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An Exploration of a Code of Conduct for Responsible Scientific Research involving Geoengineering

Introduction, Draft Articles and Commentaries

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Contents

Introduction

'People have forgotten this truth,' the fox said. 'But you mustn't forget it. You become responsible forever for what you've tamed. You're responsible for your rose.'

— Antoine de Saint-Exupéry, *The Little Prince*

Humankind is bound together in its shared responsibility to address the causes and consequences of climate change. Scientific advances and technological innovation in energy efficiency, renewables and other sectors are critical for coping with climate impacts if we are to shift course towards a more sustainable future. However, due to the scale of interference in the Earth system, geoengineering proposals stand apart as some of the most 'radical solutions' within the spectrum of proposed climate response strategies.[1] Geoengineering is commonly defined as the intentional large-scale modification of the planetary environment, primarily with the aim of counteracting climate change.[2] It is often distinguished from 'conventional' climate response strategies – namely, mitigation and adaptation – in terms of intent and scale.[3] Geoengineering is an umbrella term that covers a diverse set of proposed measures which either seek to draw out carbon dioxide and other greenhouse gases from the atmosphere ("greenhouse gas removal") or to directly cool the earth ("radiation management"). Caution is clearly warranted, however, since deliberate attempts to alter the land, sea or atmosphere at a regional or global scale are fraught with scientific uncertainties due, for example, to the complexity and variability of natural systems, and could cause serious, possibly irreversible harm to the environment and human communities.

None of the proposed geoengineering methods are at a stage of development where they could make a relevant contribution to any climate response strategy. Accordingly, given their largely conceptual nature, they should not bear upon current international climate negotiations and the implementation of the regime over the coming decade or longer. The feasibility of geoengineering proposals is only one aspect, however, as geoengineering cannot be relegated as a purely scientific and technical matter:[4] governance is perhaps 'the greatest challenge' surrounding the development and use of some proposed methods.[5] Geoengineering, if it is ever pursued in any form on a global scale, raises the long-term prospect of global environmental management at the Earth systems level with an immediate demand for anticipatory, reflexive and transparent oversight and control over experimentation and development of these controversial, emerging technologies. In spanning this gulf, governance would also have to be responsive to the possibility of surprises over the lifecycle of these technologies.

[1] International Bar Association (IBA), Climate Change Justice and Human Rights Task Force Report, Achieving Justice and Human Rights in an Era of Climate Disruption (July 2014) <http://www.ibanet.org/PresidentialTaskForceClimateChangeJustice2014Report.aspx> accessed 9 February 2015, 176 – 77.

[2] John Shepherd and others, 'Geoengineering the climate: Science, governance and uncertainty' (Report 10/09, The Royal Society 2009) (The Royal Society Report on Geoengineering) 1.

[3] Intergovernmental Panel on Climate Change (IPCC), 'Climate Change 2013: The Physical Science Basis. Contribution of Working Group I in T F Stocker and others (eds) Fifth Assessment Report of the IPCC (Cambridge University Press 2013) (IPCC AR5 WG1), Annex III Glossary, 1454.

[4] The Royal Society Report on Geoengineering (n 2) ix.

[5] Scott Barrett, 'Solar Geoengineering Brave New World: Thoughts on the Governance of Unprecedented Techno-logy' (2014) 8 *Review of Environmental Economics and Policy* 249, 251.

From an international law perspective, these governance demands place the existing Westphalian system under some strain. The prospect of geoengineering touches upon many subject areas of international law, including sustainable development, the protection of the environment and the global commons, international peace and security, and human rights and equity. These global interdependences have practical and normative implications for State sovereignty that serve to justify some degree of international cooperation in geoengineering governance – perhaps from the very inception of these methods at the research and development phase.[6]

Surveys of the existing international legal landscape show that there are general rules and principles in international treaties and customary international law with relevance to geoengineering.[7] However, with the exception of the recent amendment to the 1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Protocol, LP)[8] on marine geoengineering[9] and the legally non-binding decision X/33 by the Parties to the Convention on Biological Diversity (CBD),[10] none of these were adopted with geoengineering in mind. The development of governance and regulation for the conduct of scientific research has been identified as the most pressing need, given the level of development of geoengineering proposals.[11]

The challenges faced by the international legal system in addressing geoengineering are not limited to gaps in the existing international legal framework, but also encompass potential normative overlaps. Like climate change, geoengineering covers many subject areas of international law. The topic falls within the regulatory and geographic scope of several international regimes governing the land, atmosphere and oceans. Sectoral regulation without effective coordination could give rise to legal fragmentation, conflict of laws, and overlapping institutional mandates. Indeed, the topic of geoengineering has already been taken up by several international agreements, such as the CBD and the 1972 Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention, LC) and its 1996 London Protocol, as well as intergovernmental organisations such as the Intergovernmental Panel on Climate Change (IPCC) and the Intergovernmental Oceanographic Commission of UNESCO (IOC-UNESCO). Regime interaction relating to geoengineering may occur in the law-making phase and in the interpretation and implementation of existing treaties with differing objectives, from different times and with different parties and institutional contexts.[12]

It is against this background that the Royal Society, in its influential report on geoengineering, recommended a programme of work on 'the development and implementation of governance frameworks to guide both research and development in the short term, and possible deployment in the longer term'.[13]

[6] Stefan Schäfer and others, 'Field tests of solar climate engineering' (2013) 3 *Nature Climate Change* 776.

[7] See Catherine Redgwell, 'Geoengineering the Climate: Technological Solutions to Mitigation – Failure or Continuing Carbon Addiction?' (2011) 2 *Carbon and Climate Law Review* 178; Daniel Bodansky, 'May we engineer the climate?' (1996) 33 *Climatic Change* 309; Rosemary Rayfuse, Mark G Lawrence and Kristina M Gjerde, 'Ocean Fertilisation and Climate Change: The Need to Regulate Emerging High Seas Uses' (2008) 23 *International Journal of Marine and Coastal Law* 297.

[8] Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (1996) 36 ILM 1 (London Protocol, LP).

[9] Resolution LP.4(8) on the amendment to the London Protocol to Regulate the Placement of Matter for Ocean Fertilisation and Other Marine Geoengineering Activities (18 October 2013) in 'Report of the Thirty-Fifth Consultative Meeting and the Eighth Meeting of the Contracting Parties' UN Doc LC 35/15 (21 October 2013) (Resolution LP.4(8)), Annex 4.

[10] Convention on Biological Diversity (CBD), Decision X/33, 'Biodiversity and Climate Change' (19 December 2010) UN Doc UNEP/CBD/COP/10/27 (CBD Decision X/33)

[11] A notable exception is Part XIII of the LOSC that, together with other provisions in the LOSC, provides a legal framework for the conduct of marine scientific research.

[12] See Margret A Young, 'Regime Interaction in Creating, Implementing and Enforcing International Law' in Margaret A Young (ed) *Regime Interaction in International Law: Facing Fragmentation* (Cambridge University Press 2012).

[13] The Royal Society Report on Geoengineering (n 2) 57.

In approaching this task, it is underscored that geoengineering does not exist in a legal void. There are treaty and customary obligations that directly apply to constrain State behaviour, as well as applicable national legislation and regulations in various jurisdictions. Where existing law is too general, opaque or exhibits gaps, there are instruments and norms that would nevertheless bear upon the design of an appropriate governance architecture for geoengineering. This does not preclude the need to develop new approaches and mechanisms. However, governance arrangements should take into account the interrelated and increasingly integrated system of formal and informal rules and norms, from the sub-national to international levels. The Oxford Principles – five high-level principles for geoengineering governance that have been endorsed by the UK House of Commons Select Committee on Science and Technology – provide a sound foundation for the elaboration of more concrete governance arrangements for research and potential deployment of these techniques.[14] This work has been augmented by the Asilomar Principles for Responsible Conduct of Climate Engineering Research.[15]

In terms of next steps, the Royal Society's Report on 'Geoengineering the Climate' recommended the development of 'a code of practice for geoengineering research' that will 'provide recommendations to the international scientific community for a voluntary research governance framework' and 'the establishment of a *de minimis* standard for regulation of research.'[16] Similar proposals are echoed throughout the literature on geoengineering.[17]

Following this recommendation, this working paper explores elements for a 'Draft Code of Conduct for Responsible Scientific Research involving Geoengineering'. Together with its accompanying commentaries, it represents the preliminary work of legal scholars carried out in consultation with academics from the natural and social sciences, as well as representatives of governmental agencies and civil society organisations. The working paper builds upon existing legal scholarship and policy recommendations and takes into account advancing scientific, political, sociological and economic discussions. It endeavours to provide a comprehensive survey of salient legal concepts, principles and procedures relevant to geoengineering, focusing on the near-term prospect of scientific research conducted in the open environment. Beyond this, however, it is directed at stimulating further focused and critical discussion by advancing tentative conclusions in the form of draft guidelines. Throughout the commentaries, a distinction is made between binding international law and places in which progressive developments are proposed in the text of the draft Articles, for example, regarding the interpretation or amplification of the terms of existing treaties. Although limited, the working paper also identifies unresolved policy questions and the need for institutional structures and processes for implementing effective governance. Finally, issues related to legal form are also examined.

[14] Steve Rayner and others, 'The Oxford Principles' (2013) 121 *Climatic Change* 499, 507 endorsed by the UK House of Commons Science and Technology Select Committee on 'The Regulation of Geoengineering' (HC 2009–10, 221–V) 34.

[15] See, e.g., Asilomar Scientific Organizing Committee (ASOC), 'The Asilomar Conference Recommendations on Principles for Research into Climate Engineering Techniques' (Climate Institute, November 2010) (ASILOMAR Geoengineering Conference Report).

[16] The Royal Society Report on Geoengineering (n 2) 61. See further in that Report, 51: 'An internationally agreed (but initially voluntary) code of conduct and system for approval for geoengineering research would be highly desirable. This should include provisions for appropriate environmental monitoring and reporting, depending on the magnitude and spatial scale of the experiments. […] The Code of Practice could follow the general principles provided by the London Convention […] and require the characterisation of the what, where and how of the intervention, an assessment of potential effects, appropriate monitoring, and an assessment of the likelihood of achieving the desired climate impact. Only experiments with effects that would in aggregate exceed some agreed minimum (*de minimis*) level would need to be subject to such regulation. The appropriate level would need to be decided collectively.'

[17] See further Catherine Redgwell, 'Abstract for Keynote III-1: Policy, Governance and Socio-Economical Aspects of Geoengineering' in O Edenhofer and others (eds), 'IPCC Expert Meeting Report on Geoengineering Meeting Report' (IPCC Working Group III Technical Support Unit and Potsdam Institute for Climate Impact Research 2012) (IPCC Expert Meeting Report on Geoengineering), Annex 3. See also Daniel Bodansky, 'The who, what, and where of geoengineering governance' (2013) 121 *Climatic Change* 539, 547; Schäfer and others (n 6); Editorial, 'Look ahead: research into climate engineering must proceed – even if it turns out to be unnecessary' *Nature* (2 December 2014) < http://www.nature.com/news/look-ahead-1.16466> accessed 9 February 2015.

This working paper takes as it starting point the question of how geoengineering research should be governed, but this is not intended to preempt important societal debate regarding the acceptability of geoengineering, including whether some of these technologies should be researched and developed at all. In any event, the aim is to provide a legal analysis – also taking into account ongoing developments in international relations and current literature – of the necessary elements for a goverance and regulatory framework if further research of geoengineering methods is undertaken.

The analysis is directed at two categories of concerns raised about scientific research activities involving geoengineering. The first is that scientific research conducted in the open environment could damage the environment or human health and safety. Harm may result from invasive sampling methods or damage caused by the use of instruments and equipment. Physical impacts arising from scientific research are not limited to observational studies, but also extend to experiments that involve perturbing the natural environment to understand it better. The second area of concern is not that experimental tests could cause any direct and immediate physical harm, but instead relates to the societal implications of the knowledge gained from conducting these studies, and from the societal response to the fact that the studies are being carried out. Plainly, research and development of global technologies for planetary management are not exclusively within the problem-solving capabilities of reductionist science. In managing human interactions with the environment, it is also necessary to accommodate deep uncertainties and pluralistic human values and preferences.

The analysis treats scientific research as a distinct issue area subject to special considerations that might not come into play in the regulation of other established uses; for example, focusing on science-specific general principles, such as the conduct of scientific research for the common good and relevance to the freedom of scientific research, its content, limits and ongoing evolution. Particular attention is also given to the large uncertainties associated with research activities, specifically given the novelty factor of perturbative experiments conducted in the open environment, but also factoring in other societal concerns such as technological control and path dependency. Although the focus is on scientific research, the analysis also takes into account the long-term horizon in the face of the possible use geoengineering.

In terms of instrument choice, there are widespread calls for a flexible governance framework for research activities that interacts at multiple levels. There is also a need for an instrument that reaches beyond the traditional sphere of international law, in which States remain the principle actors, to involve other sectors of society, including intergovernmental and non-governmental organisations, companies, and scientific institutions, academies and individual scientists in order to respond to the transnational demands of climate governance.

The first part of the draft Code of Conduct mainly contains general principles to guide responsible scientific research that is consistent with the wider framework of international law and sustainable development. Draft Article 1 addresses the nature, scope and form of the draft Code of Conduct as a legal harmonising instrument, stating that it is voluntary, based upon the relevant rules and principles of international law, and that it primarily addresses scientific research activities conducted in the open environment. The objectives, as laid out in draft Article 2, mainly relate to the elaboration of rules and principles in accordance with international law for responsible scientific research involving geoengineering. Draft Article 4 further clarifies the scope of the draft Code by defining key terms including geoengineering, greenhouse gas removal and radiation management. Draft Article 5 situates geoengineering within the wider normative framework of international climate law and policy, while draft Article 6 addresses international cooperation as a central principle of international environmental law. Draft Articles 7 and 8 set out the fundamental, related principles of prevention and precaution. Draft Article 9 incorporates the main elements of legally non-binding CBD decision X/33(8)(w) that creates an exception for scientific research involving geoengineering, but adopts a moratorium against the use of geoengineering until there is a rational basis for such action. Draft Article 10 is directed at government authorities, but also directly at scientists and establishes general principles for the conduct of scientific research in the open environment.

Substantive guidance on the conduct of scientific research involving geoengineering is accompanied by an examination of adaptive risk assessment procedures for evaluating proposed research projects on a case-by-case basis as well as plans, programmes and policies more generally. The normal threshold for triggering international regulation of an activity is the risk of significant harm to the environment. Perhaps the most far reaching progressive development pursued by these draft Articles is the lowering of the threshold for procedural obligations to cover all scientific research involving geoengineering conducted in the open environment. This *lex ferenda* proposal is justified on various grounds, including fostering a culture of international cooperation, public consultation and transparency for geoengineering from the outset. The draft Code includes a two-tiered assessment procedure, which aims to take a light touch upon the regulation of research activities, balanced against the need for open, deliberative assessment of the science. Once it has been established that a proposed research activity involves geoengineering (draft Article 11) and has proper scientific attributes (draft Article 12), it is recommended that all research proposals undergo an initial environmental assessment (draft Article 13). If it is determined that the activity remains below a specific risk threshold, taking into account the precautionary principle, authorisation could be granted (draft Article 16), subject to other guidance regarding public participation, post-project monitoring, and the exchange of information. This establishes a bottom floor to ensure the proper evaluation of research into geoengineering, even if the direct physical risk to the environment is predicted to be minimal. If the proposed research activity surpasses the relevant risk threshold, a comprehensive environmental assessment is recommended (draft Article 14). States are also called upon to facilitate public participation (draft Article 15) and ensure adequate post-project monitoring of the research activity (draft Article 17). Furthermore, to facilitate key objectives of international cooperation, transparency and information exchange, States and other actors are called upon to ensure the timely, complete and reliable reporting and exchange of all results, data and other information arising from the conduct of scientific research (draft Article 18).

In view of the 'absence of a science-based, global, transparent and effective regulatory and control mechanisms for geoengineering',[18] this working paper by no means aims to resolve all the complex and interconnected issues that arise with respect to the regulation and governance of scientific research involving geoengineering. Rather, the primary objective is more limited: to show that the issue of geoengineering is located within a large body of evolving international norms and an existing legal framework, and that rules, principles and mechanisms established in other contexts can make a contribution to the elaboration of responsible governance of geoengineering at all levels. It is hoped that this study will stimulate further discussion and scholarly work as societies grapple with the serious and complex questions related to geoengineering governance and regulation at all levels.

[18] CBD Decision X/33.

Draft Article 1

Nature and Scope

1. This draft Code of Conduct is voluntary. However, certain parts of it are based on the relevant rules and principles of international law. It also contains provisions that may be binding by means of other obligatory legal instruments amongst the Parties of such instruments.[19]

2. This draft Code of Conduct is global in scope and is directed at States as well as other relevant actors and organisations with an interest in promoting responsible practices for the conduct of scientific research involving geoengineering, including members of scientific community and its institutions.[20]

3. This draft Code of Conduct aims to contribute to the establishment of principles and procedures applicable to geoengineering. Taking into account draft Article 9, its provisions primarily address scientific research conducted in the open environment, but parts of it also cover other geoengineering activities, including policies, plans and programmes.

Commentary

(1) An important question is whether there are useful examples in international law that can be applied to developing a code of conduct for geoengineering research, taking into account the characterisation of the issue and the relevant recommendations in the literature on geoengineering governance and regulation. In terms of form and approach, one potentially useful model is the inter-governmental FAO Code of Conduct for Responsible Fisheries. Like climate change and geoengineering, global fisheries governance is a broad issue that entails a high degree of regime interaction and normative overlap between agreements and organisations such as marine environmental protection under the umbrella of the United Nations Convention of the Law of the Sea (LOSC), global trade under the auspices of the World Trade Organisation (WTO), and food security under the United Nations Food and Agriculture Organisation (FAO). The FAO Code was a document negotiated by States to provide a legally non-binding, harmonising instrument to enhance fisheries governance and the implementation of existing agreements. It finds its genesis in other internationally negotiated instruments and was designed to be compatible with the LOSC and UN Fish Stocks Agreement. Similarly, this voluntary draft Code of Conduct takes into account a wide range of international agreements and general customary norms with the aim of promoting harmonised emerging law-making on geoengineering at the national, regional and international levels.

(2) In addition, although the FAO Code of Conduct is primarily directed at the international level in which States preside as dominant actors, it was recognised that governance would also require broader involvement of stakeholders including industry, fishermen, and members of coastal communities in order to enhance the implementation of its principles. In the same way, this draft Code of Conduct contemplates a role for both State and non-State actors, including members of the scientific community as key stakeholders in the development and application of measures for the responsible conduct of scientific research involving geoengineering. It is envisaged that the implementation of the guidance set out in this draft Code at the international level will require the involvement and coordinative efforts of existing or new international institutions, treaty bodies, governments and other non-State actors such as NGOs, business, research institutes, scientific academies and individual scientists.

[19] Food and Agriculture Organisation of the United Nations (FAO), 'FAO Code of Conduct for Responsible Fisheries' 28th Session of the FAO Conference (31 October 1995), art 1.1.

[20] FAO Code of Conduct for Responsible Fisheries, art 1.2.

(3) The first provision of this draft Code essentially repeats verbatim the corresponding article in the FAO Code of Conduct for Responsible Fisheries, addressing the legal form, objectives, and regulatory scope of this draft Code of Conduct as an instrument as a whole. Although each draft Article can provide stand-alone guidance on geoengineering, this legal study also explores possible options for legal form. The structure of this draft Code is as a voluntary, harmonising instrument addressed to different levels and actors. Parson and Keith argue that 'there may be a window' to build cooperation and transparency on geoengineering now before State interests galvanise.[21] The idea here is to mimic a bottom-up, 'facilitative' global governance model to promote the development of cooperation and good practices and engender buy-in at this early stage of exploratory research as well as to allow for flexibility to accommodate adaptive policy approaches and experimentation given the high levels of uncertainty.[22] The weakness of this approach in terms of overall effectiveness is that, as a non-binding instrument, compliance cannot be compelled by law. Despite the drawback of this approach in terms of lacking teeth, there would be disadvantages to pursuing more stringent 'contractual' models, particularly at this early stage.[23] This does not preclude that the soft aspects of this guidance could calcify into hard law at some later date.

(4) International lawyers make a distinction between an instrument's legal form as a whole and whether particular provisions of an instrument are mandatory or hortatory. In principle, any combination is possible. Paragraph 1 proposes a draft Code of Conduct in the shape of a legally non-binding or 'voluntary' instrument. Although the instrument as a whole is devised to be soft, some of its provisions incorporate legally binding obligations. The second sentence of this paragraph simply clarifies that references in this voluntary draft Code of Conduct to binding obligations of customary international law,[24] or to treaty provisions that bind States Parties to other international or regional agreements,[25] do not detract from the obligatory character.[26] Other provisions of this draft Code are merely recommendations in that they propose novel language and solutions to address specific problems related to geoengineering or are derived from other soft-law sources. These include interstate conference

[21] See Edward A Parson and David W Keith, 'End the Deadlock on Governance of Geoengineering Research' (2013) 339 *Science* 1278, 1279.

[22] Daniel Bodansky, 'The who, what, and where of geoengineering governance' (2013) 121 *Climatic Change* 539, 545.

[23] See Catherine Redgwell, 'Keynote III-1: Policy, Governance and Socio-Economical Aspects of Geoengineering' in O Edenhofer and others (eds), 'Expert Meeting Report on Geoengineering' (IPCC Working Group III Technical Support Unit and Potsdam Institute for Climate Impact Research, 2012) (IPCC Expert Meeting Report on Geoengineering) concluding that the negotiation of a 'bespoke' multilateral instrument on geoengineering is undesirable at this point in time.

[24] See, e.g., draft Article 7, below.

[25] These commentaries annotate and describe the genesis of each draft Article. They draw upon a wide range of multilateral, regional and bilateral treaties, including the United Nations Framework Convention on Climate Change (adopted 9 May 1992, entered into force 21 March 1994) (1992) 31 ILM 851 (UNFCCC); Convention on Biological Diversity (adopted 5 June 1992, entered into force 29 December 1993) 1760 UNTS 79 (CBD); United Nations Convention on the Law of the Sea (adopted 10 December 1982, entered into force 16 November 1994) 1833 UNTS 3 (LOSC); Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (1972) 11 ILM 1358 (London Convention, LC); Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and other Matters (adopted 7 November 1996) 36 ILM 1 (1997) (London Protocol, LP); Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (adopted 25 June 1998, entered into force 30 October 2001) 2161 UNTC 447 (Aarhus Convention); The Antarctic Treaty (adopted 1 December 1959, entered into force 25 June 1962) 402 UNTS 71; and the Protocol to the Antarctic Treaty on Environmental Protection (adopted 4 October 1991, entered into force 14 January 1998) 30 ILM I461 (Madrid Protocol).

[26] Tullio Treves, 'The FAO Code of Conduct for Responsible Fisheries between Soft and Hard Law' in Michael W Lodge and Myron H Nordquist (eds) *Peaceful Order in the World's Oceans: Essays in Honour of Satya N Nandan* (Brill 2014) 302, 305–07.

declarations,[27] UN General Assembly instruments,[28] codes of conduct, guidelines and recommendations of international organisations.[29] Strictly speaking, the bright line that divides legally binding and non-binding sources is that the former will give rise to legal consequences if there is a breach of the obligation.[30] Boyle points out, however, that in contemporary international law the distinction between hard and soft law is 'not necessary decisive', but instead 'is often the product of a complex and evolving interplay of instruments, both binding and non-binding, and of custom and general principles'.[31] Finally, the development of a legally non-binding code of conduct as a first step does not preclude that such a code could give rise to legal effects in the future. Although the role, effectiveness and legitimacy of codes of conduct in international law are debated,[32] such instruments can have normative significance by influencing contemporary international relations and state practice, and perhaps ultimately by generating new law.[33]

(5) Paragraph 2 contains the first mention of the primary objective of this draft Code of Conduct to promote responsible practices for the conduct of scientific research involving geoengineering.[34] To whom is this guidance directed? It is conceivable that geoengineering research could be carried out by either State or non-State actors, such as scientists, scientific institutions, companies or other individuals.[35] 'States are, at this moment of history, still at the heart of the international legal system.'[36] International rules typically regulate non-State actors through the implementation and enforcement of national laws and regulations that give legal effect to the international rules within a particular jurisdiction.[37] However, this orthodox view that international law serves a strictly coordinative role between States is softening such that 'by now [it] has a governing function with a view to steering the actions of States, and to a more limited extent juridical or natural persons.'[38] Paragraph 2 is modelled upon Article 1.2 of the FAO Code of Conduct for Responsible Fisheries – an internationally negotiated instrument that is distinctive for taking a multi-actor approach to the regulation of fisheries. Although the FAO Code recognises the primary role of the State, certain international legal norms were 'devolved down' to the level of local communities, the private sector, and individual fishermen in recognition that 'the role of government, except perhaps as a guarantor internationally, may in prac-

[27] See, e.g., Declaration of the UN Conference on the Environment and Development, (12 August 1992) UN Doc. A/CONF.151/26/Rev.1 (Rio Declaration).

[28] See, e.g., United Nations General Assembly (UNGA), 'Universal Declaration of Human Rights' (10 December 1949) UN Doc A/RES/3/217 (UDHR); UNGA 'Declaration on Principles of International Law Concerning Friendly Relations and Co-operation among States in Accordance with the Charter of the United Nations' (24 October 1970) UN Doc A/RES/25/2625 (Friendly Relations Declaration).

[29] See, e.g., FAO Code of Conduct for Responsible Fisheries; United Nations Environmental Programme (UNEP) 'Goals and Principles of Environmental Impact Assessment' (16 January 1987) UN Doc UNEP/GC.14/17 (1987 UNEP Goals and Principles of EIA); Convention on Biological Diversity (CBD), Decision X/33, 'Biodiversity and Climate Change' (19 December 2010) UN Doc UNEP/CBD/COP/10/27 (CBD Decision X/33); Resolution LC-LP.1(2008) (31 October 2008); Resolution LC-LP.2(2010) 'Assessment Framework for Scientific Research Involving Ocean Fertilization' (11–15 October 2010).

[30] International Law Commission (ILC), 'Draft Articles on the Responsibility of States for Internationally Wrongful Acts' (2001) 2 Yearbook of the ILC, part two (ILC Draft Articles on State Responsibility).

[31] Alan Boyle and Christine Chinkin, *The Making of International Law* (Oxford University Press 2007) 210.

[32] Some caution is warranted regarding the possible legal effects of codes of conduct, e.g., that the expressly voluntary nature of such instruments could circumvent the will of States, raising important issues regarding legitimacy. See Helen Keller, 'Codes of Conduct and their Implementation: the Question of Legitimacy' and Armin von Bogandy 'Codes of Conduct and the Legitimacy of International Law' in Armin von Bogandy and Rüdiger Wolfrum (eds) Legitimacy in International Law (Springer 2008).

[33] On the possible legal or policy effects of soft-law codes of conduct at the international level, see Jürgen Friedrich, 'Codes of Conduct' in *Max Plank Encyclopaedia of Public International Law* (October 2010), paras 20–25. See also Boyle and Chinkin (n 31) ch 5.

[34] See draft Article 5(4), below.

[35] Bodansky (n 22) 545.

[36] Rosalyn Higgins, *Problems and Process International Law and How We Use It* (Oxford University Press 1993) 39.

[37] States have jurisdiction over activities conducted within their sovereign territory. Geoengineering activities carried out by private actors in areas beyond national jurisdiction, such as the high seas and subadjacent airspace present more difficult jurisdictional issues. See Rayfuse, Lawrence and Gjerde (n 7).

[38] Rüdiger Wolfrum, 'International Law' in Max Plank Encyclopaedia of Public International Law (November 2006).

tice be limited, but the same principles may be considered to apply.[39] An inclusive approach may also be useful for building early governance and regulation of scientific research involving geoengineering given that there are various stakeholders with an important role to play in legal development. It could also facilitate widespread acceptance and implementation of governance measures. Therefore, this draft Code is directed not only at States, but also calls for the involvement of a broader range of actors with a stake in developing responsible practices and standards for geoengineering research. There are a number of ways that guidance could be taken up, including implementation by international organisations,[40] national agencies (e.g., through processes for providing public research funding and infrastructure), private or quasi-private institutions, NGOs, scientific academies or individual researchers.

(6) Paragraph 3 clarifies that this draft Code is primarily directed at 'scientific research conducted in the open environment.' Nevertheless, its scope covers a broader spectrum of activities than just outdoor research. At one end of the spectrum, the reference to 'policies, plans, and programmes' in paragraph 3 raises the possibility of developing processes for strategic environmental assessment (SEA) for geoengineering. SEA could have wider implications for such higher-level activities involving geoengineering, for example, by influencing funding decisions and domestic policies related to geoengineering and thereby also impacting on desk research and laboratory studies.[41] At the other end of the spectrum, this draft Code also tentatively addresses the possible larger-scale deployment of geoengineering measures. This is done expressly in draft Article 9, which incorporates legally non-binding CBD decision X/33, which effectively prohibits States from carrying out the 'use' of geoengineering while allowing scientific research to proceed under certain conditions. Furthermore, some of the general principles in this draft Code have the long-term horizon in mind regarding the possible use of some geoengineering measures. One might foresee that the global governance of geoengineering is likely to develop progressively, building on earlier approaches as new, specific standards and procedures unfold and as understanding of different techniques grows. Experience from the early governance and regulation of scientific research could therefore lay the foundation for the further development of principles and rules for a later large-scale implementation of a geoengineering measure, should it be deemed necessary in the future.

(7) The distinction drawn between 'scientific research' and 'other geoengineering activities' in paragraph 3 gives rise to the fundamental question of what constitutes scientific research?[42] This has become an increasingly important issue as the role of science and innovation in society has become more prominent, and as policymakers are faced with weighing the potential benefits of certain lines of scientific inquiry against the direct and indirect environmental and other societal ramifications and uncertainties linked to these research activities.

(8) The issue of the meaning of 'scientific research' is not merely confined to the political or scientific spheres. Many international environmental agreements contain exceptions for scientific research, an approach that has also been adopted with respect to geoengineering at the international level.[43] Although references to scientific research in international treaties are frequent, almost none define the term ex-

[39] J F Caddy, 'The Code of Conduct for Responsible Fisheries as a basis for evaluating fisheries research: a suggested operational procedure' (2000) 48 *Fisheries Research* 205, 207.

[40] For example, article 238 of the LOSC recognises the right of international organisations to conduct marine scientific research.

[41] See draft Article 11(2), below.

[42] See also draft Articles 9 and 12, below.

[43] See, e.g., CBD Decision X/33, para 8(w); Ocean Fertilisation Assessment Framework. See further Elmar Döhler and Carsten Nemitz, 'Wissenschaft und Wissenschaftsfreiheit in internationalen Vereinbarungen' in Helmut Wagner (ed), *Rechtliche Rahmenbedingungen für Wissenschaft und Forschung. Forschungsfreiheit und Staatliche Regulierung*, vol 1 (Namos 2000).

pressly.[44] The issue of the legal interpretation of the meaning of the term 'scientific research' was recently considered by the ICJ in the *Whaling in the Antarctic Case* regarding whether the Japanese Whale Research Programme under Special Permit in the Antarctic (JARPA II) was being conducted 'for the purposes of scientific research' in accordance with scientific exception set out in Art. VIII of the International Convention on the Regulation of Whaling (ICRW).[45] Focusing on the second part of the test regarding whether the evidence supported that the whaling activities were being conducted for 'the purposes of scientific research', allowed the Court to sidestep the need to devise criteria or provide a general definition of 'scientific research' in its judgement.[46] Like other international environmental agreements that refer to scientific research, this draft Code of Conduct does not define the concept expressly in the definitions set out in draft Article 4. Furthermore, in draft Article 9 it incorporates an exception to the moratorium on geoengineering for activities conducted 'for the purposes of scientific research' in line with CBD decision X/33.[47]

(9) In practice, distinguishing between scientific and non-scientific activities can be difficult for several reasons. Challenges include distinguishing the underlying object and purpose of conducting scientific research *ex ante* in relation to experimental design. In the worst case, for instance, a scientist may claim in a funding proposal to be carrying out the research to answer certain research questions, but as a kind of subterfuge have an underlying intention to apply research results, after the fact, to a different set of questions. Furthermore, regardless of the true purpose of conducting a research project, it is simply the nature of scientific research that the same data, measurements and samples from a single research endeavour may give rise to knowledge relevant for multiple ends. Moreover, prior intent may be rendered irrelevant given that serendipity continues to animate advances in scientific knowledge.[48] In addition, in the case of geoengineering, some scientists have argued previously that field testing some methods to determine their actual global impact would have to be carried out at time and spatial scales which are equivalent to deployment.[49]

(10) Narrowing down the inquiry even further, what constitutes scientific research conducted in the open environment? The literature refers to a range of possible 'field tests', 'experiments' or 'perturbative studies' which – depending on the activity and the particular characterisation – may be categorised as basic research, applied research or technological R&D.[50] 'Outdoor research' may furthermore cover observational studies on the effects of natural or other analogues[51] or may be restricted to environmental perturbation experiments.[52] In most cases, one might presume that observational studies might not give rise to the same

[44] Ronald B Mitchell, International Environmental Agreements Database Project (2002–2014) <http://iea.uoregon.edu/> accessed 30 August 2014 cited in the Memorial of Australia in *Whaling in the Antarctic (Australia v Japan)* [2014] ICJ <http://www.icj-cij.org/docket/files/148/18136.pdf> accessed 6 February 2015, para 4.43. For example, although several specific definitions were proposed during the course of the negotiations leading to the adoption of the LOSC, the final text did not include an express definition of the term 'marine scientific research,' on the ground that an explicit definition was unnecessary. See Florian H Th Wegelein, *Marine Scientific Research: the Operation and Status of Research Vessels and other Platforms in international Law* (Martinus Nijhoff Publishers 2005) 11; Alfred H A Soons, *Marine Scientific Research and the Law of the Sea* (Kluwer Law 1982) 124.

[45] Whaling in the Antarctic Case (Australia v Japan) [2014] ICJ <http://www.icj-cij.org/docket/files/148/18136.pdf> accessed 6 February 2015.

[46] *Whaling in the Antarctic Case*, paras 73–86.

[47] CBD Decision X/33.

[48] Patricia Birnie, 'Law of the Sea and Ocean Resources: Implications for MSR' (1995) 10 *International Journal of Marine and Coastal Law* 229, 242.

[49] Alan Robock and others, 'A test for geoengineering?' (2010) 327 Science 530; Martin Bunzl, 'Researching geoengineering: should not or could not?' (2009) 4 *Environmental Research Letters* 045104.

[50] Regarding radiation management, see Andy Parker 'Governing solar geoengineering research as it leaves the laboratory' (2014) 372 *Philosophical Transactions of the Royal Society* A 20140173. David W Keith, Riley Duren and Douglas G MacMartin, 'Field experiments on solar geoengineering: an exploration of a representative research portfolio' (2014) 372 *Philosophical Transactions of the Royal Society A*.

[51] According to Parker (n 50) such studies may include observing plant reactions to diffuse light due to the elevated concentration of aerosols from the burning of fossil fuels or observing of volcanic eruptions.

[52] Regarding the meaning of scientific research 'involving geoengineering', see commentary to draft Article 4, below.

environmental concerns as perturbation experiments. However, concerns have been raised about observational studies in the marine environment that use equipment or methods that can damage vulnerable sites. Furthermore, from a policy perspective, there may be advantages to covering a wider range of research activities and promoting more extensive cooperation and information sharing on geoengineering. The major trade-off of this inclusive approach relates to efficiency in that including a wider range of activities will create additional work for regulatory authorities and members of the scientific community.

(11) The fact that the main objective of these draft Articles is to address scientific research also warrants a closer examination of whether there are particular norms or approaches that apply to research as a distinct activity, in addition to a broader contextual analysis of the governance principles and structures of which science on geoengineering forms a part (e.g., protection of the environment). In this regard, the freedom of scientific research is often mentioned as a guiding principle for the governance and regulation of geoengineering.[53] However, the supporting analysis of the legal status, content and scope, and limits of this norm or concept under international law is limited.[54]

(12) As a starting point, it has been observed that 'research, as distinct from the application of technology with known impacts or risks, is generally not restricted under international law.'[55] However, the lack of express regulation is only a first step of the analysis, since it is a fundamental tenet of the international legal system that what is not prohibited is permitted. In other words, the absence of regulation cannot be directly equated with the legal guarantee of the freedom of scientific research.[56] Some legal scholars argue that the freedom of scientific inquiry is provided for under international law, albeit weakly, and also by virtue of the fact that it is necessary to ensure the effective operation of international law.[57] In general, there is no explicit guarantee of the freedom of scientific research in international law that equates with more robust and explicit formulations provided for in some national constitutions.[58]

(13) Several international and regional human rights instruments broadly recognise the right of everyone to enjoy the benefits of scientific research.[59] The freedom of scientific research can thus be seen in the light of the emerging conversation about the human rights implications of developing geoengineering measures. A 2012 Report of the Special Rapporteur in the field of cultural rights[60] recently examined the nature of a right to enjoy the benefits of scientific progress and its applications. The report identifies this right as being closely linked, and often a precursor, to other human rights, and to the duty of States to cooperate in the realisation of scientific progress.[61] Special Rapporteur Shaheed defined the scope of the concept broadly:

[53] A See, e.g., Parson and Keith (n 21).

[54] See generally Gerald Francis Graham, 'The Freedom of Scientific Research in International Law: Outer Space, the Antarctic and the Oceans' (DPhil Thesis, Universite de Geneve 1980); Döhler and Nemitz (n 43); Matthias Ruffert and Sebastian Steinecke, *The Global Administrative Law of Science* (Springer 2011).

[55] Secretariat of the CBD, Geoengineering in Relation to the CBD: Technical and Regulatory Matters (Technical Series No. 66, 2012) (CBD Report on Geoengineering) 141.

[56] *Case of the SS 'Lotus' (France v Turkey)* [1927] PCIJ Rep Series A No 10, 18, [i]nternational law governs relations between independent States. The rules of law binding upon states therefore emanate from their own free will [...]. Restrictions upon the independence of States cannot therefore be presumed.' However, see Judge Simma, criticising the Lotus principle in *Accordance with International Law of the unilateral declaration of independence in respect of Kosovo* (Advisory Opinion of 22 July 2010) ICGJ 423, Declaration of Simma J. See also Georges Abi-Saab, 'Whither the International Community?' (1998) 9 *European Journal of International Law* 248, 252.

[57] See Matthias Ruffert and Sebastian Steinecke, *The Global Administrative Law of Science* (Springer 2011) 29 – 35; Graham (n 54).

[58] Döhler and Nemitz (n 43) 186.

[59] See, e.g., UDHR, art. 27(1); International Covenant on Civil and Political Rights (adopted 16 December 1966, entered into force 23 March 1976) 999 UNTS 171 (ICCPR), art 15(1) and (3); Charter of Fundamental Rights of the European Union, 2000/C 364/01 (18 December 2000), art 13.

[60] Report of the Special Rapporteur in the field of cultural rights, Farida Shaheed: The right to enjoy the benefits of scientific progress and its applications, UN Doc A/HRC/20/26 (14 May 2012) (Report of the Special Rapporteur on the Benefits of Scientific Progress).

[61] Report of the Special Rapporteur on the Benefits of Scientific Progress, para 8. See also draft Article 6, below.

> Science must be understood as knowledge that is testable and refutable, in all fields of inquiry, including social sciences, and encompassing all research. The terms 'benefits' of science and 'scientific progress' convey the idea of a positive impact on the well-being of people and the realisation of their human rights. The 'benefits' of science encompass not only scientific results and outcomes but also the scientific process, its methodologies and tools.[62]

Special Rapporteur Shaheed goes on to define the normative content of the right to benefit from scientific progress and its applications as including:

> (a) access to the benefits of science by everyone, without discrimination; (b) opportunities for all to contribute to the scientific enterprise and freedom indispensable for scientific research; (c) participation of individuals and communities in decision-making; and (d) an enabling environment fostering the conservation, development and diffusion of science and technology.

(14) However, like other general norms of international law with relevance to geoengineering, the analysis of this human right *vis-à-vis* geoengineering is not clear cut. For example, a cursory examination suggests that the first aspect of this guarantee concerning 'access to the benefits of science by everyone, without discrimination' includes a right of access to scientific information.[63] This guarantee is provided for in draft Article 18. However, it is also suggested that this right extends beyond this to a 'right to have access to scientific applications and technologies.' However, the Special Rapporteur notes that '[t]he potential implications of scientific advances likely to have a significant impact on human rights, such as electricity, information and communication technologies, nanotechnology and synthetic biology, need attention.'[64] Some radiation management methods raise serious human rights concerns related to the preservation of the 'international democratic order' both at the domestic level in terms of public participation and consultation on geoengineering and at the international level concerning interference in the affairs of sovereign states in accordance with Article 2(7) of the United Nations Charter.[65] It is noteworthy in this regard that the human right to benefit from scientific progress also encompasses a right of individuals to participate in science-related decision-making. In particular, the participatory dimensions of this right cover, firstly, the obligation to protect all persons 'against the negative consequences of scientific testing or applications, on, in particular, their food, security, health or environment,' and, secondly, the need to ensure that scientific research is conducted on key issues. These obligations can be read in several ways regarding whether further geoengineering research should be pursued or not. The bottom line is, however, that 'major decisions regarding funding and research priorities, science policies, emerging areas of research, and new technological applications should entail a participatory process', as provided for in draft Article 15.[66] The freedom of scientific research is interpreted as having an internal balancing function, whereby 'the scientific enterprise remains free of political and other interference, while guaranteeing the highest standards of ethical safeguards by scientific professions.'[67] However, the limits of this freedom regarding outdoor experimentation were not addressed by the Special Rapporteur.

[62] Report of the Special Rapporteur on the Benefits of Scientific Progress, para 24.

[63] Report of the Special Rapporteur on the Benefits of Scientific Progress, paras 26 – 28.

[64] Report of the Special Rapporteur on the Benefits of Scientific Progress, para 29.

[65] Alfred de Zayas, International Law Association (ILA) Panel on Geoengineering (New York, 24 October 2014) <https://dezayasalfred.wordpress.com/2014/11/27/international-law-weekend-panel-on-geo-engineering-alfred-de-zayas/> accessed 11 February 2015.

[66] Report of the Special Rapporteur on the Benefits of Scientific Progress, para 43.

[67] Report of the Special Rapporteur on the Benefits of Scientific Progress, para 39.

(15) One can also look to national law, in particular, constitutional sources, as evidence of the general principles of law recognised by civilised nations pursuant to Art. 38(1)(c) of the Statute of the International Court of Justice.[68] Santosuosso identifies three ways that constitutional guarantees may cover the freedom of scientific research: firstly, it is protected in most countries as a general protection of free expression; secondly, it receives express recognition mainly in Europe; and finally, it is provided for through the positive support of States around the globe promoting research.[69] However, there are significant differences in the expression of this guarantee in national law.[70]

(16) It is also important to recall that the freedom of scientific research is not without its limits, even if guaranteed constitutionally by domestic legal systems. Emancipatory accounts may not fully recognise that attached to this freedom are corresponding obligations and responsibilities upon scientists,[71] such as integrity in the practice of science, accurate communication, and care to maximise the benefits from scientific research. Within the international law sphere these are also widely recognised. For instance, the underlying rationale for the promotion and guarantee of the freedom of scientific research in international law – which is generally framed in terms of advancing the collective interests of the international community, and not as an individual right to conduct research – is highly relevant in terms of what the governance of geoengineering research should look like. Transparency and the open exchange and dissemination of scientific data and information about geoengineering are important to ensure that everyone benefits from scientific research in this area, especially given that research activities may have environmental and other societal consequences.

(17) Finally, as a counterargument to policy preferences for limited regulatory oversight of geoengineering research to advance scientific progress, it should also be borne in mind that an effective regulatory framework for geoengineering research could actually promote the freedom of scientific inquiry (in contrast to the complete absence of regulation). For example, binding regulation can provide legal certainty and may actually facilitate scientific research by providing for a clear authorisation process that establishes ground rules to constrain and prevent arbitrary or capricious decision-making by authorities on this controversial topic.

(18) Although these questions require further study, it can be tentatively concluded that the freedom of scientific research still has relevance today, but that 'the world in which it serves is vastly more complex, integrated and dependent on science and technology, and scientific and technological innovation than when the idea first came to be advanced.'[72] Contemporary understandings are more nuanced in the face of the changing role of science in society and tend to eschew previously held progress narratives that unfettered scientific freedom is central to advancing scientific discovery.[73] The tensions revealed in these commentaries relating to the freedom of scientific research, its limits and corresponding responsibilities are probably best explained by the statement that today 'scientific freedom can be usefully understood as a practice of governance,'[74] which is embedded a system 'marked [...] by increasingly intense, extended and complicated interaction between all sites of social, political and economic organisation, spanning across all pre-existing jurisdictional boundaries.'[75]

[68] (adopted 26 June 1945, entered into force 24 October 1945) 3 Bevans 1179; 59 Stat 1031.

[69] Amedeo Santosuosso, 'Freedom of Research and Constitutional Law: Some Critical Points' in Simona Giordano, John Coggon and Marco Cappato (eds), *Scientific Freedom: An Anthology on the Freedom of Scientific Research* (Bloomsbury 2012).

[70] See Report of the Special Rapporteur on the Benefits of Scientific Progress, paras 13–15; Eric Barendt, *Academic Freedom and the Law: A Comparative Study* (Hart 2010).

[71] For a social science analysis of the role for responsibility in science and innovation, see Jack Stilgoe, Richard Owen and Phil Macnaghten, 'Developing a framework for responsible innovation' (2013) 42 *Research Policy* 1568.

[72] Jim Falk, 'Scientific Freedom in an Evolving World' in Simona Giordano, John Coggon and Marco Cappato (eds), Scientific Freedom: An Anthology on the Freedom of Scientific Research (Bloomsbury 2012).

[73] See, e.g., Sheila Jasanoff, 'Technologies of Humility: Citizen Participation in Governing Science' (2003) 41 *Minerva* 223, 224.

[74] Falk (n 72) 60.

[75] Falk (n 72) 62.

Draft Article 2

Objectives

The objectives of this draft Code of Conduct are to:

1. contribute to the establishment of rules and principles, in accordance with international law, for responsible scientific research involving geoengineering, taking into account all relevant environmental, scientific, technological, economic, social, cultural and other concerns;[76]

2. contribute to the establishment of principles and criteria for the elaboration and implementation of national laws, regulations, measures and policies for responsible scientific research involving geoengineering;[77]

3. serve as an instrument of reference to assist States in establishing or improving the legal and institutional framework required for responsible scientific research involving geoengineering and in the formulation and implementation of appropriate measures;[78]

4. provide guidance which may be used where appropriate in the formulation and implementation of international agreements and other legal instruments, both binding and voluntary, as well to promote harmonisation;[79]

5. facilitate and promote scientific, technical, and other cooperation for the promotion of responsible scientific research involving geoengineering;[80]

6. provide standards of conduct for all persons or other bodies involved in scientific research involving geoengineering.[81]

Commentary

(1) Draft Article 2 lays down the overall objectives for the establishment of this draft Code of Conduct,[82] which was developed by legal scholars in collaboration with scientists and other experts to provide a legal analysis and reference instrument to contribute to the interpretation, implementation and further development of existing international rules and principles for the promotion of the responsible conduct of scientific research involving geoengineering. In addition to having a gap-filling function, this draft Code could also serve as an umbrella instrument to promote harmonisation across legal regimes and at the national, regional and international levels.

[76] FAO Code of Conduct for Responsible Fisheries, art 2(a).
[77] FAO Code of Conduct for Responsible Fisheries, art 2(b).
[78] FAO Code of Conduct for Responsible Fisheries, art 2(c).
[79] FAO Code of Conduct for Responsible Fisheries, art 2(d).
[80] FAO Code of Conduct for Responsible Fisheries, art. 2(e).
[81] See draft Article 10, below.
[82] See also draft Article 1(3), above.

Draft Article 3

Relationship with International Law

This draft Code of Conduct is to be interpreted and applied in conformity with the relevant rules and principles of international law, including the respective obligations of States pursuant to international agreements to which they are party and other relevant declarations and international and regional instruments. Nothing in these draft Articles prejudices the rights, jurisdiction and duties of States under international law.[83]

Commentary

(1) Draft Article 3 clarifies the relationship between this draft Code of Conduct and international law. Adopting the language of Article 3 of the FAO Code of Conduct, this provision 'aims at ensuring consistency between the provisions of the code and other rules and instruments, binding and not binding.'[84] It incorporates a savings clause which clarifies that the provisions of this draft Code are without prejudice to international law.

Draft Article 4

Definitions

For the purposes of this draft Code of Conduct:

1. "Adverse effect" means changes in the physical environment or biota which have deleterious effects on the composition, resilience or productivity of natural and managed ecosystems, on the operation of socio-economic systems, or on human health and welfare.[85]

2. "Climate change" means a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is, in addition to natural climate variability, observed over comparable time periods.[86]

3. "Climate system" means the totality of the atmosphere, hydrosphere, biosphere and geosphere and their interactions.[87]

4. "Emissions" means the release of greenhouse gases and/or their precursors into the atmosphere over a specified area and period of time.[88]

5. "Geoengineering" means response strategies or measures that aim to deliberately modify the environment on a large scale, including for the purpose of counteracting anthropogenic climate change and/or its adverse effects or scientific research related to that aim. Geoengineering is either greenhouse gas removal or radiation management.

6. "Greenhouse gases" means those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and re-emit infrared radiation.

7. "Greenhouse gas removal" means response strategies or measures that aim to remove greenhouse gases from the atmosphere. Greenhouse gas removal includes, *inter alia*, [...]. It does not include, *inter alia*, [...].

8. "Radiation management" means response strategies or measures that aim to reduce the amount of solar radiation absorbed by the Earth or enhance the amount of thermal radiation emitted from the Earth's surface to space. Radiation management includes, inter alia, [...]. It does not include, *inter alia*, [...].

[83] FAO Code of Conduct for Responsible Fisheries, art 1.1. See also Declaration of the UN Conference on the Human Environment (Stockholm) UN Doc A/CONF/48/14/REV.1 (Stockholm Declaration), Principle 21; Rio Declaration, Principle 2.

[84] Treves (n 26) 302.

[85] UNFCCC, art 1(1).

[86] UNFCCC, art 1(2).

[87] UNFCCC, art 1(3).

[88] UNFCCC, art 1(4).

Commentary

(1) Draft Article 4 defines relevant terms related to geoengineering for governance and regulatory purposes. In order to ensure the conformity of this draft Code of Conduct with the principles in the international climate protection regime, draft Article 4 incorporates the verbatim definitions of 'adverse effect', 'climate change', 'climate system', 'emissions', 'greenhouse gases' set out in the UNFCCC. Beyond this, draft Article 4 includes definitions of 'geoengineering', 'greenhouse gas removal' and 'radiation management' consistent with a broad, contemporary understanding of these concepts. Clearly, defining and categorising geoengineering techniques presents a challenge, as there is no consensus regarding which activities fall within the meaning of the term and those that fall outside of it, such as conventional mitigation or adaptation.[89] The relationship of geoengineering to other activities, such as weather modification and ecological engineering is also regarded as 'fuzzy'.[90]

(2) Paragraph 5 attempts to provide a workable definition of the term 'geoengineering.'[91] The difficulty in defining this term with any precision is complicated by a fundamental lack of agreement regarding the nature and scope of the subject matter for regulation. Geoengineering is an umbrella term that refers to a wide variety of proposed techniques, involving different methods, technical requirements, types and levels of risk and benefits, and feasibility. Even the term 'geoengineering' is not universally accepted and is used in parallel with others such as 'climate engineering', 'climate-related geoengineering', 'climate remediation', etc. In fact, some argue that due to the disparate nature of these proposed measures, the overarching category of 'geoengineering' should be abandoned altogether. However, at this early stage, an all-encompassing definition is useful for the establishment of general principles and rules and a general deliberative process for assessing these proposed methods 'all of which would carry side effects and long-term consequences on a global scale.'[92] Specific standards and procedures could be developed later for individual methods (e.g., in the form of technical annexes), as necessary, but in a way that is consistent with an overarching framework to avoid fragmentation. Concepts such as 'mitigation' or 'adaptation' are both categories that are also highly diverse in terms of the different measures that they cover. Nevertheless, they still have relevance and meaning as general categories in international climate law and policy. Thus, even though there is limited common ground regarding the use of terminology in international instruments, documents, government reports and other literature, paragraph 5 attempts to provide an all-inclusive definition of the term 'geoengineering' for regulatory purposes, taking into account the common features of different formulations. The term 'geoengineering' (as opposed to 'climate engineering') is used in this draft Code of Conduct mainly due to its adoption in the recent IPCC Report AR5,[93] and its legal significance as a term of art in the amendment to the London Protocol.[94]

[89] See Ralph Bodle and others, 'Options and Proposals for the International Governance of Geoengineering' (German Federal Environment Agency, June 2013) <http://www.umweltbundesamt.de/publikationen/options-proposals-for-the-international-governance> accessed 30 August 2014.

[90] IPCC Expert Meeting Report on Geoengineering (n 23) 2. Regarding weather modification, in its First Report on the Protection of the Atmosphere' (14 February 2014) UN Doc A/CN.4/667 (ILC First Report on the Protection of the Atmosphere), para 74, the ILC recently noted in the potential harmful consequences of such activities, recommending that 'progressive development of international law in this particular area should be pursued'. It further suggested that particular aspects should be considered on weather modification: 'the duty to benefit the common good of mankind; the duty not to cause significant transboundary harm, the duty to perform environmental impact assessments; public participation; the duty to cooperate; exchange information and notification; consultation; the duty to utilise international organisations; and State responsibility.'

[91] See David Keith, 'Geoengineering the Climate: History and Prospect' (2000) 25 *Annual Review of Energy and the Environment* 245; Y A Izrael, A G Ryaboshapko and N Petrov, 'Comparative analysis of geoengineering approaches to climate stabilisation' (2009) 34 *Russian Meteorology and Hydrology* 335; The Royal Society Report on Geoengineering (n 2); IPCC Expert Meeting Report on Geoengineering (n 90) 70.

[92] IPCC AR5 WG1 (n 3) 29.

[93] See IPCC AR5 WG1 (n 3).

[94] See Bodle and others (n 89) 39 observing that 'geoengineering is the most common term of reference.'

(3) The term 'geoengineering' may call to mind the notion of the development and use of technology.[95] Yet this characterisation is not entirely apt in the sense that some measures are not highly technical in nature and given that currently none of them constitute fully-fledged, working 'technologies', but instead exist as paper proposals that have not undergone any significant testing.[96] An advantage of the phrase 'response strategies or measures,' set out in paragraph 5, is its broader connotation in capturing the full range of geoengineering proposals, regardless of whether they are highly engineered and in the light of their development over time. Paragraph 5 adopts the language of 'response strategies' and 'measures' in order to remain consistent with the language adopted in the UNFCCC.

(4) The requirement of intention constitutes a common element in almost all definitions of geoengineering.[97] Firstly, these include the idea that the intervention in the environment must be 'deliberate.'[98] In other words, the modification of environmental conditions must be intentional, and not a side effect of some other activity carried out for a different purpose. Secondly, most definitions link the activity of geoengineering to the aim of modifying the environment for some specific purpose. Generally, the goal is to modify the climate system or to counteract the adverse effects of climate change.[99] However, in the marine context, the definition of geoengineering includes activities conducted for purposes other than offsetting climate change impacts.[100] These include marine geoengineering measures relating to the cultivation of marine macro-algae as a source biofuel, fisheries enhancement, increasing ocean alkalinity to combat ocean acidification,[101] or recovering marine dead zones created by nutrient overload and oxygen deprivation.[102] Bearing in mind the purpose of this draft Code of Conduct as a legal harmonising instrument for geoengineering activities conducted in the marine, terrestrial and atmospheric domains, the definition of geoengineering in paragraph 5 expressly 'includes,' but is not restricted to measures carried out for the purpose of offsetting climate change impacts. Nevertheless, a compromise was made in the text for the sake of clarity: while the definition of geoengineering acknowledges that geoengineering can be conducted for purposes other than offsetting the adverse effects of climate change, the second sentence, which states that '[g]eoengineering is either greenhouse gas removal or radiation management,' largely restricts the scope of application of this draft Code to geoengineering activities conducted for addressing climate change.

(5) The definition of geoengineering also incorporates the element of 'large-scale' modification of the environment. The criterion of scale is considered by the IPCC to be of 'central importance.' It is also reflected in the CBD decisions X/33 and XI/21, which also define geoengineering as 'technologies that deliberately reduce solar insolation or increase carbon sequestration from the atmosphere on a large scale.' Furthermore, the requirement of 'large-scale' with regard to geoengineering is of utmost importance when interpreting the legally non-binding moratorium established by the CBD decision X/33 and reflected in draft Article 9. Based on this definition, small-scale activities would not fall within the applicability of the CBD moratorium

[95] See, e.g., National Academy of Science (NAS), 'Policy Implications of Greenhouse Warming: Mitigation, Adaptation and the Science Base' (Panel on Policy Implications of Greenhouse Warming Washington D.C., National Academies Press 1992); Rickels and others, 'Large-Scale Intentional Interventions into the Climate System? Assessing the Climate Engineering Debate' (Scoping report conducted on behalf of the German Federal Ministry of Education and Research 2011) <http://www.kiel-earth-institute.de/scoping-report-climate-engineering.html> accessed 30 August 2014.

[96] Bodle (n 89) 40.

[97] IPCC AR5 WG1 (n 3) Annex III Glossary, 1454.

[98] IPCC AR5 WG1 (n 3) Annex III Glossary, 1454; Resolution LP.4(8); The Royal Society Report on Geoengineering (n 2) 1.

[99] Bodle (n 89) 40.

[100] 'Marine geoengineering' is defined in Resolution LP.4(8) as 'a deliberate intervention in the marine environment to manipulate natural processes, including to counteract anthropogenic climate change and/or its impacts, and that has the potential to result in deleterious effects, especially where those effects may be widespread, long-lasting or severe.'

[101] Chris Vivian, 'Brief Summary of Marine Geoengineering Techniques' (Centre for Environment, Fisheries and Aquaculture Science 'Cefas' 2013) <http://www.cefas.defra.gov.uk/publications/files/20120213-Brief-Summary-Marine-Geoeng-Techs.pdf> accessed 30 August 2014.

[102] Daniel J Conley, 'Save the Baltic Sea' (2012) 486 *Nature* 463.

or this draft Code of Conduct unless classified as scientific research.[103] Nevertheless, the question of what is to be considered large-scale for a particular geoengineering measure still remains unclear and would have to be settled on scientific, technical and political grounds.[104]

(6) The reference to 'large-scale' or 'planetary-scale' in most definitions of geoengineering also creates the problem that most research activities would fall outside the scope of these terms.[105] The wording of the definition of 'marine geoengineering' in the London Protocol has the advantage that it is wide enough to capture perturbative research studies with the 'potential to result in deleterious effects,'[106] but even this threshold is too high to target scientific research activities with *de minimis* environmental effects that also carry other societal concerns that suggest a need for governance. Paragraph 5 attempts to overcome this issue by explicitly referring to response strategies or measures that aim to deliberately modify the environment on a large scale or 'scientific research related to that aim.'[107]

(7) The formulation of definitions of geoengineering in relation to scientific research activities is also problematic as it relates to the question of intent and purpose. Scientific research on geoengineering that is carried out to gain a better understanding of the risks, benefits and feasibility of a proposed method could be regarded as having distinct purpose – that is, to gain knowledge about a proposed geoengineering measure. This goal is distinct from that of actually offsetting the effects of greenhouse gas emissions. This distinction regarding intention could hold true even if the research activity was carried out at scales large enough to significantly alter environmental parameters.

(8) The definition of 'geoengineering' adopted in draft Article 4 does not avoid some of the issues relating to the governance and regulation of geoengineering research. For example, the definition in paragraph 5 could capture other experimental activities conducted in the open environment (e.g., intentional perturbative atmospheric experiments to understand climate change). Some may argue in favour of regulating all perturbative research studies, regardless of whether they relate to geoengineering or not, to provide greater legal certainty and perhaps greater protection to the environment. However, as a practical issue, this approach could drive scientists away from working on such topics that are subject to additional oversight. More fundamentally, in the light of possible guarantees of the freedom of scientific research, it may be difficult to justify restrictions on such a wide swathe of research activities which may have significant benefits to society and pose little to no environmental or societal concerns in order to address a relatively small number of more controversial geoengineering-related research activities conducted in the open environment.

(9) The final sentence of the definition in paragraph 6, draft Article 4 states that geoengineering constitutes either Greenhouse Gas Removal or Radiation Management. 'Greenhouse Gas Removal' is defined in paragraph 7 as 'response strategies or measures that aim to remove greenhouse gases from the atmosphere'. The term is thus not limited to the removal of carbon dioxide, but refers to other greenhouse gases included in Art. 1(5) of the UNFCCC and thus paragraph 6 of draft Article 4.[108] Nevertheless, the vast majority of currently proposed greenhouse gas removal techniques are for the removal of carbon dioxide (CDR) – the primary

[103] See draft Article 9, below.

[104] See Parson and Keith (n 21) who define a threshold, based on a scientific and technical understanding, what might be considered large-scale for stratospheric aerosol injection.

[105] CBD Report on Geoengineering (n 55) 141.

[106] Kukil Bora, 'Researchers Release Oil into North Sea to Study Immediate Result of an Oil Spill' International Business Times (11 August 2014) <http://www.ibtimes.com/researchers-release-oil-north-sea-study-immediate-result-oil-spill-1654318> accessed 30 August 2014.

[107] CBD Report on Geoengineering (n 55) 141. For example, The Royal Society Report on Geoengineering (n 2) 1 defined 'geoengineering' as the 'large-scale manipulation of the planetary environment'.

[108] Regarding GGR methods for methane removal see J K Stolaroff and others, 'Review of Methane Mitigation Technologies with Application to Rapid Release of Methane from the Arctic' (2012) 46 *Environmental Science & Technology* 6455. However, see Vivian (n 101) noting that '[t]echniques to address other climate warming substances, e.g., methane are very limited and at an early stage of development.'

greenhouse gas emitted from human activities. They work by either directly removing carbon dioxide from by atmosphere or by increasing natural carbon sinks or by using engineered chemical means.[109] These approaches to reducing pre-existing carbon dioxide emissions in the atmosphere may have 'biogeochemical and technological limitations to their potential on a global scale' and there is insufficient knowledge to quantify how many emissions could be partially offset by such measures on a century timescale.[110] An IPCC Expert Meeting Report on Geoengineering also noted the overlap between the definition of CDR and mitigation, 'with the distinction being based on the magnitude, scale, and impact of the particular [...] activities.'[111] Those measures that lie on the borderlands between mitigation and geoengineering may include the use of forests as carbon sinks (i.e., afforestation and reforestation), carbon capture and storage (CCS), and soil carbon sequestration.[112] The definition of the term 'emissions' in the UNFCCC, which is used in paragraph 4, is useful for drawing the distinction between mitigation as the prevention of the release of greenhouse gases into the atmosphere, and geoengineering by means of greenhouse gas removal methods which reduce pre-existing atmospheric concentrations.[113]

(10) Paragraph 8 defines 'radiation management' as encompassing 'response strategies or measures that aim to reduce the amount of solar radiation absorbed by the Earth or enhance the amount of thermal radiation emitted from the Earth's surface to space'. The IPCC's most recent Fifth Assessment Report noted some of the advantages and drawbacks of these methods, which 'if realisable, have the potential to substantially offset a global temperature rise, but [...] would also modify the global water cycle, and would not reduce ocean acidification.'[114] Furthermore, if 'terminated for any reason, there is high confidence that global surface temperatures would rise very rapidly to values consistent with the greenhouse gas forcing.'[115]The IPCC has also commented that solar-based techniques probably do not fall within the usual definitions of mitigation and adaptation.[116]

[109] IPCC AR5 WG1 (n 3) Annex III Glossary, 1449.

[110] IPCC AR5 WG1 (n 3).

[111] IPCC Expert Meeting Report on Geoengineering (n 90) 2.

[112] A non-exhaustive list of examples of carbon dioxide removal methods is provided in Table 6.14 IPCC AR5 WG1 (n 3) 547

[113] See IPCC AR5 WG1 (n 3) 546 stating that '[l]arge-scale industrial methods such as carbon capture and storage (CCS), biofuel energy production (without CCS) and reducing emissions from deforestation and degradation (REDD) cannot be called CDR methods since they reduce fossil fuel use or land use change CO_2 emissions to the atmosphere but they do not involve a net removal of CO_2 that is already in the atmosphere.' 'Mitigation' has been defined by the IPCC as 'technological change and substitution that reduce resource inputs and emissions per unit of output,' further specifying that 'although several social, economic and technological policies would produce an emission reduction, with respect to climate change, mitigation means implementing policies to reduce greenhouse gas emissions and enhance sinks.' See Contribution of Working Groups I, II and III in RK Pachauri and A Reisinger (eds) Fourth Assessment Report of the IPCC (2007), Annex II Glossary.

[114] IPCC AR5 WG1 (n 3) 29.

[115] IPCC AR5 WG1 (n 3) 29.

[116] IPCC Expert Meeting Report on Geoengineering (n 90) 2. However, the line between radiation management and adaptation may not in practice be clear cut. See further D N Berstein and others, 'Could aerosol emissions be used for regional heat wave mitigation? (2013) 13 *Atmospheric Chemistry and Physics* 6373; J Latham and others, 'Weakening of hurricanes via marine cloud brightening (MCB)' (2012) 13 *Atmospheric Science Letters* 231; J Latham and others, 'Can marine cloud brightening reduce coral bleaching?' (2013) 14 *Atmospheric Science Letters* 214; S Mernon and others, 'Radiative forcing and temperature response to changes in urban albedos and associated CO_2 offsets' (2010) 5 *Environmental Research Letters* 0014005; Hashem Akbari, H Damon Matthews and Donny Seto, 'The long-term effect of increasing the albedo of urban areas' (2012) 7 *Environmental Research Letters* 024004.

(11) Legal definitions are an important in determining the scope of application of the rights and obligations of States under an international agreement. Here, the meaning of the terms 'geoengineering,' 'greenhouse gas removal,' and 'radiation management' clarify which strategies and measures lie within the scope of this draft Code of Conduct and those that fall outside of it. Two aims pull in opposite directions: on the one hand, there is a need for a broad, resilient definition that covers all methods that are regarded as geoengineering, both now and in the future, taking into account the possibility of future advances and new proposals; on the other hand, there is a need for legal certainty which favours a precise, more narrowly circumscribed definition that clearly establishes which activities are subject to regulation. The picture is further complicated by uncertainties about the risks, benefits and feasibility of geoengineering methods and about how geoengineering proposals will develop and be assessed over time. The recently adopted amendment to the London Protocol on marine geoengineering incorporates an innovative procedural mechanism for balancing the requirement for more coercive, hard-law regulation while remaining sensitive to the possibility of future scientific developments given the rudimentary physical science understanding of the proposed techniques. The text includes a broad definition of 'marine geoengineering', which establishes the general subject matter to be regulated. This definition is coupled with a 'positive-listing approach' – provided that an activity falls within the definition of 'marine geoengineering', the only activities subject to binding regulation are those that the Contracting Parties have agreed to include in a new annex. Since it is easier procedurally to amend an annex than it is to change the text of the treaty itself, this provides a mechanism to 'future proof' the London Protocol by allowing the Contracting Parties to respond quickly to marine geoengineering activities that may have deleterious effects on the marine environment while clearly establishing the rights and obligations under the regulation.

(12) The picture looks different for a voluntary code of conduct. The positive-listing approach taken under the London Protocol cannot not be relied upon directly for this draft Code, since it lacks a specified institutional structure for its ongoing implementation. Nonetheless, to demonstrate this approach, paragraph 7 on greenhouse gas removal and paragraph 8 on radiation management both provide an indicative list of those techniques that could be subject to the guidance provided in this draft Code of Conduct, and also include an exclusionary list of activities that do not constitute geoengineering.[117] The lack of direct legal consequences flowing from a non-binding instrument alleviates some of the demand for precise legal definitions. Soft-law instruments can contribute to the evolution of an accepted meaning and practices that define geoengineering for regulatory purposes as the knowledge and understanding of these proposed technologies develop over time. Recommendations, declarations and decisions on geoengineering taken by existing international institutions and scientific bodies such as the IPCC could provide additional guidance to States regarding which activities are constitute geoengineering.

[117] For example, pursuant to Resolution LP.4(8), Annex 4, para 1.1.,'ocean fertilisation' is defined as '[a]ny activity undertaken by humans with the principle intention of stimulating primary productivity in the oceans. Ocean fertilisation does not include conventional aquaculture or mariculture or the creation of artificial reefs.'

Draft Article 5

General Principles

1. Change in the Earth's climate and its adverse effects are a common concern of humankind.[118] In the light of the international community's wide acceptance of sustainable development as a global objective,[119] States shall cooperate and promote, on the basis of equity and in accordance with the common interest of all present and future generations, the prevention of dangerous anthropogenic interference with the climate system, recalling their obligations and participation in a prompt, effective and appropriate international response with a view to accelerating the reduction of greenhouse gas emissions.[120]

2. States and other relevant organisations and actors shall not promote or use geoengineering as a substitute for measures which anticipate, prevent or minimise the causes of climate change, in particular, with a view to accelerating the reduction of greenhouse gas emissions.[121]

3. States shall give full consideration to the specific needs and concerns of developing States arising from the impact of scientific research and the development of geoengineering as a potential response to address the adverse effects of climate change.[122]

4. In order to contribute to a prompt, effective and appropriate international response to climate change and in view of the risks and uncertainties related to geoengineering, States and other relevant organisations and actors should ensure that scientific research involving geoengineering is conducted in a responsible manner in accordance with international law and taking into account the guidance provided in these draft Articles.

[118] UNGA, 'Protection of the global climate for present and future generations of mankind' (6 December 1988) UN Doc A/RES/43/53; UNFCCC, preamble.

[119] See, e.g., Rio Declaration; United Nations Conference on Environment and Development, 'Agenda 21' (adopted 14 June 1992) UN Doc A/CONF.151/26, vol.II (Agenda 21); ILA, 'New Delhi Declaration of Principles of International Law relating to Sustainable Development' (9 August 2002) UN Doc A/CONF.199/8 (ILA New Delhi Principles on Sustainable Development), preamble; ILA, 'Sofia Guiding Statements on the Judicial Elaboration of the 2002 New Delhi Declaration of Principles of International Law Relating to Sustainable Development' (26–30 August 2012) Report of the Seventy-Fifth Conference, Resolution No. 7/2012. See also ILA 'Legal Principles relating to Climate Change' (7–11 April 2014) 76th Conference of the ILA Resolution 2/2014 <http://www.ila-hq.org/en/committees/index.cfm/cid/1029> accessed 30 August 2014 (ILA Legal Principles relating to Climate Change), art 3.

[120] UNFCCC, 'Report of the Conference of the Parties on its seventeenth session' (Durban, 28 November –11 December 2011) FCCC /CP/2011/9/Add.1 (Durban Platform for Enhanced Action); UNFCCC, preamble and art 2; Rio Declaration, principle 7.

[121] See UNFCCC, art 3(3); Resolution LP.4(8), preamble 'emphasising that ocean fertilisation and other types of marine geoengineering should not be considered as a substitute for mitigation measures to reduce carbon dioxide emissions.' See discussion on the relationship between remediation and prevention, Commentary to draft Article 7, below.

[122] UNFCCC, art 4(8). For an overview of the principle of common but differentiated responsibility in international law see Philippe Sands and Jacqueline Peel, *Principles of International Environmental Law*, 3rd edn (Cambridge University Press 2012) 233–236.

Commentary

(1) Draft Article 5 examines geoengineering proposals within the context of some of the central guiding principles of international environmental law and sustainable development. In particular, given that geoengineering measures mainly target climate change, draft Article 5 considers geoengineering within the context of international climate law and policy, examining the principles of the 'constitutional framework' laid down in the UNFCCC and its ongoing evolution.[123] The building blocks of this regime and international environmental law in general are embodied in draft Article 5, namely, international cooperation, sustainable development, and equity.[124]

(2) There are two important provisos to this analysis. Firstly, although the framework convention has clear relevance, States Parties to the UNFCCC have not formally dealt with the topic of geoengineering to date. Recent consideration of geoengineering by the IPCC could mark an entry point for this discussion within UNFCCC processes.[125] Secondly, the climate change regime is currently undergoing an important evolutionary process regarding the development of a new instrument pursuant to the Durban Platform for Enhanced Action.[126] Thus it cannot be finally ruled out – depending upon the outcome of negotiations that are currently underway and set to finish by 2015 – that the central objective and core principles laid down in the UNFCCC could still be amended.[127] Against this backdrop, draft Article 5 should be read simply as a reasoned extension of these general principles in the light of current discussions on geoengineering and the UNFCCC.

(3) The 'ultimate objective' in Article 2 of the UNFCCC to achieve the 'stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system' is ambiguous as it pertains to geoengineering. It is generally concluded that the use of radiation management could not likely be construed as meeting this aim, because these methods are not targeted at stabilising greenhouse gas levels and may also be read as being a potentially dangerous human interference with the climate system. However, greenhouse gas removal methods may fall within the plain wording of this objective by helping to reduce atmospheric greenhouse gas concentrations. Interestingly, the Durban Platform refers to the need for States Parties to raise the level of ambition and aim 'for the widest possible cooperation by all countries and their participation in an effective and appropriate international response, *with a view to accelerating the reduction of global greenhouse gas emissions'* [emphasis added]. This updated, albeit hortatory language narrows down the aim in Article 2 of the UNFCCC by explicitly calling for the reduction of greenhouse gas emissions as the goal.[128] This is at least a strong political signal that preventing the release of greenhouse gas emissions remains a priority under the international climate regime for addressing climate change. Logically, however, pursuit of the goal to reduce greenhouse gas emissions does not preclude or prohibit geoengineering as an additional response strategy for addressing climate change.[129]

[123] See, e.g., Karen N Scott, 'International Law in the Anthropocene: Responding to the Geoengineering Challenge (2013) 34(2) *Michigan Journal of International Law* 309, 355 concluding that 'the segregation of geoengineering from climate change mitigation and adaptation more generally is undesirable.' For a recent description see ILA Legal Principles relating to Climate Change (n 119); Catherine Redgwell, 'Climate change and international environmental law' in Rosemary Rayfuse and Shirley V. Scott (eds), *International Law in the Era of Climate Change* (Edward Elgar Publishing 2012).

[124] The international community's commitment to cooperation is discussed in detail in draft Article 6, below.

[125] IPCC Expert Meeting Report on Geoengineering (n 90) 2; IPCC AR 5 WG 1 (n 92).

[126] Bodansky (n 22).

[127] Bodansky (n 22).

[128] See Bali Action Plan, UNFCCC, 'Report of the Conference of the Parties on its thirteenth session' (Bali, 3–15 December 2007) FCCC/CP/2007/6/Add.1 (14 March 2008) in which States Parties expressed their aim of 'working towards identifying a global goal for substantially reducing global emissions by 2050 and a time frame for a global peaking of greenhouse gas emissions.'

[129] Regarding scientific assessment, IPCC AR5 scenario RCP 2.6 only gives a 50 per cent chance of staying below a 2°C average warming by the end of 2100 and assumes not only a massive global effort to reduce greenhouse

(4) Paragraph 1 begins with the preambular declaration in the UNFCCC that 'climate change and its adverse effects are the common concern of humankind.' Rooted in the Trail Smelter Arbitration of 1938, international environmental law was grounded in the sovereign right of States to use their territories and resources as they see fit, balanced against their responsibility not to cause serious harm to the territory of another State or to areas beyond national jurisdiction.[130] Over time, however, this framing based on bilateral reciprocity had to become more attuned to the growing number of global environmental threats and the interdependencies of environmental processes and components that interact irrespective of territorial boundaries.[131] Hence, international environmental law has gradually evolved in recognition that some environmental problems, such as global warming, degradation of atmospheric ozone, and the conservation of biological diversity, require legal concepts that transcend the permanent sovereignty of individual States to effectively address collective environmental concerns.[132]

(5) The 'common concern of humankind' concept was expressly adopted in the preambles of the UNFCCC and the CBD. Other international agreements, including the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer, may also amount to common concern regimes even though they do not explicitly refer to the concept.[123] The application of this concept in addressing ozone degradation and climate change and the linkages between transboundary air pollution suggests that the 'totality of the global atmosphere can now properly be regarded as the "common concern of humankind,"' a conclusion recently confirmed in the International Law Commission's First Report on the Protection of the Atmosphere.[124] The normative contours of the common concern doctrine have not yet been clearly delimited and require further elaboration in international law. Notwithstanding this, the doctrine has been characterised as having both political and legal implications.[135] On the one hand, it acknowledges a political necessity for law-making on an issue at the international level. Common concerns are generally invoked as reason to justify global regulation in areas that were previously considered to belong to the exclusive domain of domestic jurisdiction by obliging States to develop measures to protect the common interest within their territories and beyond. In terms of its legal effects, the common concern doctrine does not establish direct legal obligations upon States, for example, by imposing positive duties to prevent or mitigate harm or prohibitions against taking specific actions that interfere with the common interest.[136] However, it does provide the underlying rationale for progressive development of the law for areas touching upon the common concern. Any direct legal obligations would have to be adopted by States in treaties or emerge as customary international law. Thus, while the recognition of limitations on state sovereignty as far as common interests are concerned is an important aspect in the development of specific regulations and structures of global governance for an issue, the concept is contained by the requirement of state consent for new international obligations to crystallise. In this sense, the identification of a common concern equates with the general responsibility of states to cooperate to address a collective interest.[137]

[130] Jutta Brunnée, 'Common Areas, Common Heritage, and Common Concern' in Daniel Bodansky, Jutta Brunnée, and Ellen Hey (eds) Oxford Handbook of International Environmental Law (Oxford University Press 2007). See generally Bruno Simma, 'From Bilateralism to Community Interest' (1994) 250 *Recueil des cours 221.*

[131] Brunnée (n 130).

[132] Brunnée (n 130). Cf Rio Declaration, principle 7.

[133] Brunnée (n 130) 565.

[134] Patricia Birnie, Alan Boyle and Catherine Redgwell, *International Law and the Environment* (3rd edn, Oxford University Press 2009) 339. See further ILC, First Report on the Protection of the Atmosphere (n 90); Draft guideline 3(a), paras 86–90.

[135] Nele Matz, 'Comment: The Common Interest in International Law: Some Reflections on its Normative Content' (2002) *Zeitschrift for ausländisches öffentliches Recht und Völkerrecht* 17.

[136] The ILC has noted in this respect that it 'may also be premature to consider the concept of common concern as creating rights for individuals and future generations.' See ILC First Report on the Protection of the Atmosphere (n 90) para 89.

[137] Brunnée (n 130) 567.

(6) A further legal implication of the invocation of a common concern relates to the enforcement of international obligations.[138] In the *Barcelona Traction Case*, the ICJ noted the 'essential distinction' between obligations owed to particular States and those owed 'towards the international community as a whole'.[139] Regarding this second category, the Court remarked that '[i]n view of the importance of the rights involved, all States can be held to have a legal interest in their protection; they are obligations *erga omnes*.'[140] Caution is warranted, however, as current international law may not have progressed to the stage that the concept of a common concern gives rise to a right of all States to have legal standing in the enforcement of rules relating to the protection of the atmosphere invoked on behalf of the international community as a whole.[141]

(7) As yet, there has been no express statement in any instrument or decision that geoengineering constitutes a common concern of humankind. Nevertheless, it appears to be a relevant concept for the governance and regulation of this matter in line with the existing corpus and the development of international environmental law. Firstly, geoengineering touches upon existing common concern regimes as expressed under international law. Geoengineering, as defined in draft Article 4, clearly falls within the plain language of the preamble to the UNFCCC 'that change in the Earth's climate and its adverse effects are a common concern of humankind.' The UNFCCC applies to all components of the climate system, including the oceans as part of the hydrosphere and activities on land as the sovereign territory of States.[142] Some geoengineering techniques, such as stratospheric aerosol injection, could degrade the ozone layer and thus may fall within the ambit of the Vienna Convention for the Protection of the Ozone Layer as part of the atmosphere.[143] Also, the fact that States Parties to the CBD, a multilateral treaty with near universal membership, have taken up the issue of geoengineering as a matter which could impact the conservation of biological diversity also invokes a common concern. Secondly, the direction of state practice also suggests that geoengineering may be an issue which has been elevated to the international sphere. For example, States Parties to the CBD and LC/LP have both established as a criterion the need for 'global' control and regulatory mechanisms for geoengineering.[144] Looking beyond the subject area of international environmental law, geoengineering may also have implications for global peace and security and impact human rights and thus may fall within those objectives commonly deemed to justify law-making at the international level. Therefore the principle of sovereignty holds,[145] but should not be read as absolute when considering the governance implications for geoengineering research.

(8) Paragraph 1 also refers to the concept of equity, which serves as a cornerstone of the climate change regime[146] and sustainable development.[147] In its most general understanding, 'equity' concerns 'what is fair and reasonable in the administration of justice'.[148] Equity and related equitable concepts are widely ref-

[138] ILC First Report on the Protection of the Atmosphere (n 90) para 89.

[139] *Barcelona Traction Case (Belgium v Spain)* (Judgment) [1970] ICJ Rep 3, 32, para 33.

[140] *Barcelona Traction Case* (Judgment), para 33. See also ILC Draft Articles on State Responsibility, art 48.

[141] ILC First Report on the Protection of the Atmosphere (n 90) para 89; Alan Boyle, 'International law and the protection of the global atmosphere: concepts, categories and principles' in Robin Churchill and David Freestone (eds) *International Law and Global Climate Change* (Graham and Trotman 1991) 11–13.

[142] UNFCCC, art 1(3).

[143] Vienna Convention for the Protection of the Ozone Layer (adopted 22 March 1985, entered into force 22 September 1988) 1513 UNTS 293.

[144] The recent adoption of a legal mechanism to regulate marine geoengineering under the London Protocol under Resolution LP.4(8) could be regarded as a partial fulfilment of such calls for international regulation with respect to the protection of the marine environment.

[145] UNFCCC, preamble.

[146] UNFCCC, preamble, art 3(1), 4(2)(a) and 11(2).

[147] See, e.g., Rio Declaration, preamble and principle 3. On the equitable use of shared natural resources see the decisions of the ICJ in *Gabčíkovo-Nagymaros* Dam Case, 56; Pulp Mills Case, para 177.

[148] Francesco Francioni, 'Equity in International Law' in *Max Plank Encyclopaedia of Public International Law* (April 2007).

erenced in international environmental treaties and instruments.[149] The UNFCCC does not expressly define the concept of equity. Nevertheless, it forms the basis for burden-sharing under the UNFCCC[150] and is articulated in Article 3(1)[151] in terms of the need to protect the climate for the benefit of present and future generations[152] and regarding the differentiated responsibilities and capabilities of developed and developing nations.[153] The latter principle of common but differentiated responsibilities and respective capabilities (CBDRRC) is a specific expression of equity, which takes into account the disproportionate contributions of nations to the problem of climate change and their respective capabilities in addressing it.[154]

(9) Geoengineering has been framed by some as a possible 'techno-fix' to sidestep the beleaguered international diplomatic processes for addressing climate change[155] – a process that is impacted by the politics associated with the CBDRRC principle. Yet, geoengineering raises serious equity and distributional issues of its own. The Royal Society commented in its influential report on geoengineering that 'there will probably be winners and losers associated with the applications of the different methods.'[156] Questions regarding the application of equity to geoengineering under international law have not been addressed comprehensively in the literature.[157] Indeed, given the intractable debate over burden-sharing on climate change mitigation, it would also likely be a monumental task for the international community to come up with an agreed formula for how to implement a deliberate large-scale modification of the climate system in a way that accommodates pluralistic views of what is fair and just.[158] Liability and compensation schemes for geoengineering have been proposed in the literature, but are only roughly hewn at this stage.[159] There are some papers in the scientific literature that make implicit arguments regarding what would amount to a fair deployment scenario in terms of optimising SRM deployment to minimise regional

[149] See Francioni (n 148) para 22 concluding that 'even a cursory look of the content of [international environmental treaties] reveals an extensive and systematic use of equity and equitable principles. The reasons for this lay essentially in a) the need to base environmental governance on forward-looking and policy-oriented regulation, rather than on a fixed set of rights and obligations of the parties, b) the requirement that environmental protection takes into account the profound economic and technological disparities between developed and developing States, and c) the consequent need to look for a reasonable compromise between conflicting interests as a basis for the consent to be bound by treaty obligations.' See, e.g., LOSC, preamble, arts 69, 70, 74, 82(4), 83, 140, 155(2), 160(2) and 173(2); UN Convention on the Law of Non-Navigational Uses of International Watercourses (1997) 36 ILM 1462, art 5; UN Convention to Combat Desertification in Countries Experiencing Serious Drought and/or Desertification, particularly in Africa (adopted 14 October 1994, entered into force 26 December 1996) 1954 UNTS 3 (Desertification Convention), arts 16(g), 17(1)(c), and 18(2)(b); CBD, Arts. 1, 8, 15 and19.

[150] Commentary to ILA Legal Principles relating to Climate Change (n 119) 10.

[151] See also UNFCCC, arts 3 and 4.

[152] UNFCCC, preamble.

[153] For an overview of the principle of common but differentiated responsibility in international law, see Sands and Peel (n 122) 233–236.

[154] Lavanya Rajamani, 'The Durban Platform for Enhanced Action and the Future of the Climate Regime' (2012) 61 *International and Comparative Law Quarterly* 501, 517.

[155] David G Victor and others, 'International governance of a possible geoengineering intervention to combat climate change' (2009) 95 *Climatic Change* 103; Thilo Wiertz, 'Technology and Politics in the Anthropocene: the Case of Geoengineering' in Simon Dalby and Shannon O'Lear (eds) *Reframing Climate Change* (Routledge, forthcoming).

[156] The Royal Society Report on Geoengineering (n 2) 51.

[157] W C G Burns, 'Climate geoengineering: solar radiation management and its implications for intergenerational equity' (2011) 1 *Stanford Journal of Law, Science & Policy* 39; M Goes, N Tuana and K Keller, 'The Economics (or Lack Thereof) of Aerosol Geoengineering' (2011) 109 Climatic Change 719; N Tuana, 'The Ethical Dimensions of Geoengineering: Solar Radiation Management through Sulphate Particle Injection' (2013) Geoengineering Our Climate Working Paper and Opinion Article Series <http://geoengineeringourclimate.com> accessed 12 September 2014.

[158] See draft Article 9, below.

[159] Pak-Hang Wong, Tom Douglas and Julian Savulescu, 'Compensation for Geoengineering Harams and No-Fault Climate Change Compensation', (Geoengineering Our Climate Working Paper and Opinion Article Series 2014) <http://geoengineering-governance-research.org/perch/resources/workingpaper8wongdouglassavulescucompensationfinal-.pdf> accessed 12 September 2014; Tony Svobota and Peter Irvine 'Ethical and Technical Challenges in Compensating for (2014) 17 *Ethics, Policy & Environment* 157; Martin Bunzl, 'Geoengineering Harms and Compensation' (2011) 4 *Stanford Journal of Law, Science and Policy* 71.

differences.[160] However, formal equality between States regarding the implementation of geoengineering is only one (and perhaps an impoverished) view of the justice issues inherent in geoengineering. It is also possible to contemplate more redistributive approaches in terms of sharing the benefits and burdens from adverse effects of geoengineering and climate change.[161] An in-depth analysis of the application of equity to geoengineering in line with contemporary concepts under international law is in order; in particular, an investigation of whether some methods are compatible, and if so in what modes, with notions of intra-generational and inter-generational equity as a dimension of sustainable development.

(10) One tentative conclusion regarding equity and radiation management, as an imperfect method for counteracting climate change, is that such measures could probably not be used to promote a business-as-usual scenario in lieu of adequate efforts to address the root causes of global warming (e.g., deploying large-scale stratospheric aerosol injection to reduce global temperature without reducing greenhouse gas emissions). This would shift the burden of climate change onto future generations and, by not addressing the root causes of climate and other environmental damage, would also *prima facie* appear to contravene the principle of equitable use (e.g., by creating the risk of a termination effect and not addressing ocean acidification). Against this background, paragraph 2 admonishes States and other organisations and individuals to not promote or use geoengineering as a substitute for the reduction of greenhouse gas emissions. This provision is backed by the principle in paragraph 1 that States comply with their duty under Article 2 of the UNFCCC and 'recalling their obligations and participation in a prompt, effective and appropriate international response with a view to accelerating the reduction of greenhouse gas emissions' in line with the Durban Platform.[162]

(11) Paragraph 3 also relates to intra-generational equity. The international climate regime emphasises mitigation and refers to the historical and current global emissions of developed States as a basis for applying the CBDRRC principle.[163] On the face of it, the idea that developed States have a responsibility to take the lead in protecting the climate system,[164] based on their historic contributions and advanced technological capabilities, sits uncomfortably alongside geoengineering, where there has been much discussion of the potential dangers posed by unilateral, global deployment of geoengineering by a single State or small group of States or even a rogue individual.[165] Above all, what should be avoided is the shifting of the negative consequences of geoengineering to those countries that are already most vulnerable to the adverse impacts of climate change, without taking into account the significant economic and technological disparities between developed and developing countries.[166]

[160] Juan Moreno-Cruz, Katherine L Ricke and David W Keith, 'A simple model to account for regional inequalities for Solar Radiation Management' (2012) 110 *Climate Change Journal* 649.

[161] Tony Svoboda and others, 'Sulfate Aerosol Geoengineering: The Question of Justice' (2011) 25 *Public Affairs Quarterly* 157.

[162] A similar wording was recently adopted in the preamble to the amendment to the London Protocol on marine geoengineering. See Resolution LP.4(8), preamble 'emphasising that ocean fertilisation and other types of marine geoengineering should not be considered as a substitute for mitigation measures to reduce carbon dioxide emissions.'

[163] UNFCCC, art 3(1) and (2) and 4(1). See also Commentary to ILA Draft Articles on Climate Change, draft art 4. By contrast, the burden of adaptation primarily remains on individual States. See the Commentary to ILA Draft Articles on Climate Change, draft Article 5, para 6.

[164] UNFCCC, art 3(1).

[165] Gareth Davies, 'Law and Policy Issues of Unilateral Geoengineering: Moving to a Managed World' in Select Proceedings of the European Society of International Law, vol 2 (2008) 627; Joshua B Horton, 'Geoengineering and the Myth of Unilateralism: Pressures and Prospects for International Cooperation' (2011) 4 *Stanford Journal of Law*, Science & Policy 56; Daniel Bodansky, 'Governing Climate Engineering: Scenarios for Analysis' (November 2011) Harvard Project on Climate Agreements Discussion Paper 2011–47 <http://belfercenter.ksg.harvard.edu/files/bodansky-dp-47-nov-final.pdf> accessed 12 September 2014.

[166] Robert L Olson, 'Geoengineering for Decision Makers' (Woodrow Wilson Center Report 2011); Solar Radiation Management Governance Initiative, 'Solar Radiation Management: The Governance of Research' (2012) <http://www.srmgi.org/files/2012/01/DES2391_SRMGI-report_web_11112.pdf> accessed 12 September 2014 (SRMGI Report); Wylie A. Carr and others, 'Public Engagement on Solar Radiation Management and Why It Needs to Happen Now' (2013) 121 *Climatic Change* 567; Christopher J Preston, 'Solar Radiation Management and Vulnerable Populations: The Moral Deficit and Its Prospects' in Christopher J Preston (ed), *Engineering the Climate: The Ethics of Solar Radiation Management* (Lexington Press 2012) 77.

What is important for the time being is that research and development of geoengineering measures take into account the specific needs and special circumstances of developing countries and ensure adequate consultation and information-sharing in the spirit of international cooperation regarding the intentional modification of the global climate system so as not to contribute to an information gap between researching and non-researching States.[167]

(12) Paragraph 4 expresses a fundamental principle of this draft Code of Conduct that scientific research involving geoengineering should be conducted in an environmentally responsible way in accordance with international law. This provision is also rooted in the concept of sustainable development that 'requires action across a wide array of fields, including regulation and technology having environmental, developmental and social implications.'[168] However, it should be acknowledged that existing international law may fall short, particularly in terms of providing effective and transparent oversight and control of scientific research activities,[169] which may fall below the threshold which triggers the due diligence obligations of States to prevent harm to the global environment.[170] Hence, a central objective of this draft Code of Conduct is to provide guidance on how geoengineering research could proceed cautiously and responsibly, given the associated risks and uncertainties, if it is undertaken at all.

Draft Article 6

International Cooperation

1. In order to contribute to an effective and appropriate international response to climate change, States and other relevant organisations and actors shall cooperate in good faith to promote and ensure that scientific research involving geoengineering is conducted in a responsible manner and in accordance with international law, taking into account the guidance provided in this draft Code of Conduct.

2. To this end, in accordance with their respective capabilities and taking into account the relevant scientific, technical and other considerations, States and other relevant organisations and actors shall:

(a) Cooperate, through appropriate policy, legal and institutional frameworks, in the establishment, further development and effective implementation and enforcement of laws or measures for the responsible conduct of scientific research involving geoengineering. Laws or measures, whether at local, national, regional or international level, should be based on the best scientific and technical information available and take into account other relevant environmental, scientific, technological, economic, social and cultural aspects;[171]

(b) Promote and cooperate in the full, open and prompt exchange of relevant scientific and other information related to the protection of the environment, including that related to the climate system and climate change, and to the environmental, economic, social and other consequences of various response strategies, including, if undertaken, scientific and other information on geoengineering, taking into account the need to avoid the duplication of effort.[172] [States and others shall protect the confidentiality of any information they receive, where such confidentiality is protected by law];[173]

[167] SRMGI Report (n 166).

[168] Commentary to ILA Legal Principles relating to Climate Change (n 119) draft Article 3.

[169] CBD Report on Geoengineering (n 55) 141–42.

[170] An exception is the provisions on marine scientific research and the protection of the marine in the LOSC. Anna-Maria Hubert, 'The New Paradox in Marine Scientific Research: Regulating the Potential Environmental Impacts of Conducting Ocean Science' (2011) 42 *Ocean Development & International Law* 329.

[171] FAO Code of Conduct for Responsible Fisheries, art 6.4 and reflected in UNFCCC, art 3(1); Durban Platform for Enhanced Action (n 120), preamble.

[172] See, e.g., UNFCCC, art 4(1)(h); LOSC, art 204 and 205

[173] See, e.g., Aarhus Convention, art 4.; Convention on Environmental Impact Assessment in a Transboundary Context (1991) 30 ILM 802 (Espoo Convention), Appendix IV, para 8; CBD, art 8.

(c) Cooperate in scientific and other research related to the protection of the environment, including that related to the climate system and climate change and intended to further the understanding and assess the environmental, economic, social, and other consequences of various response strategies, including, if undertaken, research involving geoengineering, taking into account the need to avoid the duplication of effort;[174]

(d) Cooperate with each other to formulate, elaborate and implement international law relating to geoengineering in a mutually supportive manner with other relevant international law;[175]

(e) Cooperate to develop further the international law regarding liability and compensation for the victims of pollution and other environmental damage caused by geoengineering activities within the jurisdiction or control of such States and to areas beyond their jurisdiction.[176]

Commentary

(1) One of the debated topics in geoengineering is the extent to which common values, norms and postulated factual conditions support or even demand international cooperation on geoengineering. There are diverging views expressed in the literature on whether geoengineering research should be subject to international or national regulation. Regarding conceptions of sovereignty and its evolution, over the course of this century, the sovereign independence of individual nation states is increasingly giving way to a world order premised on the idea of mutual interdependence and the recognition of common interests shared by a group of states or the international community as a whole. Enhanced scientific and technological prowess creates interdependences from trade and economic integration, but has also caused environmental damage. Widely recognised common state interests that are deeply entrenched in international environmental law are the prevention of significant transboundary harm and the need for concerted state action to address the declining condition of the global environment due to degradation of the ozone layer, loss of biodiversity, the risk of climate change, and marine environmental degradation. These environmental processes and components are all interconnected, as are the human societies that they support. In his dissenting opinion in the ICJ's *Advisory Opinion on the Legality of the Threat or Use of Nuclear Weapons*, Judge Weeramantry noted that these examples of 'mutual interdependence' are a product of '[a] world order in which every sovereign state depends on the same global environment'.[177] The expansion and deepening of States' commitments to protect the environment means that as new issues arise 'theoretically important areas for decisions are much restricted and hemmed in by treaties, by customary international law and by the consequences [...] of the sheer interdependence of all sovereign states of today.'[178] In other words, as the body of international rules becomes denser and state affairs increasingly intertwined, there is a greater likelihood that new issues will be treated as common problems that demand international cooperation in order to be resolved.

[174] UNFCCC, art 4(1)(g).

[175] ILA Legal Principles relating to Climate Change (n 119) draft Article 10; ILA New Delhi Principles on Sustainable Development (n 119) art 7.

[176] See, e.g., Stockholm Declaration, principle 22; Rio Declaration, principle 13; CBD, art 14(2); Cartagena Protocol on Biosafety to the Convention on Biological Diversity (2000) 39 ILM 1027, art 27.

[177] *The Legality of the Threat or Use of Nuclear Weapons* (Advisory Opinion) [1996] ICJ Rep 226, 505.

[178] Robert Jennings, 'Sovereignty and International Law' in Gerard Kreijen and others (eds), *State, Sovereignty, and International Governance* (Oxford University Press 2002) 31.

(2) Research and development of some geoengineering measures may have consequences that resonate beyond national borders. For example, ocean fertilisation studies, mostly carried out in areas beyond national jurisdiction, have been characterised as a form of marine pollution that comes within the ambit of the international rules that regulate dumping at sea. A more difficult case concerns the extent to which there is a mandate to strengthen mechanisms and arrangements for international cooperation and regulation of geoengineering research from the outset – in particular, small-scale field experiments conducted on sovereign territory which are likely to have no transboundary or even just *de minimis* environmental effects.

(3) Draft Article 6 tackles the issue of international cooperation on geoengineering. The commentaries to this provision explore the existing normative conditions that give rise to further international cooperation in this area. Paragraph 1 lays down the overarching duty of States to cooperate, also acknowledging the contribution of other interested stakeholders to cooperate in good faith to ensure that geoengineering research is conducted in a responsible manner. Paragraph 2 further articulates specific aspects of this duty regarding the development of the regulatory and governance framework for geoengineering and, related to this, scientific and technical cooperation.

(4) The general obligation of States to cooperate is reflected in many treaties[179] and other instruments, resolutions and policy documents. UNGA Res. 25/2625 (24 October 1970) declares that '[a]ll States have the duty to cooperate with one another [...] to maintain international peace and security and to promote international economic stability and progress [...].' Although the obligation may be formulated differently in different instruments, international cooperation is mandated for several matters that are potentially touched upon by geoengineering and thus fall within the common interest of the international community. For example, a duty of cooperation is articulated in international law for the maintenance of international peace and security,[180] the use of commons areas,[181] the protection of the environment[182] and sustainable development,[183] and in the area of science and technology.[184]

(5) The duty of cooperation permeates most of the law on global environmental protection. In his separate opinion in the *Mox Plant Case*, Judge Wolfrum described cooperation as the 'overriding principle of international environmental law,' which ensures that 'community interests are taken into account *vis-à-vis* individualistic State interests.'[185] The idea of international cooperation on environmental protection as a limit on State sovereignty is explicitly recognised in Principle 24 of the Stockholm Declaration, which reads:

> Cooperation through multilateral or bilateral arrangements or other appropriate means is essential to effectively control, prevent, reduce and eliminate adverse environmental effects resulting from activities conducted in all spheres, in such a way that due account is taken of the sovereignty and interests of all States.

[179] See, e.g., LOSC, preamble. The obligation to cooperate may be stated in mandatory terms in international agreements, or may be qualified by wording such as that in art 5 of the CBD, which reads that States shall cooperate 'as far as possible and as appropriate'. This qualified language recognises the discretion of States and acknowledges their differing capacities in fulfilling their duty to cooperate.

[180] See, e.g., Friendly Relations Declaration (n 28) preamble, which refers to the codification and progressive development of the '[t]he duty of States to co-operate with one another in accordance with the Charter.'

[181] See, e.g., Antarctic Treaty (1959) 402 UNTS 71, preamble, arts 2 and 3; Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and other Celestial Bodies (1967) 6 ILM 386 (Outer Space Treaty), preamble, arts I, III, IX; LOSC, Part XI on The Area.

[182] See *Mox Plant Case* (Provisional Measures, Sep. Op. Wolfrum) 4 stating: 'I fully endorse, however, paragraphs 82 to 84 of the Order, considering that the obligation to cooperate is the overriding principle of international environmental law, in particular when the interests of neighbouring States are at stake. The duty to cooperate denotes an important shift in the general orientation of the international legal order. It balances the principle of sovereignty of States and thus ensures that community interests are taken into account *vis-à-vis* individualistic State interests.'

[183] Rio Declaration, preamble, principles 5, 7, 9, 12–14 and 24.

[184] The Friendly Relations Declaration (n 28) declares in relation to the 'duty of States to cooperate in accordance with the Charter' that 'States should cooperate in the economic, social and cultural fields as well as in the field of science and technology.'

[185] See n 182, above.

This duty was reaffirmed in Principle 7 of the Rio Declaration which predicates the need for States to work together 'in a spirit of global partnership to conserve, protect and restore the health and integrity of the Earth's ecosystem' based upon developed and developing countries' differentiated historical responsibility for environmental degradation and their ability to pay.[186] Related to this is the capacity-building function of international cooperation to redress imbalances between developed and developing states as an expression of international equity. This includes, for example, the sharing of information about the environment and access to technologies that can contribute to improved governance at the global level. Many multilateral environmental agreements, including those relevant to geoengineering, contain provisions on participation in the conduct of scientific research,[187] also relating to information sharing, capacity building, and technology transfer. At present, geoengineering research remains largely within the sphere of a handful of developed States. On the one hand, it can be argued that there is a need for knowledge transfer and transparency to increase understanding about the benefits, risks and uncertainties of geoengineering technologies and to improve global decision-making on its governance. On the other hand, it is unclear how such provisions will be interpreted in the light of the potential threat posed by some geoengineering measures, for example, unilateral, large-scale deployment of stratospheric aerosol injection.[188]

(6) Originating in the law respecting shared natural resources, the duty to cooperate in international environmental law also entails procedural obligations of prior notification and consultation.[189] These requirements now apply to the management of transboundary risks, reflected in Principle 19 of the Rio Declaration and the ILC's Draft Articles on the Prevention of Transboundary Harm,[190] forming part of the corpus of customary international rules where there is a risk of significant adverse transboundary environmental effects.[191] Although largely procedural in nature, these obligations cannot be conducted as a 'mere formality,'[192] but also have substantive content in that they must be carried out in a way that is 'meaningful' and in good faith.[193]

[186] This notion of common but differentiated responsibilities relating to international cooperation on the protection of the environment is reference in the chapeau of draft Article 6(2), which qualifies the duty to cooperate 'in accordance with their respective capabilities' and is based on the framework of the UNFCCC.

[187] Provisions on joint participation in the conduct of scientific research help to open up scientific fields that have been previously shut off to developing countries due to a lack of capacity. Article 5 of the UNFCCC on 'research and systematic observation' is particularly far-reaching. It requires that States Parties support, further develop and finance research programmes and research networks, taking into account the need to minimise duplication of effort and promote access to and the exchange of data. It also calls upon states to support international efforts to strengthen research capacities and capabilities, particularly for developing countries. This right of actual participation in research addresses the gap in scientific and technological knowledge and capacity far beyond a right of mere access to information.

[188] Pursuant to art 31(1) of the Vienna Convention on the Law of Treaties (adopted 23 May 1969, entered into force 27 January 1980) 1155 UNTS 331, 8 ILM 689 (VCLT), treaty articles on cooperation on scientific research must interpreted in good faith in accordance with the ordinary meaning to be given to the terms of the treaty in their context and in the light of its object and purpose. Positive obligations to promote and jointly conduct research may be expressed in obligatory or hortatory language and likely would not, e.g., comprise a duty to promote research that defeats the aims of the agreement. See also LOSC, art. 30; *Gabčíkovo-Nagymaros Dam Case*, para 30. For an in depth analysis of the treatment of good faith by the ICJ in the *Whaling in the Antarctic Case*, see Caroline E Foster, 'Motivations and Methodologies: Was Japan's Whaling Programme for Purposes of Scientific Research?' (Whaling in the Antarctic: The ICJ Judgment and its Implications Symposium at Kobe University, 31 May – 1 June 2014) <www.edu.kobe-u.ac.jp/ilaw/en/whaling_docs/paper_Foster.pdf> accessed 29 January 2015.

[189] *Lac Lanoux Arbitration (France v Spain)* [1957] 24 ILR 101. See also *Gabčíkovo-Nagymaros Dam* case, paras 140 – 47. See generally Rio Declaration, principles 7, 9, 12, 13, 14, 18, 19 and 27.

[190] ILC, Report of the Commission to the General Assembly on the work of its fifty-third session, Draft Articles on Prevention of Transboundary Harm from Hazardous Activities, with commentaries (10 August 2001) UN Doc A/56/10 (ILC Draft Articles on the Prevention of Transboundary Harm), art 4.

[191] See Birnie, Boyle and Redgwell (n 134) 177.

[192] *Lac Lanoux Arbitration*, 119

[193] *Lac Lanoux Arbitration*; *North Sea Continental Shelf Cases (Germany v Denmark; Germany v Netherlands)* (Judgment) [1969] Rep 3, para 85.

(7) A duty of cooperation also functions as the backbone of most, if not all, international agreements on the protection of the environment.[194] The content of this duty may vary in relation to the objectives of the instrument and may have substantive, procedural, and institutional elements.[195] It includes requirements to provide technical assistance, to promote scientific research and information exchange, to call for joint action on environmental assessment and monitoring, and to further develop and implement of international rules and national laws and measures. For multilateral agreements, cooperation is not only necessary for the effective implementation of existing obligations, but also serves to facilitate the progressive development of treaty regimes, often through international institutions, treaty bodies or other organisational structures.[196] International cooperation can also provide the basis for harmonising domestic laws and policies and coordinating national action,[197] and if sufficiently widespread, could help to alleviate the problem of forum shopping through the formulation and harmonisation of international minimum standards.

(8) Pursuant to paragraph 1, international cooperation on geoengineering is mandated for various reasons, not least because geoengineering touches upon many subject areas of international law that fall within the global common interest, taking into account the status of the climate system as a common concern of humankind,[198] to promote collective learning and responsible governance and regulation, and to address forum shopping and the protection of the global commons.[199] Early cooperative action on governance could alleviate the threat of unilateral action from some geoengineering measures.

(9) Paragraph 2 stipulates specific modes for cooperation relating to geoengineering. Subparagraph (a) calls for wide and inclusive cooperation relating to all facets of the development of effective geoengineering governance at various levels. Drawing upon the language in the FAO Code of Conduct for Responsible Fisheries, it includes international regulation of geoengineering by legally enforceable rules, also contemplating a broader role for global governance writ large.[200] According to this provision, the establishment, further development and implementation of measures for responsible scientific research involving geoengineering should partly be based upon the 'best scientific and technical information available'. This benchmark has been widely adopted in international and national laws and constitutes an evolving standard that integrates new knowledge and understand-

[194] In the international context, see LOSC, Part XII, Vienna Convention for the Protection of the Ozone Layer, preamble, art 2(2)(a), (c) and (d), art 3(3) and art 4; UNFCCC, preamble, art 3(3) and (5), 4(1)(c), (d), (e), (g)–(i), art 5(c) and art 6(b); Convention on Long-Range Transboundary Air Pollution (adopted 13 November 1979, entered into force 16 March 1983) 18 ILM 1442 (LRTAP), preamble; LOSC, Part XII, Sections 2–5, including arts 194 and 197. In the regional context, see North American Agreement on Environmental Co-operation (1993) 32 ILM 1482, art 1. See further Birnie, Boyle, and Redgwell (n 134) 175–76; Rüdiger Wolfrum 'International Law of Cooperation' in Max *Plank Encyclopaedia of Public International Law* (April 2010), paras 28–31.

[195] Wolfrum (n 194). See also Alex G Oude Elferink, 'Governance Principles for Areas Beyond National Jurisdiction' (2012) 27 *International Journal of Marine and Coastal Law* 205, 218, regarding the duty to cooperate under the LOSC, stating that: 'Although the Convention does not formulate a general duty of States to cooperate, it contains numerous references to the duty to cooperate. However, in such cases the object of cooperation is always specified.' It is also pointed out that the duty to cooperate may be implicitly required in order to ensure that certain requirements are effectively implemented.

[196] See, e.g., OSPAR Convention for the Protection of the Marine Environment of the North-East Atlantic (adopted 22 September 1992, entered into force 25 March 1998) 2354 UNTS 67 (OSPAR Convention) art 7. See generally Wolfrum (n 194).

[197] See, e.g., LRTAP, preamble: 'Affirming their willingness to reinforce active international cooperation to develop appropriate national policies and by means of exchange of information, consultation, research and monitoring to coordinate national action for combating air pollution including long-range transboundary air pollution.'

[198] See discussion on draft Article 5, above.

[199] Regarding international cooperation in areas beyond national jurisdiction, see, e.g., LOSC, Part VII and XI; Antarctic Treaty, Preamble, arts 2 and 3; Outer Space Treaty, art I. See also 'Our Common Future: Report of the World Commission on Environment and Development' UN Doc A/42/427, Annex (4 August 1987), ch 10 'Managing the Commons.'

[200] See FAO Code of Conduct for Responsible Fisheries, art 7.1.1.

ing of a subject over time. [201] Sound science provides information for understanding changes in the environment, understanding how ecosystems operate, and predicting how a change in environmental conditions may affect ecosystem functioning. It has a legitimising function in international environmental regulation.[202] However, it is important to also recognise the appropriate limits and usefulness of science in environmental decision-making. Scientific information may be incomplete, uncertain and contested.[203] Science alone cannot serve as the basis for law- and policymaking on geoengineering, because environmental assessment and goal setting are also value-laden determinations that also require the input of a broader range of societal stakeholders.[204] Bearing this in mind, subparagraph (a) calls for decision-makers to take into account other considerations (not just scientific) such as socio-political concerns.

(10) Subparagraphs (b) to (c) address international cooperation on scientific research and information exchange. The duty to promote international cooperation on scientific and technical matters is articulated in many international treaties and other less formal instruments, such as memoranda of understanding between States.[205] The United Nations General Assembly has declared in the 'Declaration on the Use of Scientific and Technological Progress in the Interests of Peace and for the Benefit of Mankind' that

> [a]ll States shall promote international cooperation to ensure that the results of scientific and technological developments are used in the interests of strengthening international peace and security, freedom and independence, and also for the purpose of the economic and social development of peoples.[206]

This language points to an underlying purpose of international cooperation on scientific research to promote knowledge sharing and extend the collective benefits of scientific progress to society as a whole.[207]

(11) Cooperative action on research is often mandated in treaties to advance the protective objectives of the instrument.[208] This highlights the key role of science in international environmental law, for example, by identifying emerging environmental concerns and formulating, implementing and further elaborating evidence-based environmental regulations and policies.[209] While many binding and non-binding instruments call for international cooperation for the promotion of scientific research generally,[210] agreements may also contain specific provisions that set out con-

[201] At the international level, see, e.g., Resolution LP.4(8); FAO Code of Conduct for Responsible Fisheries. At the national level, see the US Endangered Species act; National Standard 2 Magnuson-Stevens Fishery Conservation and Management Act. Institute for Regulatory Science, 'Best Available Science: Metrics for the Evaluation of Scientific Claims' <http://www.nars.org/bas.html> accessed 30 August 2014.

[202] Jacqueline Peel, *The Precautionary Principle in Practice: Environmental Decision-Making and Scientific Uncertainty* (The Federation Press 2005) ch 4. Regarding the role of science and technology in international environmental law, generally, see Steinar Andresen and Jon Birger Skjaerseth 'Science and Technology: From Agenda Setting to Implementation' in Bodansky, Brunnée and Hey (n 131) 182.

[203] Vern Walker, 'Myth of Science as a Neutral Arbiter for Triggering Precautions' (2003) 26 *B.C. International & Comparative Law Review* 197; Brian Wynne, 'Uncertainty and Environmental Learning: Reconceiving Science and Policy in the Preventative Paradigm' (1992) 2 *Global Environmental Change* 111.

[204] David Winickoff and others, 'Adjudicating the GM Food Wars: Science, Risk and Democracy in World Trade Law' (2005) 30 *Yale Journal of International Law* 81.

[205] See generally Döhler and Nemitz (n 43).

[206] UNGA, 'Declaration of the Use of Science and Technological Progress in the Interests of Peace and for the Benefit of Mankind' (10 November 1975) UN Doc A/RES/30/3384.

[207] See, generally, Report of the Special Rapporteur on the Benefits of Scientific Progress.

[208] CBD, preamble.

[209] See, e.g., LOSC, art 201; Vienna Convention for the Protection of the Ozone Layer, Preamble; OSPAR Convention, Annex IV, art 2(e). See also Hubert (n 170); Birnie (n 48).

[210] See, e.g., LOSC, art 242.

crete terms for joint participation in the conduct of scientific research and monitoring,[211] and provide for the exchange of scientific information, including co-operation on scientific programmes, the generation of observations and data,[212] the publication and dissemination of scientific information,[213] and scientific and technical capacity building.[214] Cooperation on scientific and technical matters may take place directly between States, through international bodies or via other cooperative structures.[215]

(12) Transparency is frequently cited as an important tenet of the governance of geoengineering,[216] and information exchange and research coordination are emerging as central pillars of the governance framework for geoengineering at the international level.[217] Leaving aside those instruments that have addressed geoengineering directly, the language of some multilateral environmental agreements may nonetheless cover cooperation in scientific research related to some forms of geoengineering. For example, in achieving its aim of protecting human health and the environment against adverse effects resulting or likely to result from human activities, the Vienna Ozone Convention contains several articles on cooperation by means of systematic observations, research and information exchange.[218] Modelled upon similar provisions in other international agreements, subparagraph (b) deals with the exchange of information on the protection of the environment, in particular, concerning the functioning of the climate system and climate change as well as the consideration of various response strategies, including geoengineering. Such information may be scientific, technological or technical in nature, but could also include other relevant socio-economic, legal, or commercial information.[219] Disclosure should be 'full, open and prompt,' but is also made subject to the applicable laws protecting the disclosure and confidentiality of information.[220]

(13) Subparagraph (c) calls for international cooperation on scientific and other research related to the protection of the environment, and specifically for cooperation on research about the climate system, climate change, and strategies for addressing it. Practical cooperation of this kind between States and other stakeholders surpasses mere access to information and knowledge provided for in subparagraph (b), and may include joint participation research projects as well as other forms of collaboration, such as the joint organisation of research projects, publications, seminars or training, transfer of scientific and technical information, exchange of personnel, and the provision of equipment, instruments, samples, materials,

[211] Vienna Convention for the Protection of the Ozone Layer, art 3; United Nations Convention against Illicit Traffic in Narcotic Drugs and Psychotropic Substances (adopted 20 December 1988, entered into force 11 November 1990) 28 ILM 493, Art 9; LRTAP, art 7; Convention on the Protection of the Alps (1991) 31 ILM 767 (Alpine Convention), art 3; Convention on the Protection and Use of Transboundary Watercourses and International Lakes (adopted 17 March 1992, entered into force 6 December 1996) 31 ILM 1312 (Helsinki Water Convention), art 5; OSPAR Convention, art 8, Annex IV, art 2; Desertification Convention, art 10(4) and 12.

[212] Antarctic Treaty, Art. III; International Convention for the Regulation of Whaling (adopted 2 December 1946, entered into force 10 November 1948) 161 UNTS 72 (ICRW), art VIII; OSPAR Convention, art 9.

[213] For example, article 4(4) of the Alpine Convention is particularly far-reaching in requiring that 'Contracting Parties shall ensure that the public are regularly kept informed in an appropriate manner about the results of research, monitoring and action taken.' See also LRTAP, art 4.

[214] See, e.g., LOSC, art 202 and 203, Parts XIII and XIV; UNFCCC, art 6; Vienna Convention for the Protection of the Ozone Layer, art 4(2); CBD, preamble and art 12; Desertification Convention, art 10(4), 12, 17 and 18.

[215] See, e.g., LRTAP, art 10; ICRW, Art. VIII; OSPAR Convention, art 8.

[216] See draft Article 18, below.

[217] For instance, the CBD Secretariat has recently invited States Parties to report on measures undertaken in relation to Decisions X/33, para 8(w) on geoengineering and to make this information available through the clearing-house mechanism. See CBD, 'Notification: Follow-up to decisions X/33 and XI/20 in relation to climate-related geoengineering' (12 November 2013) UN Doc SCBD/SAM/SS/ac/82893 (CBD Follow-up to decisions X/33 and XI/20 in Relation to Climate-Related Geoengineering).

[218] Vienna Convention for the Protection of the Ozone Layer, arts 2 – 4.

[219] UNFCCC, art 4(1)(h).

[220] See, e.g., Aarhus Convention, art 4(4), which provides an extensive listing of exemptions relating to the disclosure of environmental information. See further draft Article 18, below.

or data.[221] However, given the controversial nature of geoengineering, unlike other treaties that incorporate a positive obligation for States to promote the conduct of scientific research on certain topics, this provision only calls for cooperation on research by States and other stakeholders if they have chosen to undertake research in this area.[222]

(14) Both subparagraphs (b) and (c) refer to the function of scientific and technical cooperation in avoiding the duplication of effort for research activities.[223] As well as being good practice in terms of the efficient use of scientific resources, this also serves as a useful principle for minimising environmental risks of perturbation experiments by maximising the value of each in *situ field* trial.[224]

(15) Subparagraph (d) refers to the 'principle of integration and inter-relationship' which is essential to achieving sustainable development by reflecting the interdependence of social, economic, financial, environmental and human rights aspects of principles and rules of international law.[225] The large-scale modification of ecosystems to address the effects of climate change gives rise to other environmental issues such as ozone depletion, the conservation and sustainable use of biodiversity, and the protection of the marine environment, and may affect other areas of the law such as human rights or the law of the sea more generally. International governance and regulation of geoengineering is only just emerging, and is being addressed by multiple agreements and bodies, giving rise to the potential for overlapping or colliding obligations in the future. Regime conflicts are also to be avoided since this 'doubling of efforts' can erode the effectiveness of international law by wasting scarce resources and result in legal uncertainties regarding the interpretation and implementation of international law.[226] The duty set out in subparagraph (d) relates to the interpretative principle of harmonisation according to which 'when several norms bear on a single issue they should, to the extent possible, be interpreted so as to give rise to a single set of compatible obligations.'[227] Given that regulation of geoengineering is only now unfolding, an important aspect of this duty relates to the need to formulate and elaborate international law for greater coherence and efficiency. A central objective of this draft Code of Conduct is to promote harmonisation and coordination of legal development relating to geoengineering in order to ensure that it is pursued responsibly and sustainably.

(16) Subparagraph (e) addresses the need to further develop international law with regard to allocating liability and redress for damage caused by the intentional modification of the environment using geoengineering. The functions of liability systems in law include the need to ensure that victims have effective recourse against those responsible for causing environmental damage and that they are adequately compensated so that the burden to pay for losses falls equitably on the responsible party.[228] In addition to providing for fairness and equity, such rules can operate to prevent environmental damage before it occurs by deterring activities. Given the prediction that some geoengineering methods are likely to produce 'winners and losers,'[229] legal responsibility and redress for damaging outcomes from geoengineering activities has therefore been identified as an impor-

[221] See, e.g., LOSC, art 200.

[222] However, see Desertification Convention, art 17(1)(g), requiring that 'Parties undertake, according to their respective capabilities, to promote technical and scientific cooperation in the fields of combating desertification and mitigating the effects of drought through appropriate national, sub-regional, regional and international institutions' including to the end that 'they shall support research activities that [...] enhance the availability of water resources in affected areas, by means of, *inter alia, cloud-seeding*' [emphasis added].

[223] See, e.g., UNFCCC, art 5(a).

[224] See draft Article 10, below.

[225] ILA New Delhi Principles on Sustainable Development, art 7. See also draft Article 19(3), below.

[226] Rüdiger Wolfrum and Nele Matz, C*onflicts in International Environmental Law* (Springer 2003) 3.

[227] ILC, 'Fragmentation of International Law: Difficulties Arising from the Diversification and Expansion of International Law, Report of the Study Group of the International Law Commission' (July 18, 2006) UN Doc A/CN.4/L.702, 8.

[228] See, generally, Jutta Brunnée, 'International Legal Accountability through the Lens of the Law of State Responsibility' (2005) 36 *Netherlands Yearbook of International Law* 21.

[229] The Royal Society Report on Geoengineering (n 2) 51.

tant consideration in the governance and legal regulation of geoengineering.[230] At the international level, notions of liability and reparation for environmental damage are predominately addressed in the customary international rules of state responsibility.[231] 'State responsibility' refers to the secondary rules governing the general conditions under which a state is responsible for wrongful acts or omissions and the resulting legal consequences which form part of the corpus of customary international law.[232] Several thorny issues arise with regard to state responsibility and liability for geoengineering activities,[233] including the difficulty of establishing a causal link between an action and the harm to the required standard of proof.[234] This provision is modelled on several provisions in instruments which call for progressive developments in the law relating to resolving disputes and determining legal responsibility and liability.[235] The development of bespoke arrangements concerning liability and redress could help to overcome shortcomings in the existing international law for environmental damage that occurs in connection with geoengineering activities.[236]

[230] The Royal Society Report on Geoengineering (n 2) 41 and 51; ASILOMAR Geoengineering Conference Report (n 15) Recommendation 2.

[231] According to the CBD Report on Geoengineering (n 55) 144 most of the treaties that may apply to geoengineering activities do not contain specific provisions on liability and redress and thus the general customary international rules on state responsibility are applicable.

[232] See further ILC Draft Articles on State Responsibility.

[233] Gerd Winter, 'Climate Engineering and International Law' Last Resort or the End of Humanity?' (2001) 20 *RECIEL* 277

[234] David Reichwein, Anna-Maria Hubert, Peter J Irvine, Francois Benduhn and Mark G Lawrence, 'State Responsibility for Environmental harm from Climate Engineering' manuscript submitted to the *Climate Law* special issue on climate engineering (forthcoming 2015).

[235] Stockholm Declaration, principle 22; Rio Declaration, principle 13.

[236] Brunnée (n 419).

Draft Article 7

Preventive Principle

States have the sovereign right to exploit their own resources pursuant to their own environmental and developmental policies and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or to areas beyond the limits of national jurisdiction.[237] States shall take all appropriate and effective measures to anticipate, prevent or minimise significant adverse effects from the conduct of scientific research involving geoengineering in accordance with the relevant rules of international law.[238]

Commentary

(1) Draft Article 7 incorporates the customary law obligation of States to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.

(2) The ICJ has recognised that the obligation of prevention now forms 'part of the corpus of international law relating to the environment.'[239] Laid down in Principle 21 of the Stockholm Declaration and later reaffirmed in Principle 2 of the Rio Declaration, the preventive principle is also well established in international treaties, international jurisprudence, and the writings of jurists. [240] The obligation was furthermore dealt with in detail by the ILC in its Draft Articles on the Prevention of Transboundary Harm.[241] In the context of treaty instruments with direct relevance to geoengineering, Principle 2 of the Rio Declaration is repeated (2) almost verbatim in the preamble of the UNFCCC and Article 3 of the CBD, and is also referenced in the preamble of the London Convention.[242]

[237] See, e.g., Stockholm Declaration, principle 2; Rio Declaration, principle 2. Confirmed as reflecting customary international law by the ICJ in The Legality of the Threat or Use of Nuclear Weapons (Advisory Opinion), para 29, and cited with approval in the Iron Rhine Case, para. 222. See further Sands and Peel (n 122) 190–200.

[238] Cf Stockholm Declaration, Principles 6, 7, 15, 18 and 24; Rio Declaration, Principle 11; LOSC, arts 194(1) and (2), 195, 192, 196, 204, 207–212; UN Agreement Relating to the Conservation and Management of Straddling Fish Stocks and Migratory Fish Stocks (1995) 34 ILM 1542 (UN Fish Stocks Agreement), art 5; OSPAR Convention, art 2; London Convention, arts I, II and VII(2); London Protocol, art 2; Protocol Relating to the Convention for the Prevention of Pollution from Ships (1978) 17 ILM 246 (MARPOL 73/78), Preamble and Art. 1(1); Madrid Protocol, Annex IV; Convention on the Regulation of Antarctic Mineral Resource Activities (1988) 27 ILM 859, Art 7(5); Helsinki Water Convention, art 2(1); Convention on the Law of the Non-Navigational Uses of International Watercourses (1997) 36 ILM 719, art 21; Helsinki Water Convention, art 2(1); Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and under Water (adopted 5 August 1963, entered into force 10 October 1963) (1963) 480 UNTS (Nuclear Test Ban Treaty), art 1(1); Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques (adopted 18 May 1977, entered into force 5 October 1978) (1977) 1108 UNTS 151 (ENMOD Convention), art 1(1); UNFCCC, art 3(3); LRTAP, art 2; Vienna Convention for the Protection of the Ozone Layer, art 2; 1987 Montreal Protocol, preamble; Convention on the Transboundary Effects of Industrial Accidents, (1992) 31 ILM 1330, art 3(1); Espoo Convention, preamble and art 2(1); EU Directive No 18/2011 on the deliberate release into the environment of genetically modified organisms [2011] OJ L106/1, preamble; ILC Draft Articles on the Prevention of Transboundary Harm, art 3. Confirmed as customary international law by the arbitral tribunal in the *Iron Rhine Case*, paras 59 and 222 and later by the ICJ in the *Pulp Mills Case*, paras 101 and 197.

[239] *The Legality of the Threat or Use of Nuclear Weapons* (Advisory Opinion), para 29 reaffirmed in the *Gabčíkovo-Nagymaros Dam Case*.

[240] See *Trail Smelter Arbitration (United States v Canada)* (1941) 3 RIAA 1907, 1967; *Corfu Channel Case (UK v Albania)* (Judgment) [1949] ICJ Rep 4, 22; *Pulp Mills on the River Uruguay Case (Argentina v Uruguay)* (Provisional Measures) [2006] ICJ Rep 113, para 101.

[241] ILC Draft Articles on the Prevention of Transboundary Harm, 31.

[242] See also LOSC, art 194.

(3) With its roots in the *Trail Smelter Arbitration*, a case of transboundary pollution, the scope of the customary law duty of prevention also extends to harm to areas beyond national jurisdiction,[243] covering damage to the atmosphere, the marine environment, and outer space. Grounded in the concept of due diligence, the obligation of prevention requires that States regulate and control activities within their territory or subject to their jurisdiction or control that pose a significant risk of environmental harm. The duty is invoked where the risk of harm is 'significant,' meaning 'something more than "detectable"' but not necessarily '"serious" or "substantial,"' and is to be assessed based on factual and objective criteria and depending on the particular circumstances of the case.[244] To recover for actual or anticipated damage, there must be proof of a causal link between the activity in question and the risk of significant harm to the environment to the relevant evidentiary standard.[245] The degree of care expected of a deploying state is proportional to the degree of hazard involved and the harm or risks must be foreseeable.[246] Geoengineering activities which fall below the threshold of a risk of significant harm or pose no physical risks to the environment, even if they have other societal consequences (e.g., Collingridge dilemma, moral hazard), would not be caught by the preventive principle.

(4) The customary rule of prevention entails both procedural and substantive elements. Procedural duties include the requirement to conduct an environmental impact assessment,[247] as well as collateral obligations of consultation and negotiation.[248] Regarding the substantive elements of prevention, the requirement to take all appropriate and effective measures to prevent and minimise the risk of significant environmental harm, as set out in the second sentence of draft Article 7, is an obligation of due diligence. It is an obligation to take appropriate measures to prevent or minimise as far as possible significant risks to the environment, and not merely a basis for reparation after damage has occurred.[249] Hence, the preventive principle is not an obligation of result that constitutes an absolute prohibition against causing actual harm from occurring, if it could not have been prevented.[250] Rather, a State is obligated to make all possible efforts to prevent or minimise the risks.[251]

(5) The standard of care required by a State to meet its duty of due diligence is that expected of a good government.[252] States must in a timely manner formulate and effectively implement policies, legislation and administrative controls applicable to public and private operators to prevent environmental damage.[253] In the context of marine geoengineering, the issue has already arisen regarding the responsibility of States for the activities of private operators. In this regard, States' duty to act with due diligence 'entails not only the adoption of appropriate rules and measures, but also a certain level of vigilance in their enforcement and the exercise of administrative control applicable to public and private operators, such as the monitoring of activities undertaken by such operators'.[254]

(6) The standard for evaluating State conduct is proportionate to the degree of risk under the particular circumstances,[255] such that '[t]he standard of due diligence has to be more severe for the riskier activi-

[243] 1978 UNEP Draft Principles, principle 3; 1982 World Charter for Nature, para 21(2).

[244] Draft Articles on the Prevention of Transboundary Harm, 152.

[245] Roda Verheyen, *Climate Damage and International Law: Prevention Duties and State Responsibilities* (Martinus Nijhoff 2005) 317–321.

[246] ILC Draft Articles on the Prevention of Transboundary Harm, 155.

[247] *Pulp Mills Case*, para 204.

[248] See ILC Draft Articles on the Prevention of Transboundary Harm, art 9 and 10.

[249] ILC Draft Articles on the Prevention of Transboundary Harm, art 3.

[250] Draft Articles on the Prevention of Transboundary Harm, 154.

[251] Draft Articles on the Prevention of Transboundary Harm, 154.

[252] ILC Draft Articles on the Prevention of Transboundary Harm, 155.

[253] *Pulp Mills Case*, para. 197; cited by the ITLOS Seabed Disputes Chamber in *Responsibilities and obligations of States with respect to activities in the Area* (Advisory Opinion, 1 February 2011) ITLOS Reports 2011, 10, para 117.

[254] *Pulp Mills Case*, para 197, cited by the ITLOS Seabed Disputes Chamber in *Responsibilities and Obligations of States Sponsoring Persons and Entities with Respect to Activities in the Area* (Advisory Opinion), 36.

ties."[256] The recently adopted International Law Association (ILA) 'Legal Principles relating to Climate Change' make note of this with regard to geoengineering, stating '[w]hat is judged to be "riskier" will depend upon both the nature of the risks involved in a particular measure (for instance, geoengineering projects involving solar radiation management) and the vulnerability to harm affected States.'[257]

(7) Overall, as noted by the Seabed Disputes Chamber in its *Advisory Opinion on the Responsibilities and Obligations of States*, due diligence 'is a variable concept', which requires an overall assessment of the circumstances of the case, including scale of the activity, its location, special climate conditions, materials used, and whether the conclusions drawn on the basis of these factors were reasonable under the circumstances.[258] Prevention therefore entails an evolving standard of care. States have a continuing obligation to take steps to identify activities that may pose a risk of significant environmental harm, for example, through environmental impact assessment or monitoring[259] and by taking into account best available science, technology and practices.[260] As a part of their due diligence obligation, States are obligated to keep abreast of scientific and technical developments related to geoengineering, which could prove to be a challenge in the light of the rapid pace of scientific research and technological endeavours in this field.

(8) In this respect, the principles of prevention and precaution are closely related, and their spheres of operation overlap to some extent.[261] Prevention applies where the risk of harm is known and supported by strong scientific evidence (e.g., regarding cause and effect relationships and quantified risks),[262] whereas precaution urges prudence where scientific uncertainty persists. The ITLOS Seabed Disputes Chamber in its *Advisory Opinion* further clarified the link between prevention and precaution, stating that the precautionary principle formed part of the due diligence obligation of States, which applied even outside the scope of the regulations at issue in that matter.[263] The relationship between the application of prevention and precaution is important in the context of geoengineering activities, particularly for scientific research, where scientific assessments have identified potential serious or irreversible environmental risks from conducting in situ experiments, but where scientific evidence proving a causal connection between geoengineering and environmental damage is lacking.[264]

(9) Geoengineering approaches are sometimes labelled 'climate remediation technologies,' raising the question of how the duty of States to prevent environmental damage regarding climate change relates to this characterisation of geoengineering as a kind of clean-up measure.[265] In the Draft Articles on the Prevention of Transboundary Harm, the ILC noted the 'emphasis upon the duty to prevent as opposed to the obligation to repair, remedy or compensate', stating: '[p]revention should be a preferred policy because compensation in case of harm often cannot

[256] *Responsibilities and Obligations of States Sponsoring Persons and Entities with Respect to Activities in the Area* (Advisory Opinion), para 117. See also ILC Draft Articles on the Prevention of Transboundary Harm, 154 that activities which 'may be considered ultrahazardous require a much higher standard of care in designing policies and a much higher degree of vigour on the part of the State to enforce them.'

[257] Commentaries to draft Article 7A of the ILA Legal Principles relating to Climate Change (n 119) para 9.

[258] ILC Draft Articles on the Prevention of Transboundary Harm, 154.

[259] ILC Draft Articles on the Prevention of Transboundary Harm, 154–55. In its judgment in the *Gabčíkovo-Nagymaros Dam Case (Hungary v Slovakia)* [1997] ICJ Rep 7, 926, the ICJ invited the Parties to 'look afresh at the effects on the environment of the operation of the *Gabčíkovo* power plant,' built on the Danube pursuant to the Treaty on the Construction and Operation of the *Gabčíkovo*-Nagymaros Barrage System of 1977 in the light of the new requirements of environmental protection.

[260] ILC Draft Articles on the Prevention of Transboundary Harm, 154.

[261] See Commentary to draft Article 8, below.

[262] According to the ILC Draft Articles on the Prevention of Transboundary Harm, 152, 'risk' means the combined effect of the probability of an undesirable event occurring and its magnitude.

[263] *Responsibilities and Obligations of States Sponsoring Persons and Entities with Respect to Activities in the Area* (Advisory Opinion), para 31.

[264] Rickels and others (n 95) 99; Reichwein and others (n 234).

[265] Bipartisan Policy Centre's Task Force on Climate Remediation Research, 'Geoengineering: A National Strategic Plan for the Effectiveness, Feasibility and Consequences of Climate Remediation Technologies' (4 October 2011) <http://bipartisanpolicy.org/library/report/task-force-climate-remediation-research> accessed 1 September 2014 (Bipartisan Policy Centre on Climate Remediation Research).

restore the situation prevailing prior to the event or accident."[266] In the context of climate change, the duty of prevention has been framed as the obligation of States to take appropriate mitigation measures to respond to the causes of climate change, in particular, by the reduction of greenhouse gas emissions, and appropriate adaptation measures addressing the adverse effects of climate change.[267] In the broader context of risk-risk trade-offs relating to climate change damage and geoengineering, the implications of this preference for 'prevention as a policy [being] better than cure' are not settled.[268] However, the issue has been raised whether deliberate interventions into the climate system give rise to a 'moral hazard' problem by reducing incentives to mitigate.[269] Some geoengineering techniques, such as stratospheric aerosol injection, could entail serious or potentially irreversible environmental risks.[270] Such interventions could be regarded as remediation in the sense that they would not be 'curative,' i.e., they would not address the root cause of the problem, namely, rising greenhouse gas emissions, and would not restore the climate system to its previous state but would create an altered climate state. This policy preference for prevention underlies the principle set out in draft Article 5(2) which declares that geoengineering should not be regarded as a basis for measures which anticipate, prevent or minimise the causes of climate change.

(10) A State's breach of its obligation of diligent prevention would give rise to state responsibility for damage caused to the environment of other States or to areas beyond national jurisdiction.[271] With respect to the latter protection of global commons areas, the obligation to anticipate, minimise and prevent the risk of environmental damage benefits the international community as a whole, and therefore may operate *erga omnes*.[272] In general, however, proving the required causal link between the wrongful act and the damage to make out a claim for a breach of the preventive principle could prove to be difficult for complex, non-linear systems, thus making it difficult to make out the case for state responsibility arising from the risks of some geoengineering activities.[273]

(11) In conclusion, regarding the application of the duty of prevention to geoengineering under customary international law, a State would be required to exercise the requisite level of due diligence for those geoengineering activities which pose a significant risk of harm to the environment. However, a State would not be responsible under this rule for environmental damage that was not foreseeable, or that nevertheless occurred where it had met its standard of care and fulfilled its procedural obligations. A State would also not be responsible for those risks that fall below the threshold of 'significant'. As a result, smaller-scale scientific research activities may not fall within the scope of the customary rule of prevention.

[266] ILC Draft Articles on the Prevention of Transboundary Harm, 148.

[267] It also states that 'where possible, mitigation measures should take priority over adaptation measures.' Commentary to draft Article 7A of the ILA Legal Principles relating to Climate Change (n 119) para 8.

[268] ILC Draft Articles on the Prevention of Transboundary Harm, 148.

[269] M Gores, 'The Economics (or Lack Thereof) of Aerosol Geoengineering' (2011) 109 Climatic Change 719; K Gramstatd and S Tjotta, 'Climate Engineering: Cost Benefit and Beyond' (Working Papers in Economics No. 05/10) <http://mpra.ub.uni-muenchen.de/27302/1/MPRA_paper_27302.pdf> accessed 6 October 2014; David Keith, 'Geoengineering the Climate: History and Prospect' (2000) 25 *Annual Review of Energy and Environment* 245; B Hale, 'The World that Would have Been: Moral Hazard Arguments against Geoengineering' in Christopher J Preston (ed) Engineering the Climate: The Ethics of Solar Radiation Management (Lexington Books 2013); Albert Lin, 'Does Geoengineering Pose a Moral Hazard?' (2012) 40 *Ecology Law Quarterly* 673.

[270] Regarding the relationship between remediation (or 'curative' or 'corrective' measures) and preventative measures, according to Nicolas de Sadeleer, 'The principles of prevention and precaution in international law: two heads of the same coin?' in Mallgosia Fitzmaurice, David M Ong and Panos Merkouris (eds), *Research Handbook on International Environmental Law* (Edward Elgar Publishing 2011) 182: '[C]urative measures may remediate environmental damage, but they come too late to avert it. In contrast, preventive measures do not depend on the appearance of ecological problems; they anticipate damage or, where it has already occurred, try to ensure it does not spread. In any case, common sense dictates timely prevention of environmental damage to the greatest extent possible, particularly when it is likely to be irreversible or too insidious or diffuse to be effectively dealt with through civil liability or when reparation would be extremely expensive' [emphasis added].

[271] ILC Draft Articles on State Responsibility, art 1.1.

[272] Birnie, Boyle and Redgwell (n 134) 145; Jonathan I Charney, 'Third States Remedies for Environmental Damage to the World's Common Spaces' in Francesco Francioni and Tullio Scovazzi, *International Responsibility for Environmental Harm* (Grahm & Trotman 1991) 149.

[273] Reichwein and others (n 234).

Draft Article 8

Precautionary Principle

Where there is a reasonably foreseeable threat of serious or irreversible damage, States shall take measures to anticipate, prevent or minimise adverse effects from geoengineering, including in the conduct of scientific research involving geoengineering, without waiting for conclusive scientific proof of that damage.

Commentary

(1) Draft Article 8 stipulates precaution as the key legal principle for dealing with scientific uncertainty in the face of potential risks to the environment caused by geoengineering. Although some aspects of its content and its legal status are still debated, the concept of precaution runs through much of contemporary international law and policy on the protection of the environment and the governance of science, innovation and technology.[274]

(2) The legal regime of precaution comes as a more recent addition to international environmental law aimed at 'adjusting the insufficiencies of the regimes of prevention' given the widespread growth and intensification of human activities and technologies, a lack of knowledge of the impact of such phenomena on ecosystems, and the need to anticipate serious or irreversible damage.[275] Although the association between these related sets of obligations is fluid,[276] the fundamental distinction lies in the extent of the evidence of harm from an activity: the preventive principle applies where the risks are known and can be proven scientifically, whereas the precautionary principle 'runs in advance' of prevention by calling for action to protect the environment before sufficient scientific evidence of harm can be fully furnished.[277] The precautionary principle therefore has obvious relevance to geoengineering since it generally covers circumstances in which a potential risk arising from an activity can be identified, often using traditional risk analysis or scientific evaluation, but scientific data is insufficient to fully demonstrate or quantify the risk or to prove a cause and effect relationship between the activity and possible adverse effects.

[273] Reichwein and others (n 234).

[274] The 'precautionary principle' or 'precautionary approach' is expressly adopted many treaties including the Vienna Convention for the Protection of the Ozone Layer, Preamble; Bamako Convention on the Ban of the Import into Africa and the Control of Transboundary Movement and Management of Hazardous Wastes within Africa (1991) 30 ILM 773, art 4; Treaty on the European Union (Treaty of Maastricht) [1992] OJ 191/01, art. 130(r); UNFCCC, art 3(3); CBD, preamble; Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (1996) 36 ILM 7, art 3(1). According to David Freestone, 'Satya Nandan's Contribution to the Development of the Precautionary Approach in International Law' in Lodge and Nordquist (n 26) 313, precaution has also been accepted implicitly or operationally in a many different existing international instruments including the Convention on Wetlands of International Importance Especially as Waterfowl Habitat (1971) 996 UNTS 245 (Ramsar Convention); Convention on the Conservation of Migratory Species of Wild Animals (1979) 19 ILM 15; Convention on the Conservation of European Wildlife and Natural Habitats (1979) UKTS 56; as well as the decisions of the London Convention, International Whaling Commission and CITES.

[275] Gerhard Hafner and Isabelle Buffard, 'Obligations of Prevention and the Precautionary Principle' in James Crawford, Alain Pallet and Simon Olleson (eds), *The Law of International Responsibility* (Oxford University Press 2010) 525; Nicolas de Sadeleer, *Environmental Principles: From Political Slogans to Legal Rules* (Oxford University Press 2002)

[276] Hafner and Buffard (n 275). new requirements of environmental protection.

[277] Freestone (n 274) 311–12; Commentary to draft Article 7 of the ILA Legal Principles relating to Climate Change (n 119) para 2.

(3) Regarding its legal status, expressions of the precautionary principle have been widely incorporated into international agreements, national legislation, the jurisprudence of international and national courts, and the writings of legal scholars.[278] In the past, international courts and tribunals have tended to shy away from addressing its legal status directly, in particular, regarding whether it has evolved into a customary rule of international law.[279] ITLOS alluded to precaution in the *Southern Bluefin Tuna Cases* in which it called upon the parties to act with 'prudence and caution to ensure that effective conservation measures are taken to prevent serious harm to the stock of southern bluefin tuna'.[280] In the *Pulp Mills Case*, the ICJ found that 'a precautionary approach may be relevant in the interpretation and application of the provisions of the (3) Statute', [281] a statement to be read in the light of Article 31(3) of the Vienna Convention on the Law of Treaties.[282] More recently, the ITLOS Seabed Disputes Chamber provided a more definite statement on the legal status of the precautionary principle in its *Advisory Opinion on the Responsibilities and Obligations of States Sponsoring Persons and Entities with Respect to Activities in the Area*.[283] Although in that case the relevant regulations contained an express obligation to take a precautionary approach, the Chamber nevertheless identified precaution as reflected in Principle 15 of the Rio Declaration to be 'an integral part of the general obligation of due diligence of sponsoring States, which is applicable even outside the scope of the Regulations.'[284] It further noted that the precautionary principle is being incorporated into an increasing number of international instruments, reflecting a 'trend towards making this approach part of customary international law'.[285]

(4) Although core elements of the concept can be easily identified, the 'precautionary principle' or 'precautionary approach' is 'notoriously uncertain' in terms of its normative content, partially arising from its modulated formulations in different treaties and international documents.[286] More conservative versions as embodied in Principle 15 of the Rio Declaration[287] and other multilateral agreements, such as Article 3(3) of the UNFCCC and preamble of the CBD, are considered to be non-controversial. These stipulate that a lack of decisive evidence of harm should not be a ground for refusing to regulate. In other words, the Rio Declaration formulation is generally read to permit precautionary action in the face of serious or irreversible threats, but does not compel regulatory action. By contrast, stronger versions are not merely permissive, but instead require States to take precautionary measures in the face of a potential risk to human health or the environment or even to reverse the burden of harm.

(5) The formulation of the precautionary principle in draft Article 8 lays down two key elements that trigger the obligation to take precautionary measures: firstly, the reasonable foreseeability of harm in the absence of conclusive proof, and, secondly, a threat of serious or irreversible harm. Regarding the first element, Principle 15 of the Rio Declaration refers to a

[278] See Nicolas de Sadeleer, Environmental Principles: *From Political Slogans to Legal Rules* (Oxford University Press 2002), ch 3.

[279] *EC – Measures Concerning Meat and Meat Products (Beef Hormones Case)*, (1997) WT/DS26/AB/R; *Southern Bluefin Tuna Cases (Nos 3 & 4) (New Zealand v Japan; Australia v Japan)* (Provisional Measures, Order 27 August 1999) ITLOS Reports 1999, 262; *MOX Plant Case (No 10) (Ireland v United Kingdom)* (Provisional Measures, Order 3 December 2001) ITLOS Reports 2001, 95.

[280] *Southern Bluefin Tuna Cases*, para 77.

[281] *Pulp Mills Case*, para 164.

[282] *Pulp Mills Case, para 164.*

[283] *Responsibilities and Obligations of States Sponsoring Persons and Entities with Respect to Activities in the Area* (Advisory Opinion), para 135.

[284] *Responsibilities and Obligations of States Sponsoring Persons and Entities with Respect to Activities in the Area* (Advisory Opinion), para 131.

[285] *Responsibilities and Obligations of States Sponsoring Persons and Entities with Respect to Activities in the Area* (advisory opinion), para 135. See also *Beef Hormones Case*, para 123.

[286] Malgosia Fitzmaurice, *Contemporary Issues in International Environmental Law* (Edward Elgar 2009) ch 1.

[287] Principle 15 of the Rio Declaration reads: 'Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.'

'lack of full scientific certainty', language that is criticised for being vague. The *Advisory Opinion* of the ITLOS Seabed Disputes Chamber is helpful in that it discusses the level of proof required to trigger the application of the precautionary principle in the face of threatened damage by referring to 'plausible indications of potential risks.'[288] A similar criterion of a 'reasonably foreseeable threat' is suggested in draft Article 8.[289] This criterion also operates in the opposite direction by clarifying the minimum level of scientific evidence required to justify precautionary measures. The precautionary principle has been criticised that its indiscriminate application may stifle innovation and hamper scientific and technological advancements by giving rise to highly restrictive measures or blanket prohibitions of activities without a sufficient evidentiary basis for such measures or that the lack of a sound evidentiary base may result in arbitrary decision-making and legal uncertainty[290] This also relates to the so-called 'secondary risks' of the regulation of scientific research,[291] whereby precautionary regulation of an activity such as geoengineering may produce substitute risks.[292] This concern has been expressed with respect to scientific research involving geoengineering in the face of the risk-risk trade-offs associated with not conducting research in relation to dangerous climate change. To guard against these secondary risks, it is important to bear in mind that the precautionary principle covers risks where there is still 'some evidence' of a threat.[293] Furthermore, traditional risk assessment and scientific advice still play an important role in the application of the precautionary principle.[294] The second element for triggering the application of the precautionary principle as set out in draft Article 8 relates to the level of the risk of damage by requiring a 'threat of serious or irreversible damage'. This wording accords with that of Principle 15 of the Rio Declaration and other treaties.

(6) Is the precautionary principle applicable to geoengineering activities, in particular scientific research? Is a precautionary approach already reflected in current practice and governance initiatives? Significant amounts of amassed literature reflect divergent views on these questions. The United Kingdom Science and Technology Committee recommended that the precautionary principle should not be included as a discrete principle to supplement the Oxford Principles, for fear that it would result in a disproportionate ban on geoengineering research and, perhaps, in covert testing.[295] However, it should not be assumed that the application of precaution automatically mandates an immediate ban on risky activities or technologies, or that it demands rigid, legally binding regulation, or that it is antithetical to scientific risk assessment.[296] A hallmark of geoengineering is the significant scientific uncertainties regarding the risks and benefits of what are largely conceptual technologies that are still in the preliminary experimental and design phase. Given the uncertainties surrounding geoengineering and climate change, the precautionary principle is *prima facie* applicable and useful for anticipating

[288] The Seabed Disputes Chamber in *Responsibilities and Obligations of States Sponsoring Persons and Entities with Respect to Activities in the Area* (Advisory Opinion), para 31, found that the 'precautionary approach' formed part of States' due diligence obligation to prevent damage 'where scientific evidence concerning the scope and potential negative impact of the activity in question is insufficient, but where there are plausible indications of potential risks.'

[289] The recent ILA Legal Principles relating to Climate Change (n 119) draft Article 7B(1) adopt a similar approach to that taken by the Seabed Disputes Chamber, but substitute the phrase of a 'reasonably foreseeable threat.'

[290] Cass R Sunstein, 'Beyond the Precautionary Principle' (2003) 151 *University of Pennsylvania Law Review* 1003.

[291] Hans-Heinrich Trute, 'Democratising Science: Expertise and Participation in Administrative Decision-making' in Helga Nowotny and others, *The Public Nature of Science under Assault: Politics, Markets, Science and the Law* (Springer 2005) 87.

[292] Sunstein (n 290).

[293] Birnie, Boyle and Redgwell (n 134) 157.

[294] See European Commission, 'Communication from the Commission on the Precautionary Principle' (2 February 2000) COM(2000) 1 (European Commission Communication on the Precautionary Principle) 4, stating that '[r]ecourse to the precautionary principle presupposes that potentially dangerous effects deriving from a phenomenon, product or process have been identified, and that scientific evaluation does not allow the risk to be determined with sufficient certainty.'

[295] Science and Technology Committee (United Kingdom) (n 14). See also Daniel Bodansky, 'May We Engineer the Climate?' (1996) 33 *Climatic Change* 309, 319.

[296] Elizabeth Fisher, 'Is the Precautionary Principle Justiciable?' (2001) 3 *Journal of Environmental Law* 315; Andy Stirling, 'Risk, Uncertainty and Precaution: Some Instrumental Implications from the Social Sciences' in F Berkhout, M Leach and I Scoones (eds) *Negotiating Change* (Elgar 2003) 33.

'unpleasant surprises' and urging prudent decision-making in the face of scientific uncertainty about the possibility of serious or irreversible harm.

(7) Once the triggering conditions in draft Article 8 have been met, the language of draft Article 8 is consistent with stronger versions of the precautionary principle by requiring that measures be taken to anticipate, prevent or minimise adverse effects from geoengineering activities from the conduct of scientific research involving geoengineering. Yet a problem still arises with respect to implementation, since the precautionary principle does not dictate how decision-makers should act when the circumstances warrant the application of precaution.[297] Commentators have suggested a range of possible policy options and governance measures with respect to geoengineering, and these are often contradictory or equivocatory depending on the author's views of the possible risks and benefits of geoengineering compared with the risks of climate change. A survey of the literature indicates that these range from a legally binding prohibition of or moratorium on all geoengineering including research[298] on the one hand, to aggressively funding scientific research programmes to promote understanding or even early large-scale deployment, on the other. As a starting point, questions regarding how to control risks or what level of risk is socially acceptable are fundamentally 'policy questions which in most societies are best answered by politicians and by society as a whole, rather than courts or scientists'.[299] Especially for societally controversial, low-knowledge issues, the social science literature is clear that judgments regarding what is an acceptable level risk to impose upon society are not exclusively a scientific question,[300] for example, to be solely based on the establishment of rational technical thresholds.[301] The 'EU Communication on the Precautionary Principle' provides a useful discussion of general principles and conditions for measures taken in reliance upon the precautionary principle.[302] The document highlights the need for proportionate, non-discriminatory, consistent and transparent actions. It further emphasises the importance of a cost-benefit analysis of action and a lack of action, including the socio-economic and other non-economic considerations associated with different responses, to the extent that such analysis is appropriate and feasible.[303] It is also recommended that precautionary measures should be provisional, i.e., they should be reviewed in the light of new scientific data, but maintained as long as scientific knowledge is insufficient but decision-makers consider the risks too high to be imposed on society.[304]

(8) A few additional observations can be made about the practicalities of implementation. Since there are large differences in the risks and uncertainties associated with different techniques, a reasonable application of the precautionary principle would ensure that precautionary measures be designed in a way that

[297] Jonathan B Wiener, 'Precaution' in Bodansky, Brunnée and Hey (n 131) 605; Birnie, Boyle and Redgwell (n 134) 161. In this regard, the precautionary principle, as it reads in Article 3(3) of the UNFCCC, explicitly outlines some of the considerations that should be taken into account in the implementation of precautionary measures and policies.

[298] See, e.g., ETC Group, 'Geoengineering's Governance Vacuum: Unilateralism and the Future of the Planet Prepared by ETC Group for the U.S. National Academies Workshop: Geoengineering Options to Respond to Climate Change – Steps to Establish a Research Agenda' Presentation at the US National Academies Workshop 'Geoengineering Options to Respond to Climate Change: Steps to Establish a Research Agenda,' (Washington DC 2009).

[299] Birnie, Boyle and Redgwell (n 134) 161.

[300] European Commission Communication on the Precautionary Principle (n 294) 4; *Beef Hormones Case*, paras 179–86.

[301] See, e.g., Parson and Keith (n 21).

[302] European Commission Communication on the Precautionary Principle (n 294) 4: 'The implementation of an approach based on the precautionary principle should start with a scientific evaluation, as complete as possible, and where possible, identifying the degree of scientific uncertainty at each stage of the risk governance process'.

[303] Elizabeth Fisher, 'Precaution, Precaution Everywhere: Developing a "Common Understanding" of the Precautionary Principle in the European Community' (2002) 9 *Maastricht Journal of European Law* 7. Rickels and others (n 95) 102.

[304] Agreement on Sanitary and Phytosanitary Measures (15 April 1994) Marrakesh Agreement Establishing the World Trade Organisation, Multilateral Agreements on Trade in Goods (1994) 33 ILM 1125 (SPS Agreement), art 5(7).

takes into account these differences.[305] There is also a strong case to be made that scientific research and deployment should be treated differently given their different aims and the nature of the risks and uncertainties they present.[306] Based on a rudimentary understanding of geoengineering and the threat of irreversible risks or even catastrophe, at present, it would be beyond the bounds of reason to justify a global-scale deployment of a technique on the basis that it is a precautionary measure to offset climate change. Against this background, CBD decision X/33 cites precaution as a basis for what has been referred to as the *de facto* moratorium on geoengineering activities while allowing small-scale research that is scientifically justified and assessed to proceed.[307]

(9) On the other hand, taking into account the principles in the EU Communication and other discussions on practical implementation, it would also be difficult to justify an outright precautionary ban against all geoengineering research. The cost-benefit analysis of action or a lack of action and balancing between the freedom and rights at play against the potential risks of adverse effects is fundamentally different for scientific research than the large-scale use of a technology. The purpose of scientific research is arguably to improve existing knowledge about both the risks and benefits of geoengineering. Therefore, on a summary analysis, some geoengineering methods might be seriously investigated given the potential to reduce the physical risks of climate change or show that some techniques are unfeasible as a 'Plan B' or pose unacceptable risks to society.[308] The knowledge gained from conducting geoengineering field experiments may also have other benefits such as providing insights into basic environmental processes or climate change phenomena. Moreover, a ban on research may not be proportional to the risks of field research or consistent with other measures adopted in similar circumstances given the prospect of a research privilege in international law. Precautionary measures should also be subject to review in the light of new scientific information. This suggests that 'efforts be undertaken to elicit or generate the necessary scientific data',[309] though it is also important not to be naive about the socio-political implications of conducting research on a topic which may, for instance, contribute to technological path dependencies. The precautionary measures applied to research therefore depend on the specific case and whether the potential risks are acceptable to society. A prohibition of some kinds of research may be reasonable in the case of some proposed techniques which are predicted to offer very little in terms of climate or other societal benefits, but have a strong likelihood of causing grave or irreversible harm or raise other serious societal concerns.

(10) This is not an argument that scientific research conducted in the open environment should proceed unrestrained. Perturbative research may still pose a risk of serious or irreversible harm. In principle, scientific research entails greater epistemic uncertainties compared with other established activities and uses. In the context of scientific research conducted in the open environment, for which the very purpose of carrying out the activity is to acquire new knowledge through systematic observation and *in situ* experimentation, scientific uncertainty could be construed as the rule, not the exception. Indeed, the main objective of a proposed *in situ* experiment may be to gain a better understanding of the particular risks of a geoengineering technology to human health and the environment. Thus, although scientific assessments

[305] Kevin Elliot, 'Geoengineering and the Precautionary Principle', (2010) 24 *International Journal of Applied Philosophy* 237, 238.

[306] However, the distinction between research and deployment can break down, particularly where field research to understand the global effects of a full-scale use would approach deployment in terms of scale, duration and intensity. Regarding stratospheric aerosol injection geoengineering, see Alan Robock and others, 'A Test for Geoengineering' (2010) 327 *Science* 530.

[307] See draft Article 9, below.

[308] Peter J Irvine, Stefan Schäfer and Mark G Lawrence, 'Solar Radiation Management Could be a Game Changer' (2014) 4 *Nature Climate Change* 842.

[309] Philippe Kouralski and Geneviève Viney, *Le principe de précaution–Rapport au Premier ministre* (15 October 1999) <http://www.ladocumentationfrancaise.fr/var/storage/rapports-publics/004000402/0000.pdf> accessed 3 January 2015, 5; European Commission Communication on the Precautionary Principle (n 294) 12. See, e.g., Montreal Protocol on Substances that Deplete the Ozone Layer (1987) 1522 UNTS 3 (Montreal Protocol), preamble referring to the States Parties' objective 'to protect the ozone layer by taking precautionary measures to control equitably total global emissions of substances that deplete it, with the ultimate objective of their elimination on the basis of developments in scientific knowledge, taking into account technical and economic considerations.'

of geoengineering have identified some potential environmental risks of geoengineering techniques based on their current understanding of the ecological processes involved, the novelty of a research activity could make it difficult to scientifically assess the likelihood and seriousness of harm of *in situ* experiments with much accuracy or even to characterise the uncertainties.

(11) This analysis generally points in the direction that precaution should be applied so that the policy option is open such that 'genuine research into geoengineering techniques [be] subjected to an appropriate, cautious regulatory regime rather than a blanket ban.'[310] Some of the uncertainties associated with research activities can be mitigated by taking a stepwise approach as an expression of precaution,[311] which tracks the typical life cycle of the development of technologies. Under this approach, deployment would be based on a large body of experimental and other research and smaller-scale field tests. At this early stage when field tests and experiments remain largely in the planning phase and our knowledge of geoengineering is very limited, a prudent approach to conducting scientific experiments in the open environment would be to start with smaller-scale activities over short time periods in order to minimise the potential for causing environmental harm. This approach has limitations in that it would not, however, address all epistemic uncertainties since some risks of some geoengineering measures can only be experimentally tested at global scales akin to deployment. Other sources of uncertainty for geoengineering research extend to a lack of basic knowledge about ecological processes, species composition, physical and chemical parameters, feedbacks, etc.[312] This clearly has implications for evaluating the potential risks of a research activity, although depending upon experimental design and scientific methodology, perturbation experiments involving geoengineering could also have the benefit of enhancing our basic knowledge of environmental processes related to the environment, including enhancing our understanding of the climate system and climate change.[313] This goal of maximising knowledge and learning from perturbative experiments is employed in this draft Code of Conduct as precautionary measure. These elements are also reflected in international practice on the governance of geoengineering research. The London Protocol is a strongly precautionary instrument and it is interesting to note that the recently adopted amendment on marine geoengineering fulfils most of these criteria on precautionary action by allowing for legitimate scientific research involving ocean fertilisation, but only if it is thoroughly and independently assessed and subject to monitoring and reporting requirements.

(12) There is also clearly a societal dimension to the uncertainties and ambiguities with regard to scientific research involving geoengineering relating to risk tolerance and policy actions. By enabling informed decision-making, scientific research may help to alleviate certain societal risks, for example, that a dangerous large-scale deployment would be carried out in an emergency situation in relative ignorance of whether it would work or how it might best be carried out. But scientific research might also contribute to other risks, for example, by creating a 'moral hazard' by reducing the motivation for States to limit emissions. In keeping with the objective of sustainable development, precautionary measures should be based upon an analysis of the potential costs and benefits of action or a lack of action to society and the environment, both in the short and long term. When dealing with complex, uncertain and ambiguous risks, this weighing-up process related to societal concerns is not limited to an economic analysis, but may include non-economic considerations, such as the technical efficacy of possible options, conflict potential, psychological stress and discomfort associated with the risk or risk source, and equity considerations related to the spatial and temporal distribution of risks.[314] Uncertainties relating to social concerns could be identified through various risk appraisal methods that have been designed to add information of this nature.[315] In

[310] Science and Technology Committee (United Kingdom) (n 14) para 85.

[311] See draft Article 10(4), below.

[312] Resolution LP.4(8), para 7.

[313] See draft Article 17, below.

[314] European Commission Communication on the Precautionary Principle (n 294) 19–20; Ortwin Renn, *Risk Governance: Coping with Uncertainty in a Complex World* (Earthscan 2008) 72–74.

sum, process-oriented, adaptive governance of geoengineering research that promotes public participation in decision-making and transparency may itself be regarded as a precautionary measure.[316]

(13) The regulation on marine geoengineering under the London Protocol is also a useful model for the implementation of the precautionary principle in another sense. As discussed throughout these commentaries, the content and meaning of the term 'geoengineering' is also subject to significant normative and interpretative ambiguity. There is no general agreement as to which proposed geoengineering techniques fall within the concept of marine geoengineering, or for that matter, what the meaning and scope of the term 'geoengineering' itself encompasses. This normative and interpretive ambiguity regarding the use of the term geoengineering partially reflects the fact that the current state of the science is not very advanced and will continue to evolve given that much of the present scientific work relating to marine geoengineering is theoretical, at the modelling stage, or restricted to the laboratory. Some geoengineering proposals would have to overcome serious technical or engineering challenges before such methods would become viable measures. Hence, understanding of 'geoengineering' is likely to evolve as new innovative ideas emerge and existing proposals for intervening in Earth systems change or fall out of favour for reasons such as technical unfeasibility or cost. The Contracting Parties to the London Protocol have taken a novel approach to balancing scientific uncertainties relating to research and development of these technologies against the need for legal certainty in the form of a legally-binding regulation. The new amendment incorporates a mechanism for possible binding regulation of other marine geoengineering activities in the future by means of the so-called adaptive 'positive-listing' approach, which provides for the inclusion of new geoengineering activities in the Annexes (which are easier to amend than the text of the treaty itself) and the development of general assessment guidance.[317]

(14) To summarise, the precautionary principle is an emerging norm of international law that is *prima facie* applicable to geoengineering given the high levels of uncertainty related to these proposals. Draft Article 8 provides guidance on an appropriate formulation of the principle, taking into account developments in international cases and scholarly analysis. In practical terms, the triggering of the precautionary principle normally occurs as a part of the traditional risk analysis process in which a scientific evaluation of the existing knowledge and availability of information indicates that the data is insufficient or inconclusive to calculate the risk in question, but where there is a reasonably foreseeable threat of serious or irreversible damage.[318] The question of what constitutes an appropriate response in the face of uncertainty is a political determination and a function of the risk tolerance level that is 'acceptable' to society. However, taking into account existing guidance on the implementation of the precautionary principle, one might question whether an absolute ban on all scientific research in the absence of a reasonably foreseeable risk would be a reasonable application of the precautionary principle to geoengineering. Even though the risks and benefits of geoengineering are highly uncertain, the development of geoengineering technologies could be regarded as precautionary action, given that such techniques could potentially help to combat some of the impacts of climate change or that research may shed light on the feasibility of a 'Plan B'.[319] However, a moratorium on the use of geoengineering is entirely reasonable presumably until such

[315] See, e.g., Wissenschaftlicher Beirat der Bundesregierung Globale Umweltveränderungen (WBGU, German Advisory Council on Global Change), 'World in Transition: Strategies for Managing Global Environmental Risks' (Annual Report, Springer 2000).

[316] Trute (n 291).

[317] However, see Resolution LP.4(8) regarding the consequential amendment to Article 3.1 of the London Protocol in the amendment on marine geoengineering: 'In implementing this Protocol, Contracting Parties shall apply a precautionary approach to environmental protection from the dumping of wastes or other matter or from placement of matter for marine geoengineering activities which may be considered for permits according to Annex 4.'

[318] European Commission Communication on the Precautionary Principle (n 294) 4, 15 states that '[t]he implementation of an approach based on the precautionary principle should start with a scientific evaluation, as complete as possible, and where possible, identifying the degree of scientific uncertainty at each stage of the risk governance process.'

[319] Elizabeth Tedsen and Gesa Homann 'Implementing the Precautionary Principle for Climate Engineering' (2013) 2 *Carbon and Climate Law Review* 90; Kerstin Güssow and others, 'Ocean Iron Fertilisation: Why Further Research is Needed' (2010) *Marine Policy* 911.

time as understanding of the implications of these proposed technologies improves (should this course of action be pursued). On the other hand, it may be fair to assume that uncertainties will persist despite best efforts to increase knowledge and understanding by undertaking further research and may not result in definite conclusions about the nature and likelihood of the risks of geoengineering due to the inherent complexities of the natural and human systems being altered. Although further research may be able to reduce or even eliminate some of the uncertainties regarding effectiveness and side effects, the complexity and non-linearity of the climate system and ecosystems makes it difficult to establish cause and effect relationships and predict all the effects and side effects and societal implications of developing geoengineering technologies. Therefore, ongoing research endeavours involving model calculations and scaling-up field experiments would almost certainly not result in risk-free geoengineering.

Draft Article 9

Use of Geoengineering

1. In the absence of science-based, global, transparent and effective control and regulatory mechanisms for geoengineering, and in accordance with the precautionary principle and international law on environmental impact assessment, States and other relevant organisations and actors shall ensure that no use of geoengineering takes place, except for the purposes of scientific research involving geoengineering that is conducted in accordance with the relevant rules of international law and taking into account the guidance provided in this draft Code of Conduct and subject to paragraph 2.

2. States and other relevant organisations and actors should refrain from carrying out and causing, encouraging or in any way participating in the carrying out of the use of geoengineering and shall prohibit and prevent any such use within their territory and jurisdiction until there is a scientifically sound basis on which to justify such uses, appropriate consideration of the environmental risks and other concerns related to such uses and in accordance with the general agreement of States and the relevant rules of international law.

Commentary

(1) Draft Article 9 draws upon the language of paragraph 8(w) of legally non-binding CBD decision X/33 on biodiversity and climate change, which at present is the only international decision which addresses all forms of geoengineering techniques.[320] The chapeau of paragraph 8(w) invites States Parties and other governments, according to national circumstances and priorities, as well as relevant organisations and processes to consider the guidance set out in this decision, including that they:

> Ensure, in line and consistent with decision IX/16 on ocean fertilization and biodiversity and climate change, in the absence of science based, global, transparent and effective control and regulatory mechanisms for geo-engineering, and in accordance with the precautionary approach and Article 14 of the Convention, that no climate-related geoengineering activities that may affect biodiversity take place, until there is an adequate scientific basis on which to justify such activities and appropriate consideration of the associated risks for the environment and biodiversity and associated social, economic and cultural impacts, with the exception of small-scale scientific research studies that would be conducted in a controlled setting in accordance with Article 3 of the Convention, and only if they are justified by the need to gather specific scientific data and are subject to a thorough prior assessment of the potential impacts on the environment;

[320] CBD Decision X/33 (n 29), reaffirmed in CBD Decision XI/20, 'Climate-related Geoengineering' (5 December 2012) UN Doc UNEP/CBD/COP/DEC/XI/20. The Contracting Parties to the LC/LP adopted a similar approach to the regulation of ocean fertilisation.

(2) Decisions taken by States Parties to the CBD are non-binding,[321] and the legal effect of decision X/33 is further signalled by the hortatory language in the chapeau of paragraph 8. However, the legally non-binding force of such decisions in international law 'can be over-stated'.[322] Soft-law resolutions, recommendations and decisions of international treaty bodies can have legal significance in that they may represent carefully negotiated and drafted statements, which may be intended to have some normative effect even though they take a non-binding form. According to Boyle, '[t]here is at least an element of good faith commitment, and in many cases, a desire to influence state practice and an element of law-making intention and progressive development'.[323] In this context, soft-law instruments can provide a mechanism for the authoritative interpretation or amplification of the terms of the treaty, or may serve as the first step in the conclusion of a new multilateral treaty.[224] Given that the CBD is a multilateral environmental agreement with near universal membership, the decision has significant political weight, and thus can be taken as a statement on the direction of international policy on geoengineering in international relations.[325] Together with other similar decisions and statements by international treaties and institutions, the CBD decision can be read as support for a policy of 'voluntary restraint' against non-scientific activities related to geoengineering.[326]

(3) Aspects of CBD decision X/33 have been criticised for being vague or ambiguous, but in terms of its core content it provides the following guidance on geoengineering: firstly, the decision acknowledges the need for effective governance and regulation of geoengineering, which should be science-based, global, transparent and effective. Moreover, it expressly recognises the importance of certain norms of international environmental law for geoengineering, in particular the precautionary principle, which is included in the preamble of the CBD as a refrain of Principle 15 of the Rio Declaration, and EIA pursuant to Art. 14 of the CBD. Beyond these general conditions, the decision does not provide specific guidance on how geoengineering measures should be regulated. A subsequent CBD decision XI/20 adds by noting that effective regulatory and control mechanisms 'may be most necessary for those geoengineering activities that have a potential to cause significant adverse transboundary effects, and those deployed in areas beyond national jurisdiction and the atmosphere'.[327]

(4) Secondly, CBD decision X/33 establishes what is sometimes referred to by commentators as a *de facto* moratorium on geoengineering deployment. Moratoria, defined as the postponement or suspension of an activity, are common in international legal practice.[328] They can be instituted through resolutions, treaties or even by the unilateral acts of States, either recom-

[321] Rüdiger Wolfrum, 'Zusammenfassung der Gutachten zum deutsch-indischen LOHAFEX-Experiment im Südwestatlantik sowie abschließendes Votum' <http://www.bmbf.de/_media/press/Univ_Heidelberg_zu_LOHAFEX.pdf> accessed 21 September 2014.

[322] Alan E Boyle, 'Some Reflections on the Relationship of Treaties and Soft Law' (1999) 48 *The International and Comparative Law Quarterly* 901, 906.

[323] Boyle (n 322) 902.

[324] Boyle (n 322) 904–5.

[325] The US has signed, but not ratified the CBD.

[326] Regarding conditions for the implementation of a policy of voluntary restraint in the context of the moratorium against exploration and exploitation of minerals in the Antarctic regime, see Scientific Committee on Antarctic Research (SCAR), Recommendation ATCM IX-1 (1977): '(i) the Consultative Parties should continue to play an active and responsible role in dealing with the question of Antarctic mineral resources; (ii) the Antarctic Treaty must be maintained in its entirety; (iii) protection of the unique Antarctic environment and of its dependent ecosystems should be a basic consideration; (iv) the Consultative Parties, in dealing with the question of mineral resources in Antarctica, should not prejudice the interests of all mankind in Antarctica.'

[327] Although it is not clear from the text, the specific mention of the atmosphere in this decision could refer to the lack of overarching principles and rules to the protection of the atmosphere in a comprehensive and systematic manner comparable to the law of the sea and its legal status as a common concern of humankind. See ILC First Report on the Protection of the Atmosphere (n 90).

[328] See Wenqiang Yin, 'Moratorium in International Law' (2012) 11 *Chinese Journal of International Law* 321.

mendatory or obligatory,[329] and have been applied to a wide range of subject areas including resources, disarmament, territorial claims, and treaty implementation.[330] In this case, States Parties, as well as 'other Governments [...] relevant organisations and processes' are called upon to ensure that other geoengineering activities that may affect biodiversity are not carried out, while carving out an exception for scientific research on geoengineering.[331] Moratoria, which by definition function as temporary prohibitions, are typically time-limited or specify conditions for when they are to be lifted.[332] Yin reports that moratoria which do not specify a time for termination are rarely used in legally binding situations for the reason that this would give rise to too much legal uncertainty.[333] The CBD voluntary moratorium on geoengineering does not indicate an exact duration, only setting out qualitative criteria regarding 'an adequate scientific basis on which to justify such activities' and 'appropriate consideration of the associated risks for the environment and biodiversity and associated social, economic and cultural impacts'. Regarding the first condition, the text fails to clarify what level or kind of scientific evidence would be required to justify the use of geoengineering measures, nor does it outline a mechanism or process for deciding the point at which an adequate scientific basis exists. As it currently stands, this determination falls within the discretion of individual States and other organisations and actors.[334] The decision also stipulates that geoengineering activities other than research should not proceed until such time as such measures are scientifically justified and subject to a risk assessment. To fall within the scientific exception, scientific research should meet four conditions under this decision: it must be small-scale, conducted in a controlled setting, justified by the need to gather specific scientific data, and subject to a thorough prior assessment of the potential impacts on the environment. The exact meaning of these criteria is left open to interpretation. As a policy tool in international environmental law, moratoria like this one, which apply to specified activities, are often established for the purpose of temporarily resolving an uncertain or complex situation or to create conditions to allow for further cooperation and consultation to achieve a particular aim.[335] An agreed temporary suspension of an activity is also 'clearly an illustration of the application of the precautionary principle',[336] and regarded as a strongly conservative application at that.[337] The objective of the CBD decision is obviously to provide a period for the examination and study of geoengineering measures, while also establishing a ceiling to ensure the adequate protection of biodiversity. Moratoria are also sometimes attractive to law-makers, because they 'create bright-line rules, and thus avoid the need for complex, ongoing decision-making, which may be beyond the institutional capacity of the international community, particularly in cases of significant uncertainty'.[338] However, the legal uncertainty created by prohibitions created by prohibitions or moratoria can dissipate with the parallel adoption of a scientific ex-

[329] See, e.g., Edward Guntrip, 'The Common Heritage of Mankind: An Adequate Regime for Managing the Deep Seabed?' (2003) 4 *Melbourne Journal of International Law* 376, 382 referring to the statement of the Legal Adviser of the US State Department regarding the American position on UN General Assembly Resolution 2574D (15 December 1969) UN Doc A/Res/2574 (XXIV), declaring a moratorium on deep sea mining: 'The Resolution is recommendatory and not obligatory. The United States is, therefore, not legally bound by it. The United States is, however, required to give good faith consideration to the Resolution in determining its policies. [...] The United States is not, however, obligated to implement the recommendations.'

[330] Yin (n 328) 323–327.

[331] A similar approach was taken in the LC/LP resolutions on ocean fertilisation.

[332] See ICRW, Schedule, para 10(e), which provides that the moratorium on commercial whaling be kept under review based upon the best scientific advice, and as modified by the IWC. In addition, Resolutions 44/225, 46/215, 51/36 and 53/33 called upon States to establish a global moratorium on all large-scale pelagic drift-net fishing on the high seas.

[333] Yin (n 328) 333.

[334] Bodle (n 89) 57.

[335] Yin (n 328) 329.

[336] Ellen Hey, 'Global Fisheries Regulations in the First Half of the 1990s' (1996) 11 *International Journal of Marine and Coastal Law* 459, 466.

[337] G Hewison, 'The Precautionary Approach to Fisheries Management: An Environmental Perspective'' (1996) 11 *International Journal of Marine and Coastal Law* 310.

[338] Bodansky (n 22) 546–47.

ception – which can be exploited as a loophole given the difficulty in delimiting the boundary between scientific research and other activities.[339]

(5) Closely following the approach adopted in CBD decision X/33, paragraph 1 prohibits the 'use' of geoengineering measures except for the purposes of scientific research.[340] Following the inclusive approach of the CBD decision, this paragraph is directed at States as well as 'other relevant organisations and actors' in the interest of promoting effective multistakeholder governance for geoengineering.[341] The justification for this provisional ban on uses is based upon precautionary reasoning pertaining to the lack of scientific evidence to justify such uses, taking into account the statement that 'no single geoengineering approach that currently meets basic criteria for effectiveness, safety and affordability, and that approaches may prove difficult to deploy or govern.'[342]

(6) Regarding the exception for geoengineering activities conducted 'for the purposes of scientific research', exemption clauses for scientific research are commonplace in international environmental treaties. Nonetheless, the interpretation of the meaning and scope of such clauses is increasingly a matter of controversy. Almost without exception, treaties and other non-binding instruments and decisions do not explicitly define the term 'scientific research.'[343] This question of the interpretation of a scientific exception was raised before the ICJ in the *Whaling in the Antarctic Case* regarding whether the scientific whaling programme JARPA II authorised by Japan was conducted 'for the purposes of scientific research' and met the conditions of scientific exception within the meaning of Article XIII(1) of the ICRW. The Court found that the applicable standard of review was an objective determination of the reasonableness of issuing the permits, and not a matter wholly within state discretion. It laid down a two-part test for determining whether the killing, taking and treating of whales was conducted for the purposes of scientific research: firstly, whether the research programme involved 'scientific research', and secondly, by examining the purposes of the programme. Regarding the first part of the test, the Court did not agree with Australia's argument based on expert opinion that 'scientific research' must exhibit certain essential characteristics.[344] It also avoided providing a general definition of 'scientific research' itself or suggesting alternative criteria of its own. The ICJ nevertheless found that JARPA II involved scientific research based on its objectives and activities, which entailed the systematic collection and analysis of data by scientists. The critical part of the analysis related to the second prong of the test regarding whether the permits were granted for the purposes of scientific research. Here, the Court did not inquire into the merits of the scientific inquiry, which it characterised as a matter of scientific opinion. However, in support of its conclusion that the special permits granted by Japan were not 'for the purposes of scientific research', the Court found that the design and implementation of the research programme were not reasonably related to its objectives and that it was unreasonable for Japan not to consider non-lethal alternatives, taking into account its obligations to cooperate with the International Whaling Commission (IWC), its own scientific policy and the existence of new technologies for avoiding lethal sampling. Finally, it also considered proportionality

[339] According to Peter J Beck, *The International Politics of Antarctica* (Routledge 2014), the Consultative Parties to the Antarctic Treaty adopted a voluntary moratorium on activities relating to mineral resources, but, similar to the problem related to the scientific exception to the ban on commercial whaling adopted by the International Whaling Commission, there are allegations that some States have been exploring for minerals under the guise of scientific research.

[340] In the ILC's First Report on the Protection of the Atmosphere, para 73, weather modification and geoengineering were both listed as a possible 'use' of the atmosphere and will be examined further by the ILC.

[341] See also recommendation XI-1 in which the Consultative Parties moratorium on mineral activities in the Antarctic Treaty Area also 'urge[d] nationals and other States' to voluntarily comply with their decision.

[342] CBD Decision XI/20, para 6.

[343] Ronald B Mitchell, International Environmental Agreements Database Project (2002-2014) <http://iea.uoregon.edu/> accessed 30 August 2014 cited in the Memorial of Australia, para 4.43 *in Whaling in the Antarctic Case*.

[344] These were (1) defined and achievable objectives that aim to contribute to knowledge important to the conservation and management of stocks; (2) appropriate methods, including the use of lethal methods only where the objectives of the research cannot be achieved by any other means; (3) peer review; and (4) the avoidance of adverse effects on stock. *Whaling in the Antarctic Case*, para 74.

and the underlying commercial motivations, stating 'a State party may not, in order to fund the research for which a special permit has been granted, use lethal sampling on a greater scale than is otherwise reasonable in relation to achieving the programme's stated objectives'. This Court's analysis is useful for how a scientific exception for geoengineering research would be reviewed. This draft Code offers further guidance by establishing an assessment process based upon the Ocean Fertilisation Assessment Framework for determining whether a geoengineering activity exhibits 'proper scientific attributes'.[345]

(7) Paragraph 2 aims to clarify the possible conditions for lifting the moratorium on a geoengineering measure. The strengthening of the language on the temporary prohibition against the use of geoengineering draws upon other international instruments that prohibit specific kinds of activities by international agreement, in particular, Article 1 of the Comprehensive Nuclear Test Ban Treaty.[346] This paragraph also clarifies the conditions under which a moratorium on any geoengineering measure or strategy could be lifted: a scientifically sound basis before resorting to such a use, adequate assessment of the environmental risks and other consequences of the geoengineering measure, and that such a use must be carried out in accordance with international law and subject to the general agreement of States.[347]

(8) Unlike the CBD decision on geoengineering, draft Article 9 does not refer to 'small-scale' experiments, a term which can be criticised for being ambiguous and vague and not necessarily guaranteeing sufficient environmental protection. All research activities are subject to the general obligation of prevention that States shall not authorise scientific research activities which pose the risk of having significant adverse effects to the environment of other States or to areas beyond the limits of national jurisdiction. Although this may appear in effect to raise the ceiling regarding the scale of activities which may be permitted under the scientific exception in the CBD decision, it aims to take a longer-term adaptive regulatory approach and is circumscribed by the other principles set out in this draft Code including draft Article 10 on scientific research involving geoengineering (e.g., proportionality, step-by-step approach) and the application of the precautionary principle. Secondly, this draft provision further defines the scope of the exception for scientific research by stipulating that such activities exhibit 'proper scientific attributes' pursuant to draft Article 12, which provides a procedure for evaluating whether proposed experiments exhibit the traits of legitimate scientific research.[348] Finally, this draft provision makes all scientific research subject to a prior assessment, as set out in draft Articles 11 to 17, as well as the other guidance provided in the draft Code of Conduct and subject to the relevant rules of international law.

(9) Draft Article 9 is a central norm in this draft Code of Conduct to clarify the objective and its scope of application. Paragraph 1 sets up the *de facto* moratorium for all geoengineering activities other than scientific research in accordance with CBD decision X/33 and in line with the approach to the regulation of ocean fertilisation under the LC/LP. The scientific exception is limited by the relevant rules of international law and the guidance provided under this draft Code, which provide general principles for avoiding and minimising harm in the conduct of scientific research involving geoengineering and is made subject to the requirements of assessment, monitoring, and reporting and information exchange. However, the implementation of draft Article 9 is problematic in terms of which activities constitute geoengineering and are thus subject to guidance provided in this draft Code of Conduct. Like the CBD decision, the *de facto* moratorium in paragraph 1 addresses all geoengineering, namely, all response strategies and measures that aim to deliberately modify the environment including for the purpose of counteracting anthropogenic climate change and/or its adverse effects. To provide

[345] See commentary to draft Article 12, below.

[346] (1997) 35 ILM 1439. Cf UN Doc A/50/1027 (26 August 1996), adopted in UN General Assembly Res 50/245 and UN Doc A/RES/50/245 (17 September 1996).

[347] Regarding the question of international agreement for the deployment of geoengineering see Albert Lin, 'Geoengineering's Thermostat Dilemma' Law of the Future Series No. 1 (2012) <https://law.ucdavis.edu/faculty/lin/files/GeoE.Thermostat.LawOfTheFuture.pdf> accessed 6 October 2014.

[348] This evaluation of 'proper scientific attributes' includes the requirement that the proposed research activity aims 'to contribute to the existing body of scientific knowledge' which is a broader restatement of the wording in CBD Decision X/33, para 8(w) as 'justified by the need to gather specific scientific data.'

any legal certainty, it requires, in the authors' view, a very specific and clear application of the definition of geoengineering. The umbrella term 'geoengineering' as defined in draft Article 4 captures a wide range of disparate proposed strategies and measures conducted for different purposes, including the addressing of some of the adverse impacts of climate change. The commentaries to draft Article 4 suggest some approaches for how to provide for greater clarity in the application of these draft Articles to particular activities, for example, by including a listing of techniques and exceptions. Furthermore, based on the definition used in draft Article 4 and further discussions in the commentary, paragraph 1 should be interpreted according to which the modification of environmental conditions must not just be a side effect of the activity, but a deliberate intervention carried out for a specific purpose. Hence, operating a factory that produces a lot of black carbon and reflects sunlight back into space does not presumptively fall within the application of this draft Code of Conduct.

(10) The current definition read together with the other provisions of the draft Code still present various loopholes. How are non-research geoengineering activities, where the intent is to make art or paint one's driveway white to test asphalt paints,[349] which do not pose a threat of significant adverse environmental effects to be addressed?[350] What about privately-funded commercial research that does not pass across the desk of research agencies? At this point it is probably helpful to restate the purpose of these draft Articles and the accompanying legal commentaries. The objective here is not to regulate geoengineering directly, in particular, the activities of scientists or other private individuals or entities. Rather, this draft Code of Conduct was developed to provide a concrete guidance mainly to States about how the existing international landscape of legal norms can contribute to governance and legal regulation of geoengineering. It builds upon the general principles of international law: the principle of cooperation and its intertwined duties of information exchange, notification and consultation, as well as the preventive and precautionary principles which provide a backstop for further legal development. The progression of the law suggested here is based upon the idea that the results of scientific research on these proposed geoengineering measures should be transparent, given that the fully developed application of these scientific ideas is to understand and progress towards real-world operational technologies to alter the global climate.[351] The normative justification for this includes the recognition of the climate system as the common concern of humankind[352] and the casting of scientific knowledge about the global environment as a public good.[353] Furthermore, the guidance in this draft Code of Conduct is largely voluntary.[354] This means that unless bound by an applicable international rule, the implementation of these draft Articles by national authorities is entirely discretionary, and the assessment and authorisation procedures are mainly designed to capture publicly funded research projects to contribute to best practices. In other words, national authorities would decide themselves whether and how the legal guidance in these draft Articles should be applied to activities within their jurisdiction and control.[355] The draft Code has relevance to commercially funded research and private research activities to the extent that it also aims to establish practices for geoengineering research for non-State actors.[356] But whether the geoengineering research community decides to take up this guidance is entirely voluntarily unless elements of these draft Articles are incorporated into relevant national legislation.

[349] Ken Caldeira and Katherine L Ricke, 'Prudence on solar climate engineering' (2013) 3 *Nature Climate Change* 941.

[350] Caldeira and Ricke (n 349) argue 'that a governance regime can consider intent in weighing whether an activity can go forward, but determination of intent should not be a prerequisite for determining which scheme of governance applies. The trigger for a formal regime should be based on a physical description of the proposed activities and not its intent.' See further the Commentaries to this draft Code of Conduct regarding the issue of intent in international law as it relates to geoengineering as a deliberate intervention in the environment for a specific purpose and scientific exceptions for activities conducted for the purposes of scientific research.

[351] Schäfer and others (n 6).

[352] See draft Article 5(1), above.

[353] See Agenda 21, Item 17.104; Madrid Protocol, arts 2 and 3.

[354] See draft Article 1(1), above.

[355] An advantage of a code of conduct in that it may contribute to the development of state practice regarding which activities constitute geoengineering and how they should be governed or regulated.

[356] See draft Article 1(2), above.

Draft Article 10

Scientific Research involving Geoengineering

1. States and other relevant organisations and actors should ensure, as far as practicable, that adverse effects from scientific research involving geoengineering are avoided or minimised and that the scientific benefits of the scientific research activity are maximised.[357]

2. Scientific researchers should avoid conducting scientific research activities in the open environment with the potential for adverse effects which are not necessary and scientifically justified in terms of contributing to the existing body of scientific knowledge.[358]

3. Scientific researchers should, as far as practicable, ensure that in the conduct of scientific research involving geoengineering in the open environment they use appropriate methods and means and best scientific practices.[359]

4. As far as practicable and taking into account the relevant circumstances, scientific research involving geoengineering should be conducted taking a prudent, step-by-step approach.[360] The nature, scale, duration and intensity of scientific research activities conducted in the environment should be proportionate to the current state of scientific knowledge about the adverse effects of that research activity taking into account the precautionary principle. The information and knowledge gained at each step shall be reported and used to guide future policies and measures and the assessment and authorisation of scientific research involving geoengineering in accordance with the relevant rules of international law and taking into account the guidance provided in this draft Code of Conduct.

[357] See LC/LP, 'Assessment Framework for Scientific Research Involving Ocean Fertilisation' (London, 11–15 October 2010) Resolution LC-LP.2 (2010) (Ocean Fertilisation Assessment Framework), paras 3.6.1 and 4.1; InterRidge, InterRidge Statement of Commitment to Responsible Research Practices at Deep-Sea Hydrothermal Vents (2006) <http://www.interridge.org/IRStatement> accessed 7 September 2014 (InterRidge Code of Conduct), paras 1–4; Irish Department of the Environment, Heritage and Local Government, Code of Practice of Marine Scientific Research at Irish Coral Reef Special Areas of Conservation (September 2006) <http://www.npws.ie/media/npws/publications/marine/media,5171,en.pdf> accessed 7 September 2014 ('Irish Code of Practice'), 11, para 18; International Whaling Commission (IWC) 'Resolution on Scientific Permits' 37th Report (1987) 25. Recommendation 4; IWC 'Resolution on Scientific Research Programmes' 38th Report (1988) 27, Recommendation 4. See also *Whaling in the Antarctic Case*, para 85.

[358] See Ocean Fertilisation Assessment Framework, para 2.2.1; OSPAR Commission, OSPAR Code of Conduct for Responsible Marine Research in the Deep Seas and High Seas of the OSPAR Maritime Area (2008) OSPAR 08.24/1, Annex 6 (2008) ('OSPAR Code of Conduct for Responsible Marine Research') <www.ospar.org> accessed 7 September 2014 para 21; International Whaling Commission (IWC) 'Resolution on Scientific Permits' 37th Report (1987) 25. Recommendation 4; IWC 'Resolution on Scientific Research Programmes' 38th Report (1988) 27. Recommendation 4; IWC, 'Resolution on Whaling under Special Permit' 46th Report (1996), Recommendation 1, Request 1; IWC, Resolution 1999-2; IWC, 'Resolution on Special Permits for Scientific Research' 51st Meeting in 1999 (2000), 52; International Whaling Commission (IWC), 'Process for the Review of Scientific Permits and Research Results from Existing Permits' Report of the Scientific Committee, Revised Annex P.

[359] See LOSC, art 240(b); OSPAR Code of Conduct for Responsible Marine Research, para 19.

[360] See EU Directive on the deliberate release into the environment of GMOs, preamble in which the step-by-step principle in the context of the release into the environment of GMOs refers to 'the containment of GMOs is reduced and the scale of release increased gradually, step by step but only if the evaluation of the earlier steps in terms of protection of human health and the environment indicates that the next step can be taken.'

5. Scientific researchers shall aim to contribute to the fullest possible collaboration and cooperation with other members of the scientific community and its institutions in order to avoid adverse effects from the conduct of scientific research involving geoengineering and further contribute to the existing body of scientific information about the environment and the objective of sustainable development.

6. States and other relevant organisations and actors should take into account the interests of scientific researchers and their vital role in adding to the existing body of knowledge, including the conduct of scientific research as essential to understanding the global environment and sustainable development.

7. Members of the scientific community and its institutions are called upon to promote and ensure the responsible conduct of scientific research involving geoengineering including by taking into account the guidance provided in this draft Code of Conduct when planning or carrying out their research.[361]

8. States and other relevant organisations and actors should ensure that the granting of research funds, ship time and other scientific resources are contingent on the application of this draft Code of Conduct by organisations or actors who intend to conduct scientific research involving geoengineering.[362]

9. States and other relevant organisations and actors should ensure that scientific research involving geoengineering does not supplant other scientific research conducted to understand the environment and climate change as well as scientific research on other various response strategies, including measures which anticipate, prevent or minimise the causes of climate change, in particular, by the reduction of greenhouse gas emissions, including actions related to funding.

Commentary

(1) Directed primarily at the scientific community and scientists, but also at governmental agencies and other interested stakeholders, draft Article 10 lays down principles related to the conduct of scientific research involving geoengineering and the development of related science policy. Although most countries have ethical guidelines for research involving human and animal subjects, the establishment of ethical standards for conducting field research in the open environment is a relatively new concern that has only recently received attention.[363] Such concerns may arise in relation to the collection of samples and organisms, the effects of scientific observation on individual organisms, population, species, and habitat and experimental manipulations of ecosystems.[364] This draft Article largely draws upon recent guidance that has been developed mainly for the conduct of scientific research in the marine environment. The underlying tension embodied in draft Article 10 relates to the firmly entrenched role of science in informing environmental protection law and policy weighed against the duty to avoid causing environmental disturbance in the course of scientific study.

(2) Echoing the balancing approach taken in the Ocean Fertilisation Assessment Framework, paragraph 1 calls for an optimisation of the potential risks and benefits associated with geoengineering research, by which decision-makers and others must weigh the objective of preventing environmental harm against the need to acquire new knowledge about geoengineering in the light of the risks of climate change. To the extent that these objectives are in opposition, these societal goods must be considered alongside one another, taking into account *inter alia* the particular circumstances, the need for precaution in

[361] See, e.g., OSPAR Code of Conduct for Responsible Marine Research; Deutsche Senatskommission für Ozeanographie der DFG and Konsortium Deutsche Meeresforschung (KDM), Erklärung zu einer verantwortungsvollen Meeresforschung (Commitment to Responsible German Marine Research) reproduced in English in the International Council for the Exploration of the Sea (ICES), Report of the ICES NAFO Joint Working Group on Deep Water Ecology (WGDEC), (March 10–14, 2008) ICES CM 2008/ACOM:45, Annex 13.4, 97 <http://www.ices.dk/sites/pub/Publication%20Reports/Expert%20Group%20Report/acom/2010/WGDEC/wgdec_final_2010.pdf> accessed 7 September 2014; Irish Code of Practice (n 357); InterRidge Code of Conduct (n 357).

[362] See OSPAR Code of Conduct for Responsible Marine Research, para 10.

[363] Helene Marsh and Richard Kenchington, 'The Role of Ethics in Experimental Marine Biology and Ecology' (2004) 300 *Journal of Experimental Marine Biology and Ecology* 5; Elizabeth J Farnsworth and Judy Rosovsky, 'The Ethics of Ecological Field Experimentation' (1993) 7 *Conservation Biology* 463.

[364] Farnsworth and Rosovsky (n 363).

the face of uncertainty, and the short- and long-term horizons. When examined on a case-by-case basis, a single perturbation experiment could result in environmental harm and this is to be avoided to the greatest extent possible. For example, data could be gathered on some questions by analysing existing data, using less invasive techniques, or studying natural analogues. But it would also be necessary to take into account bigger-picture considerations, to the extent that information gained from conducting research on geoengineering is necessary for improving effective climate protection strategies and policies (e.g., by advancing understanding about whether such measures could contribute to an effective response strategy for addressing the adverse effects of climate change or by proving that such measures may give rise to unacceptable risks or are technically unfeasible).[365] Draft Article 10 sets out some principles for how this balancing could be carried out. Paragraph 1 is couched in a due diligence requirement and should be applied in a reasonable manner, being subject to the qualification 'as far as practicable'.

(3) Paragraph 2 lays down the baseline principle that the only potentially damaging scientific activities that should be carried out in the open environment are those which can be justified as necessary for gathering specific scientific information.[366] The existing state of knowledge provides the context for making this determination and this is a reason for gathering information by means of a risk assessment. Paragraph 3 adds to this recommendation by addressing the way in which *in situ* research studies are to be carried out – by using appropriate methods and means and the best scientific and technical information that are reasonably available. Examples of best practices to minimise environmental harm include using the least intrusive tools and sampling methods, avoiding non-essential sample collections and the use of hazardous materials or chemicals or favouring more benign alternatives, and designing methodologies to take into account the site-specific characteristics of the area.[367] The peer-review process, mandated in draft Article 12(d), provides an accepted mechanism internal to the scientific system for evaluating the scientific merit and quality of a research proposal. However, in addition to the question of whether members of the scientific community judge a proposed study as being 'good science', the societal impact of research might also be integrated in the peer review process in evaluating the scientific merit of the research proposal.[368]

(4) Building upon the above provision, paragraph 4 calls for a prudent and incremental approach to perturbation experiments and field tests. The step-by-step approach can be regarded as a concrete application of the precautionary principle in the face of the risks and uncertainties associated with the intentional manipulation of environmental conditions. Instead of relying on ambiguous terms such as 'small-scale', this provision applies a flexible and evolving standard of proportionality by requiring that the scale, duration and intensity of the activity is commensurate with the state of art of scientific knowledge, taking into account the relevant circumstances. One approach for determining the potential impact of scientific activities on the environment is to compare the activity with the potential for disturbance by natural processes or other lawful activities or within the parameters of natural variability.[369] One must also be mindful that the application of the step-by-step approach is not always fitting, since some information about geoengineering only requires small-scale experiments or very large, even deployment-scale studies.[370] Requirements relating to information exchange and reporting are also necessary to support this reflexive, incremental knowledge production process to avoid serious environmental damage from one-off scientific activities.

[365] Hubert (n 170); Güssow and others (n 319).

[366] See draft Article 12 on 'proper scientific attributes,' below.

[367] OSPAR Code of Conduct for Responsible Marine Research, paras 18, 19 and 21.

[368] Regarding challenges of integrating broader ethical and societal considerations as a part of peer review of scientific merit, see Robert Frodeman and Adam Briggle, 'The Dedisciplining of Peer Review' (2012) 50 *Minerva* 3.

[369] OSPAR Code of Conduct for Responsible Marine Research, para 6.

[370] David Keith, 'Field experiments on solar geoengineering: report of a workshop exploring a representative research portfolio' (2014) 372 *Philosophical Transactions of the Royal Society A* <http://rsta.royalsocietypublishing.org/content/372/2031.toc> accessed 23 November 2014.

(5) Paragraph 5 provides another approach to avoiding environmental harm where there is a justifiable need to conduct perturbative research studies by ensuring that the information gained from a single outdoor experiment is maximised, thus minimising redundant research in the open environment. There are several ways in which this could be achieved in the planning and conduct of research studies and analysis of the resulting data, for example, by sharing data, samples and results in order to avoid redundant experimental work. This principle is an expression of the duty to cooperate set out in draft Article 6 on international cooperation.

(6) Paragraphs 6 and 7 recognise reciprocal duties to be included as essential terms of the social contract between science and society.[371] Grounded in a main rationale for the freedom of scientific research under international law, paragraph 6 expressly recognises the societal benefits of scientific research and advice in informing environmental regulation and policy.[372] Scientists play a vital role in describing the physical world, identifying environmental risks and providing the information necessary for environmental assessment and monitoring as well as for establishing rules, standards, recommended practices, and procedures to address environmental threats.[373] Similar statements are echoed in other instruments, such as the 'OSPAR Code of Conduct for Responsible Marine Research in the Deep Seas and High Seas of the OSPAR Maritime Area'. In addition to recognising the contribution of scientists to the governance of research activities and environmental protection more broadly,[374] these documents also point to the underlying motivations for this contribution, noting that 'scientists appreciate the uniqueness and complexity of the marine environment, and are therefore particularly interested in preserving this scientifically, aesthetically, ecologically, and potentially economically valuable environment.'[375] In exchange, paragraph 7 calls upon scientists to promote and ensure the responsible conduct of scientific research involving geoengineering, including by taking into account the guidance set out in this draft Code of Conduct, including the avoidance of environmental and other harm.[376]

(7) Generally, the request that scientists follow the guidance set out in the draft Code of Conduct is voluntary. However, paragraph 8 suggests an alternative mechanism by which national authorities could implement these principles and enhance compliance by making the granting of funds, ship and other research resources contingent upon the application of the draft Code of Conduct with those who intend to carry out the proposed research activity in the environment.[377]

(8) Paragraph 9 addresses the position of geoengineering research in the broader landscape of scientific research activities undertaken and promoted by States. Related to the so-called 'moral hazard' problem,[378] the concern has been raised that scientific research on geoengineering could siphon away resources that could be directed at other research on climate change or other important areas. The recommendation in paragraph 9 aims to ensure that geoengineering research does not receive a disproportionate amount of policy attention and funding *vis-à-vis* other scientific research concerned with climate change.

[371] Michael Gibbons, 'Science's new social contract with society' (1999) 402 *Nature* C 81; J Francisco Alvarez and Jesus Zamora-Bonilla, 'The Social Contract of Science' in Christoph Luetge (ed) *Handbook of the Philosophical Foundations of Business Ethics* (Springer 2013).

[372] Regarding the role of science and technology in international environmental law see Andresen and Skjaerseth (n 202) 182.

[373] Andresen and Skjaerseth (n 202) 186–87.

[374] OSPAR Code of Conduct for Responsible Marine Research, paras 7 and 8.

[375] OSPAR Code of Conduct for Responsible Marine Research, Introduction, para 5.

[376] See also draft Article 2(7), above.

[377] OSPAR Code of Conduct for Responsible Marine Research, para 10.

[378] See draft Article 9, above.

Draft Article 11

General Principles for the Assessment of Scientific Research involving Geoengineering

1. Scientific research involving geoengineering shall be assessed in accordance with the relevant rules of international law and taking into account the guidance provided in this draft Code of Conduct.[379]

2. States shall at a minimum assess proposed research activities involving geoengineering on a case-by-case basis at the project level.[380] To the extent appropriate, the States shall also endeavour to assess policies, plans and programmes involving geoengineering.[381]

3. Prior to authorising a proposed research activity involving geoengineering in accordance with draft Article 16, States shall undertake an assessment which includes:[382]

(a) an evaluation to determine whether the purpose of the proposed research activity concerns scientific research involving geoengineering in accordance with draft Article 4;[383]

(b) an assessment for proper scientific attributes in accordance with draft Article 12;[384] and

(c) an environmental assessment in accordance with draft Articles 13 and 14.[385]

[379] Regarding provisions related to environmental assessment in treaties and other binding instruments see, e.g., Council Directive (EC) 85/337/EEC on the assessment of the effects of certain public and private projects on the environment [1985] OJ L175 (EIA Directive), amended by Council Directives (EC) 97/11/EC [1997], 2003/35/EC [2003], 2009/31/EC [2009]; Espoo Convention; Association of South East Asean Nations Agreement on the Conservation of Nature and Natural Resources (adopted 9 July 1985) 15 EPL 64, art 14(1); LOSC, art 206; Madrid Protocol, art 8 and Annex I; Convention on the Conservation of Antarctic Marine Living Resources (adopted 20 May 1980, entered into force 7 April 1982) (1980) 19 ILM 841 (CCAMLR), art XV2(d); Convention on the Protection and Use of Transboundary Watercourses and International Lakes (adopted 17 March 1992, entered into force 6 October 1996) (1992) 31 ILM 1312, arts 3(1)(h) and 9(2)(j); Aarhus Convention, art 6(2)(e) and Annex I; Regulations on Prospecting and Exploration for Polymetallic Nodules in the Area, 13 July 2000, official text published as document ISBA/6/A/18, annex (13 July 2000); Regulations on prospecting and exploration for polymetallic sulphides in the Area, ISBA/16/A/12/Rev.1 (7 May 2010) <http://www.isa.org.jm/files/documents/EN/Regs/PolymetallicSulphides.pdf> accessed 11 February 2015, regulation 20(1)(c), section 24(1)(c), section 5(2)(a); Regulations on Prospecting and Exploration for Cobalt-rich Ferromanganese Crusts in the Area, ISBA/18/A/11 (27 July 2012) <http://www.isa.org.jm/files/documents/EN/16Sess/Council/ISBA-16C-WP2.pdf> accessed 11 February 2015, regulation 20(1)(c), section 24(1)(c), section 5(2)(a); Regulations on Prospecting and Exploration for Polymetallic Nodules in the Area, ISBA/19/C/17 (22 July 2013) <http://www.isa.org.jm/files/documents/EN/Regs/PolymetallicSulphides.pdf> accessed 11 February 2015, section 5.2(a); UNFCCC, art 4(1)(f); CBD, arts 7(c) and 14(1); Cartagena Protocol on Biosafety, art 15(1), Annex III, arts 1 and 3; EU Directive on the deliberate release into the environment of GMOs, art 4, Annex II. Regarding environmental assessment in non-binding instruments see, e.g., 1982 World Charter for Nature, paras 11(b) and (c); 1987 UNEP Goals and Principles of EIA; Rio Declaration, Principle 17; Agenda 21, paras 7.41(b), 8.4., 8.5(b), 10.8(b); ILC Draft Articles on the Prevention of Transboundary Harm, art 7. Regarding environmental assessment in international case law see Nuclear Tests Cases (New Zealand v France) (Judgment) (1974) ICJ Reports 457; *Gabčíkovo-Nagymaros Dam Case* (Judgment) para 140 and (Sep Op. Weeramantry) 111–115; *The MOX Plant Case (Ireland v. United Kingdom)* (Provisional Measures, Order of 3 December 2001) ITLOS Reports *Pulp Mills Case*, paras 204–205; *Responsibilities and Obligations of States Sponsoring Persons and Entities with Respect to Activities in the Area* (Advisory Opinion), paras 141–150.

[380] See, e.g., Espoo Convention, art 2(3); Cartagena Protocol on Biosafety, Annex III, art 6; EU Directive on the deliberate release into the environment of GMOs, preamble. See also 1987 UNEP Goals and Principles of EIA, principle 1.

[381] Regarding strategic environmental assessment (SEA) requirements in international law see, e.g., Espoo Convention, art 2(7); Protocol on Strategic Environmental Assessment to the Convention on Environmental Impact Assessment in a Transboundary Context (adopted 21 May 2003, entered into force 11 July 2010) UN Doc ECE/MP.EIA/2003/2 (Kiev SEA Protocol to the Espoo Convention). See also CBD decision VI/7, 'Identification, monitoring, indicators and assessments' (2002), Annex 'Guidelines for incorporating biodiversity-related issues into environmental impact assessment legislation and/or process and in strategic environmental assessment' <www.cbd.int/decision/cop/?id=7181> accessed 5 February 2015.

[382] Regarding the requirement to carry out an assessment prior to decision-making see, e.g., Espoo Convention, art 2(3); Madrid Protocol, Annex I, art 1(1); EU Directive on the deliberate release into the environment of GMOs, preamble. See also 1987 UNEP Goals and Principles of EIA, principles 1 and 6.

[383] See Ocean Fertilisation Assessment Framework, para 2.1.

[384] See Ocean Fertilisation Assessment Framework, para 2.2.

[385] See Ocean Fertilisation Assessment Framework, para 3.

4. Assessment procedures shall also be applied to any fundamental change to a proposed research activity, if it is determined that the proposed changes may result in potential adverse effects which were not considered previously.[386]

5. If proposed research activities involving geoengineering are planned jointly by more than one State or international organisation, those involved shall consult and coordinate with each other, taking into account the guidance provided in this draft Code of Conduct.[387]

6. Scientific research involving geoengineering shall be assessed based on the best scientific and technical information available and with a degree of detail sufficient but proportionate to the potential adverse effects and other concerns to allow for informed judgments, taking into account the precautionary principle.[388]

7. In carrying out these assessment procedures, States shall identify and assess any gaps, uncertainties, and assumptions relating to the proposed research activity.[389] Lack of scientific knowledge or scientific consensus should not necessarily be interpreted as indicating a particular level of risk, an absence of risk, or an acceptable risk.[390] Such information shall be used for planning, assessing and monitoring future proposed research activities and for improving the legal and institutional framework required for the conduct of responsible scientific research involving geoengineering and in the formulation and implementation of appropriate laws and measures.[391]

Commentary

(1) Draft Article 11 lays down general principles for the assessment of scientific research involving geoengineering. Further guidance is elaborated upon in ensuing draft articles, which draw upon various legal sources and other relevant experience to provide guidance for national authorities undertaking the assessment of scientific research involving geoengineering projects and programmes. These provisions are based upon the text of existing international EIA requirements and risk assessment procedures,[392] in particular, incorporating several elements of the largely technical framework developed under the LC/LP for assessing ocean fertilisation research activities. The idea is to discuss and sketch the outline of a flexible, adaptive risk governance framework for responding to the uncertain, complex environmental, social, political and economic impacts associated with the special governance demands associated with geoengineering.[393] Careful treatment of scientific uncertainty in all of its forms is paramount given that knowledge of geoengineering is limited. Peel cautions that 'careful attention be given to the overall design of the regulatory scheme' when balancing the requirements of a governance framework for the implementation of the precautionary principle against conventional risk assessment processes:

> Simply adding the precautionary principle onto an established framework for risk assessment and risk management may not be adequate to provide the means for a comprehensive evaluation of the uncertainties that arise. As we move increasingly into an

[386] See, e.g., Espoo Convention, art 1(v); EU Directive on the deliberate release into the environment of GMOs, art 8.

[387] See, e.g., Ocean Fertilisation Assessment Framework, para 1.4; EU Directive on the deliberate release into the environment of GMOs, art 5(2) and (3). Regarding the conduct of scientific research by international organisations in the marine environment, see LOSC, arts 238 and 242.

[388] See, e.g., Ocean Fertilisation Assessment Framework, paras 1.6, 3.5.13.2; Cartagena Protocol on Biosafety, Annex III, art 6; EU Directive on the deliberate release into the environment of GMOs, preamble; Madrid Protocol, art 3(2)(c). See also 1987 UNEP Goals and Principles of EIA, principle 5.

[389] See, e.g., Espoo Convention, Appendix II(g); Ocean Fertilisation Assessment Framework, para 3.4.2.3.

[390] See Cartagena Protocol on Biosafety, Annex III, art 4.

[391] See Ocean Fertilisation Assessment Framework, para 3.5.13.2.

[392] On the distinction between EIA and risk assessment procedures see Sands and Peel (n 122) 616–17.

[393] SRMGI Report (n 166) 38–39, specifically recommending with regards to the governance of solar geoengineering methods that '[a]s SRM technologies are still nascent and evolving, any governance schemes could quickly become out of date. Risk assessments at an early stage would be speculative, particularly for early project proposals, and it would be extremely difficult to conduct a comprehensive risk assessment of all future research projects before some SRM research has been carried out. Risk assessment could therefore be an adaptive process, learning from early small experiments and advancing knowledge to inform future assessments.'

> era of precautionary implementation, this indicates the need for a rethinking of standard decision-making frameworks, including whether provisions made for inviting different inputs into the process used to evaluate the threats of damage are capable of facilitating an effective response to relevant issues of scientific uncertainty.[394]

These draft guidelines on assessment are therefore only a starting point for discussion and further research on how addresses the complexities of risk governance related to geoengineering research.[395]

(2) Most appraisals of what constitutes an appropriate governance architecture for geoengineering research include a role for the independent assessment of impacts.[396] Assessment procedures feature prominently in the structure and content of this draft Code of Conduct. Paragraph 1 takes as its starting point that geoengineering research activities should be assessed 'in accordance with the relevant rules of international law.' As a legal baseline, general international law now recognises the obligation of all States to carry out an environmental impact assessment (EIA) where the proposed activity may have a significant adverse effect on the environment in a transboundary context or on areas beyond the limits of national jurisdiction.[397] EIA requirements are also widely adopted regional and international environmental agreements.[398] Scott concludes in her comprehensive examination of international law and geoengineering that '[i]t is almost inconceivable that any geoengineering option other than urban albedo enhancement and perhaps reforestation could take place without first being subject to some form of environmental impact assessment.'[399] However, there is an outstanding question of whether the existing environmental assessment mechanisms at all levels are adequate for addressing the governance needs of smaller-scale geoengineering research,[400] and, if not, how assessment processes should be designed so that they can be fit for purpose to address the risks and concerns associated with geoengineering.[401] These questions are revisited in further detail in the commentaries below.

(3) The more detailed assessment procedures that follow are mainly directed at the project level, calling for a case-by-case examination of planned research activities involving geoengineering. However, paragraph 2 also encourages earlier, top-down strategic environmental assessment (SEA) as a mechanism to better integrate environmental considerations into draft policies, plans, and programmes related to geoengineering.[402] SEA is increasingly being applied globally, regionally and nationally as a process for promoting

[394] Peel (n 202) 183.

[395] See generally Peel (n 202) 370–71; Ortwin Renn, Risk Governance: Coping with Uncertainty in a Complex World (Earthscan 2008) 72–74; Jeren P van der Sluijs, 'Uncertainty and Dissent in Climate Risk Assessment: A Post-Normal Perspective' (2012) 7 *Nature and Culture* 174; Céline Kermisch, 'Risk and Responsibility: A Complex and Evolving Relationship' (2012) 18 *Science and Engineering Ethics* 91.

[396] Rayner and others (n 14) 507, Oxford Principle 4; ASILOMAR Geoengineering Conference Report (n 15) Recommendation 4; SRMGI Report (n 166) 39.

[397] *Pulp Mills Case*, para 204. See also *Responsibilities and Obligations of States Sponsoring Persons and Entities with Respect to Activities in the Area* (Advisory Opinion), para 148, in which the Seabed Disputes Chamber found that the that the customary law obligation to conduct an EIA may also apply where there is a risk of significant harm to the environment of areas beyond national jurisdiction. See Sands and Peel (n 122) ch 14 who broadly refer to the need for further guidelines to strengthen existing legal framework on international EIA.

[398] See discussion in commentaries to draft Article 13, below.

[399] Scott (n 123) 346.

[400] Tracy Hester, 'Remaking the World to Save it: Applying US Environmental Law to Climate Engineering Projects' (2011) 38 *Ecology Law Quarterly* 851, 884–887; Neil Craik, Jason Blackstock, and Anna-Maria Hubert, 'Regulating Geoengineering Research through Domestic Environmental Protection Frameworks: Reflections on the Recent Canadian Ocean Fertlisation Case' (2013) 2 *Carbon & Climate Law Review* 117.

[401] See Rayner and others (n 14) 507. See also Neil Craik, 'EIA and Climate Engineering' (Workshop on Understanding Process Mechanisms for the Governance of SRM Field Experiments, Potsdam, April 2014); Neil Craik, 'Transboundary EIA and Geoengineering: Do Emerging Technologies Require Special Rules' (Climate Engineering Conference '14, Berlin, August 2014).

[402] Hussein Abaza, Ron Bisset and Barry Sadler, 'Environmental Impact Assessment and Strategic Environmental Assessment: Towards an Integrated Approach' (UNEP 2004) <http://www.unep.ch/etu/publications/textONUbr.pdf> accessed 6 January 2014.

sustainable development.[403] It supplements project-level EIA by linking these processes to higher-level governmental programmatic and planning decisions at an earlier stage to improve the quality and legitimacy of decision-making.[404] Like EIA, SEA offers significant benefits in terms of integrating environmental and development considerations, identifying unforeseen impacts, considering alternatives, building public engagement in decision-making, and facilitating international cooperation and good governance.[405] Currently, field research related to geoengineering is limited, but several governments are currently considering research priorities and funding regarding geoengineering. The application of SEA to these programmatic and planning decisions may be important to ensure that environmental considerations and policy alternatives are accounted for in these decision-making processes even now. SEA would probably have implications for a wider range of geoengineering research activities – not being strictly confined to individual experimental proposals, but also potentially covering laboratory studies, computer modelling and desk research.

(4) Paragraph 3 outlines the steps of the assessment process laid down in this draft Code. It includes an evaluation of whether the proposed research activity involves geoengineering, an assessment of the scientific quality of a research proposal pursuant to the scientific exception laid down in draft Article 9, and a two-tiered environmental assessment procedure. Throughout these commentaries it is mentioned that research and development of geoengineering measures give rise to environmental risks and other societal concerns that may justify closer regulatory oversight, higher transparency requirements, and early international cooperation on the development of these technologies from the outset.[406] But this increased scrutiny might not be appropriate for all research activities conducted outdoors. In practice, however, it may prove difficult to determine whether a proposed experiment 'involves geoengineering' based on the factual circumstances.[407] This provision pertains to regulatory scope regarding whether the proposed research activity relates to scientific research involving geoengineering taking into account the definitions provided in draft Article 4.

(5) Also regarding paragraph 3, the approach advocated in this draft Code, given the high level of uncertainty and controversies associated with geoengineering research, is to adopt an adaptive risk governance framework.[408] In other words, these draft Articles hang together by treating prior assessment, public participation and post-decision monitoring as an iterative learning process that operates over the lifespan of a research project and incorporates information feedbacks so that management experience can lead to systematic improvements in future risk decision-making.[409] Before authorising research projects involving geoengineering pursuant to draft Article 16, it is recommended that national officials take into account the information and results of the assessment of research proposals in good faith, including

[403] Kulsum Ahmed and Ernesto Sanchez Trina (eds), S*trategic Environmental Assessment for Policies: An Instrument for Good Governance* (World Bank 2008); Simon Marsden, *Strategic Environmental Assessment in International and European Law: A Practitioner's Guide* (Earthscan 2008); Jan de Mulder, 'The Protocol on Strategic Environmental Assessment: A Matter of Good Governance' (2011) 20 *RECIEL* 232; Simon Marsden, 'The Espoo Convention and Strategic Environmental Assessment Protocol in the European Union: Implementation, Compliance, Enforcement and Reform' (2011) 20 *RECIEL* 267.

[404] de Mulder (n 403) 234.

[405] de Mulder (n 403) 234.

[406] See summary of this discussion in Lisa Dilling and Rachel Hauser, 'Governing Geoengineering Research: Why, When and How?' (2013) 121 *Climatic Change* 553, 554–5.

[407] Anna-Maria Hubert, 'Marine Scientific Research and the Protection of the Seas and Oceans' in R Rayfuse (ed), *Research Handbook on International Marine Environmental Law* (Edward Elgar, forthcoming 2015).

[408] Dilling and Hauser (n 406); SRMGI Report (n 166) 39; Bipartisan Policy Centre on Climate Remediation Research (n 265) 14, principle 6.

[409] See Carl Walters, 'Is Adaptive Management Helping to Solve Fisheries Problems?' (2007) 36 *Ambio* 304; Rosie Cooney and Andrew T F Lang, 'Taking Uncertainty Seriously: Adaptive Governance and International Trade' (2007) 18 *European Journal of International Law* 523.

public participation pursuant to draft Article 15 and subject to post-project monitoring requirements laid down in draft Article 17.[410] It is envisaged that particular emphasis upon different parts of the assessment process may differ for scientific research activities involving geoengineering conducted in the open environment in the light of the novelty factor associated with such activities. The identification and evaluation the environmental impact of a project *ex ante* serves as a valuable planning tool for existing uses where the risks are relatively well understood.[411] Insufficient knowledge for predicting the adverse environmental effects of a proposed research project may shift greater reliance upon post-project analysis as part of a broader risk mitigation strategy based on an adaptive management approach, whereby information from previous experiments is fed into future decision-making on geoengineering research. However, in adopting this 'learning by doing' stance, caution should be taken to avoid at all costs catastrophic or irreversible outcomes. Another key parameter to be included, given the controversial nature of geoengineering, is mechanisms for open, transparent and pluralistic processes that involve a variety of knowledge perspectives beyond scientific expertise.[412] An adaptive risk governance model also has limitations. For example, Peel points out that although adaptive strategies can be used to promote policy experimentation as knowledge improves through normal scientific work, it cannot be used to resolve some uncertainties where there are strong socio-cultural preferences for risk aversion.[413]

(6) Paragraph 4 stipulates that assessment procedures should be applied to any fundamental change to the planned research activity in instances when the proposed changes give rise to new concerns about environmental impacts which were not previously considered.

(7) Paragraph 5 deals with the situation that scientific research projects may be carried out collaboratively between two or more States or international organisations.[414] In such cases, those involved in the research project should jointly apply the guidance set out in this draft Code of Conduct.[415]

(8) The need for reliable and accurate information to feed into the assessment process cannot be underemphasised, but this requirement is multifaceted.[416] Draft Article 11 gives general guidance on the treatment of scientific information and expert advice in the assessment exercise. Paragraph 6 acknowledges the importance of scientific information and expertise in identifying and assessing risks by stipulating that assessments should be made based on the best scientific and technical information available. However, throughout this draft Code and more widely in the literature on geoengineering it is suggested that decision-makers not only take into account information about the physical impact of geoengineering research activities, but also 'other concerns,'[417] defined in other documents to generally include 'interrelated socio-economic, cultural, and human health impacts, both beneficial and adverse.'[418] This reflects that geoengineering is a complex risk concern, which will necessitate sound scientific and technical input

[410] See draft Articles 12 to 18, below.

[411] Birnie, Boyle, and Redgwell (n 134) 170.

[412] Cooney and Lang (n 409) 537, 544.

[413] Peel (n 202) 370–71.

[414] Regarding the conduct of scientific research by international organisations in the marine environment, see LOSC, arts 238 and 242.

[415] Ocean Fertilisation Assessment Framework, para 1.4.

[416] Alexander Gillespie, 'Environmental Impact Assessments in International Law' (2008) 17 *RECIEL* 221, 229.

[417] See also ASILOMAR Geoengineering Conference Report (n 15) 22.

[418] DCBD, Decision VI/7, 'Identification, Monitoring, Indicators and Assessment' (19 April 2002) UN Doc UNEP/CBD/COP/6/20. Art 1(vii) of the ESPOO Convention defines 'impact' broadly as 'any effect caused by a proposed activity on the environment including human health and safety, flora, fauna, soil, air, water, climate, landscape and historical monuments or other physical structures or the interaction among these factors; it also includes effects on cultural heritage or socio-economic conditions resulting from alterations to those factors.' In this regard, EIA may not capture other societal concerns arising from geoengineering research activities that do not impact the environment physically (e.g., technological lock-in, potential implications for disincentivising emissions reductions, etc.).

in decision-making as well as the integration of public views and lay perspectives in the assessment and management of risks involving geoengineering.[419] Hence, expert scientific advice should be supplemented by participatory requirements and the input of laypeople at various stages to make the assessment process more rigorous, legitimate and democratically accountable[420]

(9) Contemporary risk assessment, particularly in complex risk areas related to health and the environment, also involves taking into account circumstances of ambiguity, uncertainty and ignorance.[421] This requirement is echoed in paragraph 7, which calls upon decision-makers to also assess gaps, uncertainties and assumptions when undertaking an assessment of a geoengineering research proposal. When paired with effective post-project monitoring and information sharing, a knowledge-gap analysis can help to direct and improve the quality of science policy and research programmes. However, it should be borne in mind that when factoring in uncertainty, scientific risk assessors have a tendency to reduce unknowns to calculable risk.[422] Here, together with other commentators on this topic representing different disciplines, we advocate the design of assessment frameworks that promote a more reflective and deliberative approach to uncertainty at the science-policy interface, where the best available science and societal expectations and values are both adequately represented.[423]

(10) In terms of the degree of information required, these draft Articles on the assessment of scientific research involving geoengineering attempt to balance the need to preserve the efficiency and effectiveness of the scientific system against the need to ensure that the environment is adequately protected. This is the main rationale for suggesting this tiered environmental assessment procedure. It is based upon the Madrid Protocol to the Antarctic Treaty – a regime designed with the freedom of scientific investigation and scientific cooperation in mind.[424] In this vein, paragraph 6 requires that geoengineering research activities be planned and conducted with a degree of detail sufficient, but proportionate to the potential adverse effects on the environment. This provision is targeted at the concern that environmental assessment processes can sometimes be 'cumbersome, expensive, and cause delay.'[425] This criticism has been levelled specifically with regard to environmental assessment procedures applied to scientific research activities, in which extensive regulatory and administrative requirements could hinder scientific innovation and advancement. It is even argued by those working in the area of science policy that the mere perception of regulatory and administrative requirements could push scientists out of research in those areas involving additional red tape, even if such research has obvious scientific merit and societal value. Clearly, there is a balance to be struck between the need for environmental protection from the conduct of geoengineering field research and ensuring that the supply of information for informing climate policy is not inadvertently cut off or truncated. Done properly, it is generally recommended that an activity should be assessed with a level of detail that corresponds to its potential adverse effects on the environment,[426] a recommendation that has been incorporated into these draft Articles on the assessment of geoengineering research. At all costs, however, serious or irreversible harm to the environment or human health is to be avoided.

[419] In her comprehensive study of the role of science in international risk governance, Peel (n 202) 116 draws attention to a political motive underlying of the rhetoric of sound science, stating: 'Many of the most strident invocations of sound science in recent times have come from advocates of minimal regulation for new technologies. Sound science in such manifestations is used as a bulwark against what is seen to be unnecessary risk regulation, hindering scientific research and scientific progress. The legitimacy-enhancing power of science is drawn in a negative way to question the need for domestic or international action to address a particular risk in the absence of sound scientific proof of possible harm.'

[420] See Boyle (n 141) 231, arguing that the finding by the ICJ in the *Pulp Mills Case* that 'no legal obligation to consult the affected populations arises for the parties from the instruments invoked by Argentina' should be read restrictively, 'confined literally to the instruments invoked by Argentina.' Cf Espoo Convention, art 2(6).

[421] Peel (n 202) 99–102.

[422] Brian Wynne, 'Uncertainty and Environmental Learning: Reconceiving Science and Policy in the Preventive Paradigm' (1992) *Global Environmental Change* 111.

[423] Jeren P van der Sluijs, 'Uncertainty and Dissent in Climate Risk Assessment: A Post-Normal Perspective' (2012) 7 *Nature and Culture* 174;

[424] Graham (n 54).

[425] Birnie, Boyle and Redgwell (n 134) 165.

[426] 1987 UNEP Goals and Principles of EIA, principle 5.

Draft Article 12

Assessment for Proper Scientific Attributes

1. States shall ensure that the proposed research activity involving geoengineering has proper scientific attributes, including:[427]

(a) that the proposed research activity has defined and achievable objectives that aim to contribute to the existing body of scientific knowledge, including knowledge important to:[428]

(i) understanding the natural processes, components and structures that may be affected by geoengineering;

(ii) understanding the potential environmental risks of geoengineering, including the gathering of data relevant to constructing and improving scientific modelling studies;

(iii) understanding the potential effectiveness of the geoengineering measure, including to offset the adverse effects of climate change; and

(iv) improving the legal and institutional framework required for the conduct of responsible scientific research involving geoengineering and in the formulation and implementation of appropriate measures.[429]

(b) that economic interests do not directly influence the design, conduct or outcomes of the proposed research activity;[430]

(c) that the proposed research activity uses the best scientific methods and means that are reasonably available;[431]

(d) that the proposed research activity undergoes an independent peer review at appropriate stages of the assessment process;[432]

(e) that proponents of the research activity make a commitment to make data and outcomes publicly available in a timely manner;[433] and

(f) that proponents of the research activity make a commitment to publish the results in peer-reviewed scientific publications in a timely manner.[434]

2. In making their assessment, States should ensure that the proponents of the research activity provide sufficient information to support the evaluation, assessment and authorisation process, including information on:

(a) the rationale, research objectives and purposes, and scientific hypotheses;

(b) the methods and means used;

(c) scale, timings and locations;

(d) the names of the principles of the research team and their affiliations;

(e) funding sources;

(f) any relevant financial or commercial interests; and

(g) any other relevant information.[435]

3. Any decision to authorise a proposed research activity involving geoengineering should take into account whether such an activity has proper scientific attributes taking into account the guidance provided in this draft Code of Conduct.[436]

[427] Resolution LP.4(8), Annex 5, para 8.

[428] Ocean Fertilisation Assessment Framework, para 2.2.1.

[429] Resolution LP.4(8), Annex 5, para 7.

[430] Ocean Fertilisation Assessment Framework, para 2.2.2.

[431] See, e.g., LOSC, art 240(b); OSPAR Code of Conduct for Responsible Marine Research, para 19.

[432] Ocean Fertilisation Assessment Framework, para 2.2.3.

[433] Ocean Fertilisation Assessment Framework, para 2.2.4.

[434] Ocean Fertilisation Assessment Framework, para 2.2.4.

[435] See Madrid Protocol, art 3(2)(c). Cf Ocean Fertilisation Assessment Framework, para 2.2.1; Cartagena Protocol on Biosafety, Annex III, 8; 1987 UNEP Goals and Principles of EIA, principle 5.

[436] See Ocean Fertilisation Assessment Framework, para 2.3.

Commentary

(1) Based on the Ocean Fertilisation Assessment Framework adopted in the recent amendment to the London Protocol on marine geoengineering, draft Article 12 lays out a procedure for evaluating whether a proposed research activity exhibits 'proper scientific attributes'. A common thread that runs through the literature on geoengineering governance is the question of how to create sufficient space for scientific investigation while avoiding the precipitous application of geoengineering methods. As discussed in the commentaries to draft Article 9 above, one legal mechanism for addressing this problem is to create a scientific exception to allow research to go ahead, while also imposing a prohibition or moratorium on other non-scientific activities. The issue is how to create a bright line test for making this distinction?

(2) Subparagraph (a), paragraph 1 requires that the research project has defined and achievable objectives and aims to contribute to the existing body of knowledge.[437] It provides a non-exhaustive listing of some reasons for conducting scientific research involving geoengineering. This kind of list could be used to encourage a broader range of scientific objectives than, for example, testing the mere technical and commercial feasibility of a geoengineering measure from a single field experiment: experimental design that aims to contribute to the fulfilment of more than one of these aims can be considered an application of the principle in draft Article 10(1) that aims to minimise the number of perturbative experiments required and maximise scientific understanding. However, serendipity also continues to animate scientific advances (e.g., an experiment conducted for the purposes of basic research may yield commercially useful information or applications). In principle, sufficient allowances should be made for individual researchers to apply their creativity and specialised knowledge in pursuit of their scientific questions, subject to an independent peer review of the scientific merits of the activity.

(3) Subparagraph (b) recommends that economic interests should not directly influence the design, conduct or outcome of the proposed experiment.[438] Commercial interests have been a major concern in the context of ocean fertilisation and other marine Greenhouse Gas Removal methods related to the selling of carbon credits on unregulated voluntary markets. To our knowledge, financial incentives for pursuing commercially relevant research involving Radiation Management has not emerged as an issue to date.

(4) Subparagraph (c) calls for an evaluation of whether the proposed research project uses the best scientific methods and means that are reasonably available to achieve its stated objectives.[439] This requirement is set out in many legally binding[440] and non-binding instruments[441] and policy recommendations.[442] An evaluation regarding whether the proposed methods and means are 'appropriate' is associated with the peer review process suggested in draft Article 12(1)(d), which is discussed below.

(5) Independent peer review is an accepted mechanism within the scientific community for evaluating the merits and scientific quality of a research proposal. The United States Supreme Court affirmed in *Daubert v. Merrell Dow Pharmaceuticals* that 'submis-

[437] Ocean Fertilisation Assessment Framework, para 2.2.1.

[438] Ocean Fertilisation Assessment Framework, para 2.2.2.

[439] Hubert (n 407).

[440] LOSC, art 240(b). Regarding the interpretation of Article 240(b) of the LOSC, see Soons (n 44); Hubert (n 170). For example, OSPAR Code of Conduct for Responsible Marine Research, paras 19–21 provide guidance on environmentally friendly methods for marine scientific research, relating to sampling methodologies, the use of chemical tracers, the level and duration of underwater noise, the transport of biota and sample collections.

[441] OSPAR Code of Conduct for Responsible Marine Research (n 358); InterRidge Code of Conduct (n 357)

[442] Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area (ACCOBAMS) 'Guidelines on the Granting of Exceptions to Article II Paragraph 1, For the Purpose of Non-Lethal in *situ* Research in the Agreement Area' (9–12 November 2010) ACCOBAMS-MOP4/2010/Res4.18 <www.accobams.org/images/stories/MOP/MOP4/Resolutions/res%204.18_guidelines%20on%20the%20granting%20of%20exceptions%20to%20article%20ii%201.pdf> accessed 6 January 2015, para 7.6.

sion to the scrutiny of the scientific community is a component of "good science", in part because it increases the likelihood that substantive flaws in methodology will be detected.'[443] Peer review of research proposals and results provides an additional check-and-balance, allowing the scrutiny of scientific ideas by the scientific community.[444] Without peer review, 'an expert's self-serving assertion that his conclusions were "derived by the scientific method" [cannot] be deemed conclusive.'[445] A peer review requirement has been incorporated into the amendment to the London Protocol on marine geoengineering.[446] Peer review should be 'independent'[447] and should take place at 'appropriate stages of the assessment process.'[448] The latter may require that a proposed research activity is evaluated prior to its authorisation to determine inter alia whether it uses appropriate methods and has achievable objectives, but also may require further re-evaluation if there is a fundamental change to the proposed activity. Finally, the results of the research activity may also undergo peer review prior to publication in accordance with subparagraph (f) to ensure the credibility of the findings.[449] The review of scientific research and results can also be facilitated under the aegis of treaties bodies.[450] Caution is warranted, however, in placing too much confidence in peer review, particularly in instances where the scientific community is scrutinising 'matters at the very cutting edge of scientific research.'[451] Concerns about subjectivity and reliability may therefore be greater for peer review at the early stages of research on geoengineering methods. On the whole, peer review functions as 'one essential part of the complex enterprise of scientific research' but should be tempered by a fair appreciation of 'what it can and cannot do.'[452]

[443] *Daubert v Merrell Dow Pharmaceuticals, Inc* 509 US 579 (1992) 593.

[444] See Lutz Bornmann, 'Scientific Peer Review' (2011) 45 *Annual Review of Information Science and Technology* 199; Alister Scott, 'Peer review and the Relevance of Science' (2007) 39 *Futures* 827; Sarah Grimmer, 'Recent Developments in Administrative Law: Public Controversy over Peer Review' (2005) 57 *Administrative Law Review* 275; Robert Frodeman and Adam Briggle, 'The Dedisciplining of Peer Review' (2012) 50 *Minerva* 3.

[445] *Daubert v Merrell Dow Pharmaceuticals, Inc* (United States Court of Appeals, Ninth Circuit) 43 F.3d 1311 (1995) 1313, 1315–16.

[446] Resolution LP.4(8), Annex 5, paras 8 and 12. Regarding the meaning of 'independent' see, e.g., European Commission, 'Rules of Procedures: The Scientific Committees on Consumer Safety (SCCS), Health and Environmental Risks (SCHER), Emerging and Newly Identified Health Risks'(April 2013), Part V. Rules and Procedures related to Independence.

[447] Resolution LP.4(8), Annex 5, para 12.

[448] Resolution LP.4(8), preamble incorporating Ocean Fertilisation Assessment Framework, para 2.2.3. and Annex 5, para 8.

[449] Ocean Fertilisation Assessment Framework, para 2.2.4.

[450] See, e.g., ICRW, Schedule, para 30; Resolution LP.4(8), preamble, leading to the adoption by the Contracting Parties of a 'Description of Arrangements for a roster of experts on marine geoengineering in the consultation process (with regard to paragraph 12 of Annex 5 to the London Protocol)' in LC 36-16 (10 November 2014), Annex 4. Regarding the issue of the interpretation of the phrase 'for the purposes of scientific research' in the ICRW, see *Whaling in the Antarctic Case*, para 84.

[451] See the decision of the United States Court of Appeals, *Ninth Circuit in Daubert v Merrell Dow Pharmaceuticals, Inc* (n 445) 1316 in which the court observed with respect to the question of the admissibility of expert testimony on matters involving scientific uncertainty: 'The task before us is more daunting still when the dispute concerns matters at the very cutting edge of scientific research, where fact meets theory and certainty dissolves into probability. As the record in this case illustrates, scientists often have vigorous and sincere disagreements as to what research methodology is proper, what should be accepted as sufficient proof for the existence of a "fact," and whether information derived by a particular method can tell us anything useful about the subject under study.' See also Sheila Jasanoff, *The Fifth Branch: Science Advisers as Policymakers* (Harvard University Press 1990) 61–76.

[452] Arnold S Relman and Marcia Angell, 'How Good is Peer Review?' (1989) 321 *New England Journal of Medicine* 829, 829.

(6) Subparagraph (e) aims to promote transparency by requiring States to encourage the proponents of a research proposal to commit to making data and results publicly available in a timely manner.[453] Although this provision is directed at States, the implementation of this commitment largely falls upon the scientific researchers involved in the project and should be considered an element of good practice of researchers working on geoengineering pursuant to the principles in draft Articles 10(4) and 18(2). The publication of data and results, including in peer-reviewed journals, not only contributes to ensuring the quality of the scientific information and enhances public trust in the research process: information, data and sample sharing and the open publication of scientific findings can help to minimise the overall impact of perturbative research activities on the environment by avoiding duplication of scientific efforts.[454] The wide dissemination of scientific information can also be used to support evidence-based policy- and law-making on geoengineering.[455]

(7) Paragraph 2 provides a non-exhaustive list of the types of information that should be provided by the proponents of the research activity so that decision-makers can properly assess whether the proposed project has proper scientific attributes.[456] This recommendation should be applied in accordance with the principle of proportionality set out in draft Article 10(4).

(8) Paragraph 3 closes the procedural loop by stipulating that national authorities consider information gathered regarding whether the proposed research activity exhibits proper scientific attributes prior to its authorisation.

[453] See, e.g., LOSC, art 244; Ocean Fertilisation Assessment Framework, para 2.2.4.

[454] See, e.g., OSPAR Code of Conduct for Responsible Marine Research, paras 16 and 17.

[455] See, e.g., OSPAR Code of Conduct for Responsible Marine Research, para 17.

[456] Ocean Fertilisation Assessment Framework, para 2.2.1; Madrid Protocol, art 3(2)(c). The principle of proportionality is an internationally accepted tenant for the conduct of research using animal subjects. See World Organization for Animal Health, 'Terrestrial Animal Health Code' (2014), ch 7.8 <http://www.oie.int/en/international-standard-setting/terrestrial-code/access-online> accessed 6 January 2014.

Draft Article 13

Initial Environmental Assessment

1. States shall ensure that an initial environmental assessment is undertaken for all proposed research involving geoengineering, which contains a detailed description of:[457]

(a) the proposed activity, including its purpose, location, duration and intensity;

(b) consideration of alternatives to the proposed research activity including a justification for why the objectives are scientifically necessary and cannot be achieved by other, less invasive methods or means which do not perturb the environment; and

(c) any potential adverse effects and uncertainties.

2. If the initial environmental assessment indicates that the proposed research activity will [only have a risk of a *de minimis* adverse effect], the State may authorise the proposed research activity forthwith in accordance with draft Article 16, provided that appropriate procedures, including public participation and monitoring, are put in place to assess and verify the proposed research activity.[458]

3. If the initial environmental assessment indicates that the proposed research activity will [have a risk of more than a *de minimis* adverse effect], States shall prepare a comprehensive environmental assessment in accordance with draft Article 14.[459]

4. If upon completion of the initial environmental assessment there is uncertainty regarding the level of risk or any gaps in knowledge and uncertainties, these may be addressed by requesting further information on the specific issues of concern or by implementing appropriate risk management strategies and/or monitoring in accordance with draft Article 17.[460] If significant uncertainties remain regarding the potential adverse effects of the proposed research activity, taking into account the precautionary principle, a comprehensive environmental assessment shall be prepared.[461]

Commentary

(1) Draft Articles 13 and 14 set out a two-tiered environmental assessment procedure for analysing the effects of a proposed geoengineering research activity. EIA is process for evaluating the likely impact of a proposed activity on the environment.[562] It allows for the integration of environmental considerations into the decision-making process prior to final decisions about planned activities with a view to ensuring environmentally sound and sustainable development.[463] In standard practice, EIA does not compel decision-makers to reach particular substantive outcomes that conform to specific environmental standards.[464] Rather, it is largely cast as a deliberative procedure by which information on the environmental consequences of a project is evaluated alongside any other considerations (e.g., socio-economic) on a case-by-case basis.[465] This process facilitates the alignment of interests and promotes further legal development

[457] See Madrid Protocol, art 3(2)(c)(i); Madrid Protocol, Annex I, art 2; 1987 UNEP Goals and Principles of EIA, principle 2(d).

[458] See Madrid Protocol, Annex I, art 2(2).

[459] See Madrid Protocol, Annex I, art 3(1).

[460] See Cartagena Protocol on Biosafety, Annex III, para. 8(f).

[461] See Madrid Protocol, Annex I, art 3(1).

[462] ESPOO Convention, art 1(vi). See also UNEP Goals and Principles of EIA; CBD, Decision VI/7.

[463] UNEP Goals and Principles of EIA, Preliminary Note, principle 3.

[464] Neil Craik, *The International Law of Environmental Impact Assessment: Process, Substance and Integration* (Cambridge University Press 2010) 208.

[465] Neil Craik, 'Deliberation and Legitimacy in Transnational Governance: The Case of Environmental Impact Assessments' (2007) 38 *Victoria University of Wellington Law Review* 381.

through interest coordination and policy formation in line with the goals of international environmental law.[466] Professor Craik concludes in his comprehensive study of international EIAs that they 'are a superior institutional mechanism in areas of high uncertainty and only provisional agreement on regime objectives.'[467] Plainly, these are key variables in the current geoengineering governance equation, and it is frequently stated that environmental assessment should play some role in the wider governance of geoengineering, including for research activities.[468] In the context of international agreements applicable to geoengineering, environmental assessment is specifically mandated under CBD decision X/33 and provided for in the LP amendment on marine geoengineering, which also incorporates the Ocean Fertilisation Assessment Framework adopted in the 2010 resolution on ocean fertilisation.[469] Nevertheless, as noted above, a specific examination of the applicability and utility of EIA as a governance mechanism for geoengineering is still forthcoming, and only aspects of its application are discussed in the commentaries that follow. As fundamentally a national instrument, EIA is entrenched in the domestic law of a large number of States. [470] The legal literature published to date has only scratched the surface in terms of analysing the applicability of domestic legislation and regulations to geoengineering research activities.[471] In some countries, government funding for scientific research is linked to domestic EIA requirements. For example, the Natural Sciences and Engineering Research Council of Canada (NSERC), as a federal authority, must comply with the Canadian Environmental Assessment Act, 2012 (CEAA 2012)[472] by ensuring that funded research projects are not likely to have significant adverse environmental effects on federal lands or outside Canada.[473] Furthermore, the Canadian Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals may also be applicable to geoengineering activities within federal jurisdiction.[474] NSERC requires that grant applicants indicate when they plan to conduct any proposed activities outdoors in areas within federal jurisdiction. However, many small-scale field studies involving geoengineering – in particular, those which pose low to negligible physical risks to the environment – would probably not trigger existing domestic EIA requirements, because they fall below the legally-relevant threshold of 'significant adverse effects.'

(2) Turning to the international level, EIAs have gained widespread acceptance, both in international and domestic spheres, as a mechanism for promoting sustainable development. Principle 17 of the Rio Declaration reflects the overall nature of EIA in domestic, transboundary and international settings, reading: 'Environmental impact assessment, as a national instrument, shall be undertaken for proposed

[466] Craik (n 464) 228.

[467] Craik (n 464) 272.

[468] SRMGI Report (n 166); The Royal Society Report on Geoengineering (n 2); Rayner and others (n 14); Scott (n 123) 344–346.

[469] Resolution LP.4(8), preamble.

[470] Rio Declaration, principle 17.

[471] See Tracy Hester, 'Remaking the World to Save it: Applying US Environmental Law to Climate Engineering Projects' (2011) 38 *Ecology Law Quarterly* 851, 884–887; Craik, Blackstock and Hubert (n 400). Further comparative study of whether domestic EIA processes apply and are sufficient for addressing the potential risks and other socio-political concerns of geoengineering research would be useful.

[472] SC 2012, c 19, s 52.

[473] Natural Sciences and Engineering Research Council of Canada (NSERC), 'NSERC's Guidelines on Environmental Review and Assessment' <www.nserc-crsng.gc.ca/NSERC-CRSNG/Policies-Politiques/enviroassess-enviroeval_eng.asp> accessed 5 January 2014; Panel on Responsible Conduct of Research (Canada), 'Tri-Agency Framework: Responsible Conduct of Research' (2011) <www.rcr.ethics.gc.ca/_doc/Framework-CadreReference_eng.pdf> accessed 5 January 2015.

[474] Privy Council Office and Canadian Environmental Assessment Agency, 'Strategic Environmental Assessment: Cabinet Directive on the Environmental Assessment of Policy, Plan an Program Proposals' (Ottawa 2010) <www.ceaa-acee.gc.ca/Content/B/3/1/B3186435-E3D0-4671-8F23-2042A82D3F8F/Cabinet_Directive_on_Environmental_Assessment_of_Policy_Plan_and_Program_Proposals.pdf> accessed 5 January 2015.

activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority.' Though many treaties incorporate environmental assessment requirements,[475] the most developed instrument on international EIA is the 1991 ESPOO Convention on Environmental Impact Assessment in a Transboundary Context. International courts and tribunals have dealt with matters related to EIA on several occasions.[476]

(3) By now, the obligation to conduct an EIA for projects with potentially transboundary impacts has been recognised by the ICJ as part of customary international law. In the 2010 *Pulp Mills Case*, referring to the ILC's Draft Articles on Prevention of Transboundary Harm, the ICJ held that conducting an EIA was 'a requirement under general international law to undertake an environmental impact assessment where there is a risk that the proposed industrial activity may have a significant adverse impact in a transboundary context, in particular, on a shared resource.'[477] This requirement also applies to global commons areas.[478] Transboundary EIA was furthermore held to be an element of the due diligence standard for the prevention of transboundary harm.[479] For those States undertaking geoengineering activities, 'international law requires at a minimum that an EIA assess possible effects on people, property and the environment of other States likely to be affected. If national law does not ensure that such an assessment is carried out, then there is inevitably a breach of the obligation to do a transboundary EIA.'[480] Regarding the content of the legal obligation to conduct a prior transboundary EIA, the ICJ found in the *Pulp Mills Case* that

> it is for each State to determine in its domestic legislation or in the authorisation process for the project, the specific content of the EIA required in each case, having regard to the nature and magnitude of the proposed development and its likely adverse impact on the environment as well as the need to exercise due diligence in conducting such an assessment.[481]

In the absence of any specific treaty requirements, EIA under general international law is fundamentally linked to national procedures for evaluating the likely impact of a proposed activity on the environment.

(4) There are two requirements that limit the scope of the duty to conduct an EIA under general international law. Before the obligation to conduct an EIA is triggered, the legal threshold of a significant risk of harm must be met,[482] and the risks must be foreseeable.[483] Some treaties stipulate a lower threshold.[484] Professor Boyle concludes that the threshold of proof for triggering the EIA requirement is relatively low: 'an EIA must be undertaken if there is some evidence of a risk of significant harm to the human or natural environment – even if the risk is uncertain and the potential harm not necessarily irreparable.'[485] The ILC in its Draft Articles on the Prevention of Transboundary Harm has indicated that the determination of

[475] See n 379, above. 'Environmental impact assessment' is defined in art 1(iv) of the Espoo Convention as 'a national procedure for evaluating the likely impact of a proposed activity on the environment.' See also Madrid Protocol, Annex I, art 1(1).

[476] See n 379.

[477] *Pulp Mills Case*, para 204.

[478] However, see Birnie, Boyle, and Redgwell (n 134) 167, raising the question regarding whether current state practice supports that this customary law duty extends to the assessment of possible global or domestic adverse environmental effects.

[479] *Pulp Mills Case*, para 204.

[480] Alan Boyle, 'Developments in the International Law of Environmental Impact Assessments and their Relation to the Espoo Convention' (2011) 20 *RECIEL* 227, 229.

[481] *Pulp Mills Case*, para 205.

[482] Rio Declaration, principle 17; ILC Draft Articles on the Prevention of Transboundary Harm, art 1.

[483] Birnie, Boyle, and Redgwell (n 134) 171.

[484] For example, the Madrid Protocol adopts a tiered assessment procedure based on the threshold of 'a minor or transitory impact.'

[485] Boyle (n 480) 228.

whether a risk is 'significant' is 'not without ambiguity' depending on the circumstances.[486] 'Significant' means 'something more than "detectable" but need not be at the level of "serious" or "substantial."'[487] The triggering threshold for an EIA under customary international law may nevertheless prove problematic for ensuring the prior assessment of small-scale perturbative geoengineering experiments, some of which may fall below the legally required risk of significant harm. The Ocean Fertilisation Assessment Framework dispenses with the threshold condition in requiring that all activities that fall within the definition of 'ocean fertilisation' be subject to a prior EIA. CBD decision X/33 permits small-scale research activities, but only if they are subjected to 'a thorough prior assessment of the potential impacts on the environment.' The foreseeability requirement may also not be met to trigger an EIA for geoengineering research activities given the many uncertainties that underlie much of our understanding of the risks of different geoengineering methods, where potential risks may be identified but not quantified in terms of their magnitude and likelihood. However, the precautionary principle may operate to lower the evidential standard for determining whether an EIA is necessary,[488] or to inform more precautionary formulations for triggering the obligation to conduct an environmental assessment.[489]

(5) Consonant with the approach taken in other international agreements and decisions on geoengineering, the main innovation proposed in this draft Article in relation to general international law is to lower the threshold for triggering environmental assessment procedures. This draft Code recommends that all scientific research involving geoengineering conducted in the open environment should undergo a prior assessment.[490] This is a departure from the general idea that a certain risk threshold should be crossed before legal obligations are triggered or de *minimis non curat lex* – the law should not concern itself with trifles.[491] The rationale for promoting a policy requiring the assessment of all geoengineering research is that, even if the potential physical impacts of experiments on the environment and human health and safety are negligible, such activities are more than 'mere trifles': there may be uncertainties related to the risk of harm to the environment from in situ geoengineering experiments, and geoengineering as a topic touches upon several international interests and gives rise to particular socio-political and ethical concerns. Reliance upon EIA in the regulation of geoengineering research aims to 'shap[e] policy outcomes in both political and scientific processes,'[492] ensure the participation of potentially affected persons in decision-making processes, and encourage knowledge sharing and dissemination.[493] Therefore, the function of EIA in this draft Code is not just to identify and manage physical risks, but also to provide a mechanism for promoting good governance and environmental sustainability, by 'bring[ing] transnational actors into the policymaking process, influenc[ing] the scope and direction of scientific inquiry and facilitat[ing] cooperation between the parties.'[494] EIA is cast as a 'deliberative process' for promoting accountability, legitimacy and transparency in decision-making about geoengineering as a global technology, which down the line could be used to deliberately alter the shared climate system.[495]

[486] ILC Draft Articles on the Prevention of Transboundary Harm, 152.

[487] ILC Draft Articles on the Prevention of Transboundary Harm, 152.

[488] Birnie, Boyle, and Redgwell (n 134) 171.

[489] See Catherine Redgwell, 'The International Law of Public Participation: Protected Areas, Endangered Species and Biological Diversity' in Donald M Zillman, Alastair Lucas and George (Rock) Ping (eds), *Human Rights in Natural Resource Development: Public Participation in the Sustainable Development of Mining and Energy Resources* (Oxford Scholarship Online 2002) 213.

[490] See draft Article 11(1)(3).

[491] *Black's Law Dictionary* (7th ed, West Group 1999) 443.

[492] Madrid Protocol, Annex I, art 2(2).

[493] Sands and Peel (n 122) 601.

[494] Craik (n 464) 273.

[495] Craik (n 464) 275.

(6) The Madrid Protocol to the Antarctic Treaty provides the model for the tiered EIA procedure adopted here, whereby the likely environmental impact of a research activity accords with the comprehensiveness of the EIA requirements.[496] This reflects the general principle of proportionality for EIA[497] and is an application of the 'principle of not-unreasonable interference with scientific research.'[498] A staged assessment process has the advantage of easing the administrative and regulatory burden on scientists. This research privilege is balanced against the need to identify and assess research activities to avoid environmental harm.[499] The purpose of adopting a two-tiered threshold is to streamline the environmental assessment process while ensuring that assessment is undertaken for all geoengineering activities at an early stage and to promote learning by implementing effective monitoring measures and adaptive risk management and by developing a culture of information exchange and openness between States and between States and other stakeholders through public participation and consultation. The determination of what constitutes an appropriate risk threshold for triggering an EIA, including the mid-point threshold that would prompt a more comprehensive EIA, would depend upon value judgements that may be specific to the type of research activity in question. The square brackets around the *'de minimis'* threshold indicate an illustrative example of a reduced mid-point threshold. *De minimis* is commonly interpreted to mean 'risks that are so trivial that action to reduce risk generally would be unwarranted', 'negligible risks' or 'risk so small that it is beyond concern, or equivalent (from a decision perspective) to no risk at all.'[500] Other examples of language that indicate a lower threshold for triggering the obligation to conduct an environmental assessment include 'more than a minor or transitory impact'[501] or 'possible adverse effects.'[502]

(7) Paragraph 1 spells out the minimum information to be gathered under an initial impact assessment. Although less information is required at this first stage, the information provided must nevertheless be accurate and robust. This information should include a full analysis of the possible adverse effects (including short- and long-term, direct and indirect). There must also be a consideration of alternatives, which has been identified as a fundamental goal of the EIA to 'help with the creation of win-win scenarios, whereby the proposed project can proceed without having the same level of significant environmental impact as originally envisaged.'[503] The scope of this inquiry regarding alternatives is debated, although Gillespie notes that this evaluation should include consideration of the 'no project' option.[504] An analysis of appropriate mitigation measures and the requirement of public participation are also necessary at this first stage.

(8) Paragraphs 2 and 3 recognise that the national authority enjoys a discretion regarding whether to authorise a proposed research activity after an initial environmental assessment is carried out or whether a comprehensive environmental assessment must be prepared.

(10) Paragraph 4 deals with uncertainties that arise in the process of carrying out an initial environmental assessment. This provision encourages national authorities to inquire deeper into the specific issue of concern or adequately address it by instituting appropriate risk management or monitoring measures. However, if these solutions appear inadequate taking into account the need for precaution, then the provision recommends that a comprehensive environmental assessment shall be prepared.

[496] Madrid Protocol, art 3(2)(c)(i); Annex I to the Madrid Protocol, art 2. These paragraphs are based on art 3 of Annex I to the Protocol on Environmental Protection to the Antarctic Treaty.

[497] See draft Article 11(6), above.

[498] Graham (n 54) 8.

[499] See draft Article 11(6), above. See also 1987 UNEP Goals and Principles of EIA, principle 5.

[500] Martin Peterson, '*What is a De Minimis Risk?*' (2002) 4 *Risk Management* 47, 47. See also David C Kocher, 'Criteria for Establishing *De Minimis* Levels of Radionuclides and Hazardous Chemicals in the Environment' (June 1996) Prepared for the US Department of Energy Office of Environmental Management, ES/ER/TM-187;

[501] Article 8 of the Madrid Protocol, art 8.

[502] Redgwell (n 489).

[503] Alexander Gillespie, Conservation, Biodiversity and International Law (Edward Elgar Publication 2013) ch 16.

[504] See draft Articles 10(2) and 12, above. See also Madrid Protocol, Annex I, art 3(2)(a); Resolution LP.4(8).

Draft Article 14

Comprehensive Environmental Assessment

1. A comprehensive environmental assessment shall include:[505]

(a) a description of the proposed research activity, including the purpose, location, duration and intensity;

(b) a justification for why the objectives of the proposed research activity are scientifically necessary and cannot be achieved by other, less invasive methods or means which do not perturb the environment, including that the scale, duration and intensity of the proposed research activity is proportionate to the objectives of the proposed research project and the current state of scientific knowledge, taking into account any gaps in knowledge and uncertainties;

(c) a description of the initial environmental reference state including information on experimental baseline conditions specifically related to the proposed research activity and information on baseline conditions collected over a longer period of time which is relevant to the environmental assessment, including data on natural variability;

(d) a description of the proposed methods and means to be used;

(e) a description of the proposed installations and equipment to be used;

(f) a justification that the scale, duration and intensity of the proposed research activity is proportionate to achieving the objectives of the proposed research project in the light of the current state of scientific knowledge, including knowledge regarding potential adverse effects, taking into account the precautionary principle;

(g) an estimation of the nature, extent, duration, and intensity of the likely direct or indirect adverse effects of the proposed research activity;

(h) a consideration of cumulative adverse effects of the proposed research activity in the light of existing activities and other known planned activities;

(i) a consideration of the impacts of the proposed research activity on the conduct of other scientific research and on other activities in the area;

(j) an identification of plans and measures, including monitoring and emergency response plans, which could minimise adverse effects of the proposed research activity, detect unforeseen adverse effects, provide early warning of any adverse effects of the activity, and deal promptly and effectively with accidents;

(k) an identification of gaps in knowledge and uncertainties encountered in compiling the information required under this paragraph;

(l) the names of the principals of the research team and their affiliations and training;

(m) the name and address of the person or organisation which prepared the comprehensive environmental evaluation; and

(n) any other information necessary to make prior assessments of, and informed judgements about the proposed research activity.

2. Any decision to authorise a proposed research activity should be based on the comprehensive environmental assessment as well as other relevant considerations in accordance with the relevant rules of international law and into account the guidance provided in this draft Code of Conduct.[506]

[505]See Madrid Protocol, art 3(2), Annex I, 2(c) to (e); Resolution LP.4(8), Annex 5, paras 13–19.

[506]See Madrid Protocol, art 3(2)(c)(i); Madrid Protocol, Annex I, art 3(2)(a).

Commentary

(1) Draft Article 14 outlines a procedure for cases in which a comprehensive environmental assessment is deemed necessary in accordance with draft Article 13(3) and (4). Paragraph 1 provides a non-exhaustive list of the information to be provided by the proponent of the research proposal if it is decided by the relevant national authority that a proposed research activity surpasses the relevant risk threshold for triggering a comprehensive environmental assessment (e.g., more than a *de minimis* risk of adverse effects on the environment).[507]

(2) Subparagraph (a) asks for essential information regarding the purpose, location, duration and intensity of the proposed research activity for assessing its likely impact on the environment.[508] Sometimes the requirement to provide information about location, timings, etc. in advance can be problematic for researchers. For example, mesoscale ocean eddies are considered by some experts to be the ideal and safest place to study the growth and demise of iron-fertilised algal blooms.[509] However, these ocean features are ephemeral, sometimes lasting for only a few months, and thus it may be difficult for scientists to provide exact information about the timing and locations of such experiments when seeking authorisation well in advance of the start of a research cruise. In comparable situations, national authorities could bear in mind the principle set out in draft Article 13(6) when considering the completeness of the information provided about the experimental conditions when carrying out a comprehensive environmental assessment.

(3) Due to the limits of control that can be imposed on perturbative experiments conducted in the open environment, the principle expounded in subparagraph (b) is that decision-makers should take into account information about whether a proposed research activity is scientifically necessary.[510] This provision calls for information about the objectives of the proposed experiment and whether (non-perturbative) alternatives are available.

(4) The results of *in situ* perturbation studies conducted in the open environment should be measured against environmental baseline conditions, which are variable annually by season and inter-annually from one year to the next. Subparagraph (c) asks scientists to provide information about the environmental baseline conditions related to the proposed research activity as a part of a comprehensive environmental assessment.[511] However, in some cases this will be incomplete due to a lack of basic information about environmental conditions. Pursuant to subparagraph (k) and paragraph 7 of draft Article 11, researchers should also furnish information about informational gaps and uncertainties related to the baseline state conditions.[512]

(5) Subparagraphs (g)[513] and (h)[514] request information about direct, indirect and cumulative impacts of the proposed research activity. In some cases, this may require that scientists provide an accurate and complete account of other activities in the area for assessing the cumulative environmental impact of the proposed perturbative study. This includes the need for information about other scientific research being carried out nearby, as required under subparagraph (i).[515]

[507] Such information is also useful for States to determine the nature and extent of their relevant legal obligations under international law (e.g., details about where the experiment is to be carried out such as marine areas beyond national jurisdiction).

[508] Ocean Fertilisation Assessment Framework, para 1.9.

[509] Victor Smetacek and SWA Naqvi, 'The Next Generation of Ocean fertilisation experiments in the Southern Ocean' (2008) 366 *Philosophical Transactions of the Royal Society* A 3947.

[510] Madrid Protocol, Annex I, art 3(2)(a). LP Amendment on marine geo-engineering; Ocean Fertilisation Assessment Framework.

[511] Madrid Protocol, Annex I, art 3(2)(b); Ocean Fertilisation Assessment Framework, para 3.2.4.

[512] See Ocean Fertilisation Assessment Framework.

[513] Madrid Protocol, Annex I, art 3(2)(d) and (e).

[514] Madrid Protocol, art 3(2)(c)(ii) and Annex I, art 3(2)(f).

[515] Madrid Protocol, art 3(2)(c)(iii) and Annex I, art 3(2)(i); OSPAR Code of Conduct for Responsible Marine Research, para 18.

6) Subparagraph (j) asks researchers to provide details about emergency plans and proposed monitoring measures that could be taken to minimise the impacts of perturbative studies.[516] This information may also be useful for designing suitable mitigation measures and research contingency planning in accordance with draft Article.

(7) Subparagraph (k) asks for information about any known knowledge gaps and uncertainties.[517]

(8) Paragraph 2 requires that decision-makers take into account the information gathered for the comprehensive environmental assessment and other relevant rules of international law, in particular, obligations and due diligence requirements linked to transboundary EIA, before authorising a proposed research activity in accordance with draft Article 16.

Draft Article 15

Public Participation

1. States shall guarantee the rights of access to information,[518] public participation in decision-making, and access to justice in environmental matters concerning climate change and its effects and develop adequate responses, including geoengineering as a potential response measure to address the adverse effects of climate change and its consequences.[519]

2. Prior to authorising scientific research studies involving geoengineering, States should in accordance with national laws, regulations and procedures provide the public affected by a proposed research activity involving geoengineering with relevant information and ascertain their views by providing for early public participation.[520]

[516] Madrid Protocol, art. 3(2)(c)(iv) and Annex I, art 3(2)(g).

[517] Madrid Protocol, Annex I, art 3(2)(j).

[518] See, e.g., OSPAR Convention, art 9; Convention on Civil Liability for Damage resulting from Activities Dangerous to the Environment (adopted 21 June 1993, not in force) (1993) 32 ILM 1228 (Lugano Convention), ch III; ILC Draft Articles on the Prevention of Transboundary Harm, art 13; Aarhus Convention, arts 2(3), 4 and 5. See also draft Article 18, below.

[519] See, e.g., Rio Declaration, principle 10; Aarhus Convention, art 1; UNFCCC, art 4(1)(i) and 6; FAO Code of Conduct for Responsible Fisheries, art 11.3.2.

[520] See, e.g., ILC Draft Articles on the Prevention of Transboundary Harm, art 13; CBD, art 14(1)(a) on EIA and (b) on SEA; EU Directive on the deliberate release into the environment of GMOs, preamble and art 9; Espoo Convention, art 2(6); 1987 UNEP Goals and Principles of EIA, principle 7. States Parties to the Espoo Convention further elaborated guidance on the implementation of the requirement of public participation a transboundary context in UNECE document on 'Guidance on Public Participation in Environmental Impact Assessment in a Transboundary Context' (2006) UN Doc ECE/MP.EIA/7.

Commentary

(1) Draft Article 15 addresses the issue of geoengineering and public participation in domestic environmental decision-making. Public participation has been flagged as an important element of the good governance of geoengineering.[521] The accompanying commentary to the Asilomar 'Principles for Responsible Conduct of Climate Engineering Research' explains that the 'broad environmental, societal, and even cultural implications of [geoengineering] require public consultation and participation in decisions about major field experiments.'[522] The companion requirements to provide access to information and public consultation and involvement in research planning and oversight, assessments, and the development of decision-making processes are included in the Oxford Principles of Geoengineering[523] and in the Asilomar Principles which emphasise the need 'to ensure consideration of the international and intergenerational implications of climate engineering.'[524]

(2) Participatory processes afford the public the opportunity to increase their general awareness of environmental issues, express their views, influence and be involved in decision-making regarding specific activities, plans and programmes, initiate reviews of administrative decisions, and have laws enforced.[525] Public involvement in domestic decision-making on environmental issues can also reap benefits by improving the quality and legitimacy of environmental assessments and decisions, engendering trust in public authorities and the acceptance of decisions, and building the capacity of those involved to engage in the policy process.[526] From the environmental protection side, public involvement can reduce uncertainties and supplement information gathered by experts (e.g., relating to environmental baselines or potentially affected resources).[527]

(3) Providing for access to information and effective and early public participation may be particularly important for shaping knowledge pathways and identifying risk framings, assessment and management options for geoengineering research given the controversial nature of the topic and its uncertainties. Though the 'hard' scientific and technical aspects are an important dimension of the problem, geoengineering is not an issue that is entirely within the grasp of scientists and their ability to apply reductionist methods to provide definitive, objective solutions for how to address climate change. It also has the character of a complex, uncertain and socially controversial, value-based problem.[528] There is a large body of social science literature which prescribes that, for risk situations of this nature, special efforts should be taken to 'democratise science' by engaging with stakeholders and the wider public in identifying and assessing research priorities and projects, framing, assessing and managing risks, and evaluating research results.[529] Public engagement opens up conventional forms of scientific research and decision-making processes to a wider range of perspectives and helps to ensure that researchers are asking the right questions, taking into

[521] Phil Macnaghten and Bronislaw Szerszynski, 'Living the global social experiment: an analysis of public discourse on solar radiation management and its implications for governance' (2013) 23 *Global Environmental Change* 465.

[522] ASILOMAR Geoengineering Conference Report (n 15) principle 5, 22.

[523] Rayner and others (n 14) Oxford Principle 2.

[524] ASILOMAR Geoengineering Conference Report (n 15) principles 5 and 22–24.

[525] Jonas Ebbesson, 'Public Participation' in Bodansky, Brunnée and Hey (n 131) 683.

[526] Michelle Everson and Ellen Vos, 'The Scientification of Politics and the Politicisation of Science' in Michelle Everson and Ellen Vos (eds) *Uncertain Risks Regulated* (Routledge 2009); Ebbesson (n 525) 686–88.

[527] Craik (n 464) 196–97.

[528] Winickoff and others (n 204).

[529] Gibbons and others, *The New Production of Knowledge* (Sage 1994) 65; J Turnpenny, M Jones and I Lorenzoni, 'Where now for post-normal science? A critical review of its development, definitions, and uses' (2011) 36 *Science, Technology and Human Values* 287; K Bäckstrand, 'Civic science for sustainability: Reframing the role of experts, policymakers and citizens in environmental governance' (2003) 3 *Global Environmental Politics* 24; K Bäckstrand, 'Science, uncertainty and participation in global environmental governance' (2004) 13 *Environmental Politics* 650. See also ASILOMAR Geoengineering Conference Report (n 15) 23, noting that public concerns about geoengineering research are 'likely to extend beyond risks of particular proposed experiments, including the entire trajectory of developing, evaluating and deploying climate-engineering measures.'

account the knowledge of non-academic experts, and adequately testing the validity and practicality of any proposed measures.[530]

(4) However, Sheila Jasanoff counsels caution against investing blind faith in formal participatory structures, as these 'cannot by themselves ensure the representative and democratic governance of science.'[531] Moreover, there are a myriad of theoretical and practical challenges that would have to be met in implementing existing forms and techniques for participation in relation to geoengineering research.[532] To start with, though generally true of democratic structures, participatory processes can be time-consuming, obstructing and costly.[533] Another important question for the social sciences is how knowledge co-production and public participation in early policy formation and deliberation could be designed and used to obtain prior democratic consent for the research and use of geoengineering[534] – including the need for broad public engagement on whether research on some geoengineering methods should be undertaken at all.[535] An additional challenge concerns how to effectively include the public in decisions with substantial scientific and technical content, particularly where the information is highly complex and uncertain. This is a hallmark feature of geoengineering for which the study of large-scale interventions into complex, often poorly understood natural systems is likely to result in different sources of uncertainty regarding measurements, the role of models, testing and experiments, the nature of prediction, and the possibility of unforeseen events. There is also an issue of how to scope participation in the light of the possible *erga omnes* character of geoengineering. In theory, practically everyone in the world could have an interest in the deliberate modification of the climate system. Yet, there are obvious practical constraints in terms of how inclusive the process can be, i.e., who constitutes an 'interested' or 'affected' party. Regarding public involvement in matters relating to the protection of areas beyond national jurisdiction, the identification of stakeholders and appropriate fora is particularly difficult as there are no accepted criteria for determining what it means to have an interest in global commons areas.[536]

(5) It is far beyond the scope of this work to posit a comprehensive global model of responsible innovation for geoengineering that could be written into the existing international legal framework.[537] What can be achieved, however, is to point to general international norms and incremental developments that could help to anchor good governance of scientific research involving geoengineering, while also being realistic about the existing state of international law and its responsiveness to these complex socio-political challenges related to global environmental

[530] Peel (n 202) 102–103; Craik (n 464) 196–97.

[531] Jasanoff (n 73) 237.

[532] Jasanoff (n 73) 237.

[533] Ebbesson (n 525).

[534] Macnaghten and Szerszynski (n 521). See also Oksana Udovyk and Michael Gilek, 'Participation and post-normal science in practice? Reality check for hazardous chemicals management in the European maritime environment' (2014) 63 *Futures* 15, stating that 'current participation and deliberation practices are rather under developed in the studied EU policy frameworks' and that 'the introduction of more radical approaches to knowledge co-production and participation (like post-normal science) would require epistemological, institutional and constitutional changes that are not feasible in the foreseeable future, at least not in respect to chemicals management.' At least for some radiation management techniques, which are by their nature are regarded as 'global technologies of planetary management', Macnaghten and Szerszynski (n 521) express doubts regarding whether they can be compatible with liberal democracy which requires the accommodation of diverse views and interests. For a critical analysis of solar radiation management and public engagement.

[535] See Macnaghten and Szerszynski (n 521) 427, stating that 'whereas existing analysis have found "cautious and qualified support for well-regulated and limited research" into solar radiation management, our research has found evidence of scepticism even of limited research, given that the effects were perceived by some to be knowable only in the context of full deployment.'

[536] The participation of global NGOs has raised questions about their transparency and accountability and regarding the geographical interests and societal classes they represent. However, see Redgwell (n 489) referencing the 1995 Report of the Commission on Global Governance 'which suggests that global NGOs are the best expression of international civil society.' See, generally, Steve Charnovitz, 'Two Centuries of Participation: NGOs and International Governance' (1997) 18 *Michigan Journal of International Law* 183.

[537] CA responsible innovation model was adopted for the governance the SPICE Project. See Phil Macnaghten and Richard Owen, 'Good Governance for Geoengineering' (2011) 479 *Nature* 293. See also Stilgoe, Owen and Macnaghten (n 71); Richard Owen and Nicola Goldberg, 'Responsible Innovation: A Pilot Study with the U.K. Engineering and Physical Sciences Research Council' (2010) 30 *Risk Analysis* 1699.

change. Proceeding cautiously with these caveats in mind, draft Article 15 aims to provide some normative guidance on public participation in environmental decision-making for scientific research activities involving geoengineering.

(6) From a legal perspective, public participation in domestic environmental decision-making provides an established mechanism for structuring public debate and citizen involvement in geoengineering. Principle 10 of the Rio Declaration is considered the model provision by providing an international framework for the development of national legislation and processes relating to public participation. It reads:

> Environmental issues are best handled with the participation of all concerned citizens, at the relevant level. At the national level, each individual shall have appropriate access to information concerning the environment that is held by public authorities, including information on hazardous materials and activities in their communities, and the opportunity to participate in decision-making processes. States shall facilitate and encourage public awareness and participation by making information widely available. Effective access to judicial and administrative proceedings, including redress and remedy, shall be provided.

Although generally not yet regarded as part of customary international law, Principle 10 has been highly influential in shaping the political and legal discourse.[538] It recognises three central pillars to achieving sustainable development: access to information, public participation in decision-making, and access to justice. Principle 10 is also considered significant for having advanced a concept of public participation that is grounded in a rights-based approach[539] and is related to guarantees provided in human rights law.[540] This coupling of public participation with the rights of access to information and access to justice on environmental matters is considered necessary to avoid mere *pro forma* participation in decision-making process.[541] Normative developments since the 1992 Rio Conference are mainly reflected in abstract provisions in international and regional treaties,[542] and more concretely in intergovernmental policy documents, declarations, decisions, recommendations, guidelines, and action plans and national environmental legislation.[543] One can also look to developments in international jurisprudence[544] and

[538] Jonas Ebbesson, 'Public Participation in Environmental Matters' in *Max Plank Encyclopaedia of Public International Law* (December 2009), para 5.

[539] Ebbesson (n 538) para 4. See also UNGA, 'World Charter for Nature' (28 October 1982) UN Doc A/RES/37/7, principle 23.

[540] United Nations Human Rights Council, 'Report of the Independent Expert on the issue of human rights obligations relating to the enjoyment of a safe, clean, healthy and sustainable environment, John H Knox' (30 December 2013) UN Doc A/HRC/25/53, para 30; UN Human Rights Council 'Mandate of the Working Group on the use of mercenaries as a means of violating human rights and impeding the exercise of the right of peoples to self-determination' (28 March 2008) UN Doc A/HRC/7/21, 2; United Nations Human Rights Committee, 'General Comment No. 34 (12 September 2011) UN Doc CCPR/C/GC/34; The Report of the UN Independent Expert on the issue of human rights obligations relating to the enjoyment of a safe, clean, healthy and sustainable environment includes an overview of the statements of UN bodies in support of this notion (para 32). See also Ebbesson (n 538) paras 30–31.

[541] Ebbesson (n 525) 686.

[542] See, e.g., UNFCCC, art 4(1)(i); Desertification Convention, preamble, art 3(a), 5(d), 10(2)(f), 13(1)(c), 18(2)(a), 19(1)(a) and (c), (3)(b) and 21(d); Stockholm Convention on Persistent Organic Pollutants (adopted 22 May 2001, entered into force 17 May 2004) 2256 UNTS 119 (POPs Convention), art 10(1)(d); CBD, 14(1)(a); Cartagena Protocol on Biosafety, art 23. Regarding public awareness and education, see also n 589, below.

[543] Johannesburg Plan of Implementation of the World Summit on Sustainable Development (WSSD), paras 163–66; Rio +20 Conference on Sustainable Development, 'The Future We Want,' paras 43–44 and 99; Agenda 21, Item 23.2. Regarding the implementation of the right of public participation in national processes, see Gyula Bandi, *Environmental Democracy and Law: Public Participation in Europe* (Europa Law Publishing 2014); Alfons Bora and Heiko Hausendorf (eds), *Governing Technology through Public Participation* (Brill 2010).

[544] European Court of Human Rights, *Taksin and others v Turkey* (2004) 42 EHRR 50; *Öneryildiz v Turkey* [2004] ECHR 657; Inter-American Court of Human Rights, *Claude-Reyes and others v Chile*, Judgement of 19 September 2006, Case no 12.108.

state practice.[545] In the absence of a global treaty, the Aarhus Convention, which remains a regional instrument in terms of participation,[546] establishes the most far-reaching harmonising instrument for implementing Principle 10 of the Rio Declaration. It goes farther than simply prohibiting discrimination against affected non-nationals, by introducing a 'bottom floor' for the harmonisation of national laws. [547] Ebbeson has remarked on the wider significance of these normative developments relating to public participation through interactions at all levels, which 'should be understood in the greater context of ensuring public participation, transparency, governance and control of environmental matters; and as a means for strengthening environmental democracy.'[548]

(7) Incorporating the objectives set out in Article 1 of the Aarhus Convention and Principle 10 of the Rio Declaration, paragraph 1 calls upon States to guarantee the rights of access to information, public participation in decision-making, and access to justice in environmental matters in connection with geoengineering as a potential response strategy or measure to address the adverse effects of climate change and its consequences.

(8) Paragraph 2 builds upon paragraph 1 and has the function of linking the assessment and authorisation process set out in previous draft Articles with participatory requirements. Modelled upon the recommendation set out in the ILC Draft Articles on Transboundary Harm and the basic requirements set out in Article 6 of the Aarhus Convention,[549] it stipulates that prior to authorising a proposed outdoor experiment involving geoengineering, government agencies should provide the public affected with the relevant information and an opportunity of early public participation in the process. Its scope is narrower then the preceding paragraph in that, firstly, it applies to decisions at individual project level and, secondly, it is limited to the 'public affected by the proposed research activity'. This clarifies some of the issues related to the scope of participation, which were raised above. The distinction between the general 'public'[550] and the public 'affected' or 'concerned'[551] generally acknowledges the different degrees of interest that members of the public have in a particular decision-making process. Greater priority is sometimes accorded to natural or legal persons with a direct interest in the decision-making process or outcome by requiring that they are notified and consulted.[552] In

[545] See United Nations Economic Commission for Europe (UNECE), 'Aarhus Clearinghouse' <http://aarhusclearinghouse.unece.org> accessed 17 September 2014, which provides information on national laws and practices relevant to the public's right to access to environmental information, participate in environmental decision-making and achieve justice on environmental matters.

[546] The Aarhus Convention is open to accession by non-ECE countries, subject to approval of the Meeting of the Parties, and thus in principle could evolve into a global instrument on public participation.

[547] See also Espoo Convention, art 2(6) and 3. See Ebbesson (n 525) 697–98; Craik (n 464) 142.

[548] Ebbesson (n 538) para 3.

[549] ILC Draft Articles on the Prevention of Transboundary Harm, art 13; ESPOO Convention, art 2(6). See also UNECE, 'Guidance on Public Participation in Environmental Impact Assessment in a Transboundary Context' (n 520).

[550] 'The public' is defined in Article 2(4) of the Aarhus Convention as 'one or more natural or legal persons, and, in accordance with national legislation or practice, their associations, organizations or groups.' Reaffirmed in UNEP, 'Guidelines for the Development of Access to Information, Public Participation and Access to Justice in Environmental Matters' (26 February 2010) adopted by the Governing Council for UNEP in decision SS.XI/5, part A (Bali Guidelines on Public Participation), Guideline 6.

[551] 'The public concerned' is defined in Article 2(5) of the Aarhus Convention as 'the public affected or likely to be affected by, or having an interest in, the environmental decision-making; for the purposes of this definition, non-governmental organizations promoting environmental protection and meeting any requirements under national law shall be deemed to have an interest'. Reaffirmed in the Bali Guidelines on Public Participation (n 550) Guideline 8.

[552] However, the presumption is to make the process more inclusive, see UK Department of the Environment, Transport and the Regions, 'Public Participation in Making Local Environmental Decisions: The Aarhus Convention Newcastle Workshop Good Practice Handbook' (2000) <http://bch.cbd.int/protocol/outreach/aarhus_handbook.pdf> accessed 17 September 2014, 26 noting that while it is acknowledged that the 'best way to make an exercise open to the public concerned is to make it open to everyone', providing may not be sufficient as 'the best exercises actively seek out the people and organisations likely to be affected by the decision.'

some circumstances, the 'public affected' may include persons living outside the borders of the State where the decision-making is taking place.[553] The explanatory text for Oxford Principle 2 on public participation offers additional insights into how public engagement processes for different geoengineering measures can be reasonably circumscribed:

> Wherever possible, those conducting geoengineering research should be required to notify, consult, and ideally obtain the prior informed consent of, those affected by the research activities. The identity of affected parties will be dependent on the specific technique which is being researched – for example, a technique which captures carbon dioxide from the air and geologically sequesters it within the territory of a single state will likely require consultation and agreement only at the national or local level, while a technique which involves changing the albedo of the planet by injecting aerosols into the stratosphere will likely require global agreement.[554]

Draft Article 16

Authorisation of Scientific Research Involving Geoengineering

1. A State shall only take a decision to authorise a proposed research activity if all evaluation and assessment procedures have been satisfactorily completed and conditions are in place to ensure that, as far as practicable, adverse effects from scientific research involving geoengineering are avoided or minimised and that the scientific benefits of the scientific research activity are maximised, in accordance with the relevant rules of international law and taking into account the guidance provided in this draft Code of Conduct.[555]

2. Prior to authorising a proposed research activity involving geoengineering, States shall take due account of all relevant information impartially, including the results of the assessment, public participation, information from previous assessments and monitoring relevant to the proposed research activity as well as other relevant considerations and concerns.[556]

3. Based on the assessment, a State shall issue a written statement authorising, rejecting, or seeking revisions to a proposed research activity involving geoengineering in a timely manner. The written statement shall include a summary of the reasons as a basis for the decision to authorise, reject or seek revisions to the proposed research activity.[557]

4. An authorisation of the proposed research activity shall include the scale, duration and location of the activity, the requirements for monitoring in accordance with draft Article 15 and any other conditions required by the State.[558] Authorisation should only be issued for defined periods of time and for defined locations.[559]

5. In accordance with draft Article 18 and without prejudice to the protection of confidential information, States shall ensure the timely, complete and reliable reporting and exchange of all information relating to the assessment, authorisation and monitoring of scientific research involving geoengineering that is required to be made available in accordance with general international law and their respective obligations pursuant to international agreements to which they are party and taking into account the guidance provided in this draft Code of Conduct.[560]

[553] See, e.g., Espoo Convention, art 2(2) and (6), art 3(1),(2) and (8), art 4(2) and art 6(1). See also UNECE Guidance on Public Participation (n 520).

[554] Rayner and others (n 14).

[555] See, e.g., Madrid Protocol, Annex I, art 4; Ocean Fertilisation Assessment Framework, para 4.1; Resolution LP.4(8), Annex 5, paras 20, 26 and 28; 1987 UNEP Goals and Principles of EIA, principle 5.

[556] Cf Cartagena Protocol on Biosafety, art 10.

[557] See 1987 UNEP Goals and Principles of EIA, principle 9.

[558] See Ocean Fertilisation Assessment Framework, paras 4.4.

[559] See Ocean Fertilisation Assessment Framework, paras 1.9 and 4.4.

[560] See Resolution LP.4(8), Annex 5, para 30; Ocean Fertilisation Assessment Framework, 1.8.

Commentary

(1) Draft Article 16 provides guidance on the authorisation of scientific research activities that have undergone an assessment in accordance with draft Articles 13 to 15. It is recommended that decision-makers only grant their approval to a research proposal all steps in the assessment procedure have been completed. With regard to final decisions on particular projects, there is normally no obligation in domestic and international EIA processes that decision-makers adopt the recommendations from the environmental report and public consultations. EIA is characterised mainly as a proceduralised form of governance according to which the decision-maker largely retains control over the substantive decision-making process. This discretion is typically curtailed by the duty to take 'due account' of the information gathered during the EIA process in good faith, as required in paragraph 2. The rationale and reasons for the final decision, to be provided in accordance with paragraph 3, will inevitably be evaluated against the background of substantive principles to prevent environmental harm as well as other relevant principles.[561] However, based on the Ocean Fertilisation Assessment Framework, paragraph 1 also establishes a substantive requirement for the final decision by requiring that conditions are in place to ensure that adverse effects is minimised and the scientific benefits maximised.

(2) It is important as a policy matter for the effective functioning of the scientific system that the assessment and approval process is clear, efficient and transparent.[562] According to paragraph 3, national authorities should issue their decision in writing in a timely manner, and outlining their reasons. This provision aims to remove the 'black box' around the EIA decision-making process by requiring that written reasons are provided in support of a decision in a timely manner in order to streamline the EIA process for scientists and to enhance administrative transparency and accountability, so that 'researchers appreciate the constraints under which they operate.'[563]

(3) Paragraph 4 sets out some of the terms of the final decision by requiring at a minimum that national authorities stipulate the scale, duration and location of the research activity involving geoengineering and any monitoring requirements. The authorisation should only be issued for a limited time period and a specific location.

(4) Paragraph 5 links to the requirement in draft Article 18 on the availability of information. It encourages transparency by urging States to ensure that they meet their existing obligations under international law with regard to the reporting of those geoengineering research projects that have been assessed and authorised.

[561] Craik (n 464).

[562] See Barendt (n 70) 206–207.

[563] See Barendt (n 70) 206–207.

Draft Article 17

Post-Project Monitoring

1. States should, as far as practicable and taking into account the need to gather new scientific information regarding geoengineering as a potential response to address the adverse effects of climate change and its consequences, ensure adequate monitoring of the research activity, including monitoring of potential adverse effects.[564]

2. Monitoring procedures should be designed to provide a regular and verifiable record of the proposed scientific research activity involving geoengineering, including to:

(a) monitor key environmental indicators and baselines to test assumptions about the adverse effects of the research activity, including potential long-term cumulative effects in order to deal with uncertainties;[565]

(b) verify compliance with the objectives and conditions related to the authorisation;[566]

(c) review the effectiveness of mitigation measures;[567] and

(d) verify past predictions to transfer experiences to future scientific research activities involving geoengineering of the same type, including to inform future assessments, monitoring requirements, and decisions on authorisation.[568]

3. The results of monitoring shall be used to inform future assessments and decisions on the authorisation of scientific research activities involving geoengineering.[569]

Commentary

(1) The EIA process is not strictly limited to the period before project permission is granted, but may span the life of a project through the requirement of post-project monitoring.[570] Given the significant uncertainties associated with geoengineering, which limit the informational inputs into EIA analysis, post-project monitoring stands to play a potentially important role in the environmental management of geoengineering research by enhancing learning through the introduction of feedbacks (e.g., contributing to improved understanding of environmental baseline conditions and the better design of effective mitigation measures). If properly implemented, post-project monitoring could greatly maximise the knowledge gained from perturbative experiments that pose risks to the environment and human well-being and play an important role in adaptive management of geoengineering research activities.

[564] See, e.g., Espoo Convention, Annex V; Madrid Protocol, Annex I, art 5(1); Resolution LP.4(8), Annex 5, paras 23–25; Ocean Fertilisation Assessment Framework, para 3.6.6.

[565] See, e.g., Espoo Convention, Appendix V, (b); EU Directive on the deliberate release into the environment of GMOs, preamble; Resolution LP.4(8), Annex 4, para 23 and 24, Ocean Fertilisation Assessment Framework, para 3.6.6.2; Madrid Protocol, art 3(2)(c)–(e), Annex, art 5(1).

[566] See, e.g., Espoo Convention, Appendix V, (a); Resolution LP.4(8), Annex 4, para 24; EU Directive on the deliberate release into the environment of GMOs, art 20(1); Ocean Fertilisation Assessment Framework, para 3.3.6.1.

[567] See, e.g., Espoo Convention, Appendix V, (c); Resolution LP.4(8), Annex 4, para 25; Madrid Protocol, Annex, art 5(1).

[568] See, e.g., Espoo Convention, Appendix V, (c); Resolution LP.4(8), Annex 4, para 25; Ocean Fertilisation Assessment Framework, para 3.5.13.2; Madrid Protocol, Annex, art 5(1).

[569] See, e.g., Ocean Fertilisation Assessment Framework, para 5.2.

[570] See B Sadler and S Brown, Principles of Environmental Impact Assessment: Best Practice (International Association for Impact Assessment, 2005), section 2.3. Ben Dipper, Carys Jones and Christopher Wood, 'Monitoring and Post-Auditing in Environmental Impact Assessment: a Review' (1998) 41 *Journal of Environmental Planning and Management* 731.

(2) Post-project monitoring is increasingly a requirement in domestic and international EIA.[571] In the transboundary EIA context, it is an obligation under customary international law where there is a risk of a significant harm to the environment. In the *Pulp Mills Case*, the ICJ stated in relation to the obligation to conduct a transboundary EIA that 'once operations have started and, where necessary, throughout the life of a project, continuous monitoring of its effects on the environment shall be undertaken.'[572]

(3) Monitoring generally entails the gathering of data and information over the course of the experiment and afterwards – focusing on 'those parameters for which the assessment methodology or basic data were not so well established as desired.'[573] This information is then analysed and communicated to the relevant participants of the EIA process and others in accordance with draft Article 18.

(4) Paragraph 1 recommends mandatory post-project monitoring for all geoengineering research activities carried out in the open environment.[574] This is advised to test past predictions of environmental impacts, ensure compliance with the authorisation and thereby improve decision-making and develop appropriate measures for future geoengineering research activities. Monitoring requirements should be reasonable and proportionate to the nature of the research proposal, balancing the need for information about the environmental impacts of specific geoengineering activities against the fact that scientific resources and capacities are finite. Regarding the implementation of this recommendation, the costs of monitoring could be factored into funding applications in view of its importance for maximising the knowledge gained from conducting perturbative studies and as a best practice for the design of geoengineering experiments.

(5) Paragraph 2 outlines the objectives for the design of appropriate monitoring measures for geoengineering research activities, which largely correspond to those set out in the ESPOO Convention[575] and other instruments.[576] Aside from the basic conditions in this paragraph, it is left up to the relevant national authority to determine the specific design and content of the monitoring measures for the experiment. Relevant considerations include the need to exercise proper due diligence and minimise environmental harm, the need to fill-in knowledge gaps, and the nature and scale of the proposed project.[577]

(6) Subparagraph (a) deals with the role of post-project monitoring in the EIA process to address knowledge gaps. Monitoring impacts over the course of the experiment can provide an early warning system for avoiding serious or irreversible damage. It can be also used to ensure that researchers follow through on mitigation requirements and to evaluate the effectiveness of such strategies *post hoc*.[578] This could in turn help to prevent future environmental harm from *in situ* experimentation and develop appropriate governance, for example, by creating specific assessment processes and benchmarks for addressing such scientific research activities. Accommodating uncertainty

[571] Craik (n 464) 195; Gillespie (n 416) 230.

[572] *Pulp Mills Case*, para 205.

[573] John Glasson, Riki Therivel and Andrew Chadwick, *Introduction to Environmental Impact Assessment*, 4th ed (Routledge 2005) 170.

[574] This marks a departure from the approach taken under the Madrid Protocol, Annex I, art 5(1) which only requires monitoring for activities subject to a comprehensive environmental assessments. By contrast, the Ocean Fertilisation Assessment Framework requires post-project monitoring for all ocean fertilisation activities, including those assumed to have *de minimis* environmental impact. See the conclusion by Glasson, Therivel and Chadwick (n 573) 215 that despite the importance of monitoring and auditing to the EIA process, 'this is still probably the weakest step of the process in many countries. Discretionary measures are not enough; monitoring and auditing need to be more fully integrated into EIA procedures on a mandatory basis.'

[575] ESPOO Convention, Appendix V.

[576] Ocean Fertilisation Assessment Framework, paras 3.6.6.1, 3.6.6.3., and 5.3.1–4. See also Madrid Protocol, art 3(2)(d).

[577] Glasson, Therivel and Chadwick (n 545) 169–70.

[578] Ben Dipper, Carys Jones and Christopher Wood, 'Monitoring and Post-Auditing in Environmental Impact Assessment: a Review' (1998) 41 *Journal of Environmental Planning and Management* 731.

is one of the defining challenges associated with the development of responsible policy and regulatory responses to geoengineering. Uncertainties are not limited to the possible risks of researching and developing geoengineering technologies, but also relate to their benefits as a response strategy for offsetting climate change effects. EIAs seek to incorporate information about predicted environmental risks into the planning process, but the value of this exercise may be curtailed under low-knowledge conditions where the risks are not well understood. If a policy of proactive research on geoengineering is pursued, the coupling of targeted experimentation, EIA and post-project monitoring of impacts and mitigation measures as an iterative, adaptive process can help to promote the integration of new information about risks into future assessments and the planning of further research activities.[579] In other words, post-project monitoring can 'provide a valuable feedback mechanism whereby predictive methods and proposed mitigation measures can be continually refined in light of information respecting past activities.'[580] From a normative perspective, a requirement to conduct post-project monitoring to supplement EIA processes can be justified as an application of the precautionary principle.[581]

(7) The objectives in subparagraphs (a) regarding the verification of assumptions about predicted outcomes and (b) regarding ensuring compliance with the terms of the authorisation also relate to the contribution of post-project monitoring to promote transparency, which is underscored as an important element in geoengineering governance.

Draft Article 18

Availability of Information

1. To promote and facilitate scientific and technical cooperation and to enhance transparency [and without prejudice to the protection of confidential information],[582] States and international organisations[583] shall ensure the timely, complete and reliable reporting and access to all results, data and other information related to scientific research involving geoengineering in accordance with general international law and their respective obligations pursuant to international agreements to which they are party and taking into account the guidance provided in this draft Code of Conduct.

2. Other relevant organisations and actors, including members of the scientific community and its institutions, shall cooperate to ensure the availability of information, including the timely, complete and reliable access to all results, data and other information arising from the conduct of scientific research involving geoengineering, including any null and adverse environmental effects.[584]

3. Results, data and other information related to scientific research involving geoengineering may include:

(a) research plans and contracts;

(b) information and data gathered, which are relevant to determining environmental baselines;

[579] Jorge E Vinuales, 'Legal Techniques for Dealing with Scientific Uncertainty in Environmental Law' (2010) 43 *Vanderbilt Journal of Transnational Law* 437, 467.

[580] Craik (n 464) 153.

[581] Craik (n 464) 79.

[582] Articles 3(c) and 4 of the Aarhus Convention stipulate the grounds subject to which States Parties may refuse the disclosure of environmental information. Art 4(4) states with regard to a confidentiality exemption that 'the grounds for refusal shall be interpreted in a restrictive way, taking into account the public interest served by disclosure and taking into account whether the information requested relates to emissions into the environment.'

[583] In this draft Article 18 and accompanying commentaries, all references to an 'international organisation' include reference to treaty organs. See ILA, Final Report of the 71st Conference, Berlin 2004 (ILA 2004).

[584] In accordance with Article 5(6) of the Aarhus Convention, States Parties are to encourage operators whose activities have a significant impact on the environment to regularly inform the public regarding the environmental impact of their activities.

(c) the results of peer review;

(d) the results of the assessment for proper scientific attributes;

(e) the results of the initial and/or comprehensive environmental impact assessment;[585]

(f) the results of the authorisation;

(g) the results of research, data and information, including observational data, model results and other analysis tools;

(h) the results of monitoring;[586]

(i) compliance reporting;

(j) a brief, non-technical summary in English of the information provided under the above headings;[587] and

(k) any other relevant information.[588]

4. States and other relevant organisations and actors shall cooperate to develop procedures and mechanisms to promote public education and awareness on geoengineering as a potential response to address the adverse effects of climate change,[589] as well as the availability of results, data and other information relating to the conduct of scientific research involving geoengineering, including through the establishment of a centralised clearing-house mechanism that is made publicly accessible and provides such information in a timely manner.

Commentary

(1) Draft Article 18 deals with the availability of information regarding scientific research involving geoengineering. 'Transparency' broadly encompasses 'mechanisms that facilitate the release of information about policies, capabilities, and preferences to outside bodies.'[590] As noted in the chapeau of paragraph 1 of this draft Article, the availability of information plays an important role in promoting international cooperation and fostering good governance and global equity to advance sustainable development goals. It serves several important functions in international law, including ensuring legitimacy and the effective and fair distribution of power in environmental decision-making, fostering the exchange of information in support of implementation and compliance with governance and regulatory regimes, addressing compliance and liability issues, and promoting public awareness, trust in institutions and processes, and engagement.[591]

[585] See, e.g., Ocean Fertilisation Assessment Framework, para 1.10.

[586] See, e.g., EU Directive on the deliberate release into the environment of GMOs, art 20(4).

[587] See, e.g., 1987 UNEP Goals and Principles of EIA, principle 5(h); Ocean Fertilisation Assessment Framework, para 1.10.

[588] See, e.g., Ocean Fertilisation Assessment Framework, para 1.9; Madrid Protocol, Annex I, art 3(3).

[589] Regarding positive obligations in treaties and statements in declarations calling upon States Parties to facilitate and encourage public education and awareness on environmental matters see, e.g., Rio Declaration, principle 10; Agenda 21, ch 36; Aarhus Convention, art 5; Montreal Protocol, art 9(2); UNFCCC, art 4(1)(i); CBD, art 13; Cartagena Protocol on Biosafety, art 23(1)(a); POPs Convention, art 10; Desertification Convention, art 19(3)(b). See, e.g., ASILOMAR Geoengineering Conference Report (n 15) 23.

[590] Bernard Finel and Kristin Lord, 'The Surprising Logic of Transparency' (1999) 43 *International Studies Quarterly* 315, 315.

[591] Anne Peters, 'Towards Transparency as a Global Norm' in Andrea Bianchi and Anne Peters (eds) *Transparency in International Law* (Cambridge University Press 2013) 599–600.

(2) Against this background, commentators often emphasise that transparency should play a prominent role in the governance and regulation of scientific research involving geoengineering.[592] It is furthermore seen to be necessary to the public acceptance of research[593] and public trust in science.[594] Indeed, it has already been observed that a lack of transparency has led to conflicts and undermined public acceptance of geoengineering field research.[595] Consonant with this, Principle 3 of the Oxford Principles calls for the disclosure of geoengineering research and the open publication of results – including negative results[596] – and this is further echoed in the Asilomar Principles.[597]

(3) There are clear benefits to be accrued if States, international organisations and other stakeholders work together to foster information exchange on scientific and technical matters relating to geoengineering. In particular, cooperative action on geoengineering research can be useful to:

- minimise environmental harm (particularly to less-protected areas beyond national jurisdiction) and allow for a more efficient use of global scientific resources by reducing the overall need for perturbative experiments and maximising the value of such activities by preventing duplication of research efforts;

- co-develop the knowledge base under conditions of scientific uncertainty with a view to directing international policy formation and law-making on geoengineering by influencing the advancement, scope and direction of scientific enquiry and reducing scientific and legal uncertainty with the aim of fostering the shared understandings necessary for agenda-setting and negotiation and the effectiveness of measures, thereby enhancing trust, legitimacy and accountability in decision-making and facilitating international regulation of governance grounded in law;[598] and

- promote equity and capacity building by bridging the knowledge gap between developed and developing States.[599]

(4) However, the concept of transparency is not without its critiques. In contemporary international law it has become a highly fashionable 'buzzword'.[600] Repeated calls for transparency can come across as being glib in placing so much faith in a concept that is 'overused but under analysed.'[601] The status

[592] Dilling and Hauser (n 408) 553; David G Victor and others, 'International Governance of a Possible Geoengineering Intervention to Combat Climate Change' (2009) 95 *Climatic Change* 103; Jason Blackstock and Jane Long, 'The Politics of Geoengineering' (2010) 327 *Science* 527; The Royal Society Report on Geoengineering (n 2) 51; GAO, 'Climate change: a coordinated strategy could focus federal geoengineering research and inform governance efforts' (2010) GAO Report 10–903. <http://www.gao.gov/products/GAO-10-903> accessed 7 October 2014; A Corner and N Pidgeon, 'Geoengineering the Climate: the social and ethical implications' (2010) 52 *Environment* 24; Gardiner, 'Is "arming the future" with geoengineering really the lesser evil? Some doubts about the ethics of intentionally manipulating the climate system' in S.M. Gardiner and others (eds) *Climate Ethics* (Oxford University Press 2010).

[593] See Neil Craik and Nigel Moore, 'Disclosure-Based Governance for Climate Engineering Research' (CIGI Papers No. 50, November 2014) <https://www.cigionline.org/publications/disclosure-based-governance-climate-engineering-research> accessed 10 February 2015.

[594] Craik and Moore (n 593) 5.

[595] See Erin Hale, 'Geoengineering Experiment Cancelled due to Perceived Conflict of Interest' *The Guardian* (16 May 2012) <http://www.theguardian.com/environment/2012/may/16/geoengineering-experiment-cancelled> accessed 10 February 2015.

[596] Rayner and others (n 14).

[597] ASILOMAR Geoengineering Conference Report (n 15) 20–21.

[598] Jutta Brunnée and Ellen Hey 'Transparency and International Environmental Institutions' in Andrea Bianchi and Anne Peters (eds) *Transparency in International Law* (Cambridge University Press 2013); Peter Haas, 'Epistemic Communities' in Bodansky, Brunnée and Hey (n 133) 798–799.

[599] Brunnée and Hey (n 598) 34.

[600] Anne Peters, 'Towards Transparency as a Global Norm' in in Andrea Bianchi and Anne Peters (eds) *Transparency in International Law* (Cambridge University Press 2013) 535.

[601] Aarti Gupta, 'Transparency under Scrutiny: Information Disclosure in Global Environmental Governance' (2008) 8 *Global Environmental Politics* 1, 1.

of 'transparency' in international law as a practice, rule or principle is dubious, as its precise content is unclear[602] and it lacks sufficient legal underpinning in hard law.[603] As a norm or legal concept, it is 'generally seen as "developing" or "emerging."'[604] Furthermore, in practical terms, it is not an unmitigated good. Jasanoff points out, for example, that in some cases transparency might do more harm than good by 'exacerbat[ing] rather than quell[ing] controversy, leading parties to deconstruct each other's positions instead of deliberating effectively.'[605] O'Neill observes that the unidirectional nature of transparency can be problematic in that '[d]isclosure and dissemination may leave "audiences" unaware that there has been any communication, unable to understand what was communicated, unable to see whether or how it was relevant to them or (at worst) misinformed or disinformed.'[606]

(5) There would also be several barriers regarding implementation to ensure the adequate flow of information on geoengineering. An important issue concerns what role the private sector should have in R&D and the non-disclosure of commercial information.[607] Further examination of the implications of commercial interests, proprietary data and results, and intellectual property rights in the context of geoengineering governance is necessary. Other potential issues include: the lack of concrete obligations requiring the disclosure of information by States about geoengineering research activities (in particular, regarding experimental activities that are likely to have negligible environmental risks and no transboundary implications), poor national implementation of reporting obligations, and the absence of the right of private actors and NGOs to access information and to deliberative processes carried out under the auspices of international environmental institutions. In addition, environmental treaties and national laws may contain exceptions relating to the confidentiality of information where such disclosure is normally required, for example, by providing for a right of refusal of States to provide environmental information regarding commercial or industrial interests, intellectual property rights, international relations, national defence, and public security.[608]

(6) Brunnée and Hey observe that transparency has two dimensions in international environmental law.[609] 'Transparency of governance' relates to the extent to which the activities of international organisations and treaty bodies are transparent to both State and non-State actors including other international organisations and treaty bodies, as well

[602] Andrea Bianchi, 'On Power and Illusion: The Concept of Transparency in International Law' in Andrea Bianchi and Anne Peters (eds) *Transparency in International Law* (Cambridge University Press 2013) 5–6.

[603] Alan Boyle and Kasey McCall-Smith, 'Transparency in International Law-making' in Andrea Bianchi and Anne Peters (eds) *Transparency in International Law* (Cambridge University Press 2013) 435.

[604] Bianchi (n 602) 6.

[605] Jasanoff (n 73) 237.

[606] Onora O'Neill, 'Transparency and the Ethics of Communication' in Christopher Hood and David Heald (eds) *Transparency: The Key to Better Governance* (Oxford University Press 2006), 75–90, 89.

[607] Science and Technology Committee (United Kingdom) (n 14). For example, this concern has been raised with respect to the unauthorised ocean fertilisation activities carried out by the Haida Salmon Restoration Corporation (HSRC) conducted just outside of the 200 nautical mile limit off the Canadian western coastline. See Martin Lukacs, 'World's Biggest Geoengineering Experiment "Violates" UN Rules' *The Guardian* (15 October 2012) <www.theguardian.com/environment/2012/oct/15/pacific-iron-fertilisation-geoengineering> accessed 27 January 2015. The HSRC has published its scientific data policy on its website stating that researchers, organizations and individuals are free to use their scientific data library for 'legitimate research endeavours' subject to the execution of a memorandum of understanding for access privileges. See HSRC, <www.haidasalmonrestoration.com/index.php/science/scientific-data> accessed 27 January 2015. Regarding the involvement of the private sector in developing geoengineering techniques, Oxford Principle 1, Rayner and others (n 14) states that geoengineering should be regulated as a public good, further explaining that '[w]hile the involvement of the private sector in the delivery of a geoengineering technique should not be prohibited, and may indeed be encouraged to ensure that deployment of a suitable technique can be effected in a timely and efficient manner, regulation of such techniques should be undertaken in the public interest by the appropriate bodies at the state and/or international levels.'

[608] See, e.g., Aarhus Convention, Article 3(c) and 4; UNFCCC, art 12(9).

[609] Brunnée and Hey (n 598).

as private citizens, NGOs and companies.[610] Boyle and McCall-Smith conclude that greater openness about the practices and procedures of international organisations and law-making processes is generally regarded as important, and that institutional practices are expanding.[611] Transparency of governance has been earmarked as a component of good governance or 'administration' by international organisations[612] which is important to consider in the face of further international law-making on geoengineering.[613] Participation is also fundamental in terms of allowing civil society to participate in international law-making and governance processes for in order to enhance legitimacy, accountability and effectiveness.

(7) Turning to the second dimension of transparency in international law, as categorised by Brunnée and Hey, 'transparency for governance' refers to the use of transparency mechanisms as policy instruments or 'used in support or in lieu of regulation, to influence the conduct of States and non-State actors.'[614] This dimension of transparency is relied upon heavily in this legally non-binding draft Code to promote the responsible conduct of geoengineering research, and is further entrenched in those provisions on assessment, authorisation and public participation. A caveat is, however, that the scope of draft Article 18 only relates to the 'availability of information' and therefore reflects a highly circumscribed concept of 'transparency as information'.[615] This dimension of transparency related to the exchange of information is sufficiently underpinned by international environmental law.[616] Draft Article 18 takes a bifurcated approach to transnational governance by distinguishing between the requirement that States and international organisations make available information about geoengineering activities in paragraph 1 and the requirement of other stakeholders such as scientists to share information in paragraph 2.

(8) In terms of the mechanisms for channelling information at the international level, information may be made directly available by States to other States via administrative networks or diplomatic channels, or, more commonly for environmental matters, funnelled through treaty secretariats, other treaty bodies, or international organisations. International institutions may also choose to make this information available to the wider global public through publication and dissemination via websites or other means. Wolfrum and Matz explain that 'mechanisms for the exchange of information constitute the most important form of cooperation' for promoting collaboration and coordination between treaty organs.[617] They furthermore point out that information exchange provides opportunities for harmonisation between different agreements: if data forwarded by States to treaty bodies in accordance with their reporting obligations and other implementation information was made available through a 'common exchange mechanism' then 'this would be an important step towards building the foundation necessary for a comprehensive harmonisation of implementation policies and the avoidance of conflicts between agreements.'[618] This conclusion is important in the context of emergent policy- and law-making on geoengineering, given that the issue potentially falls within the regulatory scope of several treaties (not just environmental) and international organisations. In fact, different aspects of geoengineering have already been addressed by the

[610] For example, in accordance with Decision XI/20 paras 1 and 9, the CBD Secretariat requested States Parties to submit information on measures that they have taken in accordance with decision X/33 in relation to climate-related geoengineering. The information furnished by States Parties was made publicly available via the CBD's website. See CBD Follow-up to decisions X/33 and XI/20 in relation to climate-related geoengineering (n 217). See also Fish Stocks Agreement, art 12; Aarhus Convention, art 3(7).

[611] Boyle and McCall-Smith (n 603) 435.

[612] ILA, *Final Report of the 71st Conference, Berlin 2004* (International Law Association 2004) 2.

[613] ILA, *Final Report of the 71st Conference, Berlin 2004* (International Law Association 2004) 2.

[614] Brunnée and Hey (n 598) 25.

[615] Bianchi (n 602) 15.

[616] See, e.g., Stockholm Declaration, principle 20; Rio Declaration, principle 9; ILC Draft Articles on the Prevention of Transboundary Harm, art 12. See further Sands and Peel (n 122) 626–627 regarding treaty provisions relate to the exchange of information.

[617] Wolfrum and Matz (n 226) 171.

[618] Wolfrum and Matz (n 226) 171.

LC/LP and CBD. A harmonising code of conduct of this type could help to avoid legal fragmentation and regime conflicts as international regulation develops, while promoting an integrated understanding of the interrelationship between international laws, which is a fundamental element of the concept of sustainable development.[619] The provision of information as called for in paragraph 1, draft Article 18 may not be enough 'without more'[620] and therefore paragraph 4 calls for a mechanism that promotes and facilitates information exchange. As noted in the commentaries above, the duty of international cooperation encompasses obligations related to exchange information on scientific and technical matters and about environmental threats.[621] Paragraph 1 enjoins States and international organisations to ensure the full disclosure of all information related to the conduct of scientific research involving geoengineering pursuant to their international legal obligations. In addition to general duties in international environmental law to provide general information, particularly regarding scientific and technical information, States also have a customary obligation to consult and provide information where there is a risk of significant transboundary harm to the environment.[622] However, normally, this general duty would not be triggered by geoengineering research activities that fall below the legally relevant triggering threshold – a lacuna this draft Code of Conduct seeks to fill. States Parties to specific treaties could interpret or amplify their existing obligations by requiring the exchange of scientific and technical information related to particular geoengineering measures falling within the regulatory scope of the instrument. As discussed above, many international environmental agreements provide for scientific and technical cooperation between States Parties, usually through their Secretariats and other treaty organs. However, with the exception of the amendment to the London Protocol on marine geoengineering and the non-binding recommendations of various CBD decisions, none of these agreements were negotiated with geoengineering in mind. Nevertheless, the objectives and scope of these treaties and their specific provisions on scientific cooperation may be worded in a sufficiently broad way to cover aspects of geoengineering. For instance, the objective of the Vienna Convention on the Protection of the Ozone Layer in Article 2 reads:

> The Parties shall take appropriate measures in accordance with the provisions of this Convention and of those protocols in force to which they are a party to protect human health and the environment against adverse effects resulting or likely to result from human activities which modify or are likely to modify the ozone layer.

Some of the identified risks of stratospheric aerosol injection include that it could cause stratospheric ozone degradation and impact other poorly understood chemical feedbacks in the atmosphere.[623] To meet the objective set out in Article 2 of the Vienna Ozone Convention, States Parties are obliged, in accordance with their respective resources and capabilities, to 'cooperate by means of systematic observations, research and information exchange in order to better understand and assess the effects of human activities on the ozone layer and the effects on human health and the environment from modification of the ozone layer.'[624]Specific forms of scientific and technical cooperation are also laid down in Articles 3 and 4 of the Convention. Also along these lines, States Parties to the CBD have agreed to report on any measures taken under paragraph 8(w) of decision X/33, including 'general measures that address the exception of small-scale scientific research studies contained in paragraph 8(w) and any information on their application to specific cases.'[625] In accordance with CBD

[619] See draft Article 19(3). See generally ILC, Fragmentation of International Law (n 227).

[620] Wolfrum and Matz (n 226) 171.

[621] See draft Article 6, above.

[622] ILC Draft Articles on the Prevention of Transboundary Harm, art 9; Rio Declaration, principle 19. See also Lac *Lanoux Arbitration (France v Spain)* (1957) 24 ILR 101, 140; Fisheries Jurisdiction Cases (United Kingdom v Iceland) (Merits) (1974) ICJ Reports 3, 198–99.

[623] Alan Robock and others, 'Regional climate responses to geoengineering with tropical and Arctic SO2 injections' (2008) *Journal of Geophysical Research* 113.

[624] Vienna Convention for the Protection of the Ozone Layer, art 2(2)(a).

[625] See CBD Follow-up to decisions X/33 and XI/20 in relation to climate-related geoengineering (n 217).

decision X/15 on 'scientific and technical cooperation and the clearing-house mechanism', the Executive Secretary has been requested to compile the reported information and make it available through the clearing-house mechanism created under Article 18(3) of the CBD.[626]

(9) Whereas paragraph 1 deals with the exchange and reporting of information by States as the dominant actors at the international level, paragraph 2 applies to non-State actors by calling for the disclosure of scientific information, results and data on geoengineering by scientists, scientific institutions, companies and NGOs. This requirement is voluntary, but could also be made mandatory under national legislation or contractually through the provision of public research funding or scientific infrastructure. Paragraph 3 provides an indicative list of the kinds of results, data and other information that might be made available to other States and perhaps other interested stakeholders regarding the conduct of scientific research involving geoengineering.[627] This list mainly relates to the disclosure of information at the project level in accordance with EIA procedures. Other relevant information that could support the promotion of the good governance of geoengineering information includes information regarding: policies, programmes and plans related to strategic environmental assessment; the financing and control of research, including the development of technologies and their ownership (e.g., patents); other legal or governance processes that a research activity has been subject to and the results of these processes; any other decision-making or policy processes, whether at the international or other levels. This paragraph does not address the format of reporting, but to allow for comparison and interpretation across projects, disclosure should follow standard scientific reporting standards and be available in machine-readable format(s).

(10) Draft Article 18 establishes a requirement to make information on geoengineering available, and does not focus on the type of mechanisms that could be used to enhance transparency. Paragraph 4 encourages States and other stakeholders to cooperate to develop procedures and mechanisms to promote the availability of results, data and other information arising from the conduct of research activities involving geoengineering. In particular, it contemplates the possibility of creating a central clearing-house mechanism that is publicly accessible via the Internet or some other means.[628] In their analysis of the design of disclosure mechanisms for geoengineering, Craik and Moore point to the need for bespoke solutions:

> [I]t is clear that we should not think of disclosure in this context as a unitary enterprise that can be satisfied by a single mechanism. It is more likely that the multiple objectives of transparency will require different approaches. Careful attention must be taken to understand what activities ought to be subject to disclosure requirements, when that information will be required, who will be required to disclose, the audiences to which disclosure is directed, the uses to which that information will be put and how disclosure can best be implemented.[229]

[626] CBD decision XI/20, paras 1, 9 and 15(a).

[627] See, e.g., Ocean Fertilisation Assessment Framework, para 2.2.3.; Draft Article 14(1)(c): Ocean Fertilisation Assessment Framework, para 2.2.3.; Draft Article 14(1)(e): Ocean Fertilisation Assessment Framework, para 1.9 and 1.10.; Draft Article 14(1)(g): Art VIII(1) ICRW (n 332); Ocean Fertilisation Assessment Framework?; Draft Article 14(1)(h): Ocean Fertilisation Assessment Framework, para. 5.1.; Draft Article 14(1)(i): Ocean Fertilisation Assessment Framework, para 5.1. Cf draft Article 14(1)(a), above.

[628] CBD, art 18(3).

[629] Craik and Moore (n 593) 5.

Draft Article 19

Implementation

1. All States and relevant organisations and actors shall cooperate in the fulfilment and implementation of the objectives, general principles and procedures set out in this draft Code of Conduct.[630]

2. This draft Code of Conduct should be implemented taking a flexible and adaptive approach in the light of new scientific and technical information and taking into account, as appropriate, available expertise, instruments and work undertaken in international forums with competence in the relevant area.[631]

3. This draft Code of Conduct should be implemented in a mutually supportive manner with other relevant international law in accordance with the interrelationship and integration principle.[632]

4. States should ensure compliance with and the enforcement of laws and measures to protect the environment, including for scientific research involving geoengineering.[633]

5. The effectiveness of the guidance provided in this draft Code of Conduct should be reviewed periodically, as necessary, in the light of new scientific information and on the basis of available expertise, instruments and work undertaken in international and other forums.[634]

Commentary

(1) Draft Article 19 aims to provide additional guidance on the implementation of these draft Articles. These provisions should be read in the light of the general scheme envisaged by this draft Code of Conduct as a legally non-binding, harmonising instrument that aims to provide relevant legal principles, concepts and approaches for the interpretation or amplification of the provisions of existing instruments relevant to geoengineering.

(2) Pursuant to draft Article 6 on international cooperation, paragraph 1 calls upon all States and other sectors of society to cooperate in the fulfilment and implementation of the objectives and principles set forth in this draft Code of Conduct.[635]

(3) Paragraph 2 makes the critical point that the guidance proposed in this draft Code should be applied by taking a flexible and adaptive approach to new scientific and technical information, as further explained in the commentaries to the EIA provisions above.

(4) Paragraph 3 incorporates the principle of integration and inter-relationship, which is integral to addressing a cross-cutting issue like geoengineering that touches upon various subject areas of interna-

[630] See FAO Code of Conduct for Responsible Fisheries, art 4.1; Cartagena Protocol on Biosafety, art 2.

[631] See Cartagena Protocol on Biosafety, arts 2 and 12; EU Directive on the deliberate release into the environment of GMOs, preamble.

[632] See ILA New Delhi Principles on Sustainable Development, principle 7.1; ILA Legal Principles relating to Climate Change (n 119), draft arts 1 and 10.

[633] See LOSC, art 263.

[634] See Cartagena Protocol on Biosafety, arts 2, 35.

[635] Cf para 3 of this draft Article.

tional law. Its implementation is foundational to pursuing the objective of sustainable development, since it 'reflects the interdependence of social, economic, financial, environmental and human rights aspects of principles and rules of international law relating to sustainable development as well as of the interdependence of the needs of current and future generations of humankind.'[636] Like climate change, the topic of geoengineering *prima facie* falls within many subject areas of international law. There are clear interlinkages between international climate protection law and other environmental regimes such as marine pollution, protection of biodiversity, and ozone protection. These connections also extend beyond international environmental law to subject areas such as human rights, food security, and international science law and policy. Conflict and interaction between these international legal regimes and fragmentation in the development of international rules applicable to geoengineering can hinder the achievement of the objective to promote the responsible conduct of geoengineering research, if undertaken, as well as other societal aims.[637] The principle of integration and inter-relationship is furthermore essential to supporting a multi-level, multi-actor approach to geoengineering governance set out in this draft Code of Conduct.[638]Its implementation would require strong institutional coordination and information sharing by existing or new institutions, as discussed in the commentaries to draft Article 18.[639]

(5) Paragraph 4 emphasises the need to ensure compliance and enforcement of laws and measures to protect the environment from harm caused by the conduct of scientific research involving geoengineering.[640] For example, in supplement to the general rules on state responsibility regarding the breach of an international obligation by a State *vis-à-vis* other States,[641] Article 263 of the LOSC provides a specific basis for responsibility and liability in cases where a wrongful act or omission occurs in respect of the conduct of marine scientific research.[642] States and international organisations are specifically responsible and liable under Article 263(3) for damage caused by pollution of the marine environment as a result of marine scientific research undertaken by them or on their behalf.[643]

(6) In view of the fact that the governance needs for geoengineering will evolve over time and in recognition the tentative nature of these draft Articles, paragraph 5 mandates a periodic review of this draft Code of Conduct, as necessary and appropriate.

[636] ILA New Delhi Principles on Sustainable Development (n 119) principle 7.1. See also ILA Legal Principles relating to Climate Change (n 119), draft arts 1 and 10.

[637] See Young (n 12).

[638] Cf para 1 of this draft Article. See, e.g., principle 7.2 of the ILA's New Delhi Principles on Sustainable Development (n 119), which reads: 'All levels of governance – global, regional, national, sub-national and local — and all sectors of society should implement the integration principle, which is essential to the achievement of sustainable development.'

[639] ILA New Delhi Principles on Sustainable Development (n 119) principle 7.3 reads: 'States should strive to resolve apparent conflicts between competing economic, financial, social and environmental considerations, whether through existing institutions or through the establishment of appropriate new institutions.'

[640] See draft Article 6(e), above.

[641] See ILC Articles on State Responsibility, *Report to the Untied Nations General Assembly* (2001) UN Doc A/56/10.

[642] LOSC, Article 263. See also Wegelein (n 44) 343–53.

[643] LOSC, Article 263(3).

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