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GEOENGINEERING AND INTERNATIONAL LAW: THE SEARCH FOR COMMON LEGAL GROUND

Ralph Bodle*

INTRODUCTION

Given that it is a relatively new concept covering a broad range of activities, it is no surprise that, as of yet, no internationally binding rules exist *specifically* on geoengineering. However, there are particular areas of international law that would arguably apply to particular geoengineering concepts: Space law could apply to sun-deflecting mirrors in space, legal regimes such as the United Nations Convention on the Law of the Sea (“UNCLOS”)¹ or the London Convention/London Protocol (“LC/LP”)² to ocean fertilization, and air pollution treaties to stratospheric sulphur injection.³ Carbon capture and storage and ocean fertilization in particular have been the subject of considerable debate and rule-making by the LC/LP and the Convention on Biological Diversity (“CBD”)⁴ treaty bodies. Ocean fertilization is one geoengineering concept that has been tested in a field experiment of a more than negligible scale. It sparked not only public debate but also intensified efforts to address geoengineering at an international regulatory level. In October 2010, the CBD Conference of the Parties 10 (“COP10”) adopted a decision which, for the first time at this level, addressed geoengineering in general and which some regard as a ban or “de facto moratorium.”⁵

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1. United Nations Convention on the Law of the Sea, Dec. 12, 1982, 21 I.L.M. 1261 (1982); G.A. Res. 48/263, U.N. Doc. A/RES/48/263 (Aug. 17, 1994).

2. Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, *opened for signature* Dec. 29, 1972, 11 I.L.M. 1294 (1972); 1996 Protocol to the 1972 Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, Nov. 7, 1996, 36 I.L.M. 4 (1997) [hereinafter London Protocol].

3. See, e.g., Daniel Bodansky, *May We Engineer the Climate?*, 33 CLIMATIC CHANGE 309, 314 (1996); Rex J. Zedalis, *Climate Change and the National Academy of Sciences’ Idea of Geoengineering: One American Academic’s Perspective on First Considering the Text of Existing International Agreements*, 19 EUR. ENERGY & ENVTL. L. REV. 18-32 (Feb. 2010). On the law of the sea and UNCLOS, see Karen N. Scott, *Marine Geo-engineering: A New Challenge for the Law of the Sea*, ANZSIL 18TH ANNUAL CONFERENCE (JUNE 24-26, 2010), *available at* http://ir.canterbury.ac.nz/bitstream/10092/4878/1/12626851_K%20Scott%20Marine%20Geoengineering%20-%20A%20New%20Challenge%20for%20the%20Law%20of%20the%20Sea.pdf.

4. United Nations Conference on Environment and Development, Convention on Biological Diversity, June 5, 1992, 31 I.L.M. 818 (1992) [hereinafter Convention on Biological Diversity].

5. Cf. Juliet Eilperin, *Geoengineering Sparks International Ban, First-Ever Congressional Report*, WASH. POST, Oct. 30, 2010, at A-7; *Great News: UN Agrees Moratorium on Geoengineering Experiments!*,

Against this backdrop, the focus of this article is on *overarching* rules of international law that are common legal ground and might apply to *all* concepts currently discussed under the heading “geoengineering.” In this context we analyze the legal implications of the duty to respect the environment, the precautionary principle or approach, and the duty to undertake an environmental impact assessment. In addition, the article explores to what extent the Environmental Modification Convention (“ENMOD”)⁶ could be applicable or useful as a reference. Against this backdrop I also analyze the recent decision by the CBD COP10.

INTERNATIONAL LAW APPLICABLE TO ALL GEOENGINEERING CONCEPTS

Prevention of Transboundary Harm to the Environment

One of the cornerstones of international environmental law is the general obligation of states to ensure that activities within their jurisdiction or control respect the environment of other states or of areas beyond national control. Listed as Principle 2 of the Rio Declaration,⁷ the rule has become customary international law.⁸ A state in breach of this rule could be held responsible by other states under the customary rules of state responsibility.⁹ This would entail legal obligations to cease the activity, to offer appropriate assurances and guarantees of non-repetition, if circumstances so require, and to make full reparation for the injury caused.¹⁰

In case of an alleged breach of the duty to respect the environment, establishing responsibility of a state for geoengineering would require several elements. First, the geoengineering activity must be attributable to the state in question. Second, the activity’s effects must be proven to have caused harm. Depending on the particular geoengineering activity and its scale, attribution to a state is probably possible to a large degree using global information systems and technology such as satellite observation. However, it might be more difficult to establish the further requirement that the particular geoengineering activity caused particular harm to the environment of other states or of areas beyond national control. It might not be clear whether or to what extent the geoengineering activity had an effect on the earth’s albedo or reduced CO₂ in the

HANDSOFFMOTHEREARTH.ORG (Oct. 29, 2010), <http://www.handsoffmotherearth.org/2010/10/great-news-un-agrees-moratorium-on-geoengineering-experiments/>.

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

7. United Nations Conference on Environment and Development, Rio Declaration on Environment and Development, June 13, 1992, 31 I.L.M. 876 [hereinafter Rio Declaration]. Cf. Principle 21 of the preceding United Nations Conference on the Human Environment, June 16, 1972, 11 I.L.M. 1416.

8. See, e.g., Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion, 1996 I.C.J. 226, ¶ 29 (July 8); *Gabčíkovo-Nagymaros Project* (Hung. v. Slov.), Judgment, 1997 I.C.J., 7, ¶ 53 (Sept. 25); *Pulp Mills on the River Uruguay* (Arg. v. Uru.), Judgment, 2010 I.C.J. 57, ¶ 193 (April 20), available at <http://www.icj-cij.org/docket/files/135/15877.pdf> (Note that the I.C.J.’s formulation is “activities within their jurisdiction *and* control.”) (emphasis added).

9. As codified by the International Law Commission’s Articles on Responsibility of States for Internationally Wrongful Acts, which for the most part reflect customary law. See G.A. Res. 56/83, U.N. Doc. A/RES/56/83, Annex (Jan. 28, 2002) [hereinafter Articles on State Responsibility]. The rules relied on in this article are customary law, although some other concepts in the Articles on State Responsibility may not be universally accepted.

10. *Id.* at arts. 30-31.

atmosphere. In this context, depending on the geoengineering activity in question and the scientific and statistical knowledge available, reversing the burden of proof could be worth considering for geoengineering. Such a reversal has been argued on the basis of the precautionary approach in the *Pulp Mills on the River Uruguay* case before the International Court of Justice (“ICJ”). While the ICJ accepted that a precautionary approach “may be relevant” in the interpretation and application of the treaty in question, it also stated that “it does not follow that it operates as a reversal of the burden of proof.”¹¹ The wording of the court was not clear as to whether this applies to the specific case or generally excludes a reversal. If the burden of proof was reversed in a case of alleged state responsibility for geoengineering, a state to whom a geoengineering activity is attributable would have to rebut the presumption that the earth’s albedo was changed or its CO₂ reduced. However, it would still be difficult to establish that a particular alleged harm to the environment was caused by these effects. For instance, alleged environmental harm could include changes in precipitation patterns¹² followed by floods or droughts. Potential claimant states would have to establish a causal link between the particular geoengineering activity and changes in precipitation, as well as between those changes in precipitation patterns and specific environmental harm. It remains to be seen to what extent global observation and monitoring systems could play a role in this respect.¹³

The rules of state responsibility do not require fault or negligence of the state. The conduct required or prohibited and the standards to be observed depend on the obligation in question. The international obligation not to cause transboundary environmental harm requires a due diligence standard. A state is therefore not in breach of this obligation unless it fails in applying due diligence.¹⁴ Which diligence is “due” depends on the circumstances of the particular case, which leaves considerable legal uncertainty. For instance, the obligation not to cause transboundary environmental harm and the rules on state responsibility do not distinguish between research and deployment. However, international coordination could provide guidance regarding geoengineering and indicate that research fulfilling certain criteria qualifies as due diligence. In addition, geoengineering activities would need to be distinguished from activities that are accepted although they also affect the earth’s albedo or reduce CO₂ from the atmosphere. Attempts at defining geoengineering use criteria such as whether the activity is deliberate or whether it is merely part of a cumulative effect.¹⁵

11. *Pulp Mills on the River Uruguay* ¶ 164.

12. AMS Policy Statement on Geoengineering the Climate System, available at http://www.ametsoc.org/policy/2009geoengineeringclimate_amsstatement.html (adopted by the American Meteorological Society Council on July 20, 2009); Alan Robock et al., *A Test for Geoengineering?*, 327 *Science* 531 (January 2010).

13. For an early suggestion regarding responsibility for CO₂ emissions and weather modification, compare Task Manager of the Comm’n on Sustainable Dev., *Task Manager’s Report on Decision-Making Structures: International Legal Instruments and Mechanisms*, Comm’n on Sustainable Dev., 2d Sess., May 16-27, 1994, para. 143, available at <http://www.un.org/gopher-data/esc/cn17/1994/tmr/tmr-deci> (May 16, 1994).

14. Cf. Rep. of the Int’l Law Comm’n, 53rd Sess., Apr. 23-June 1, July 2-Aug. 10, 2001, U.N. Doc. A/56/10; GAOR, 56th Sess., Supp. No. 10 (2001), available at <http://un.org/documents/ga/docs/56/a5610.pdf>; *id.* at ch. IV, art. 3, para. 8.

15. See ROYAL SOC’Y, *GEOENGINEERING THE CLIMATE: SCIENCE, GOVERNANCE AND UNCERTAINTY I* (2009), available at <http://www.royalsociety.org/geoengineering-the-climate/>; Convention on Biological

It would also be interesting to explore whether a state could avoid responsibility by relying on necessity as one of the “circumstances precluding wrongfulness.”¹⁶ For instance, a state causing transboundary environmental harm by geoengineering might argue that it is particularly affected by climate change and claim distress or necessity as a legal defense.

Further legal problems could ensue from emerging international principles regarding harmful effects of “hazardous” acts, even where such acts are not in breach of an international obligation.¹⁷ This could include making private actors liable under domestic law.¹⁸ Although neither of these rules actually prohibit geoengineering, they could be of particular relevance in view of intended global and potentially irreversible consequences.

These technical legal problems relating to potential responsibility of states are beyond the scope of this paper. Generally, international law has difficulties making individual states responsible for complex environmental effects. Although its existence as part of customary law is important, the obligation to not cause transboundary environmental harm has so far played a limited role in international environmental disputes.¹⁹ A recent case was brought in November 2010 when Ecuador instituted proceedings at the ICJ against Colombia in relation to alleged damages caused to Ecuador, its inhabitants, and the environment through the aerial spraying of chemical herbicides at and over the border. Ecuador argues that Colombia violated Ecuador’s “rights under customary and conventional international law” and claims that Colombia failed to meet its obligations of prevention and precaution.²⁰

More fundamentally, the main problem with state responsibility in relation to geoengineering is that it is retrospective and comes into play only after the geoengineering activity has taken place. International law provides only very limited means to obtain advance provisional measures in order to stop activities that could be in breach of international obligations.²¹

Diversity Decision X/33, U.N. Doc. UNEP/CBD/COP/DEC/X/33, para. 8(w) (Oct. 29, 2010), *available at* <http://www.cbd.int/cop10/doc/> [all references to Convention on Biological Diversity Decisions are hereinafter abbreviated as “CBD Decision”].

16. Articles on State Responsibility, *supra* note 9, at art. 25.

17. *See, e.g.*, the work of the ILC on *Draft Articles on Prevention of Transboundary Harm from Hazardous Activities*, in Rep. of the Int’l Law Comm’n, *supra* note 14.

18. *Cf.* Draft Principles on the Allocation of Loss in the Case of Transboundary Harm Arising Out of Hazardous Activities, Int’l Law Comm’n, 58th Sess., May 1-June 9, July 3-Aug. 11, 2006, U.N. Doc. A/61/10; GAOR, 61st Sess., Supp. No. 10 (in particular, Principle 4.2).

19. *Cf.* Legality of the Threat or Use of Nuclear Weapons, 1996 I.C.J. 226, paras. 27-33; *Gabčikovo-Nagymaros Project* (Hung. v. Slov.), 1997 I.C.J. 7 (Sept. 25).

20. *Aerial Herbicide Spraying* (Ecuador v. Colom.), Application by Ecuador, para. 37-38, (Mar. 31, 2008), *available at* <http://www.icj-cij.org/docket/files/138/14474.pdf>. It remains to be seen to which extent environmental obligations will play a role in this case.

21. In recent years the ICJ has granted only few applications for provisional measures. *See* *LaGrand* (Ger. v. U.S.), Order, 1999 I.C.J. 9 (Mar. 3); *Avena and Other Mexican Nationals* (Mex. v. U.S.), Order, 2003 I.C.J. 77 (Feb. 5); Request for interpretation of the Judgment of 15 June 1962 in the case concerning the Temple of Preah Vihear (Cam. v. Tha), Order of 18 July 2011, *available at* <http://www.icj-cij.org/docket/files/151/16564.pdf>; Certain Activities carried out by Nicaragua in the Border Area (Costa Rica v. Nicaragua), Order of 8 March 2011, *available at* <http://www.icj-cij.org/docket/files/150/16324.pdf>. All other applications were rejected. *See* *Armed Activities on the Territory of the Congo* (New Application: 2002) (Dem. Rep. Congo v. Rwanda), Order, 2002 I.C.J. 219 (July 10); *Certain Criminal Proceedings in France* (Rep. Congo v. Fr.), Order, 2003 I.C.J. 102 (June 17); *Pulp Mills on the River Uruguay* (Arg. v. Uru.), Order, 2006

PRECAUTIONARY PRINCIPLE/APPROACH

Geoengineering, with its unclear yet potentially severe and irreversible consequences, seems an ideal candidate to be addressed by the precautionary approach or principle. However, it is not clear how the precautionary principle would apply to geoengineering or what it would specifically require in legal terms.

The uncertainties begin with the legal status of the precautionary principle and the terminology as to whether there is such a legal “principle” at all or merely an “approach.”²² There is no uniform formulation or usage of the precautionary principle,²³ and its legal status in customary international law has not yet been clearly recognized,²⁴ although it has been invoked several times.²⁵ Based on a distinction between “approach” and “principle,” the U.K. House of Commons Science and Technology Committee recommended excluding the precautionary principle from a set of five key principles to govern geoengineering. The Committee argued that restricting research on this basis would lead to research being carried out elsewhere by other bodies or states not adhering to common rules.²⁶ However, in relation to geoengineering, the question of whether the

I.C.J. 113 (July 13); *Pulp Mills on the River Uruguay* (Arg. v. Uru.), Order, 2007 I.C.J. 3 (Jan. 23); Questions Relating to the Obligation to Prosecute or Extradite (Belg. v. Sen.), Order, (May 28, 2009), available at <http://www.icj-cij.org/docket/files/144/15149.pdf>; Press Release, I.C.J., Costa Rica Institutes Proceedings Against Nicaragua and Requests the Court to Indicate Provisional Measures (Nov. 19, 2010), available at <http://www.icj-cij.org/docket/files/150/16239.pdf>.

22. See generally PATRICIA W. BIRNIE, ALAN E. BOYLE & CATHERINE REDGWELL, *INTERNATIONAL LAW AND THE ENVIRONMENT*, 152 (3d ed. 2009); SCIENCE AND TECHNOLOGY COMMITTEE, *THE REGULATION OF GEOENGINEERING* (FIFTH REPT.), 2009-10, H.C. 221, para. 86 (U.K.). On the basis of the heading “Principles” in Article 3.3 of the United Nations Framework Convention on Climate Change, this article uses the term “precautionary principle” without prejudice to this debate.

23. Cf. Rio Declaration, *supra* note 7, at 879 (Principle 15); United Nations Framework Convention on Climate Change, art. 3(3), May 9, 1992, 1771 U.N.T.S. 107 [hereinafter UNFCCC]; London Protocol, *supra* note 2, art. 3, at 9; Convention on Biological Diversity, *supra* note 4, at 822 (Preamble); BIRNIE, BOYLE & REDGWELL, *supra* note 22, at 160-61.

24. Cf. John Virgoe, *International Governance of a Possible Geoengineering Intervention to Combat Climate Change*, 95 CLIMATIC CHANGE 103, 111 (2009); SCIENCE AND TECHNOLOGY COMMITTEE, *THE REGULATION OF GEOENGINEERING*, *supra* note 22, at paras. 85-86. Kerstin Güssow, Andreas Oschlies, Alexander Proelss, Katrin Rehdanz, and Wilfried Rickels acknowledge a “considerable degree of unclarity as to its normative content and validity,” but apply principle 15 of the Rio Declaration without further analysis as to legal status in *Ocean Iron Fertilization: Why Further Research is Needed* 15 (Kiel Inst. for the World Econ., Working Paper No. 1574, 2009), available at <http://www.ifw-members.ifw-kiel.de/publications/ocean-iron-fertilization-why-further-research-is-needed/kwp1574>.

25. In its judgment in *The Case Concerning Pulp Mills on the River Uruguay*, the I.C.J. considered that while a precautionary approach may be relevant in the interpretation and application of the provisions of the treaty in question, it rejected Argentina’s argument that it operates as a reversal of the burden of proof. See *Pulp Mills on the River Uruguay* (Arg. v. Uru.), Judgment, 2010 I.C.J. 57, ¶¶ 160-68 (April 20) Memorial of Argentina, *Pulp Mills on the River Uruguay*, ¶¶ 3.194-3.197, 5.15 (Jan. 15, 2007), available at <http://www.icj-cij.org/docket/files/135/15425.pdf>. See also Request for an Examination of the Situation in Accordance with Paragraph 63 of the Court’s Judgment of 20 December 1974 in the *Nuclear Tests* (N.Z. v. Fr.) Case, 1995 I.C.J. 288, ¶¶ 342, 412 (Sept. 22) (dissenting opinions of Judges Weeramantry and Palmer, respectively); Legality of the Threat or Use of Nuclear Weapons, 1996 I.C.J. 226, ¶ III.10.f (dissenting opinion of Judge Weeramantry); Appellate Body Report, *EC Measures Concerning Meat and Meat Products (Hormones)*, paras. 16, 120-25, WT/DS26/AB/R (Jan. 16, 1998); The Mox Plant Case (Ir. v. U.K.), Case No. 10, Order of Dec. 3, 2001 (Separate Opinion of Judge Wolfrum), available at http://www.itlos.org/cgi-bin/cases/case_detail.pl?id=10&lang=en#order; Simon Marr, *The Southern Bluefin Tuna Cases: The Precautionary Approach and Conservation and Management of Fish Resources*, 11 EU. J. OF INT’L LAW 815 (2000).

26. Based on the distinction between “approach” and “principle.” See SCIENCE AND TECHNOLOGY COMMITTEE, *THE REGULATION OF GEOENGINEERING*, *supra* note 22, para. 86.

precautionary principle is customary law is less relevant. As the purpose of geoengineering is to address climate change, there is a clear legal basis for applying the precautionary principle as stipulated under the heading “Principles” in Article 3(3) of the United Nations Framework Convention on Climate Change (“UNFCCC”).²⁷ Almost all states have ratified the UNFCCC,²⁸ including the United States.²⁹

The first two sentences of Article 3(3) of the UNFCCC stipulate the precautionary approach in the form of “should” obligations. The first sentence requires that Parties actively take precautionary measures. It not only covers the causes of climate change, but also explicitly includes mitigating its adverse effects. Proponents of geoengineering could argue that geoengineering concepts for CO₂ removal are measures addressing the cause of climate change³⁰ and that geoengineering concepts for solar radiation management mitigate its adverse effects. The second sentence of Article 3(3) refers to “such measures,” for example, geoengineering measures considered on the basis of the first sentence. “[L]ack of full scientific certainty should not be used as a reason for postponing such measures,” provided there are “threats of serious or irreversible damage.”³¹ Geoengineering proponents could argue that such threats exist, in view of the slow decrease or continuing increase of greenhouse gas emissions, the slow pace of the climate change negotiations, and the short remaining time period during which emission trends need to be reversed (peaking). By this rationale, the lack of full scientific certainty about geoengineering should not be a reason for postponing it. A safeguard is provided by Article 4(1)(f) of the UNFCCC, which requires all parties to employ appropriate methods “with a view to minimizing adverse effects” of their mitigation and adaptation measures on the economy, public health, and the quality of the environment.³² Impact assessments are explicitly mentioned as an example of such methods. However, geoengineering would have to qualify as a mitigation or adaptation measure within the scope of this provision.

Reading Article 3(3) of the UNFCCC this way in relation to geoengineering might seem unexpected. At the time the UNFCCC was drafted, it was intended mainly to prevent states from postponing mitigation measures by referring to scientific uncertainty about climate change. However, the actual wording allows for the above interpretation in line with Article 31(1) of the Vienna Convention on the Law of Treaties.³³ Wording and context arguably provide a legal basis for supporting geoengineering or pursuing further

27. UNFCCC, *supra* note 23.

28. There are currently 194 parties to the UNFCCC. *Parties to the Convention and Observer States*, UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE, http://unfccc.int/parties_and_observers/parties/items/2352.php (last visited Jan. 27, 2011).

29. The United States is one of the major emitters and potential geoengineering states but not party to the Kyoto Protocol. We do not address the question of whether geoengineering activities could qualify for credits under the flexible mechanisms under Articles 6, 12, and 17 of the Kyoto Protocol. See David Freestone & Rosemary Rayfuse, *Ocean Iron Fertilization and International Law*, 364 MARINE ECOLOGY PROGRESS SERIES 227, 231 (2008). See generally Christine Bertram, *Ocean Iron Fertilization in the Context of the Kyoto Protocol and the Post-Kyoto Process* (Kiel Inst. for the World Econ., Working Paper No. 1523 2009).

30. Meaning the level of CO₂ in the atmosphere. All proponents of geoengineering acknowledge and stress that it does not reduce anthropogenic CO₂ emissions levels as the underlying cause of climate change.

31. UNFCCC, *supra* note 23, at art. 3(3).

32. Freestone & Rayfuse, *supra* note 29, at 231; Bodansky, *supra* note 3, at 313.

33. Vienna Convention on the Law of Treaties, *opened for signature* May 23, 1969, 1155 U.N.T.S. 331.

geoengineering research, although it would be stretching the wording too far to read Article 3(3) of the UNFCCC as actually *requiring* geoengineering measures.³⁴

The role of the precautionary principle in Article 3(3) of the UNFCCC in the geoengineering debate remains ambiguous. Looking at the risks of *geoengineering* and the potential consequences in isolation, the precautionary principle is an argument against geoengineering because of its unclear and potentially severe and unpredictable consequences. On the other hand, looking at the risks posed by *climate change*, and assuming a low probability of reducing emissions quickly and effectively, the precautionary principle could be used to call for and legitimize further geoengineering research. In that sense, the precautionary principle embodies the core arguments both for and against geoengineering.

ENVIRONMENTAL IMPACT ASSESSMENT (“EIA”)

A further general rule is the duty to carry out an environmental impact assessment. The ICJ has recently recognized that the accepted practice amongst states amounted to “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.”³⁵ While the ICJ left it to the states to determine the specific content of the impact assessment required, it did clarify that it involves “having regard to the nature and magnitude of the proposed development and its likely adverse impact on the environment as well as to the need to exercise due diligence in conducting such an assessment.”³⁶ In addition, the ICJ added further details to the obligation: The impact assessment must be carried out prior to the implementation of the activity, and continuous monitoring of the activity’s effect on the environment is required.³⁷ This may seem obvious from the point of view of scientific standards and good practice, but as a legal rule in customary international law it is an important development, particularly in light of the continuous monitoring requirement. The requirement to carry out an environmental impact assessment is customary international law and applies even in the absence of a treaty obligation to this effect. This is not the case for strategic impact assessment (“SEA”). However, Article 14(1)(b) of the CBD provides a near-global obligation in this regard and the CBD COP has developed guidelines for its implementation.³⁸

The Environmental Modification Convention? (“ENMOD Convention”)

The ENMOD Convention provides rules that appear to address concerns raised in

34. On the precautionary approach in this regard, see BIRNIE, BOYLE, & REDGWELL, *supra* note 22, at 162, 164.

35. *Pulp Mills on the River Uruguay*, ¶ 204.

36. *Id.* ¶ 205.

37. *Id.*

38. See CBD Decision VI/7, U.N. Doc. UNEP/CBD/COP/6/20 at 93. The UNECE Espoo Convention has a Protocol on Strategic Environmental Assessment, UNECE Protocol on Strategic Environmental Assessment to the Convention on Environmental Impact Assessment in a Transboundary Context, May 21, 2003, U.N. Doc ECE/MP.EIA/2003/2.

relation to geoengineering. The Convention was a reaction to deliberate attempts at weather modification by the United States during the Vietnam War³⁹ and was intended to restrict such means of warfare. Article II of the ENMOD provides a broad definition of environmental modification techniques, including “any technique for changing — through the deliberate manipulation of natural processes — the dynamics, composition or structure of the Earth, including its biota, lithosphere, hydrosphere and atmosphere, or of outer space.”⁴⁰ The definition appears to apply to geoengineering, in particular as an interpretative understanding to Article II ENMOD explicitly lists changes in climate patterns.⁴¹ Against this background, it is tempting to apply ENMOD to geoengineering or to use it as a model for future regulation.

However, the ENMOD Convention is part of the international law of armed conflict and applies only to military or any other hostile use of environmental modification techniques. It clearly distinguishes armed conflict and peaceful purposes. The text and the interpretative notes explicitly clarify that the Convention is without prejudice to the use for peaceful purposes.⁴² There is no indication in the text or in the negotiating history that a state is free to regard the use of certain techniques as “hostile” and to invoke the ENMOD Convention when the threshold to an armed conflict is not crossed. Although it can be difficult to determine which situations constitute an armed conflict and to invoke the special body of law attached to it, the distinction between the law applying in peacetime and the law of armed conflict remains crucial. Applying the ENMOD Convention in peacetime on the basis of a subjectively determined “hostile” use would erode this distinction and introduce a grey area between the two areas of law.

Although not directly applicable, the ENMOD Convention could provide ideas and concepts useful for addressing geoengineering. For instance, it provides a definition of deliberate environmental modification and criteria for determining widespread, long-lasting or severe effects. It also envisages an interesting concept for dispute resolution through a complaint procedure to the Security Council of the United Nations.⁴³ Given the potential global effects and political implications, this might be worth considering in the context of geoengineering.⁴⁴

However, consideration of the ENMOD Convention as a model must take into account that participation is limited⁴⁵ and the rules have not been applied in practice.⁴⁶ On the other hand, some key states that have engaged in weather modification or

39. See *Weather Modification: Hearings Before the Subcomm. on Oceans and Int'l Env't of the Comm. on Foreign Relations*, 93rd Cong. 30-31, 53, 77, 88-123 (1974).

40. ENMOD, *supra* note 6, at art. II.

41. The understandings regarding the convention are not part of the treaty but are part of the negotiating record and were included in the report of the negotiating Committee to the United Nations General Assembly.

42. ENMOD, *supra* note 6, at preamble, art. III; Bodansky, *supra* note 3, at 311.

43. ENMOD, *supra* note 6, at art. V, paras. 3-6.

44. *Id.* at art. V(3)-(6).

45. It has 74 parties, of which only few have acceded in recent years. *Status of Treaties*, United Nations Treaty Collection, http://treaties.un.org/Pages/ViewDetails.aspx?src=UNTSOnline&tabid=1&mtdsg_no=XXVI-1&chapter=26&lang=en. (last accessed Jan. 28, 2011).

46. For instance, the ENMOD Convention was not invoked for the burning of oil fields by Iraq in the 1991 Gulf War, because Iraq had not ratified it. See U.S. DEP'T OF DEFENSE, *Report to Congress on the Conduct of the Persian Gulf War--Appendix on the Role of the Law of War* (Apr. 10, 1992), reprinted in 31 I.L.M. 612 (1992).

geoengineering experiments, or that may have the interest and the capacity to engage in geoengineering in the future, are parties to the ENMOD Convention, for example: Brazil, China, India, Japan, the United States, the United Kingdom, and Russia.

The CBD COP10 Decisions on Geoengineering

One particular geoengineering concept, ocean fertilization, has been addressed in detail by the treaty bodies of the LC/LP and the CBD, as well as by the United Nations General Assembly.⁴⁷ The legal implications of these statements and decisions as well as the LOHAFEX experiment carrying out ocean fertilization in 2009 have been discussed elsewhere.⁴⁸ In October 2010, CBD COP10 in Nagoya, Japan, went beyond ocean fertilization and adopted a decision addressing geoengineering in general.

CBD COP10 mainly drew attention because of the adopted “package” containing the ABS Protocol and decisions on the Strategic Plan and resource mobilization.⁴⁹ However, it also dealt with geoengineering under the agenda items “biodiversity and climate change,” “marine and coastal biodiversity,” and “new and emerging issues.”⁵⁰ The decision adopted by COP10 on biodiversity and climate change⁵¹ is remarkable, most notably because it expands the CBD’s scope of interest and addresses geoengineering as a general concept. The decision was based on a draft by the Subsidiary Body for Scientific and Technological Advice (“SBSTA”) and consultations at COP10.⁵² It builds and expands on the CBD’s previous decision on ocean fertilization.⁵³

In paragraph 8 of the decision on biodiversity and climate change, the COP

*Invites Parties and other Governments, according to national circumstance and priorities, as well as relevant organizations and processes, to consider the guidance below on ways to conserve, sustainably use and restore biodiversity and ecosystem services while contributing to climate-change mitigation and adaptation.*⁵⁴

This chapeau is followed by a long list of items and subject matters, with the guidance on geoengineering provided by two subparagraphs under the subheading “Reducing the impacts of climate change on biodiversity and biodiversity-based livelihoods.”⁵⁵

47. See G.A. Res 62/215, para. 97-98, U.N. Doc. A/RES/62/215 (Mar. 14, 2008). See also G.A. Res 63/111, paras. 115-116, U.N. Doc. A/RES/63/111 (Feb. 12, 2009); G.A. Res 64/71, paras. 132-33, U.N. Doc. A/RES/64/71 (Mar. 12, 2010); G.A. Res 65/137, paras. 132-33, U.N. Doc. A/RES/65/37 (draft doc. A/65/L.20 adopted).

48. See Freestone & Rayfuse, *supra* note 29, at 227-33; Harald Ginzky, *Ocean Fertilization as Climate Change Mitigation Measure — Consideration Under International Law* 7 J. FOR EUROPEAN ENVTL & PLAN. L. 57-58 (2010); Philomene Verlaan, *Geo-engineering, the Law of the Sea, and Climate Change*, 3 CARBON & CLIMATE L. REV. 446 (2009).

49. See CBD Decision X/1, U.N. Doc. UNEP/CBD/COP/DEC/X/1 (Oct. 29, 2010); CBD Decision X/2, U.N. Doc. UNEP/CBD/COP/DEC/X/2 (Oct. 29, 2010); CBD Decision X/3, U.N. Doc. UNEP/CBD/COP/DEC/X/3 (Oct. 29, 2010).

50. See List of Decisions Adopted by the Conference of the Parties to the Convention on Biological Diversity at Its Tenth Meeting, available at <http://www.cbd.int/cop10/doc/>.

51. CBD Decision X/33, *supra* note 15.

52. See Draft Decisions for the Tenth Meeting of the Conference of the Parties to the Convention on Biological Diversity, item 5.6, U.N. Doc. UNEP/CBD/COP/10/1/Add.2/Rev.1 (Oct. 1, 2010). See also Report of Working Group I, U.N. Doc. UNEP/CBD/COP/10/L.1/Add.1 (Oct. 28, 2010).

53. CBD Decision IX/16, U.N. Doc. UNEP/CBD/COP/DEC/IX/16 (Oct. 9, 2008).

54. CBD Decision X/33, *supra* note 15, at para. 8 (emphasis added).

55. *Id.* at para. 2.

Subparagraph 8(x) refers to the COP's previous decision on ocean fertilization⁵⁶ and the work of the LC/LP. Subparagraph 8(w) goes beyond this previous focus and provides "guidance" on geoengineering as a general concept:

Ensure, in line and consistent with decision IX/16 C, 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 geo-engineering 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.⁵⁷

The words "make sure" and "ensure" in subparagraphs 8(w) and 8(x) usually signify clear legal obligations.⁵⁸ However, there is no legal restriction on geoengineering. The language of the chapeau of paragraph 8 merely "invites" parties and other governments "to consider" the COP's guidance contained in the following subparagraphs (see above). Further flexibility is provided by the qualifiers "according to national circumstances and priorities."⁵⁹ The question of whether and to what extent a COP decision under the CBD could impose binding obligations on parties does not arise. It remains to be seen whether the decision amounts to a de facto moratorium, as some have claimed.⁶⁰

Despite the absence of a legal obligation, this "guidance" is important in several respects. First, the COP addresses geoengineering in general. On the basis of the broad mandate given to the COP in Article 23.4(i) of the CBD,⁶¹ the decision refers to all climate-related geo-engineering activities that may affect biodiversity. The phrase "that may affect biodiversity"⁶² redundantly appears both in the definition and in the operative part of the decision. Previous drafts of the friends of the chair-group had required that the activity "substantially" affect biodiversity.⁶³ The text adopted by the COP links geoengineering to biodiversity in the broadest possible sense that the COP's mandate permits under the CBD and would probably cover all concepts currently discussed under the heading "geoengineering." This is a remarkable policy signal, considering there appear to be no current large-scale field experiments apart from the LOHAFEX ocean

56. *Id.* at sec. C, Ocean Fertilization.

57. *Id.* at para. 8(w) (footnote omitted).

58. *Id.* at paras. 8(w)-8(x).

59. *Id.* at para. 8.

60. *Recent MEA Activities*, MEA BULL. (Int'l Inst. for Sustainable Dev. (IISD) – Reporting Servs. Div.), Nov. 1, 2010, at 1, available at <http://www.iisd.ca/mea-l/meabulletin103.pdf>.

61. Under Art. 23.4(i) CBD, the COP has the mandate to "[c]onsider and undertake any additional action that may be required for the achievement of the purposes of this Convention in the light of experience gained in its operation." Convention on Biological Diversity, *supra* note 4, at art. 23.4(i).

62. CBD Decision X/33, *supra* note 15, at para. 8(w).

63. On file with the author.

fertilization experiment in 2009.⁶⁴ States are only beginning to consider how to approach geoengineering and whether to define a policy on it. However, further research on potential “emergency tools” is being discussed in the scientific community, and the debate on directing further research has reached policymakers and the public.⁶⁵

Definition of Geoengineering

The decision also provides a tentative definition of geoengineering in a footnote to the operative text.⁶⁶ This is a logical consequence of giving the guidance its broad scope. The decision also marked the first time that states provided a definition of geoengineering in the international formal setting of a COP and in the form of a COP decision. In view of its purpose as guidance, the definition deserves a closer look:

Without prejudice to future deliberations on the definition of geo-engineering activities, understanding that any technologies that deliberately reduce solar insolation [sic] or increase carbon sequestration from the atmosphere on a large scale that may affect biodiversity (excluding carbon capture and storage from fossil fuels when it captures carbon dioxide before it is released into the atmosphere) should be considered as forms of geo-engineering which are relevant to the Convention on Biological Diversity until a more precise definition can be developed. Noting that solar insolation is defined as a measure of solar radiation energy received on a given surface area in a given hour and that carbon sequestration is defined as the process of increasing the carbon content of a reservoir/pool other than the atmosphere.⁶⁷

The definition builds on previous work by academic and scientific institutions and includes both solar radiation management (“SRM”) and carbon dioxide removal (“CDR”) techniques.⁶⁸

The terms “deliberately” and “large-scale” are two key elements of the definition. The reference to “deliberate” is an attempt to distinguish geoengineering concepts currently discussed from other activities that reduce solar insolation; for instance, emissions that have cumulative global effects. However, it remains to be seen whether

64. See Yu. A. Izrael et al., *Field Studies of a Geo-engineering Method of Maintaining a Modern Climate With Aerosol Particles*, 34 *RUSSIAN METEOROLOGY AND HYDROLOGY* 635 (2009) (reporting a recent small-scale SRM experiment). An SRM experiment in the context of the SPICE project planned for October 2011 has recently been postponed to allow time for more engagement with stakeholders, see <http://www.epsrc.ac.uk/newsevents/news/2011/Pages/spiceupdate.aspx>.

65. See *The Asilomar Conference Recommendations on Principles for Research into Climate Engineering Techniques: Conference Report*, CLIMATE INST., Nov. 2010, available at <http://www.climate.org/PDF/AsilomarConferenceReport.pdf>. See also *Asilomar International Conference on Climate Intervention Technologies: Minimizing the Potential Risk of Research to Counter-balance Climate Change and its Impacts*, CLIMATE RESPONSE FUND, http://www.climateresponsefund.org/index.php?option=com_content&view=article&id=87&Itemid=91 (last visited Jan. 29, 2011) (agenda and materials related to the Asilomar Conference). See generally ELI KINTISCH, *HACK THE PLANET: SCIENCE’S BEST HOPE — OR WORST NIGHTMARE — FOR AVERTING CLIMATE CATASTROPHE* (2010); JEFF GOODELL, *HOW TO COOL THE PLANET: GEOENGINEERING AND THE AUDACIOUS QUEST TO FIX EARTH’S CLIMATE* (2010); Juliet Eilperin *Threat of Global Warming Sparks U.S. Interest in Geoengineering*, WASH. POST, Oct. 3, 2010, www.washingtonpost.com/wp-dyn/content/article/2010/10/03/AR2010100303437.html; *Lift-off*, ECONOMIST, Nov. 4, 2010, at 91, also available at www.economist.com/node/17414216.

66. CBD Decision X/33, *supra* note 15, at para. 8(w), n.3.

67. *Id.*

68. ROYAL SOC’Y, *supra* note 15 (the two main concepts discussed as “geoengineering” are SRM and CDR).

the requirement of “deliberate” will be helpful in future governance efforts. For instance, would the exclusion of non-deliberate large-scale effects prejudice potential state responsibility by affecting the “due diligence” standard that is part of the customary obligation not to cause transboundary environmental harm? Would the definition cover weather modification activities carried out by states that intend to change regional precipitation without changing *global* solar insolation? In addition, reforestation and afforestation appear to fall under the definition and would have to be justified under the operative part in order to be excluded from the intended moratorium.

A further element of the definition is that the effects in question have to be “on a large scale.”⁶⁹ Like “deliberately,” this element of the definition is exclusive rather than inclusive. Many technologies and activities — perhaps even deliberately — will to some extent reduce solar insolation or increase CO₂ sequestration from the atmosphere, but on a scale that is considered either negligible from a global perspective or acceptable for the time being. The definition seeks to exclude such activities. The “large scale” element seems to be at odds with the operative part of the guidance, which excludes small-scale scientific research studies. As such studies would not fit the definition of geoengineering in the first place, the exclusion in the operative part seems redundant. Perhaps the drafters of the decision and the states adopting it wanted to be sure not to stifle scientific research. The question remains by which standard or from which point of view the “large scale” is to be determined.

The definition also explicitly excludes Carbon Capture and Storage (“CCS”), a technology that is probably the most advanced in practical terms of all geoengineering concepts. Whether equivalent standards and safeguards envisaged by the decision for other types of geoengineering are in place for CCS is a question not addressed here.⁷⁰ The geological storage problems for CO₂ captured from the air are the same as for CCS.⁷¹

The CBD acknowledges shortcomings of the definition by mentioning its provisional nature twice. It is “without prejudice to future deliberations” and applies only “until a more precise definition is found.”⁷² However, the elements of this definition are not new and it is doubtful whether progress will be made in finding a “more precise” definition. A definition would have to address, *inter alia*, whether the scale of the activity and the intention of states can be useful criteria in distinguishing geoengineering from other climate-related activities. The decision highlights the problem of covering in one definition a range of different concepts that do not easily lend themselves to threshold values. The term “geoengineering” is generic, a general label that covers a wide range of approaches and concepts that are intended to address global warming

69. CBD Decision X/33, *supra* note 15, at para. 8(w), n.3.

70. The parties to the LP adopted amendments to the LP allowing the export of CO₂ streams for disposal into sub-seabed geological formations. *See* LC/LP, Resolution LP.1(1) on the Amendment to Include CO₂ Sequestration in Sub-seabed Geological Formations in Annex 1 to the London Protocol, Nov. 2, 2006, [hereinafter Resolution LP.1(1)]; LC/LP, Resolution LP.3(4) on the Amendment to Article 6 of the London Protocol, Oct. 30, 2009 [hereinafter Resolution LP.3(4)].

71. Bart Gordon, Engineering the climate research needs and strategies for international coordination: Staff report, Committee on Science and Technology, U.S. House of Representatives (Washington, DC, 2010), p. 21; ROYAL SOC’Y, *supra* note 15, at 20. For differences, see *id.* at 20.

72. CBD Decision X/33, *supra* note 15, at para. 8(w), n.3.

without reducing emissions.

The Operative Part

Based on the definition of geoengineering, the core of the operative part of paragraph 8(w) is the guidance “that no climate-related geo-engineering activities that may affect biodiversity take place.”⁷³ It is part of one sentence that is almost ten lines long and contains several qualifiers, conditions, and exceptions.

The qualifier “climate-related” seems redundant and its purpose is not clear. Against the background of the definition, which requires the deliberate application of technologies on a large scale, it is difficult to imagine such solar radiation management or carbon dioxide removal technologies that would not be climate-related. Moreover, if there were such technologies not related to climate, they could still affect biodiversity. It is not clear why the CBD would seek to restrain only climate-related geoengineering.

Although the language is not entirely clear and the grammar allows for different interpretations, it appears that the intended restriction of geoengineering in paragraph 8(w) is subject to three exceptions.

First, the whole operative part is worded as a transitional measure. Paragraph 8(w) is based on the explicit proviso that there are no science-based, global, transparent and effective control and regulatory mechanisms in place for geoengineering. One mechanism fulfilling the criteria of this general exception could be the LC/LP Assessment Framework for scientific research involving ocean fertilization, adopted just before CBD COP10 by the parties to the London Convention/London Protocol.⁷⁴ This is discussed below.

The phrase, “and in accordance with the precautionary approach and Article 14 of the Convention” is not linked to the preceding phrase on control and regulatory mechanisms.⁷⁵ The requirement, “in accordance with” does not fit together with the proviso “in the absence of” regulatory mechanisms.⁷⁶ Instead, it would seem that this part is meant to explain that the intended restriction of geoengineering is adopted on the basis of, and justified by, the precautionary approach and Article 14 of the CBD, which deals with impact assessment and minimizing adverse impacts.⁷⁷ The reference does not qualify or change the operative part.

In addition to this general exception, paragraph 8(w) provides for two further exceptions, which appear to allow for geoengineering in the absence of control and regulatory mechanisms.

The second exception applies generally to activities for which there is an “adequate scientific basis” and for which “appropriate consideration” is given to the “associated risks for the environment and biodiversity and associated social, economic and cultural impacts.”⁷⁸ It is not clear whether “adequate scientific basis” means that the concept

73. *Id.* at para. 8(w).

74. LC/LP, Resolution LC-LP.2 (2010) on the Assessment Framework for Research Involving Ocean Fertilisation, Oct. 14, 2010 [hereinafter LC-LP.2 (2010)].

75. CBD Decision X/33, *supra* note 15, at para. 8(w).

76. *Id.* at para. 8(w), n.3.

77. Convention on Biological Diversity, *supra* note 4, at art. 14.

78. CBD Decision X/33, *supra* note 15, at para. 8(w).

behind the particular activity must be based on science, whether the request to conduct the activity must come from scientists, whether the activity must be managed or conducted by scientists, or whether the risk must be manageable from a scientific point of view.

The third exception applies specifically to small-scale scientific research studies conducted in a controlled setting in accordance with Article 3 of the CBD. This provision reiterates the duty to prevent transboundary environmental harm in Principle 2 of the 1992 Rio Declaration, which was discussed above.⁷⁹ In the context of paragraph 8(w), the reference to Article 3 CBD could simply reaffirm this general customary obligation. Another interpretation could be that any small-scale research studies would have to be conducted in areas within the jurisdiction or control of Parties to the CBD. This intention was clearer in an earlier draft during CBD COP10, which required that the studies be conducted “in a controlled setting within national jurisdiction[s] bearing in mind Article 3” of the CBD. However, the fact that this wording was changed arguably indicates that the decision merely reiterates the general customary rule. The drafting history is inconclusive and, again, the decision’s language is ambiguous.

Paragraph 8(w) ends with the further requirement that “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.⁸⁰ If “they” only referred to the small scale activities under the third exception, it would render this exception narrower than the second exception. In other words, the requirements for an exception for small scale studies would be stricter than the requirements for geoengineering activities in general, which appears incongruous. Thus, the last part beginning with “they” arguably refers to “geoengineering activities” falling under the second exception. As a result, the requirements regarding scientific justification and impact assessment seem partly duplicative. To this extent, the meaning of this phrase remains unclear.

THE LC/LP ASSESSMENT FRAMEWORK

Before CBD COP10, ocean fertilization was the only geoengineering concept addressed as such at an international regulatory level, namely by the CBD and the LC/LP.⁸¹ With regard to this particular geoengineering concept, CBD COP10 reaffirmed the precautionary approach and provided guidance to parties with a view towards ensuring that no ocean fertilization takes place unless in accordance with Decision IX/16C.⁸² The COP continued its previous approach of linking to the work under the LC/LP and invited Parties and other Governments to act in accordance with resolution LC-LP.2 (2010).⁸³ In this resolution, the LC/LP had just before CBD COP10

79. The first part of Article 3 of the CBD and Principle 2 of the Rio Declaration also provide that states have the sovereign right to exploit their own resources pursuant to their own environmental and developmental policies. This part is of little relevance for paragraph 8(w) of the CBD COP10 decision. See Convention on Biological Diversity, *supra* note 4.

80. CBD Decision X/33, *supra* note 15, at para. 8(w).

81. See generally Freestone & Rayfuse, *supra* note 29; Verlaan, *supra* note 48; Ginzky, *supra* note 48.

82. CBD Decision X/29, U.N. Doc. UNEP/CBD/COP/DEC/X/29, paras. 13, 57-62 (Oct. 29, 2010), available at <http://www.cbd.int/doc/decisions/cop-10/cop-10-dec-29-en.pdf>; CBD Decision X/33, *supra* note 15, at para. 8(x).

83. CBD Decision X/29, U.N. Doc. UNEP/CBD/COP/X/29 at para. 60.

adopted an assessment framework for scientific research involving ocean fertilization (“LC/LP Assessment Framework”).⁸⁴

The LC/LP Assessment Framework does not constitute a regulatory and control mechanism that would exempt ocean fertilization under the general exception of paragraph 8(w) of the CBD COP10 decision on geoengineering. In the resolution adopting the LC/LP Assessment Framework, the parties affirm that the LC/LP should continue to work towards providing a global, transparent, and effective control and regulatory mechanism for ocean fertilization and other activities. This indicates that the parties to the LC/LP do not regard the LC/LP Assessment Framework as a fully-fledged mechanism as described by paragraph 8(w) of the CBD COP10 decision on geoengineering.

However, small-scale studies on ocean fertilization could fall under the third exception under paragraph 8(w) of the CBD COP 10 decision regarding small-scale research. For ocean fertilization activities on a larger scale, the LC/LP Assessment Framework could meet the requirements of the second exception. First, the LC/LP Assessment Framework arguably provides adequate scientific basis on which to justify ocean fertilization activities. It is the explicit purpose of the LC/LP Assessment Framework to determine whether a project is legitimate scientific research,⁸⁵ and the framework’s process is geared towards scrutinizing the project’s scientific method and merit.⁸⁶

The LC/LP Assessment Framework arguably also provides for appropriate consideration of the associated risks for the environment and biodiversity and associated social, economic, and cultural impacts. Its iterative structure provides detailed guidance on an environmental assessment that includes biodiversity.⁸⁷ It is based on an assessment of potential exposure and effects and leads to a characterization of the risks involved, including a description of the uncertainties associated with its conclusions.⁸⁸

Social, economic, and cultural effects are explicitly and implicitly addressed in several paragraphs as part of the environmental assessment.⁸⁹ Relevant information to be provided includes “other considerations” such as proximity to other uses of the sea, for example, fishing, navigation, engineering uses, areas of special concern and value, and traditional uses of the sea.⁹⁰ Further considerations include unintended impacts of the delivery method and conflicts of the delivery method with other legitimate uses of the sea⁹¹ and human health considerations, including food chain effects.⁹² The effects

84. LC-LP.2(2010), *supra* note 74. See also LC/LP, Report of the Thirty-Second Consultative Meeting and the Fifth Meeting of Contracting Parties, LC 32/15, 57, Nov. 9, 2010, available at <http://www.ucl.ac.uk/cclp/pdf/Protocol15.pdf> (for the Assessment Framework, see the draft elaborated by the Scientific Group of the London Protocol).

85. LC/LP, Assessment Framework for Scientific Research Involving Ocean Fertilization, para. 1.2, Oct. 14, 2010, available at <http://www.whoi.edu/files/server.do?id=70484&pt=10&p=39373> (last visited Jan. 20, 2011) [hereinafter Assessment Framework].

86. See, e.g., *id.* at paras. 1.2, 1.3, 2.2.

87. *Id.* at paras. 3.4, 3.4.2.3.

88. *Id.* at paras. 3.3.1, 3.5.13.

89. LC-LP.2(2010), *supra* note 74.

90. Assessment Framework, *supra* note 85, at para. 3.2.4.6 (in the context of “establishing both the Experimental Baseline and the Risk Assessment Baseline conditions and their variability”).

91. *Id.* at para. 3.3.3.7 (technical considerations as part of the exposure assessment).

assessment should address “short- and long-term primary production changes, leading to impacts to fisheries or protected species, or other social impacts including visual amenity.” The risk characterization includes hazards to navigation and restriction of fishing grounds.⁹³ In addition, the framework envisages a consultation process with all stakeholders before a final decision is made.⁹⁴ The sum of these elements arguably constitutes appropriate consideration of associated social, economic, and cultural impacts.

The LC/LP Assessment Framework is not legally binding in form or in wording. In addition, participation in the LC/LP is not comparable to, for instance, the CBD or the UNFCCC in terms of number of parties.⁹⁵ However, the CBD decision does not require binding or global rules for the second exception to apply. Ocean fertilization activities conducted in line with the LC/LP Assessment Framework would not be contrary to paragraph 8(w) of the CBD decision on biodiversity and climate change.

FURTHER WORK

The CBD COP has outlined further work on geoengineering, inviting submissions from parties and requesting further work from the Executive Secretary. In particular, the CBD requested a study on gaps in existing regulatory mechanisms for climate-related geo-engineering relevant to the Convention on Biological Diversity, bearing in mind that such mechanisms may not be best placed under the Convention on Biological Diversity.⁹⁶ The LC/LP also works towards establishing a global control and regulatory mechanism for ocean fertilization activities.⁹⁷ The debate within the science community continues⁹⁸ and geoengineering and its potential effects will also be part of the IPCC's fifth assessment report, including the possible role, options, risks, and status of geoengineering as a response option.⁹⁹

92. *Id.* at paras. 3.4.2.1, 3.4.2.2 (as part of the effects assessment).

93. *Id.* at para. 3.5.2.1.

94. *Id.* at para. 1.8.

95. There are 87 parties to the London Convention and 40 parties to the London Protocol as of November 8, 2011. See *London Convention and London Protocol*, INT'L MARITIME ORG., www.imo.org/OurWork/Environment/SpecialProgrammesAndInitiatives/Pages/London-Convention-and-Protocol.aspx (last visited Nov. 8, 2011). The parties represent about two thirds and one third of global merchant shipping tonnage respectively. See also Press Briefing, Int'l Maritime Org., Assessment Framework for Scientific Research Involving Ocean Fertilization Agreed, (Oct. 20, 2010), available at www.imo.org/MediaCentre/PressBriefings/Pages/Assessment-Framework-for-scientific-research-involving-ocean-fertilization-agreed.aspx.

96. See CBD Decision X/13, U.N. DOC. UNEP/CBD/COP/DEC/X/13, para. 4 (Oct. 29, 2010), available at <http://www.cbd.int/doc/decisions/cop-10/cop-10-dec-13-en.pdf>; CBD Decision X/33, *supra* note 15, at paras. 9(l)-(m). See also CBD Decision X/29, *supra* note 82, at paras. 57-62. The studies will be available at <http://www.cbd.int/climate/geoengineering/>.

97. LC-LP.2(2010), *supra* note 74, at 3.

98. See generally Mark New et al., *Four Degrees and Beyond: The Potential for a Global Temperature Increase of Four Degrees and its Implications*, 369 PHIL. TRANSACTIONS OF THE ROYAL SOC'Y A 6, 16 (2011); Aaron Strong et al., *Ocean Fertilization: Time to Move On*, 461 NATURE 347, 347-348 (2009); Bertram, *supra* note 29, at 3.

99. Int'l Panel on Climate Change, Scope, Content and Process for the Preparation of the Synthesis Report (SYR) of the IPCC Fifth Assessment Report (AR5), (Oct. 14, 2010), available at www.ipcc.ch/meetings/session32/doc04_p32_cont_process_SYR.pdf. In June 2011 the IPCC convened a Joint IPCC Expert Meeting of WGI, WGII, and WGIII on geo-engineering, see <http://www.ipcc-wg3.de/meetings/expert-meetings-and-workshops/em-geo-engineering>. See generally INT'L PANEL ON

CONCLUSIONS

The rules and principles identified above form the core of current international law applicable to geoengineering *in general*. As customary law or as part of the UNFCCC, they must comply with all relevant subjects of international law irrespective of the particular geoengineering technique. Although general in nature, the minimum rules analyzed above are on a solid legal footing and politically reflect states' legitimate expectations. They are common legal ground, but would be an incomplete basis for international governance and cooperation. Even in combination with international law applicable to specific geoengineering concepts, the existing rules are unlikely to be able to contain the risks posed by geoengineering or be able to avoid related political conflicts.

All applicable rules identified above include science and research without being specifically designed for these activities, and they do not distinguish between research and deployment. In terms of the risks involved, it is suggested that it is not necessary to introduce this distinction at a regulatory level. The borderline between research experiments and deployment becomes artificial once a certain scale is reached. Below that scale, the general rules do not require states to impose an unreasonable restriction on scientific research.

The CBD COP10 decision on geoengineering took the previous work by the LC/LP and the CBD a significant step further from addressing ocean fertilization to addressing geoengineering in general. It is not binding in form or language, but it sends a political signal and crystallizes the debate about the conditions that should apply to further geoengineering activities.

Legal problems arise when geoengineering is brought into the general political and regulatory sphere. The CBD decision text on geoengineering is a delicate balance between different views, and the wording and definition could be more precise and consistent. The CBD COP10 decision also raises the question of different treaties or institutions potentially competing for addressing geoengineering with overlapping or inconsistent rules or guidance.¹⁰⁰ In legal terms, the mandate of the CBD COP is sufficiently broad for it to justify addressing all geoengineering concepts relevant to biodiversity. The same goes for the mandate of other major treaty regimes, notably the UNFCCC/KP, which so far has not addressed this issue. In this context it is worth noting that the International Maritime Organization ("IMO") information on recent LC/LP activities states that the LC/LP parties "*have declared themselves the competent international bodies to regulate legitimate scientific research into ocean fertilization and to prohibit commercial activities in this field.*"¹⁰¹ Yet from a global perspective, the

CLIMATE CHANGE, CONTRIBUTION OF WORKING GROUP II TO THE FOURTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE 797, 803-04 (M.L. Parry et al. eds., 2007) (mentioning geoengineering); INT'L PANEL ON CLIMATE CHANGE, CONTRIBUTION OF WORKING GROUP III TO THE FOURTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE 624-625 (B. Metz et al. eds., 2007) (mentioning geoengineering).

100. Cf. Scott, *supra* note 3, at 10 (on marine issues). See generally Karen N. Scott, *Conflation of, and Conflict Between, Regulatory Mandates: Managing the Fragmentation of International Environmental Law in a Globalised World*, THIRD FOUR SOC'YS CONFERENCE: INT'L LAW IN THE NEW ERA OF GLOBALIZATION (Aug. 26-28, 2010).

101. LC-LP.2 (2010), *supra* note 74, at 3 (emphasis added).

different regimes and institutions have different legal and political weight, depending, for instance, on their respective levels of participation.¹⁰²

Even though most geoengineering concepts are only at an abstract or modeling stage, there are reasons for exploring and considering rules and governance models that include research activities. First, the mere potential for transboundary impacts even at an early (field testing) stage could have serious foreign policy implications and entail the risk that other nations may hold the researching or deploying state responsible for alleged impacts. Second, the public debate could become framed in terms of outright rejection or support, which could eventually polarize and divide the science community and public opinion in a way similar to the broader debate on climate change. Third, depending on the particular technique, research and experiments are likely to require coordination at the international level in order to attribute data to particular experiments and ensure valid results. Neither the existing legal rules nor the principles proposed by parts of the scientific community seem adequate to address these concerns.

102. For instance, the United States is party to the London Convention, but not the London Protocol or the CBD. However, the United States did vote in favor of the UN GA resolutions, which welcomed and took note of the LC/LP and CBD activities.