment and Development (UNCED), the Rio Earth Summit, in Rio de Janeiro, Brazil. The Rio Declaration established new principles in international soft law, and its action plan, Agenda 21, with 40 chapters negotiated and agreed by governments,⁸ became the global blueprint for sustainable development. Conditions for progress were less favorable at the World Summit on Sustainable Development in Johannesburg in 2002, which in many ways was a holding action to maintain the advances achieved in Rio, with calls for revitalizing global environmental governance.⁹ The UN Conference on Sustainable Development, again in Rio de Janeiro in 2012, was less ambitious, but it succeeded in launching a wide participatory process that led to the adoption in 2015 of the UN 2030 Agenda and its Sustainable Development Goals (SDGs), to be achieved by 2030.¹⁰

These and many other intergovernmental processes have resulted in a fragmented assemblage of hard and soft law, legally binding or increasingly accepted as customary. Many agreements are often difficult to apply, particularly at the national level where both legal capacity and technical expertise are limited. The Earth Charter was one attempt after the 1992 Earth Summit to assemble fundamental values and principles for a just, sustainable and peaceful global society,¹¹ but its origins in civil society meant that it had little weight with governments.

⁸ United Nations. 1992. *Agenda 21: Programme of Action for Sustainable Development*. United Nations Conference on Environment and Development, Rio de Janeiro, Brazil, June 3–14. New York, United Nations. <https://sustainabledevelopment.un.org/content/documents/Agenda21.pdf>.

⁹ Esty, Daniel C. and Maria H. Ivanova (eds.). 2002. *Global Environmental Governance: Options & Opportunities*, New Haven, CT, Yale School of Forestry and Environmental Studies.

¹⁰ United Nations. 2015. *Transforming Our World: The 2030 Agenda for Sustainable Development*. Outcome document of the Summit for the adoption of the Post-2015 Development Agenda, New York, September 25–27, 2015. A/70/L.1. New York, United Nations. www.un.org/ga/search/view_doc.asp?symbol=A/70/L.1&Lang=E.

¹¹ Launched by the Earth Charter Commission in The Hague on June 29, 2000. See <http://earthcharter.org/>.

To bring some legal coherence, a group of 80 experts from 40 countries recently prepared a draft Global Pact for the Environment that assembles and codifies the main principles of international environmental law, supplemented in light of current challenges.¹² It consolidates the principles already agreed in the Stockholm Declaration of 1972, the Rio declarations of 1992 and 2012, the environmental SDGs and the Paris Climate Change Agreement of 2015. They propose this as the basis for negotiating a legally binding international treaty that would supplement the existing conventions, filling gaps and providing a coherent text that would be easier to implement at the national level. The 1966 UN Covenants, one dedicated to civil and political rights, the other to economic, cultural and social rights, and enshrining fundamental and comprehensive human rights norms in binding treaties, may be a useful precedent in thinking about the development of similar binding and consolidated treaties in the environmental field. The government of France organized a Summit for the Global Pact on the sidelines of the UN General Assembly in September 2017 with some 40 heads of state and government and ministers who called for support to the project. An intergovernmental working group is now negotiating a final text.

Even in its draft form, the Global Pact is a useful summary of international environmental law. It has a preamble and 26 articles, each devoted to one aspect of international law and development – most of which enjoy consensus. In particular, it includes the right to an ecologically sound environment; the duty to take care of the environment, to exercise prevention and precaution; to remediate environmental damages; to enforce the principle that “polluters pay”; to establish intergenerational equity; to ensure public information and participation, access to environmental justice, education and training in environmental protection. The Pact also provides for the vital role of nongovernmental stakeholders; the effectiveness of environmental standards; resilience; non-regression of standards; and shared but differentiated responsibilities. It also suggests mechanisms for implementation and follow-up.

This illustrates the need for consolidation in the area of environmental protection and management as in so many other fields where the continuation of ad hoc independent negotiating and legislative processes between multiple states ultimately can only lead to international legal gridlock, overload governments and make environmental responses ever harder to implement at the national level. One challenge for strengthened global governance will be to organize the transition to a more coherent international system, which is easier for all countries to participate in and adhere to.

¹² See <http://pactenvironment.org/>.

AN ENVIRONMENTAL ORGANIZATION

It is too early to say whether other multilateral environmental agreements should lead to specialized agencies or be grouped within a strengthened UN Environment Organization. UN Environment is just a program within the United Nations, with limited resources and only administrative responsibilities for some biodiversity and chemicals conventions, while climate change has a separate convention, and the wetlands convention is not even within the UN system. It has even been suggested that the multiplicity of environmental agreements with secretariats scattered around the world was intended to prevent them from being effective and thus interfering with profits and the growth of the economy. In many cultures, humanity is an integral part of nature, or Mother Earth. The Western concept of the environment as something outside of us has made it easier to consider environmental issues as externalities and not really central to the economy. For economists, natural resources have traditionally had no value until they were exploited and marketed, with a range of pernicious consequences. Faced with the pressure of commercial interests, efforts to adopt a convention on forests have failed. Plastic pollution has become a global crisis, and many environmentally damaging chemicals remain unregulated. Now that we understand our fundamental dependence on natural capital and planetary life support systems, and the need for sustainable use of resources as we overshoot planetary boundaries,¹³ a coherent approach has become a priority for global governance.

This challenge is particularly acute because there is no easy way to achieve the current concept of a high quality of life for the entire world population without destabilizing critical planetary processes. A recent study using indicators designed to measure a “safe and just” development space between social thresholds and biophysical boundaries for over 150 countries quantified the resource use associated with meeting basic human needs and compared this with downscaled planetary boundaries. No country met basic needs for its citizens at a globally sustainable level of resource use. Physical needs such as nutrition, sanitation, access to electricity and the elimination of extreme poverty could likely be met for all people without transgressing planetary boundaries, but the level of necessary resource use must be dramatically reduced.¹⁴ However, the universal achievement of more qualitative goals such as high life satisfaction, as presently defined in our consumer society, would require a level of resource use that is two to six times the sustainable level. For these goals, non-material means should be used such as social support, generosity, freedom to make life choices and absence of corruption. Meeting this challenge will

¹³ Rockström et al., “A Safe Operating Space for Humanity”; Steffen et al., “Planetary Boundaries.”

¹⁴ Hanley, Paul. 2014. *Eleven*, Victoria, BC, Friesen Press.

require strategies that improve physical and social provisioning systems, with a focus on sufficiency and equity, in order to move nations toward sustainability.¹⁵ Global mechanisms need to be strong enough to give priority to the common good of all with justice and equity, and to use various policy tools, including more responsible tax and expenditure policies, to shift incentives in a way that puts consumption levels, particularly of the wealthy and powerful, on a more sustainable path.

One necessary innovation will be to create a global legal framework for those areas, resources, planetary processes and biogeochemical cycles that are essential to maintaining a global environment conducive to human life and well-being. They should be considered the common property of humankind and could be managed as a condominium, just as individual owners in an apartment building share responsibility for the common public areas and utilities that service the whole building.¹⁶ All states and peoples would be expected to contribute to the upkeep and protection of these common property resources, including the atmosphere, the oceans, the climate and cycles of nitrogen, phosphorus and other elements that support all life, among others.

The above reference to natural cycles illustrates that the environmental dimension of international governance has some specific characteristics, as it concerns not just human society and the built environment created by humanity for its own needs, but the natural environment and planetary life support systems that are essential for human well-being and survival. One requirement of environmental governance is ensuring that the scientific input to policy-making is adequate and objective, that the risks and uncertainties are presented correctly, and that sufficient attention is devoted to long-term as well as short-term priorities. This requires coordinated and sustained research, monitoring and scientific advisory procedures appropriate to each environmental process, with structures for multi-level governance at the scales most relevant to each characteristic or problem. Decision-makers also need to be scientifically literate to be able to understand scientific advice.

¹⁵ O'Neill, Daniel W., Andrew L. Fanning, William F. Lamb, and Julia K. Steinberger. 2018. "A Good Life for All within Planetary Boundaries." *Nature Sustainability*, Vol. 1, No. 2, pp. 88–95. <https://doi.org/10.1038/s41893-018-0021-4>.

¹⁶ The Common Home of Humanity (CHH) project proposes a new legal condominium framework for science-based governance of the global Earth System to ensure a sustainable "Safe Operating Space" for humanity, given planetary boundaries. Initiated in 2016, CHH has convened a global and interdisciplinary network to develop and build "a new theoretical and operational model of just and sustainable global governance, through a decision-making structure based on an improved knowledge of Earth System functioning and in harmony with the sovereignty of states." See www.commonhomeofhumanity.org/. It has been suggested that the facility to manage the global environment under this paradigm could replace the now-defunct Trusteeship Council under the Charter.

CLIMATE CHANGE

The challenge of climate change has been defined as a “super-wicked” problem. It needs urgent responses. It needs those responsible to accept responsibility and provide solutions and support. It requires aspects of sovereignty to be ceded to an international body, or that wide-ranging powers be conferred to a central body at the national level. And it carries perverse incentives to push action into the future.¹⁷

Leena Srivastava

A priority area for coherent international action is climate change, and the UN Framework Convention on Climate Change (UNFCCC) signed in 1992 bears this responsibility. The scientific evidence is frightening, with global warming accelerating, impacts such as extreme storms, wildfires, droughts and sea level rise increasingly costly in human and financial terms, and fears of tipping points that could cause runaway acceleration of damaging processes.¹⁸ Parts of the planet will become less able to support a human population, or even uninhabitable, due to excessively high temperatures, whereas other regions presently too cold could become more habitable, requiring significant displacement of human populations across national borders. Failure to act in time could lead to a reduced capacity of the planet to support human life, with mass fatalities.¹⁹ Yet the response from governments is too little, too late, with some even denying the reality of climate change and encouraging economic activities that increase the release of greenhouse gases.

The reason for this is that climate change is a complex and diffuse risk that has long seemed somehow to lie outside short-term priorities.²⁰ Because of its political sensitivity and economic implications, scientists have tended to make conservative evaluations of the scientific data, while there have been unanticipated accelerations in various scientific processes.²¹ It is not easy to assess the probability of tipping points beyond which runaway processes become uncontrollable but with timing that is uncertain. In addition, there have been massive attempts to deny and discredit the

¹⁷ Leena Srivastava. 2018. “Governance of Catastrophic Climate Change.” *Global Challenges Foundation Annual Report 2018*. <https://globalchallenges.org/en/our-work/annual-report/annual-report-2018/governance-of-catastrophic-climate-change>.

¹⁸ IPCC. 2018. *Global Warming of 1.5°C (SR15)*, Special Report. Summary for Policy Makers. Geneva, Intergovernmental Panel on Climate Change, October 2018. www.ipcc.ch/report/sr15/.

¹⁹ Ripple, William J., Christopher Wolf, Thomas M. Newsome, Mauro Galetti, Mohammed Alamgir, Eileen Crist, Mahmoud I. Mahmoud, William F. Laurance, and 15,364 scientist signatories from 184 countries. 2017. “World Scientists’ Warning to Humanity: A Second Notice.” *BioScience* Vol. 67, No. 12, pp. 1026–1028. <https://doi.org/10.1093/biosci/bix125>; Meadows, Donella, Jorgen Randers, and Dennis Meadows. 2004. *Limits to Growth: The 30-Year Update*, White River Junction, VT, Chelsea Green Publishing Company; McKibben, Bill. 2018. “Life on a Shrinking Planet,” *The New Yorker*, November 26, 2018, pp. 46–55.

²⁰ Marshall, George. 2014. *Don’t Even Think about It: Why Our Brains Are Wired to Ignore Climate Change*, London, Bloomsbury.

²¹ IPCC, *Global Warming of 1.5°C*.

science for ideological and political ends and to protect vested interests. It is already difficult enough to educate the public on such issues without the headwind of such negative forces that stoop to anything to win their argument, even to the extent of denying the validity of expert scientific opinion. Much of the world is in denial.

The human-induced causes of climate change are well known, with the release of greenhouse gases from fossil fuels, intensive agriculture and deforestation primarily responsible.²² Unfortunately these activities are fundamental to the present model of development and high consumption, meaning that everyone is responsible, with increasing responsibility with greater wealth and power. The only solution is a fundamental transformation in the system, but there is great inertia and resistance from vested interests. A global approach is the only option, since the failure of some countries to cooperate can doom the efforts of all the rest. However, a system of global governance still dominated by great powers defending national interests has proved itself incapable of responding to the problems of such interdependence.²³

While there are many positive signs of change, and technological solutions are largely available, the transition is not occurring quickly enough. After the failure at the UN Climate Change summit in Copenhagen in 2009, the 2015 Paris Climate Change Agreement succeeded in mapping out a way forward, agreeing to hold global warming to 2°C and aiming for 1.5°C, which is the level that might ensure the survival of some small island developing states that would otherwise drown with rising sea levels. In Paris, almost all governments promised voluntary nationally determined contributions to greenhouse gas emission reduction, but even if all of these are effectively implemented, which is far from certain, they would only limit warming to about 3°C. The Agreement therefore includes provisions for the regular review of progress and a ratcheting up of commitments to try to reach the target.²⁴

There are already some other elements of international governance for climate change in place. These include an effective scientific advisory process in the Intergovernmental Panel on Climate Change (IPCC) under the World Meteorological Organization (WMO) and UN Environment. With the rapid acceleration in the signs of climate change, it may need to increase the frequency of its reports (the next one is due in 2022), or to supplement them with near-real-time reporting where appropriate, to stimulate policy action. The Secretariat of the UNFCCC, supported by the host country France and many others, demonstrated its effectiveness in achieving the Paris Climate Change Agreement. However, as with most international agreements today, there is no enforcement mechanism. While the

²² IPCC. 2014. *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)], Geneva, IPCC.

²³ Viola, Eduardo, Matias Franchini, and Thais Lemos Ribeiro. 2012. "Climate Governance in an International System under Conservative Hegemony: The Role of Major Powers." *Revista Brasileira de Política Internacional*, Vol. 55 (special edition), pp. 9–29.

²⁴ The first review and recommitment is in 2020.

reporting mechanism is legally binding, the national commitments to reductions in emissions are explicitly voluntary both in the levels set by governments and in their implementation. The Conference of the Parties functions by consensus, so any one country can block decisions not in its national interest, and some frequently do so. The mechanisms of accountability are very weak,²⁵ relying largely on moral peer pressure to have any impact. A simple change in a national administration can easily lead to abandoning such commitments, and even to withdrawing entirely from the agreement, as we have already seen. Given the evident risks and even actual costs from climate change, and the threats to universal human well-being, this is not sufficient. Similarly, discussions of a mechanism for liability and compensation are blocked because some governments are well aware that they have contributed most to the problem and eschew accepting responsibility. Principles of good governance and responsibility that are widely accepted at the national level are rejected internationally as interference with national sovereignty and against national interests.²⁶

Given the recent evidence that the climate is already changing rapidly with negative consequences for humans and the environment, and the calls from the scientific community for urgent and immediate action,²⁷ what is really needed is a massive global campaign to transform energy, transportation and agricultural systems and the economy on what might be comparable to a war footing. There is no time to wait for fundamental improvements in global governance, but climate change could be the impetus for some first steps toward the collective global management of a significant dimension of the biosphere.

Ultimately, possibly not even waiting for the General Assembly to be reformed to give it a legislative responsibility, the UNFCCC Secretariat should be expanded into a UN Climate Change Organization with the authority to set global limits on greenhouse gas emissions necessary to keep global warming below 1.5°C or another boundary as determined by its scientific advisory process, and then to negotiate the assessment of risks and how the necessary actions will be shared among countries, with binding application and fines or other penalties for failure to respect the agreed limits. This will leave scope for different states to experiment with and evolve various approaches to returning to and staying within this planetary boundary, such as a global price for carbon or carbon tax, incentives for carbon capture and storage with both natural and technological methods, and accelerated implementation of renewable energy sources. The organization should have the financial means and technological capacity to assist poorer countries and small states to meet their mitigation obligations.

²⁵ Karlsson-Vinkhuyzen, Sylvia I., Maja Groff, Peter A. Tamás, Arthur L. Dahl, Marie Harder, and Graham Hassall. 2018. "Entry into Force and Then? The Paris Agreement and State Accountability." *Climate Policy*, Vol. 18, No. 5, pp. 593–599.

²⁶ In 2017, the United States announced its withdrawal from the Paris Agreement, has been gutting environmental regulation, and stimulating fossil fuel development.

²⁷ IPCC, *Global Warming of 1.5°C*.

Another part of the solution is educational. Formal educational systems should teach a proper understanding of science, complex systems and integrated approaches, and ethical values that favor solidarity, cooperation and service to the common good, as discussed in Chapter 19 on education and Chapter 20 on values. Media campaigns can also relate peoples' lived experience of the signs and symptoms of climate change to the larger scale of the problem and the causal factors in everyone's lifestyles and consumption patterns, including the more restrained use of natural resources, to build a sense of responsibility for action. This should be on the policy agenda of countries everywhere.

Climate-Induced Migration

It is probable, given the delays already in implementing controls to mitigate greenhouse gas emissions, that the organization will also need capacity to assist countries with adaptation to the already inevitable consequences of climate change, such as climate-induced migration (see Chapter 17). This will include anticipating the need to displace populations threatened by sea level rise or the permanent loss of essential water resources, so that this can be done proactively and not only after disaster strikes, to prevent human suffering. Since about 100 million people currently live less than 1 meter above sea level, and many others will be threatened, the magnitude of these forced permanent migrations will exceed anything the world has previously experienced on this time scale. Recent estimates of possible sea level rise from climate change now suggest that this could reach several meters by the end of the century if greenhouse gas emissions are not curtailed rapidly, displacing hundreds of millions of people and drowning coastal cities and infrastructure. The chaos this would create if not properly managed is incalculable, but holding back the waters is not an option.

Other parts of the UN system should collaborate in planning and executing the necessary migrations, many of which will have to cross national boundaries, and it may prove necessary to expand the mandate and resources of the International Organization for Migration, recently incorporated into the United Nations, to manage this process (see Chapter 17). While the need to help climate-displaced populations pull up roots, settle elsewhere and reestablish stable and productive lives is already daunting, an equally great challenge will be to prepare the receiving countries and populations, who have contributed to causing the climate to change, to welcome these immigrants and to help them integrate into their new situations.

Other Impacts

Climate change is already having a major impact on agriculture, forestry and fisheries, and thus on national economies and subsistence. First, there are the obvious impacts of droughts, floods, major storms and forest fires triggered or

accentuated by climate change. Responding to such natural disasters is usually seen as a national responsibility, but their increasing frequency and severity will push countries beyond their capacity to recover, requiring international assistance. A second dimension of climate change impact is on the very nature of these economic activities. Staple crops may no longer grow where they had previously been mainstays of local populations. Trees may be subject to new attacks by insects or diseases that the climate had previously kept under control, and tree species may no longer be adapted to changing local conditions of temperature and rainfall, such that forest types may have to be completely transformed. Trees cannot get up and walk to a better environment, so human intervention will be necessary to displace forests around the world, a process that will take many decades, often again crossing national boundaries. Ocean fish populations are already migrating in response to changing oceanographic conditions, sometimes out of reach of local fishermen and inshore fishing industries. The UN Food and Agriculture Organization (FAO) will need to add to its responsibilities the management of these large-scale transformations in the productive resources of the planet and help countries and local populations to adapt.

The same organization for managing global climate change should address another planetary boundary, that of ocean acidification, since this is caused by carbon dioxide dissolving in sea water and becoming carbonic acid. This acidification is already occurring and will impact all marine life that depends on calcified shells or skeletons, from fish and shellfish to plankton. Coral reefs are already under threat from coral bleaching due to excessively hot water, and acidification reducing coral growth will only make things worse. Efforts to control CO₂ as a greenhouse gas will also be relevant to ocean acidification, and the measures adopted for climate change mitigation and the assessment of impacts should explicitly take this other dimension into account.

At the largest scale, with our failure to respond in time to climate change, proposals are now being considered seriously for geoengineering as a last resort to stop runaway global warming. Seeding the oceans with iron to stimulate plankton blooms that might capture carbon and take it to the seabed has been proposed, but small-scale experiments have not demonstrated its effectiveness. Other proposals are to inject materials into the atmosphere that could reflect some of the sun's energy and thus cool the atmosphere, but this would also reduce photosynthesis and thus forest and crop growth. Atmospheric circulation driven by temperature differentials would be affected in unknown ways. The risks are high, the impacts uncertain and possibly catastrophic, and the effects not easily reversible in the short term. The idea that at present anyone can undertake such experiments is frightening, and businesses might see this as a new opportunity for profits. The reformed UN should have a strong technology assessment capacity to review all such proposals, to identify the risks involved and to advise the General Assembly on measures to be taken to protect the common global interest. Global legislation should be adopted to regulate all

geoengineering, to determine the necessary scientific research and development, to define the essential safeguards, and to authorize experiments or even implementation only once all risks have been addressed and minimized. It would be much more reasonable to control our greenhouse gas emissions.

Energy

The other face of the climate change challenge is energy, and specifically our present dependence on fossil fuels (coal, oil, gas) to power our material civilization. Fossil fuels represent solar energy trapped eons ago in organic matter (carbon compounds) buried in geological formations, providing a relatively cheap and concentrated form of energy. Releasing carbon dioxide to the atmosphere is a side effect of our use of these energy sources. We have become deeply dependent on (some may say addicted to) fossil fuel use, and much of our technology, from transport to petrochemicals, depends on these resources. The investments we have made in these technologies are enormous, and while alternatives now exist for much of this, managing the transition is proving very difficult. Economically, it means significant short-term costs associated with replacement of our massive investments in fossil fuels for everything from airplanes to road transport to ships to power plants, compensated by the huge economic growth that will result from investments in clean technologies and energy (with part of the funds coming from money currently spent on fossil fuel subsidies). Politically, it means depriving a range of countries that produce fossil fuels of their means of livelihood and status in the world. In human terms, there will be significant short-term unemployment across many industries, requiring retraining and new job opportunities.

Most urban infrastructure and many human habitations will have to be rethought and rebuilt. It might seem reasonable to allow many decades for this transition, but the rapid acceleration of climate change shows that this is not possible, and urgent action is required to avoid disaster. Inevitably, the inertia of the present system, vested interests in all these technologies and general resistance to change are throwing up obstacles that may seem impossible to overcome. Global governance will clearly have to play a significant role in preparing for, planning, accompanying and compensating for such fundamental changes in our civilization, yet there is presently no UN Energy Organization, only an International Energy Agency outside the UN system with 29 state members. More recently, in 2011 an International Renewable Energy Agency was established with 154 members that is supporting countries in their transition to a sustainable energy future.²⁸ The International Solar Alliance (ISA), a treaty-based intergovernmental organization of more than 121 countries within the Tropics, was initiated by India in 2015.²⁹

²⁸ Now 160 members. www.irena.org/.

²⁹ See www.isolaralliance.org/.

ENVIRONMENT AND THE BIOSPHERE

Biosphere Integrity

The Convention on Biological Diversity (CBD), the Convention on International Trade in Endangered Species (CITES), the Convention on Migratory Species (CMS), the Ramsar Convention on Wetlands and other conservation agreements, as well as many regional agreements, suggest the need for a coherent approach to the protection and ultimately restoration of the biological heritage of the planet and the integrity of the biosphere on which we all depend for survival. This includes both the functional diversity of ecosystems and life support systems, and genetic diversity represented by species or genetic resources. These are all interrelated and must be treated together. Much conservation action is implemented at the national level through endangered species protection, parks and other conservation areas, but there are also dimensions requiring an international approach, as is already the case for migratory species and trade in endangered species and their parts.

There is evidence that the sixth mass extinction event is already beginning,^{30, 31} with 60 percent of all animals on the planet lost in recent decades and pressures growing as available habitats are shrinking.³² This will have inevitable consequences for the loss of ecosystem services and the future carrying capacity of the planet for human society. Saving what is left and eventually trying to restore essential ecosystems will require international efforts beyond the national capacity of many countries. Global levels of coordination, scientific research and advice, and often financial support, will be necessary to assist countries to preserve what is left of their natural heritage.

Another related problem requiring an international approach concerns invasive species, which need to be identified, quarantined and controlled where they get out of hand. Invasive species can cause conservation catastrophes wiping out endemic species, upset the balance of ecosystems, impact human health and require expen-

³⁰ Previous mass extinctions include the Late Devonian, 375 million years ago, 75% of species lost; end of the Permian, 251 million years ago, 96% of species lost; end of the Triassic, 200 million years ago, 80% of species lost; and end of the Cretaceous, 66 million years ago, 76% of species lost.

³¹ Ceballos, Gerardo, Paul R. Ehrlich, and Rodolfo Dirzo. 2017. "Biological Annihilation via the Ongoing Sixth Mass Extinction Signaled by Vertebrate Population Losses and Declines." *PNAS – Proceedings of the National Academy of Sciences* Vol. 114, No. 30, e6089-e6096. DOI: 10.1073/pnas.1704949114; published ahead of print July 10, 2017. <https://doi.org/10.1073/pnas.1704949114>; IPBES. 2018. "Summary for policymakers of the thematic assessment report on land degradation and restoration of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services," ed. R. Scholes et al., Bonn, IPBES Secretariat.

³² WWF. 2018. *Living Planet Report – 2018: Aiming Higher*, ed. M. Grooten and R.E.A. Almond, Gland, Switzerland, WWF.

sive control measures – if they can be controlled at all.³³ The International Maritime Organization has taken the lead on invasive marine species spread in ships' ballast water, but much still needs to be done in other areas.

A further international issue is the conservation of biodiversity in areas beyond national jurisdiction. The International Whaling Convention (IWC) started as an instrument to regulate whaling, but since it failed to avoid the near-extinction of whales, it serves now primarily to conserve remaining whale populations and foster their recovery. There is a Convention for the Conservation of Antarctic Living Marine Resources, and protected areas on the high seas are now being considered under the Law of the Sea. There is no mechanism to protect the seabed and its biodiversity from proposals for seabed mining, which are being actively considered, by various companies.

Since the aims of all these processes are similar, there may be scope here for a more collective international approach in the future.

Another challenge requiring similar kinds of expertise is genetic engineering, at least in its environmental dimension (with human genetic engineering more the responsibility of the World Health Organization (WHO)). The capacity to create genetically modified organisms (GMOs) has largely been pursued by multinational agroindustries in a search for profits, with little attention to safeguards or the precautionary principle, producing a backlash against all GMOs in some regions. There is certainly a potential in genetic engineering to produce, for example, more drought-resistant crops to adapt to climate change, and other more constructive uses. A neutral science-based global mechanism is needed to review research in the field, screen proposals to release GMOs into the environment, authorize those that meet essential criteria of safety and usefulness, and monitor releases for unexpected side effects, just as is done with medicines. The mechanism should likely be global and within the UN system, carefully designed to be shielded against pressures from commercial interests.

Chemicals

The threats to human health and the environment from chemical pollution and similar human innovations and novelties such as nanomaterials represent another set of planetary boundaries to be respected. There are already the Basel, Rotterdam and Stockholm conventions that have recently been grouped as a chemicals cluster within UN Environment, with major interests also from the WHO for human health, and from the FAO for agricultural chemicals. The new Minimata

³³ For example, the predatory rosy wolf snail (*Euglandina rosea*) was introduced to French Polynesia to control the introduced giant African snail; instead it caused the extinction of 57 of 61 species of endemic snails in French Polynesia. The cane toad (*Rhinella marina*), introduced to many tropical areas to control pests in sugar cane, multiplies rapidly and its toxic skin threatens many animals that try to eat it.

Convention is now addressing mercury. The same framework might also take responsibility for the planetary boundaries for biogeochemical flows, in particular the global cycles for fixed nitrogen and phosphorus compounds, which have already been exceeded.

The current mechanisms to assess chemicals for their toxicity and the danger they represent to human health and the environment are largely national, or regional in the case of the European Union. Thousands of new chemical compounds are invented every year and must be tested and, if necessary, regulated. Many compounds and molecules created before modern testing was introduced have never been properly assessed. Coordination between these national processes is insufficient, and there is evidence that they are too easily subjected to lobbying from commercial interests. Chemicals may be banned in one country and still be freely available elsewhere. Research may suddenly demonstrate that a chemical previously thought innocuous has hidden damaging effects, as was discovered with the endocrine-disrupting compounds that upset hormonal balances in the body. The great multinational chemical companies are notorious for their efforts to protect their markets from regulation, in total disregard of the environmental and health impacts of the chemicals concerned, which have often been concealed from the public and regulators. Human susceptibility to a toxin does not depend on nationality, and chemicals, once released, do not respect national boundaries. Global governance of dangerous chemicals will be an obvious area to develop, producing considerable economies in overlapping national testing and regulatory processes, and filling gaps where countries do not have the technical means to manage such dangerous products.

Atmosphere

As much as some politicians might regret it, national boundaries do not extend into the atmosphere, and no policy or legislation can determine where the wind blows or where the air goes. The World Meteorological Organization observes the atmosphere to support weather forecasting but does not have a mandate for the composition of the atmosphere or its contaminants. Yet we know today that the atmosphere links all nations together in a global system. Pesticides used in the tropics evaporate, are carried by air currents toward the poles and condense out of the cold air to contaminate wildlife and affect human health. Vehicle traffic in the Sahara desert breaks up the surface crust, feeding dust storms that deposit iron and cause plankton blooms in the Black Sea and deliver fungal contaminants that attack marine life on Caribbean coral reefs. Dust from wind erosion on the loess plateau of northern China can reach as far as North America.

Transboundary air pollution has both regional and planetary implications. For stratospheric ozone, there is already the International Convention on the Ozone

Layer, with its Montreal Protocol on substances that deplete the ozone layer that is often cited as a great success for multilateral environmental diplomacy. Atmospheric aerosols can be transported long distances, even affecting the amount of sunlight reaching the Earth's surface. Europe has a regional Convention on Transboundary Air Pollution that has helped to control acid rain. Asia, however, has a significant problem with transboundary air pollution that has not yet been addressed, with clouds of particulate matter from East Asia reducing sunlight in India and as far away as the Maldives in the Indian Ocean. The illegal burning of tropical forests in Southeast Asia has spread smoke across the region, affecting human health and even air traffic. There is scope here for a more coherent global approach, as problems are certain to emerge in other regions with development. A global framework agreement on atmospheric pollution could encourage subsidiary regional agreements to address particular problems.

Managing Natural Resources

As a global community, we have been so focused on industrialization and now the post-industrial economy of services that we tend to forget that all of this ultimately depends on the natural resources of the planet: its soil, fields, forests and biodiversity; its air, winds and water; its minerals and fossil fuels. Our food and drink, and everything we manufacture, come ultimately from natural resources. Yet economists found it convenient to ignore them until they were exploited and turned into raw materials for products that could be marketed. Only on the fringes did some say that natural resources should be considered as natural capital, just as we have industrial capital or financial capital, and that we should try to live off the interest and maintain the capital resource sustainably. Some natural resources are renewable, and their productivity should be maintained, rather than mining them like forests for short-term profit. Others, such as some minerals or fossil fuels, are non-renewable; when they are used up, they are gone or degraded beyond use. Still others, including some metals, could be used over and over again if we recycle them in closed systems or a circular economy.

Since natural resources are not evenly distributed, they are a principal object of world trade, and this links them into a global pool of resources that requires global management. For example, the global trade in wood, pulp for paper and other forest products generates pressure to cut down forests everywhere, regardless of their importance for biodiversity conservation, watershed management, soil restoration, carbon storage, climate moderation and other ecosystem services not valued by the market. In the present economy, only marketed resources have value, so forests are logged. Clear-cutting for maximum profit may be favored over more sustainable forestry practices, and illegal logging and forest clearing are widespread, feeding corruption. National governments are often too weak to resist these pressures. There

is no mechanism to determine which forests are best conserved in the global interest, and to provide compensation or protection if necessary. Only by looking at forests as a global resource can the best uses be determined for each area, with some having their highest global value for biodiversity conservation, others for water supply and erosion control, and others suited for timber production. A share of the profits from the global timber trade could be used to finance the protection of forests with higher value for ecosystem services in their natural state.

What resource management there is today is done by multinational corporations, major traders and the market, with profit as the primary motive and the short term the temporal framework. Nations have largely lost sovereignty over their resources under global market pressures. All the non-market values of natural resources, such as the ecosystem services they provide and the maintenance of the biosphere suitable for life, are ignored. National boundaries do not correspond to natural features or ecoregions, and do not facilitate the management of shared resources. Natural resources are also unjustly distributed, with some countries well endowed and others very limited, requiring a global approach to redress inequities (see Chapter 14). In any federation or union of states, such as the United States or the European Union, it is normal for resources to be distributed where they are needed the most to reduce inequalities. The reformed United Nations should be able to earn the trust necessary to achieve this rebalancing in the common interest.

Ultimately, from a global perspective of equity and leaving no one behind, the natural resources of the planet should be seen as global assets from which everyone may benefit. They should be managed for sustainability and their distribution should be equitably regulated, which can best be done from a global perspective. The interconnectedness of energy and food systems, for example, is beyond market regulation, as when the conversion of crops to biofuel production for wealthier countries raised prices for food beyond the reach of the poor.

It will thus be necessary to replace gradually the present system of absolute national sovereignty over resources and their private or corporate ownership for profit. Accounting systems need to include natural resources, assets and processes as global natural capital to be maintained for planetary sustainability, with only the interest on that capital considered an available economic resource. Countries could be compensated for the use of resources within their territories to meet global needs, especially when there are negative impacts or trade-offs when the exploitation prevents other forms of development or benefit. They could also be compensated when a resource that could be developed has a higher use in its natural state for planetary welfare as a biodiversity conservation area or essential component of a life support system. Private enterprises could be licensed to develop resources within whatever limits are defined to protect the common interest. Institutionally, the altruistic motivation to create wealth for everyone can be just as powerful as, and

should replace, profit making for individuals or corporate entities. Profits are one sign of economic efficiency but should not become ends in themselves. Natural capital should take its place alongside financial capital and human capital and be managed and measured as such, as explained above. Costs and impacts presently treated as externalities should be incorporated in more complete accounting of costs and benefits.

Countries often sit on vast untapped natural resources that cannot be monetized or developed sustainably because of mismanagement, lack of trust, institutional weaknesses or corruption. Vast private sector resources might potentially be made available through public–private partnerships, within a framework of regulations in the common interest and providing for the equitable sharing of benefits, overseen by a credible organization or a renewed and expanded FAO with a General Assembly mandate in this area (see Chapter 14). This organization could also be given authority for the management of some resources beyond national jurisdictions, such as high seas fisheries and minerals found in the international seabed, presently a source of growing insecurity. Once some confidence is built in the global capacity to manage natural resources and ensure their equitable distribution, states may be ready to widen the scope of global management of the planet's resources where required to maintain and possibly improve planetary carrying capacity, and to remain within planetary boundaries.

Recommendations

The previous sections on global environmental challenges demonstrate the need for a strengthened global capacity for environmental governance, whether in one or several specialized agencies, supported by international scientific advisory and technology assessment processes designed to be protected from partisan national interests and industrial lobbying. This should cover climate change and ocean acidification, energy, atmospheric pollution, chemicals, and wastes such as plastics impacting the environment and human health, biodiversity and ecosystem services, and the global dimension of natural resources management. Some flexibility will be needed to take on new environmental risks that may be identified in the future. The many existing environmental programs, conventions and other bodies should be gradually integrated into this framework, retaining their competences and successes while reducing fragmentation and overlap. There will be a growing need for environmental restoration, requiring a global agency for knowledge sharing, technical assistance, and financial support to repair the damage done to our life support systems by the pillage of our planet by past and present economic activities.

Above all, an integrated approach is needed, since all environmental problems are interrelated in one global system, and they interact in complex ways. The acceleration of environmental decline – if not the collapse of essential ecological

processes – is a catastrophic risk that is far from appreciated today. Through the rising costs of natural disasters and destabilization of the resources on which our civilization depends, it could trigger social and economic crises and a downward spiral into collapse, chaos and anarchy.³⁴ Again, a rapid strengthening of global governance would be our best hope to avoid the worst outcome.

³⁴ Laybourn-Langton, Laurie, Leslie Rankin and Darren Baxter. 2019. *This Is a Crisis: Facing up to the Age of Environmental Breakdown*, London, IPPR: Institute for Public Policy Research. www.ippr.org/research/publications/age-of-environmental-breakdown.