

Arctic Dreams and Geoengineering Wishes: The Collateral Damage of Climate Change

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Moving forward into a post-Kyoto world, policymakers struggle to find effective and equitable solutions, not only for the most basic challenges climate change presents, but also for the secondary problems to which climate change gives rise. After more than twenty years of deliberations, policymakers continue to struggle with the fundamental question of how to use law as a tool for reducing greenhouse gas emissions. Yet, even as these deliberations proceed, more complex derivative questions are identified on a daily basis.

These spin-off questions range from well-established concerns about the impact of climate change on biodiversity, human health and human rights, to newer questions about the intersections between climate change law and other areas of law, to critical questions about how climate change is revealing new governance gaps. Many of these collateral questions raise pressing legal and political issues that cannot be resolved through ongoing climate negotiations. This Article examines two particularly important areas in which climate change is exposing fundamental gaps in existing systems of global governance. The first of these is governance of the Arctic Ocean at the edges of the existing regulatory reach of the United Nations Convention on the Law of the Sea. The second of these is the complete absence, for all practical pur-

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poses, of a governance regime applicable to geoengineering research and experimentation. These seemingly distinct issues are examined together for two reasons. First, they raise two of the most pressing global governance challenges today. Second, global efforts to address Arctic and geoengineering governance gaps pose discreet opportunities for the global community to debate, refine and advance the normative framework and institutional structures for management of the global commons. In both contexts, the questions asked and the answers offered will offer insight into larger questions of global environmental governance.

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I. INTRODUCTION

The 2009 Copenhagen Climate Conference revealed the extent to which the collective action problem is impeding international efforts to agree upon a new legal framework for climate change. Similarly, by late-summer 2010, with the 111th Session of the United States Congress drawing to a close, the Senate struggled to define the

parameters for a bill capping greenhouse gas emissions and ultimately abandoned the effort.¹ Even as one of the worst environmental disasters in U.S. history—the explosion of the Deepwater Horizon well²—poured hundreds of thousands of gallons of oil into U.S. waters and onto U.S. coastlines, public support and political will for a climate bill appeared to fade. As the global community and key nation-state players continued to falter in their efforts to create even the most basic legal frameworks for responding to climate change, the collateral damage of climate change continued to amass.

While policymakers locked horns over fundamental questions of greenhouse gas abatement, members of the scientific, academic and private sectors continued to identify new issues on almost a daily basis. These spin-off questions range from well-established concerns about the impact of climate change on biodiversity, human health and human rights to new questions about the intersections between climate change law and other areas of law—e.g., the law of the sea, torts, health, intellectual property and corporate law—to questions about how climate change is revealing—if not creating—new governance gaps in international law. Many of these questions raise pressing legal and political issues that cannot be resolved by ongoing climate negotiations. Much has been written about climate change at the margins,³ but equally as important is how climate change exposes pressing new—or exacerbated—governance gaps.

This Article examines two areas in which climate change is exposing fundamental gaps in existing systems of global governance. The first of these areas is governance of the Arctic Ocean—focusing on the seabed and ocean floor—at the edges of the existing regulatory reach of the United Nations Convention on the Law of the Sea (UNCLOS).⁴ The second of these areas is, for all practical purposes, the complete absence of a governance regime applicable to geoengineering research and experimentation. This Article examines these two distinct issues together not only because they raise two of the

1. See Evan Lehmann, *Senate Abandons Climate Effort, Dealing Blow to President*, E&ENews.NET, July 23, 2010, <http://www.eenews.net/climatewire/2010/07/23/1/>.

2. See generally Robin Kundis Craig, *The Gulf Oil Spill and National Marine Sanctuaries*, 40 ENVTL. L. REP. 11074 (2010), available at <http://ssrn.com/abstract=1648307>.

3. See generally IN THE WILDS OF CLIMATE LAW (Rosemary Lyster ed., 2010); Cinnamon Piñon Carlarne, *Good Climate Governance: Only a Fragmented System of International Law Away*, 30 L. & POL'Y 4 (2008).

4. United Nations Convention on the Law of the Sea, Dec. 10, 1982, 1833 U.N.T.S. 397 [hereinafter UNCLOS].

most pressing governance challenges associated with climate change, but also because at first glance they appear to present—for lack of a better word—bipolar governance challenges. One issue—Arctic governance—appears best suited to treaty-based, collective action, while the other seems ill-suited for treaty-based response due to its novelty, the absence of fundamental, guiding norms and the relative immaturity of the science. Yet, upon further analysis, the challenge that initially appears ill-suited for treaty-based response—geoengineering—involves a greater number of actors and has equal, if not greater, potential to be of critical importance to the global community. Examining these two challenges together, this Article seeks not only to define the parameters of the governance challenges, but also to begin to explore the larger governance questions and lessons offered while exploring alternative strategies in both contexts with particular regard to the evolving global governance debate on management of the global commons.

Part I of this Article posits that climate change is a “wicked” problem and examines how, as a result of its complex character, climate change is giving rise to a variety of spin-off governance challenges, including governance of the Arctic and geoengineering. Part II explores the distinct challenges posed by the absence of a governance regime for the Arctic waters beyond the purview of UNCLOS. Part II then analyzes existing and proposed regulatory regimes applicable to the Arctic and suggests key components of a new governance system for the area. Part III examines the governance challenges posed by existing and future efforts to geoengineer the climate, focusing primarily on the need to develop an underlying normative framework as a necessary prerequisite for debating a larger governance framework. In conclusion, Part IV compares two distinct governance challenges and suggests how these issues reveal both the pervasiveness of climate change and the range of challenges it poses to global governance, as well as the pressing need not only to discover our guiding norms but to locate the home of our governance efforts in a timely manner.

A. Climate Change: A Wicked Problem

Climate change gives rise to a complex web of primary and secondary governance challenges. The emerging debates about Arctic and geoengineering governance are two examples of the collateral

damage that results from the wicked, or massive,⁵ nature of climate change. Here, it is worth briefly exploring the wicked nature of climate change to better understand the complexities inherent in not only the primary challenge of addressing climate change, but also the secondary governance challenges created by climate change.

A wicked problem is one that defies definition and resolution. As first explored by urban planners H.W.J. Rittel and M.M. Webber in 1973,⁶ it is a problem that cannot be successfully treated with traditional linear, analytical approaches.⁷ Rittel and Webber contrasted wicked problems with “tame” problems. A tame problem can be complex, but it is subject to being tightly defined and capable of being solved or explained. A wicked problem is generally ill-defined and subject to being explained in different—and often contradictory—ways. Further, it creates spin-off problems and changing requirements and is not readily solvable—i.e., there are generally no final solutions, just alternative responses. As described by one legal scholar, a wicked problem is one that “defies resolution because of the enormous interdependencies, uncertainties, circularities, and conflicting stakeholders implicated.”⁸ While the concept of wicked problems was initially limited to micro-level questions, it is increasingly used as a tool for conceptualizing macro-level social and economic problems, e.g., AIDS, healthcare, terrorism and climate change.⁹

Climate change is approached as a wicked problem for many of the same reasons that terrorism is: it is viewed as an intractable dilemma that is laden with complex interdependencies and inherently interlinked with embedded social choices and values.¹⁰ However, the problem of climate change is further complicated by temporal and

5. See J.B. Ruhl & James Salzman, *Climate Change, Dead Zones, and Massive Problems in the Administrative State: A Guide for Whittling Away*, 98 CALIF. L. REV. 59, 72–80 (2010) (suggesting an alternative framework and a method/roadmap for looking at complex problems whereby the problem is approached as a “massive problem” that requires more precise definition and is capable of being more effectively—if not fully—addressed through carefully crafted regulatory frameworks).

6. Horst W.J. Rittel & Melvin M. Webber, *Dilemmas in a General Theory of Planning*, 4 POL’Y SCI. 155 (1973).

7. *Id.*

8. See, e.g., Richard J. Lazarus, *Super Wicked Problems and Climate Change: Restraining the Present To Liberate the Future*, 94 CORNELL L. REV. 1153, 1159 (2009).

9. *Id.*

10. See generally Cass R. Sunstein, *On the Divergent American Reactions to Terrorism and Climate Change* (John M. Olin Law & Economics Working Paper No. 295, 2d series 2006), available at <http://ssrn.com/abstract=906889>.

spatial complexities that have prompted it to be labeled as a “super wicked problem.”¹¹

At least three distinguishing traits compound efforts to address climate change. The first is temporal. Because climate change and its associated problems are expected to become exponentially worse over time, the costs of responding to climate change are also expected to grow exponentially over time. That is, as concentrations of greenhouse gases in the atmosphere continue to amass, both the physical and economic costs of mitigating and adapting to climate change increase.¹² Therefore, the longer society waits to respond to climate change the more difficult and costly it becomes.¹³

The second problem results from a mixture of economic and ethical disincentives. Historically, the industrialized world is the largest contributor of greenhouse gas emissions and is responsible for the majority of greenhouse gases currently accumulated in the atmosphere; it is also best positioned economically to take immediate action to curb climate change. However, the industrialized world is also generally disinclined to take potentially costly actions to address climate change because it is unlikely to be severely disadvantaged by it. The developed world is in the best position to adapt to the negative impacts of climate change and is averse to taking actions that would put it at an economic disadvantage vis-à-vis the rapidly developing economies.¹⁴

11. See Kelly Levin et al., *Playing It Forward: Path Dependency, Progressive Incrementalism, and the “Super Wicked” Problem of Global Climate Change*, 6 IOP CONF. S.: EARTH & ENVTL. SCI. 1, 8–10 (July 7, 2007), available at http://www.allacademic.com/meta/p_mla_apo_research_citation/1/7/9/7/0/pages179707/p179707-1.php (noting that “although the challenges of climate change and many other complex environmental and social problems are captured by the above characteristics, climate poses three additional features that render it a ‘super wicked problem.’”).

12. See Lazarus, *supra* note 8, at 1160.

13. See, e.g., NICHOLAS STERN, *THE ECONOMICS OF CLIMATE CHANGE: THE STERN REVIEW* (2007); Kenneth J. Arrow, *Global Climate Change: A Challenge to Policy*, ECONOMISTS’ VOICE (June 2007), <http://www.bepress.com/cgi/viewcontent.cgi?article=1270&context=ev>. But see Martin L. Weitzman, Review, *A Review of the Stern Review on the Economics of Climate Change*, 45 J. ECON. LITERATURE 703 (2007) (critiquing the *Stern Review*, with particular regard to its method of discounting); William D. Nordhaus, *The “Stern Review” on the Economics of Climate Change* (Nat’l Bureau of Econ. Research, Cambridge Mass., Working Paper No. 12741, 2006), <http://www.nber.org/papers/w12741> (last visited Apr. 1, 2011).

14. See Lazarus, *supra* note 8, at 1160.

The third problem involves the difficulties inherent in (1) recognizing the presence of an emergent issue that requires collective action, and (2) overcoming the “absence of any global lawmaking institution with a jurisdictional reach and legal authority that match[es] the scope of the problem”¹⁵—i.e., a governance deficiency. Governance deficiencies are central to many international environmental issues and will play a substantial role in the subsequent analysis of the Arctic and geoengineering governance challenges.

The traits set forth above define the parameters of the super wicked problem of climate change, but the complexities of climate change extend beyond these parameters. Climate change, like many other wicked problems, is not only highly resistant to resolution, but it spins off a series of problems that are similarly difficult in their own right, including, for example, governance of geoengineering. The intersection of these primary and secondary governance challenges poses daunting barriers to efforts to improve overarching systems of global environmental governance.

B. Governance Gaps

Ongoing domestic and international efforts to craft legislative and regulatory frameworks for mitigating climate change reflect the wicked nature of the problem: draft bills span hundreds of pages and cover hundreds of issues and yet still struggle to address even the primary causes and effects of climate change. The wicked nature of the problem is also reflected by the spin-off problems that climate change generates. These spin-off challenges range from questions of how to treat displaced people (i.e., “environmental refugees”),¹⁶ to how to balance the needs of present and future generations of humans and non-human species,¹⁷ to how to respond to the legal gaps and

15. *Id.* at 1161.

16. See generally Oliver Bakewell, *Research Beyond the Categories: The Importance of Policy Irrelevant Research into Forced Migration*, 21 J. REFUGEE STUD. 432 (2008); Stephen Castles, *The International Politics of Forced Migration*, 46 DEV. 11 (2003); Richard Black, *Environmental Refugees: Myth or Reality?* (New Issues in Refugee Research, UN High Commissioner for Refugees (UNHCR), Working Paper No. 34, 2001), available at <http://www.unhcr.org/3ae6a0d00.html>; Norman Myers, *Environmental Refugees: An Emergent Security Issue* (paper delivered at the 13th Economic Forum, Organization for Security and Co-operation in Europe, Prague, Czech Rep., Doc. No. EF.NGO/4/05 (2005), available at <http://www.osce.org/node/14851>).

17. See, e.g., Simon Dietz, Cameron J. Hepburn & Nicholas Stern, *Economics, Ethics and Climate Change*, in 2 ARGUMENTS FOR A BETTER WORLD: ESSAYS IN HONOUR OF AMARTYA SEN: SOCIETY, INSTITUTIONS AND DEVELOPMENT (Kaushik Basu & Ravi Kanbur,

overlaps between climate change and the numerous fields of law with which it interacts,¹⁸ to how to craft new legal regimes in currently open fields of law.

Within the last category, two of the most pressing governance challenges that the international community faces are how to craft governance regimes for (1) the area of the Arctic Ocean that exists beyond the jurisdiction of existing regulatory regimes, and (2) the quickly evolving techniques and technologies of geoengineering, some of which are already being tested with little to no organized regulatory oversight.¹⁹ In the context of Arctic regulation, existing systems of law and policy and historical precedent offer guiding norms, but there is a real need to examine whether these norms, and the institutions that give rise to them, remain relevant and offer sufficient structure. In contrast, in the context of geoengineering, the global community lacks either a normative or institutional framework for responding to the governance gap, creating an open playing field for debating an entirely new governance system. Despite the different starting points, in both contexts—as with climate change—there are numerous unanswered scientific and ethical questions that complicate the already complex political arena within which the debates are taking place. This Article examines each of these governance challenges in turn before considering some of the larger questions they present.

eds., 2009); Tracy Bach & Burns H. Weston, *Recalibrating The Law of Humans with The Laws of Nature: Climate Change, Human Rights, and Intergenerational Justice* (Vermont Law School Legal Studies Research Paper Series, Research Paper No. 10-06, 2009); David Schlosberg, *Climate Justice Beyond Equity: The Flourishing of Human and Non-Human Communities* (paper delivered at the American Political Science Association Annual Meeting, Toronto, Can. (2009), available at <http://ssrn.com/abstract=1449681>).

18. See, e.g., IN THE WILDS OF CLIMATE LAW, *supra* note 3; William Burns, *Potential Causes of Action for Climate Change Damages in International Fora: The Law of the Sea Convention*, 2 INT'L J. SUSTAINABLE DEV. L. & POL'Y 27 (2006).

19. See, e.g., Frank Gervais, Ulf Riebesell & Maxim Y. Gorbunov, *Changes in Primary Productivity and Chlorophyll a in Response to Iron Fertilization in the Southern Polar Frontal Zone*, 47 LIMNOLOGY AND OCEANOGRAPHY 5 (2002) (discussing several iron enrichment experiments in the Southern Ocean); see also Quirin Schiermeier, *Ocean Fertilization Experiment Draws Fire*, NATURE.COM (Jan. 15, 2009), <http://www.nature.com/news/2009/090109/full/news.2009.13.html> (discussing a controversial ocean iron fertilization experiment sponsored by the German science ministry).

II. ARCTIC GOVERNANCE GAP

At first glance, the Arctic governance gap appears to be a limited problem resting at the edges of existing governance systems. Further, one might fairly inquire why there is an Arctic governance gap at all, given that the global community has been making and applying international law in the context of the Arctic for more than half a century. There are two primary and interrelated reasons why management of the Arctic is quickly becoming a pressing political issue. First, as depicted in Figure 1 below, there are long-standing tensions over multiple claims to the outer continental shelf that converge in the middle of the Arctic Ocean, claims which are not yet settled nor capable of being fully settled under UNCLOS in its current form. Second, there are emerging concerns over the management of Arctic waters beyond the jurisdiction of existing institutions.

Figure 1²⁰



Maritime jurisdiction and boundaries in the Arctic region





With climate change proceeding at twice the pace in the Arctic as compared to the rest of the planet, and with the rate of ice loss in recent years putting Arctic melt decades ahead of model predictions, the Arctic has become the bellwether for climate change.²¹ One of the earliest effects of climate change in the Arctic is the still-ongoing loss of sea ice.²² As the sea ice melts and/or thins, vast new tracts of waters emerge. As a result, the global community anticipates obtaining access to deep sea resources and new shipping routes, creating a series of new governance challenges related to maritime access, ecosystem management, the well-being of indigenous peoples and safety and environmental issues surrounding the growth of the Arctic tourism industry.

While tensions over continental shelf claims predate the current climate debate, these claims remain unsettled for a variety of reasons. Primarily, there has been very little incentive to settle them because, until very recently, the area was largely inaccessible and the

20. The International Boundaries Research Unit at Durham University has produced this detailed map depicting recognized, claimed and contested boundaries in the Arctic Ocean. See *Maritime Jurisdiction and Boundaries in the Arctic Region*, DURHAM UNIV. (Sept. 2010), <http://www.dur.ac.uk/ibru/resources/arctic/> [hereinafter *Maritime Jurisdiction and Boundaries*].

21. See Thomas Homer-Dixon, Nonlinearity, Uncertainty, and Time Lags: Why We Must Start Planning Now To Geoengineer Earth Soon, (paper delivered at the American Political Science Association Annual Meeting, Toronto, Can. (2009), available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1450781).

22. McKenzie Funk, *Healy Mapping Mission: Arctic Landgrab*, NAT'L GEOGRAPHIC (May 2009), available at <http://ngm.nationalgeographic.com/2009/05/healy/funk-text>.

Arctic coastal states' territorial claims were largely not in dispute.²³ Despite being institutionally distinct from the climate debate, climate change is intensifying existing jurisdictional tensions as the two political issues—jurisdictional claims and Arctic sea ice melt—increasingly interact to heighten the political and economic stakes surrounding settlement of existing, new and future claims over access and control rights in Arctic waters.

A. Historical Overview of Arctic Governance

In seeking to better understand how the planet will be affected by the processes of climate change, scientists focus on the Arctic and Antarctica as our planetary predictors. Yet, due to extreme climatic and geographical conditions, these two areas are among the least understood ecosystems in the world. This is particularly true of the Arctic²⁴ and, more specifically, the Arctic Ocean, the loci of the cur-

23. See Donald R. Rothwell, *The Arctic in International Affairs: Time for a New Regime?* (ANU College of Law Research Paper No. 08-37, 2008), available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1314546; see also Betsy Baker, *Law, Science, and the Continental Shelf: The Russian Federation and the Promise of Arctic Cooperation*, 25 AM. U. INT'L L. REV. 251 (2010) [hereinafter Baker, *Law, Science, and the Continental Shelf*]. There are exceptions to this. For example, Canada and the United States have a long-standing disagreement over the maritime boundary in the Beaufort Sea. See, e.g., TED L. McDORMAN, SALT WATER NEIGHBORS: INTERNATIONAL OCEAN LAW RELATIONS BETWEEN THE UNITED STATES AND CANADA 181–90 (2009); Betsy Baker, *Filling an Arctic Gap: Legal and Regulatory Possibilities for Canadian-U.S. Cooperation in the Beaufort Sea*, 34 VT. L. REV. 57 (2009).

24. The Arctic Council describes the Arctic as “an enormous area, sprawling over one sixth of the earth's [sic] landmass; more than 30 million km² and twenty-four time zones,” with a “population of about four million, including over thirty different indigenous peoples and dozens of languages. The Arctic is a region of vast natural resources and a very clean environment compared with most areas of the world.” *About Arctic Council*, ARCTIC COUNCIL (Oct. 22, 2007), <http://arctic-council.org/article/about>. The Arctic Governance Project similarly defines the Arctic as the

circumpolar region encompassing both marine and terrestrial systems extending southward from the North Pole, covering about 8% of the Earth's surface, including areas located within the jurisdiction of eight States, providing a homeland for many indigenous peoples, and including altogether some 4 million residents. But this region is highly diverse in biophysical, socioeconomic, and cultural terms. The impacts of climate change and globalization have also intensified interactions between the Arctic and other parts of the planet.

THE ARCTIC GOVERNANCE PROJECT, ARCTIC GOVERNANCE IN AN ERA OF TRANSFORMATIVE CHANGE: CRITICAL QUESTIONS, GOVERNANCE PRINCIPLES, WAYS FORWARD: REPORT OF THE

rent governance debate. Although the Arctic Ocean is the smallest of the five oceans by over 6,000,000 square kilometers,²⁵ it is also arguably the least understood, despite the fact that more than one-quarter of the earth's entire continental shelf lies under its waters.²⁶ It is this vast area of continental shelf and the seafloor²⁷ that gives rise to the current debate, which revolves around the five coastal states²⁸ with jurisdiction claims in the Arctic, but also extends well beyond these five players to the larger interest of the global community in accessing and/or preserving the Arctic marine ecosystem.²⁹

The existing governance framework for the Arctic³⁰ involves a patchwork of bilateral, regional and international agreements, relying primarily on "soft" law,³¹ but also including key "hard" law com-

ARCTIC GOVERNANCE PROJECT 3 (2010), available at [http://img9.custompublish.com/getfile.php/1219555.1529.wyaufoxvuc/AGP+Report+April+14+2010\[1\].pdf?return=arcticgovernance.custompublish.com](http://img9.custompublish.com/getfile.php/1219555.1529.wyaufoxvuc/AGP+Report+April+14+2010[1].pdf?return=arcticgovernance.custompublish.com) [hereinafter ARCTIC GOVERNANCE].

25. *Limits of Oceans and Seas* S-23, INT'L HYDROGRAPHIC ORG. (IHO), http://www.iho-ohi.net/iho_pubs/standard/S-23/S23_Ed3_Sheet_1_Small.jpg (last visited Apr. 1, 2011); see Baker, *Law, Science, and the Continental Shelf*, *supra* note 23, at 252.

26. See Baker, *Law, Science, and the Continental Shelf*, *supra* note 23, at 252 (citing George B. Newton, *Coming to the Arctic: Oil, Ships, and LOS Convention Plus Risk and Research*, in INTERNATIONAL ENERGY POLICY, THE ARCTIC AND THE LAW OF THE SEA 321, 324 (Myron H. Nordquist et al. eds., 2005)); see also MARTIN JAKOBSSON ET AL., INTERNATIONAL BATHYMETRIC CHART OF THE ARCTIC OCEAN (IBCAO) BETA VERSION: TECHNICAL REFERENCE AND USER'S GUIDE, available at http://www.ngdc.noaa.gov/mgg/bathymetry/arctic/IBCAO_TechnicalReference.PDF.

27. Scott J. Shackelford, *Was Selden Right? The Expansion of Closed Seas and the Consequences*, 47 STAN. J. INT'L L. 2 (forthcoming 2011), available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1669737.

28. These include the United States, Russia, Canada, Norway and Denmark on behalf of Greenland. All five of these states are currently involved in efforts to map the Arctic Ocean continental shelf. See Baker, *Law, Science, and the Continental Shelf*, *supra* note 23, at 255.

29. See, e.g., Timo Koivurova, *Governance of Protected Areas in the Arctic*, 5 UTRECHT L. REV. 44 (2009).

30. For a brief overview of formal and informal governance efforts in the Arctic, see ARCTIC GOVERNANCE, *supra* note 24, at 4-5; see also PHILIP BUDZIK, U.S. ENERGY INFO. ADMIN., Arctic Oil and Natural Gas Potential (2009), available at <http://www.eia.doe.gov/oiaf/analysispaper/arctic/index.html> (providing a factual overview of the area and discussing the fact that "[j]urisdictionally, the Arctic contains portions of eight countries—Canada, Denmark (Greenland), Finland, Iceland, Norway, Russia, Sweden, and the United States. Finland and Sweden do not border the Arctic Ocean and are the only Arctic countries without jurisdictional claims in the Arctic Ocean and adjacent seas.").

31. See, e.g., Agreement Between the Government of the United States of America and the Government of the Russian Federation on the Conservation and Management of the Alaska-Chukotka Polar Bear Population, U.S.-Russ., Oct. 16, 2000, S. TREATY DOC. NO.

ponents.³² The existing governance system covers questions ranging from natural resource management,³³ to research cooperation,³⁴ territorial sovereignty,³⁵ maritime access and control,³⁶ and regulation of the deep seabed.³⁷ The extensive range of governance agreements

107-10 (2002), *available at* <http://pbsg.npolar.no/en/agreements/US-Russia.html> [hereinafter Polar Bear Population Agreement]; THE ARCTIC COUNCIL, <http://www.arctic-council.org/article/about> (established by the Ottawa Declaration of 1996 “as a high level intergovernmental forum to provide a means for promoting cooperation, coordination and interaction among the Arctic States, with the involvement of the Arctic Indigenous communities and other Arctic inhabitants on common Arctic issues, in particular issues of sustainable development and environmental protection in the Arctic”); Barents Euro-Arctic Council, Declaration: Cooperation in the Barents Euroarctic Region, Conference of Foreign Ministers in Kirkenes (Jan. 11, 1993), *available at* http://www.barentsinfo.fi/beac/docs/459_doc_KirkenesDeclaration.pdf (established in 1993 to “provide impetus to existing cooperation and consider new initiatives and proposals” in the Barents Region of the Arctic); CONSERVATION OF ARCTIC FLORA AND FAUNA PROGRAM (CAFF), <http://caff.arcticportal.org/about-caff> (last visited Apr. 1, 2011) (noting that the goals of CAFF include monitoring Arctic biodiversity, conserving Arctic species and their habitats, considering the establishment of protected areas, conserving nature outside of protected areas and integrating conservation objectives and measures for economic sectors of the society); CIRCUMPOLAR AREAS PROTECTED NETWORK (CPAN), <http://caff.arcticportal.org/expert-groups/circumpolar-protected-area-network-cpan> (last visited Apr. 1, 2011) (stating CPAN was “established in 1998 to oversee and advance the CPAN program and to provide the CAFF Board with advice on needed actions. It aims to ensure sufficient protection of all habitat types in the Arctic”). The five Arctic nations have also entered into various natural resources management regimes for reindeer, fisheries and polar bears.

32. *See, e.g.*, UNCLOS, *supra* note 4; Convention on the International Maritime Organization (IMO), art. 52, Mar. 6, 1948, 9 U.S.T. 621, 289 U.N.T.S. 48; Treaty Concerning the Archipelago of Spitsbergen, and Protocol, Paris, France, Feb. 9, 1920, 4 U.S.T. 4861, 2 L.N.T.S. 8 (the Parties to the treaty agreed to recognize Norway’s sovereignty over the Archipelago of Spitsbergen in return for a commitment from Norway to demilitarize the area and allow all Parties equal access to the area’s natural resources, encourage scientific research, and establish an equitable administrative system) [hereinafter Treaty of Spitsbergen].

33. *See, e.g.*, Polar Bear Population Agreement, *supra* note 31.

34. *See, e.g.*, Agreement Between the Government of Canada and the Government of the United States of America on Arctic Cooperation, U.S.-Can., Jan. 11, 1988, T.I.A.S. No. 11565; Agreement Between the Government of the United States of America and the Government of Canada on the Conservation of the Porcupine Caribou Herd, U.S.-Can., July 17, 1987, T.I.A.S. No. 11, 259 (this Agreement gave rise to the Plan for the International Conservation of the Porcupine Caribou Herd, *available at* http://www.taiga.net/pcmb/documents/international_conservation_plan.pdf).

35. *See, e.g.*, Treaty of Spitsbergen, *supra* note 32.

36. *See, e.g.*, UNCLOS, *supra* note 4.

37. *See id.* Part XI. *See also* James Harrison, *The International Seabed Authority and the Development of the Legal Regime for Deep Seabed Mining* (U. of Edinburgh School of

applicable to the Arctic reflects the range of issues that have challenged domestic and international affairs in the area since the end of World War II.³⁸ These past challenges, however, are rapidly being exacerbated by the effects of climate change in the area. As described by the authors of the recent report, *The Arctic Governance Challenge*, the Arctic has become a global “governance barometer in the sense that it is an area generating early indications of the growing need for innovation in governance systems worldwide.”³⁹ That is, the existing system of governance for the area falls far short of offering a roadmap for existing and future governance needs. This Article focuses on the specific governance challenge of settling outer continental shelf claims in the Arctic Ocean, but also on the long-term governance challenges which reach far beyond this issue to include far-reaching questions of human rights, environmental management⁴⁰ and maritime rights and responsibilities.⁴¹

Law Working Paper No. 2010/17, 2010), available at <http://ssrn.com/abstract=1609687> (providing an excellent overview of the issues surrounding future governance decisions of the deep seabed).

38. In contrast to the governance system that exists in Antarctica, however, the Arctic framework is piecemeal and soft. Antarctica is governed by The Protocol on Environmental Protection to the Antarctic Treaty, Oct. 4, 1991, 30 I.L.M. 1455 (1991); The Convention on the Conservation of Antarctic Marine Living Resources, May 21, 1980, 33 U.S.T. 3476, 1329 U.N.T.S. 47; The Antarctic Treaty, Dec. 1, 1959, 402 U.N.T.S. 71 (entered into force June 23, 1961).

39. ARCTIC GOVERNANCE, *supra* note 24.

40. See, e.g., Hari Osofsky, *Inuit Petition as a Bridge? Beyond Dialectics of Climate Change and Indigenous Peoples' Rights*, 31 AM. INDIAN L. REV. 675 (2007) (exploring the challenges posed to the Inuit by rapid climate change and the legal implications of the Inuit Petition to the Inter-American Human Rights Commission alleging that acts and omissions on the part of the United States violated Inuit human rights); Nobel Prize Nominee Testifies About Global Warming: Inuit Leader Sheila Watt-Cloutier's Testimony Before the Inter-American Commission on Human Rights Put Spotlight on Climate Change and Indigenous Peoples, CTR. FOR INT'L ENVTL. L. (Mar. 1, 2007) (testimony of Sheila Watt-Cloutier before Inter-American Commission on Human Rights), http://www.ciel.org/Publications/IACHR_WC_Mar07.pdf; Inuit File Petition with Inter-American Commission on Human Rights, Claiming Global Warming Caused by United States Is Destroying Their Culture and Livelihoods, CTR. FOR INT'L ENVTL. L. (Dec. 7, 2005), http://www.ciel.org/Climate/ICC_Petition_7Dec05.html.

41. See, e.g., E. J. Molenaar, *Arctic Marine Shipping: Overview of the International Legal Framework, Gaps and Options*, 18 FLA. ST. U. J. TRANSNAT'L L. & POL'Y 289 (2009).

B. Arctic Governance: UNCLOS and Beyond

As discussed above, the Arctic is currently governed by a mixture of customary international law, multilateral treaties,⁴² and a collection of regional and bilateral agreements.⁴³ Numerous complementary institutions offer overarching but soft governance institutions for the region, such as the 1991 Arctic Environmental Protection Strategy (AEPS) and the Arctic Council. The AEPS, for example, establishes action plans and working groups on particular issues, but was never intended to create a legally binding framework. Similarly, the Arctic Council was created to facilitate monitoring and implementation of AEPS, but has had limited functionality.

Recognizing potential limitations of the existing governance system, in May 2008—following Russia’s decision to plant a flag in disputed Arctic territory—the five Arctic coastal states (Canada, Russia, Denmark, Norway and the United States) with potential jurisdictional claims over the contested area of the Arctic Ocean⁴⁴ negotiated the Ilulissat Declaration.⁴⁵ The parties to the Declaration premised their negotiations on the fact that “[t]he Arctic Ocean stands at the threshold of significant changes. Climate change and the melting of ice have a potential impact on vulnerable ecosystems, the livelihoods of local inhabitants and indigenous communities, and the potential exploitation of natural resources.”⁴⁶

Noting the changing conditions in the Arctic and the possibility of overlapping jurisdictional claims raising legal disputes in the future, the parties declared that “an extensive international legal framework applies to the Arctic Ocean”⁴⁷ and that “[b]y virtue of their sovereignty, sovereign rights and jurisdiction in large areas of the Arctic Ocean the five coastal states are in a unique position to address these possibilities and challenges”⁴⁸ within the legal framework that exists. The Declaration further specifies that “the law of the sea

42. For example, UNCLOS and other law of the sea agreements, including fishery and shipping agreements.

43. See generally DONALD ROTHWELL, *THE POLAR REGIONS AND THE DEVELOPMENT OF INTERNATIONAL LAW* (1996).

44. See *Maritime Jurisdiction and Boundaries*, *supra* note 20.

45. Ilulissat Declaration, Arctic Ocean Conference, May 28, 2008, available at http://www.oceanlaw.org/downloads/arctic/Ilulissat_Declaration.pdf.

46. *Id.*

47. *Id.*

48. *Id.*

provides for important rights and obligations concerning the delineation of the outer limits of the continental shelf, the protection of the marine environment, including ice-covered areas, freedom of navigation, marine scientific research, and other uses of the sea.”⁴⁹ It continues by asserting that the legal framework offered by the law of the sea “provides a solid foundation for responsible management by the five coastal states and other users of this Ocean through national implementation and application of relevant provisions.”⁵⁰ The Parties then state that they “see no need to develop a new comprehensive international legal regime to govern the Arctic Ocean.”⁵¹

Although the Declaration contains language supporting cooperation with other non-Arctic states, the intent of the Declaration is to endorse the law of the sea⁵²—and to support Arctic and law of the sea institutions⁵³—as the framework for resolving Arctic Ocean issues, with the five Arctic coastal states serving as the key state decisionmakers in this regard. By endorsing the continuing validity of existing legal instruments as the basis for settling existing and future disputes, the five nations sought to ensure that they would maintain primary—but not exclusive⁵⁴—responsibility for managing activities in the region, including questions of development and environmental protection. In this way, the Declaration not only establishes a diplomatic framework for future peaceful negotiations, but also constitutes an effort, albeit discreet and indirect, to deter the negotiation of an alternative governance regime for the Arctic Ocean that might open governance of contested areas in the Arctic Ocean to a larger group of actors.

Thus, this is a governance issue that exists at the perimeters of existing international law. Existing treaties and governance regimes provide helpful frameworks for beginning to answer the questions, but upon closer inspection, they fall short of providing complete an-

49. *Id.*

50. *Id.*

51. *Id.*

52. The Parties’ decision to use the language of the “law of the sea” rather than to refer specifically to UNCLOS reflects the fact that the United States is not a party to UNCLOS.

53. The Parties pledge to “remain committed to this legal framework [of UNCLOS as well as the International Maritime Organization and the Arctic Council] and to the orderly settlement of any possible overlapping claims.” Ilulissat Declaration, *supra* note 45.

54. The declaration also recognizes that other states will participate in the development and protection under the provisions of international law and through the international Maritime Organization, the Arctic Council and other relevant international fora but creates the framework for ensuring that they maintain key roles. *Id.*

swers. In this regard, UNCLOS is as interesting for what it does not regulate as for what it does. In critical part, UNCLOS does not regulate areas beyond national jurisdiction, for example, the high seas, which means that—absent the settlement of continental shelf claims—much of the high seas of the Arctic are “open,” or beyond national control or international regulation. There are no well-defined, widely agreed upon guidelines for managing these areas or for protecting them from present or future misuse.

There are two pressing governance issues that arise in this context. How far do the continental shelves of the five Arctic states extend? How, and by whom, can other contested areas of the Arctic Ocean—here, focusing primarily on the seabed—be governed? UNCLOS contains numerous provisions relevant to defining and settling continental shelf claims, all of which have been the subject of critical assessment.⁵⁵ The purpose of this Article is not to undertake an exhaustive review of these provisions, but rather to provide a brief overview of relevant provisions in order to discuss how they help frame efforts to govern the Arctic.

Under UNCLOS, Part VI, Article 76(1):

The continental shelf of a coastal State comprises the seabed and subsoil of the submarine areas that extend beyond its territorial sea throughout the natural prolongation of its land territory to the outer edge of the continental margin, or to a distance of 200 nautical miles from the baselines from which the breadth of the territorial sea is measured where the outer edge of the continental margin does not extend up to that distance.⁵⁶

UNCLOS, thus, defines the continental shelf by reference to the outer edge of the continental margin, that is, the continental shelf extends either to the outer edge of the continental margin or 200 nautical miles if the continental margin⁵⁷ does not extend that far.⁵⁸

55. This Article focuses on UNCLOS Articles 76 and 77, but other articles relevant to continental shelf claims include but are not limited to: (1) Article 82, Payments and contributions with respect to the exploitation of the continental shelf beyond 200 nautical miles; (2) Article 83, Delimitation of the continental shelf between States with opposite or adjacent coasts; (3) Article 84, Charts and lists of geographical coordinates. UNCLOS, *supra* note 4, arts. 82–84.

56. *Id.* art. 76.

57. Article 76(3) defines the continental margin: “The continental margin comprises the submerged prolongation of the land mass of the coastal State, and consists of the seabed

Article 76 continues by offering guidance on how to determine the starting point for the continental margin, and thus, to establish the maximum extent of the outer⁵⁹ continental shelf.⁶⁰ In relevant part, Article 76 parts (4) to (6) establish the procedures for determining when a continental shelf claim may extend beyond 200 nautical miles up to 350 nautical miles.⁶¹

To make a claim that the continental shelf extends beyond 200 nautical miles, a party must submit information on the end of the continental shelf to the Commission on the Limits of the Continental Shelf (CLCS or Commission).⁶² The CLCS was created by the Convention and tasked with making recommendations on coastal state claims concerning the outer limits of the continental shelf where the claim extends beyond 200 nautical miles.⁶³ The Commission offers scientific and technical advice and makes recommendations to states, but its recommendations do not have direct, legally binding effect. Instead, the Commission's recommendation becomes final and bind-

and subsoil of the shelf, the slope and the rise. It does not include the deep ocean floor with its oceanic ridges or the subsoil thereof." UNCLOS, *supra* note 4, art. 76(3).

58. Harald Brekke, Scientific and Technical Guidelines of the Commission on the Limits of the Continental Shelf (unpublished presentation at 7, *available at* www.continentalshelf.org/_documents/Chapter1&2_Entitlement.ppt) (noting that "[t]he continental shelf comprises the sea-bed and subsoil" but that "the superjacent water is not included.").

59. For example, the area of the continental shelf extending as far as 350 nautical miles off the coast.

60. *See* UNCLOS, *supra* note 4, art. 76(2)–(10).

61. *Id.* art. 76(5) (specifying that the continental shelf may extend either 350 nautical miles from the baselines or 100 nautical miles from the 2,500 metre isobath, which is a line connecting the depth of 2,500 metres).

62. *Id.* art. 76(8). The purpose of the CLCS is:

to facilitate the implementation of the United Nations Convention on the Law of the Sea (the Convention) in respect of the establishment of the outer limits of the continental shelf beyond 200 nautical miles (M) from the baselines from which the breadth of the territorial sea is measured. Under the Convention, the coastal State shall establish the outer limits of its continental shelf where it extends beyond 200 M on the basis of the recommendation of the Commission. The Commission shall make recommendations to coastal States on matters related to the establishment of those limits; its recommendations and actions shall not prejudice matters relating to the delimitation of boundaries between States with opposite or adjacent coasts.

Purpose, Functions and Sessions, COMM'N ON THE LIMITS OF THE CONTINENTAL SHELF (CLCS), *available at* http://www.un.org/Depts/los/clcs_new/commission_purpose.htm (last visited Mar. 10, 2011). The functions of the CLCS are defined in Annex II to the Convention. UNCLOS, *supra* note 4, Annex II.

63. UNCLOS, *supra* note 4, art. 76(8), Annex II, art. 3.

ing once the coastal state has “established” the limit on the basis of the Commission’s recommendation.⁶⁴ In key part, however, the Commission cannot settle continental shelf claims between states with opposite or adjacent coasts.⁶⁵

Thus, if two or more states submit claims that overlap or abut, the Commission does not possess the authority to make recommendations based upon these claims, which would become legally binding if established by the coastal state. This last scenario defines the circumstances in the Arctic, where the five coastal states possess opposite and adjacent coasts, as they sit in an oval around the contested waters. Because of this unique positioning, the contested area in the high Arctic Ocean has been referred to as a potential “donut hole” because the claims of the five coastal states surround the contested waters in a near circular pattern—that is, the area is circumscribed and defined by the fact that the states are opposite and/or adjacent.⁶⁶

The ability of coastal states to establish the outer limits of their continental shelf is critical for economic and political reasons. Once the limits of a coastal state’s continental shelf are established, the state maintains exclusive sovereign rights over the continental shelf “for the purpose of exploring it and exploiting its natural resources.”⁶⁷

64. *Id.* art. 76(8). Upon establishing the Commission’s recommendation, “[t]he coastal State shall deposit with the Secretary-General of the United Nations charts and relevant information, including geodetic data, permanently describing the outer limits of its continental shelf. The Secretary-General shall give due publicity thereto.” *Id.* art. 76(9).

65. *Id.* art. 76(10); *see* United Nations Convention on the Continental Shelf, Apr. 29, 1958, 499 U.N.T.S. 311, T.I.A.S. No. 5578, art. 6, ¶ 2 [hereinafter Convention on the Continental Shelf]. The terms “opposite” and “adjacent” lend themselves to much dispute. *See, e.g.,* North Sea Continental Shelf (F.R.G. v. Den., F.R.G. v. Neth.), 1969 I.C.J. 3, ¶ 42 (Feb. 20) (determining that there is “no necessary, and certainly no complete, identity between the notions of adjacency and proximity; and therefore the question of which parts of the continental shelf ‘adjacent to’ a coastline bordering more than one State fall within the appurtenance of which of them, remains to this extent an open one, not to be determined on a basis exclusively of proximity. Even if proximity may afford one of the tests to be applied and an important one in the right conditions, it may not necessarily be the only, nor in all circumstances, the most appropriate one.”).

66. *See, e.g.,* CLIMATE GOVERNANCE IN THE ARCTIC (Timo Koivurova et al. eds., 2009) [hereinafter CLIMATE GOVERNANCE]; Molenaar, *supra* note 41, at 296. The term is also used to refer to an area in the Bering Sea with a high density of pollock.

67. UNCLOS, *supra* note 4, art. 77(1)–(3) (“The rights of the coastal State over the continental shelf do not depend on occupation, effective or notional, or on any express proclamation.”). “Non-living resources include gas and oil, gas hydrates and minerals, and living resources include bottom dwelling ‘sedentary’ species such as clams and chemo-synthetic communities such as black smokers [These resource rights] do not extend to

In the context of the Arctic Ocean, the stakes are increasingly high, as a 2008 U.S. Geological Survey (USGS) estimated that “up to a third of the world’s remaining and technically recoverable hydrocarbon reserves may be located north of the Arctic Circle,”⁶⁸ and the U.S. Energy Information Administration estimates that the Arctic could possess “about 22 percent of the world’s undiscovered conventional oil and natural gas resource base”⁶⁹ While an analysis of the above-mentioned USGS survey suggested that most of the reserves are located within the inner continental shelf (i.e., within 200 nautical miles),⁷⁰ the possibility of future reserves being discovered beyond 200 nautical miles continues to underpin efforts to secure claims to the outer continental shelf. If the Arctic coastal states were to succeed in establishing extensive outer continental shelf claims, all or nearly all of the Arctic Ocean could be divided up among the five states.⁷¹ The political and economic stakes surrounding the establishment of outer continental shelf claims in the Arctic have always been high; the rapid watershed changes brought about by climate change makes them that much higher.

In order to establish extended continental shelf claims via the CLCS, coastal states must first ratify UNCLOS, then submit any claims beyond 200 nautical miles to the CLCS to receive recommendations.⁷² Upon ratification of UNCLOS, coastal states have ten years to make claims to an extended continental shelf.⁷³ Once the Commission has issued recommendations on the claims, the coastal

resources in the water column such as fish stocks” Baker, *Law, Science, and the Continental Shelf*, *supra* note 23, at 256–57.

68. Baker, *Law, Science, and the Continental Shelf*, *supra* note 23, at 257 (citing Donald L. Gautier et al., *Assessment of the Undiscovered Oil and Gas in the Arctic*, 324 SCI. 1175, 1176 (2009)); see U.S. GEOLOGICAL SURVEY, CIRCUM-ARCTIC RESOURCE APPRAISAL: ESTIMATES OF UNDISCOVERED OIL AND GAS NORTH OF THE ARCTIC CIRCLE (Peter H. Stauffer ed., 2008), available at <http://pubs.usgs.gov/fs/2008/3049/fs2008-3049.pdf>.

69. BUDZIK, *supra* note 30, at 6.

70. Baker, *Law, Science, and the Continental Shelf*, *supra* note 23, at 257 (citing Donald L. Gautier et al., *Assessment of the Undiscovered Oil and Gas in the Arctic*, 324 SCI. 1175, 1176 (2009)).

71. Scott J. Shackelford, *The Tragedy of the Common Heritage of Mankind*, 28 STAN. ENVTL. L.J. 109, 132 (2009).

72. A state that is not a party to the Convention arguably maintains the same rights to its extended continental shelf under customary international law but is unable to establish and settle any claims to these rights using the mechanisms available under the Convention.

73. UNCLOS, *supra* note 4, Annex II: Commission on the Limits of the Continental Shelf, art. 4.

states must settle any disputes that arise between them based upon the recommendations.⁷⁴

Of the five Arctic coastal states, all but the United States are party to the Convention.⁷⁵ In accordance with the terms of the Convention, in 2001⁷⁶ and 2005,⁷⁷ respectively, Russia and Norway submitted claims to the Commission regarding outer continental shelf claims in the Central Arctic Ocean and elsewhere. The Commission submitted its recommendations to Russia in 2002 and Norway in 2009. In reference to Russia's extended claims in the Central Arctic Ocean, the Commission recommended that Russia "make a revised submission in respect of its extended continental shelf in that area,"⁷⁸ leaving open the question of Russia's claims for the time being since it has not yet made a revised submission. In reference to Norway's claims,⁷⁹ the Commission recommended that Norway establish its extended claims as proposed, but noted that "delineation of the final outer limits of the continental shelf of Norway . . . may depend on delimitation between States."⁸⁰ Neither Canada nor Denmark has yet

74. *Id.* art. 8.

75. Norway ratified the Convention in 1996; Russia ratified the Convention in 1997; Canada ratified the Convention in 2003; Denmark ratified the Convention in 2004. *United Nations Convention on the Law of the Sea, Table of Ratifications/Accessions etc.*, http://un.org/Depts/los/reference_files/status2010.pdf.

Prior to the negotiation of UNCLOS, in the 1945 Truman Declaration (Sept. 28, 1945), the United States laid the foundation for current debate declaring that the Government of the United States "regards the natural resources of the subsoil and sea bed of the continental shelf beneath the high seas but contiguous to the coasts of the United States, subject to jurisdiction and control." Proclamation No. 2667, 3 C.F.R. 67 (1945).

76. *Outer Limits of the Continental Shelf Beyond 200 Nautical Miles from the Baselines: Submissions to the Commission: Submission by the Russian Federation*, U.N. COMM'N ON THE LIMITS OF THE CONTINENTAL SHELF (June 30, 2009), http://www.un.org/Depts/los/clcs_new/submissions_files/submission_rus.htm.

77. *Outer Limits of the Continental Shelf Beyond 200 Nautical Miles from the Baselines: Submissions to the Commission: Submission by the Kingdom of Norway*, U.N. COMM'N ON THE LIMITS OF THE CONTINENTAL SHELF (Aug. 20, 2009), http://www.un.org/Depts/los/clcs_new/submissions_files/submission_nor.htm#Recommendations_.

78. U.N. Secretary-General, *Oceans and the Law of the Sea: Rep. of the Secretary-General*, ¶ 41, U.N. Doc. A/57/57/Add.1 (Oct. 8, 2002), available at <http://daccess-dds-ny.un.org/doc/UNDOC/GEN/N02/629/28/PDF/N0262928.pdf?OpenElement>.

79. Comm'n on the Limits of the Continental Shelf, *Summary of the Recommendations of the Commission on the Limits of the Continental Shelf in Regard to the Submission Made by Norway in Respect of Areas in the Arctic Ocean, the Barents Sea and the Norwegian Sea on 27 November 2006*, Annex VI (Mar. 27, 2009), http://www.un.org/Depts/los/clcs_new/submissions_files/nor06/nor_rec_summ.pdf.

80. *Id.* at 16. The Commission acknowledges Norway's claim that

submitted their claims. Based on dates of accession to the Convention, Canada has until 2013 and Denmark has until 2014 to submit their claims. All five coastal states, including the United States, are actively engaged in efforts to map their extended continental shelves.⁸¹

If any of the five coastal states disagree with a recommendation issued by the Commission and/or are unable to settle a dispute concerning delimitation of the outer continental shelf at a point involving conflicting state claims under the terms of the Convention, the parties to the dispute would have to turn to alternative means of dispute settlement. The logical outlet for such a dispute is the International Court of Justice (ICJ).

In 1969, prior to the negotiation of UNCLOS, the ICJ heard two cases related to the delimitation of the continental shelf between Germany and the Netherlands and between Germany and Denmark. In the *North Sea Continental Shelf Cases*,⁸² the parties to the dispute asked the ICJ “to state the principles and rules of international law applicable, and undertook thereafter to carry out the delimitations⁸³ on that basis.”⁸⁴ Denmark and the Netherlands contended that the delimitation of the continental shelf claims must be carried out in ac-

[n]otwithstanding this submission, Norway still reserves the right to make use of the westernmost fixed formula point of the outer limit of the continental shelf of the Russian Federation as its easternmost connecting point, at the time when such point is formally deposited with the Secretary-General by the Russian Federation.

Id. at 15 (quoting Norway’s statement in NOR-DOC-027-24-11-2008).

81. See, e.g., *U.S. Extended Continental Shelf Project*, U.S. DEP’T OF STATE, <http://www.state.gov/g/oes/continentalshelf/index.htm> (last visited Mar. 10, 2011) (“Since 2001, U.S. agencies have been engaged in gathering and analyzing data to determine the outer limits of the U.S. ECS.”).

82. *North Sea Continental Shelf* (F.R.G. v. Den., F.R.G. v. Neth.), 1969 I.C.J. 3 (Feb. 20).

83. The ICJ defines “delimiting” thus:

Delimitation is a process which involves establishing the boundaries of an area already, in principle, appertaining to the coastal State and not the determination *de novo* of such an area. Delimitation in an equitable manner is one thing, but not the same thing as awarding a just and equitable share of a previously undelimited area, even though in a number of cases the results may be comparable, or even identical.

Id. ¶ 18.

84. SUMMARIES OF JUDGMENTS, ADVISORY OPINIONS, AND ORDERS OF THE INTERNATIONAL COURT OF JUSTICE: 1948–1991, at 72 (2002), available at <http://www.icj-cij.org/docket/files/52/5563.pdf> [hereinafter ICJ SUMMARY OF JUDGMENTS].

cordance with the principle of equidistance,⁸⁵ as defined in Article 6 of the 1958 Geneva Convention on the Continental Shelf.⁸⁶ The court rejected this claim first, because Germany was not a party to that Convention and was, thus, not bound by its terms, and second, because the court found that the equidistance principle was a conventional rule that had not crystallized into a rule of customary international law.⁸⁷ In relevant part, the ICJ “held that each Party had an original right to those areas of the continental shelf which constituted the natural prolongation of its land territory into and under the sea. It was not a question of apportioning or sharing out those areas, but of delimiting them.”⁸⁸ The court further determined that “the boundary lines in question were to be drawn by agreement between the Parties and in accordance with equitable principles.”⁸⁹ To this end, the court directed the parties to resolve the dispute in accordance with equitable principles,⁹⁰

85. One example of this would be closest proximity.

86. Convention on the Continental Shelf, *supra* note 65, art. 6, ¶ 2. The Convention declares that the continental shelf extends “to where the depth of the superjacent water admits of the exploitation of the natural resources.” *Id.* Additionally, article 6, paragraphs 1 and 2 specify that:

1. Where the same continental shelf is adjacent to the territories of two or more States whose coasts are opposite each other, the boundary of the continental shelf appertaining to such States shall be determined by agreement between them. In the absence of agreement, and unless another boundary line is justified by special circumstances, the boundary is the median line, every point of which is equidistant from the nearest point of the baselines from which the breadth of the territorial sea of each State is measured.

2. Where the same continental shelf is adjacent to the territories of two adjacent States, the boundary of the continental shelf shall be determined by agreement between them. In the absence of agreement, and unless another boundary line is justified by special circumstances, the boundary shall be determined by application of the principle of equidistance from the nearest points of the baselines from which the breadth of the territorial sea of each State is measured.

Id. art. 6, ¶¶ 1–2.

87. *North Sea Continental Shelf*, 1969 I.C.J. ¶ 62.

88. ICJ SUMMARY OF JUDGMENTS, *supra* note 84, at 72.

89. *Id.*

90. *North Sea Continental Shelf*, 1969 I.C.J. ¶ 85. In considering how to resolve the issue, the court weighed the following factors:

(a) the parties are under an obligation to enter into negotiations with a view to arriving at an agreement, and not merely to go through a formal process of negotiation as a sort of prior condition for the automatic application of a certain method of delimitation in the absence of agreement; they are under an obligation so to conduct themselves that the negotiations are meaningful, which will not be the case when either of them insists upon its own position without contemplating any modification of it;

and taking account of all the relevant circumstances, in such a way as to leave as much as possible to each Party all those parts of the continental shelf that constitute a natural prolongation of its land territory into and under the sea, without encroachment on the natural prolongation of the land territory of the other.⁹¹

The court further determined that, in using these principles, “the delimitation leaves to the Parties areas that overlap[;] these are to be divided between them in agreed proportions or, failing agreement, equally, unless they decide on a régime of joint jurisdiction, user, or exploitation for the zones of overlap or any part of them.”⁹² Based upon the court’s findings, the parties were then tasked with entering into negotiations so as to reach agreement upon the boundaries on the basis of the equitable principles noted by the court. Following the decision by the ICJ, Denmark, Norway and Germany entered into tripartite negotiations and, in 1971, negotiated two bilateral treaties delimiting the North Sea continental shelf boundaries as between Germany and Denmark and Germany and the Netherlands.⁹³

The court’s decision in this case, although predating UNCLOS, offers insight into how it might consider future continental shelf boundary disputes that arise either based upon CLCS recommendations or as between a party to the LOS Convention and a non-party, e.g., the United States. In this regard, the *North Sea Continental Shelf Cases* suggest that the court would require the parties to the dispute to utilize equitable principles as the basis for undertaking a good faith effort to agree upon boundaries. However, given the existence of UNCLOS, the CLCS, and the LOS dispute settlement mechanisms, the court would also likely carefully consider and offer

(b) the parties are under an obligation to act in such a way that, in the particular case, and taking all the circumstances into account, equitable principles are applied—for this purpose the equidistance method can be used, but other methods exist and may be employed, alone or in combination, according to the areas involved;

(c) for the reasons given in paragraphs 43 and 44, the continental shelf of any State must be the natural prolongation of its land territory and must not encroach upon what is the natural prolongation of the territory of another State.

Id.

91. *Id.* ¶ 101.

92. *Id.*

93. See Treaty Between the Kingdom of Denmark and the Federal Republic of Germany Concerning the Delimitation of the Continental Shelf Under the North Sea, F.R.G.-Den., Jan. 28, 1971, 857 U.N.T.S. 109; Treaty Between the Kingdom of the Netherlands and the Federal Republic of Germany Concerning the Delimitation of the Continental Shelf Under the North Sea, F.R.G.-Neth., Jan. 28, 1971, 857 U.N.T.S. 131 (1973).

significant deference to the procedures established by UNCLOS to settle boundary claims. In the *North Sea Continental Shelf Cases*, the court carefully considered the work done by the International Law Commission⁹⁴ on the issue of continental shelf claims, as well as the terms of the Geneva Convention of 1958 on the Continental Shelf. UNCLOS offers a more detailed and issue-specific legal framework than existed at the time of the *North Sea Continental Shelf Cases*, suggesting that the court would give significant weight to a decision issued via the institutions of UNCLOS.

Looking forward, however, one central question that the court might be asked to consider is whether allowing extensive claims that result in most, if not all, of the Arctic Ocean's continental shelf being absorbed by the five Arctic coastal states is contrary to the common good, or violates the principle of the common heritage of mankind. That is, the court might be asked to consider whether key Arctic Ocean governance questions should, in fact, revolve around the interests of the five Arctic coastal states, or be rethought and expanded in reference either to the principle of the "common heritage of mankind," as applied to the high seas and the moon, or the principle of "common concern" as applied to climate change and conservation of biological diversity. If so, does the court have a valid avenue for asking and answering these questions under existing international law? And, if not, is this a question that should be considered by the global community as a pressing question of global governance before the point at which this question is directed to the ICJ, which necessarily approaches the question using a much narrower legal lens?

Thus, the question that is now presented to the global community is whether, based upon our improved understanding of the important role that the Arctic plays in the processes of global change, as well as our increased understanding of the impacts of shipping, tourism and resource extraction on the already fragile Arctic ecosystem—and the people who depend upon it—should the global community find a way to ensure that these questions are thought through based on environmental, economical, and social-cultural grounds now rather than on more narrow cartography grounds later?

The ability of the ICJ or another institution to rethink the validity of the continental shelf governance regime created by UNCLOS is limited. The preamble to UNCLOS declares that the

94. See *North Sea Continental Shelf*, 1969 I.C.J. ¶¶ 62–70. In considering the relevant principles of equity and the history of international law on the delimitation of the continental shelf between adjacent states, the court also referred to the International Law Commission's consideration of the matter between 1950–56. *Id.*

“area of the seabed and ocean floor and the subsoil thereof, beyond the limits of national jurisdiction, as well as its resources, are the common heritage of mankind, the exploration and exploitation of which shall be carried out for the benefit of mankind as a whole, irrespective of the geographical location of States.”⁹⁵ The body of the Convention further determines that “the Area”⁹⁶ and its resources are the common heritage of mankind,⁹⁷ and that “[a]ll rights in the resources of the Area are vested in mankind as a whole, on whose behalf the Authority shall act.”⁹⁸ Expanding upon this idea, Article 155(2) determines that 15 years from January 1 of the year in which the first commercial production commences under an approved plan of work in the Area the Assembly shall convene a conference to review the provisions related to the Area. In relevant part, the Conference shall be tasked to “ensure the maintenance of the principle of the common heritage of mankind, the international regime designed to ensure equitable exploitation of the resources of the Area for the benefit of all countries, especially the developing States, and an Authority to organize, conduct and control activities in the Area.”⁹⁹

The notion of common heritage, thus, is invoked under UNCLOS as the guiding principle for regulating areas of the ocean floor beyond 200–350 nautical miles,¹⁰⁰ that is, beyond the boundaries of established continental shelf limits. Yet, in expanding upon the notion of common heritage, the terms of the Convention determine that the principle of common heritage refers to ensuring that

95. UNCLOS, *supra* note 4, pmb1.

96. The Area “includes the seabed and ocean floor and subsoil thereof, beyond the limits of national jurisdiction.” *Id.* art. 1(1).

97. *Id.* art. 136.

98. *Id.* art. 137. In full, Article 137 determines that:

1. No State shall claim or exercise sovereignty or sovereign rights over any part of the Area or its resources, nor shall any State or natural or juridical person appropriate any part thereof. No such claim or exercise of sovereignty or sovereign rights nor such appropriation shall be recognized.

2. All rights in the resources of the Area are vested in mankind as a whole, on whose behalf the Authority shall act. These resources are not subject to alienation. The minerals recovered from the Area, however, may only be alienated in accordance with this Part and the rules, regulations and procedures of the Authority.

3. No State or natural or juridical person shall claim, acquire or exercise rights with respect to the minerals recovered from the Area except in accordance with this Part. Otherwise, no such claim, acquisition or exercise of such rights shall be recognized.

Id.

99. *Id.* art. 155(2).

100. *Id.* art. 136.

exploitation is equitable. In this respect, the principle of the common heritage of mankind is often contrasted with the principle of common concern. As embedded in the UN Framework Convention on Climate Change¹⁰¹ and the UN Convention on Biological Diversity,¹⁰² the principle of common concern to humankind is premised on a common responsibility to protect, and a legal interest in not harming,¹⁰³ a particular environmental resource where the resource is “shared, under the control of no state, or under the sovereign control of a state, but subject to a common legal interest,”¹⁰⁴ whereas the principle of common heritage revolves around notions of exploitation rather than conservation. And, while it might offer a starting point for ensuring that management of the Arctic seabed based on principles of multilateral governance,¹⁰⁵ it also creates the parameters for a system of multilateral governance premised on the acceptability of resource exploitation.

In light of current environmental stressors and increased awareness of the dangers of deep sea resource exploitation, a governance system premised on the acceptability of equitable exploitation is arguably outdated. Further, while UNCLOS creates a basic framework for governing the deep seabed, this system is fragmented. The existing system does not offer a comprehensive governance system for the larger range of social, environmental and economic issues that face the Arctic in either the short or long term. Neither does it allow for a full range of issues to be considered when making decisions relevant to LOS-specific issues.

101. United Nations Framework Convention on Climate Change, pmbl. para. 1, U.N. Doc. FCCC/CP/1997/7/Add.1, Dec. 10, 1997, 37 I.L.M. 22 (1998) [hereinafter UNFCCC]; see also G.A. Res. 45/212, U.N. Doc. A/RES/45/212 (Dec. 21, 1990) (determining that climate change is a “common concern of mankind” and rejecting previous proposals to denote the global climate as the “common heritage of mankind”); G.A. Res. 44/207, U.N. Doc. A/RES/44/207 (Dec. 22, 1989); G.A. Res. 43/53, U.N. Doc. A/RES/43/53 (Dec. 6, 1988).

102. Convention on Biological Diversity pmbl. para. 3, June 5, 1992, 1760 U.N.T.S. 79, available at <http://www.cbd.int/doc/legal/cbd-en.pdf> [hereinafter CBD].

103. See PHILIPPE SANDS, PRINCIPLES OF INTERNATIONAL ENVIRONMENTAL LAW 287 (2003) (1995).

104. Centre for International Sustainable Development Law, *The Principle of Common but Differentiated Responsibilities: Origins and Scope* 1 (Centre for International Sustainable Development Working Paper and Legal Brief Series, 2002), available at http://www.cisd.org/pdf/brief_common.pdf (last visited Apr. 1, 2011).

105. Schackelford, *supra* note 71, at 127–28.

Given the fragmented and incomplete system that governs the Arctic, there is an urgent need to rethink both the principles and the institutions governing the Arctic region.¹⁰⁶

C. Rethinking Arctic Governance

The current system of governance in the Arctic combines elements of customary international law, treaty law and soft law. The pieces of these various regimes, however, are fragmented and ill-fitting. They do not piece together to form a functional whole. Moving forward, there is little doubt that the global community must construct a better governance system, and the necessary starting point for these efforts must be choosing an overarching governance pathway.

The problems inherent to the negotiation, implementation and enforcement of international environmental law are well documented, and the recent struggles—arguably, failures—within the climate regime are testament to these weaknesses. The international community, thus, must choose between two imperfect courses: (1) using the existing Arctic governance system as a platform for developing a flexible, joined-up but soft system of governance; or (2) attempting to begin a new global negotiating process with the end goal of creating a framework treaty.

Given the absence of consensus concerning the future of the global climate change regime and daunting levels of conflict and inertia confronting the global community not only on the question of climate change, but also on key questions of international environmental law relating to, for example, whaling,¹⁰⁷ biodiversity protection¹⁰⁸ and food safety,¹⁰⁹ there is a strong argument to be made for

106. This is true regardless of the level of cooperation exhibited by the Arctic coastal states. See Baker, *Law, Science, and the Continental Shelf*, *supra* note 23, at 252–53 (arguing that the Arctic coastal states are exhibiting high levels of cooperation and that the media is vastly overstating the potential for conflict).

107. See e.g., Int'l Whaling Comm. [IWC], Details for the International Whaling Commission's 62nd Annual Meeting June 21–25, 2010 (2010), available at <http://iwcoffice.org/meetings/meeting2010.htm> (detailing the inability of the Parties to reach consensus on the Future of the IWC, with particular regard to the status of the Revised Management Scheme and the Moratorium on Commercial Whaling).

108. See, e.g., Juliet Eilperin, *Only One Breed of Shark, the Porbeagle, Earns Protection at CITES Conference*, WASH. POST, Mar. 24, 2010, <http://www.washingtonpost.com/wp-dyn/content/article/2010/03/23/AR2010032300667.html>; Juliet Eilperin, *Tuna, Polar Bear Protections Rejected*, WASH. POST, Mar. 18, 2010, http://views.washingtonpost.com/climate-change/post-carbon/2010/03/polar_bear_protections_rejected.html.

using a soft law approach to try to restructure global governance in the Arctic.¹¹⁰ That is, one might rightfully question whether the current political climate supports efforts to negotiate yet another multilateral environmental agreement that would bridge gaps between existing treaties, e.g., the United Nations Framework Convention on Climate Change (UNFCCC)¹¹¹ and UNCLOS, and existing soft law governance systems, e.g., the Arctic Council. The collective action problems currently plaguing UNFCCC and other global environmental law deliberations coupled with ongoing economic recession in much of the world creates a hostile environment in which to attempt to garner support for the creation of yet another global treaty regime.

Despite these obstacles, a new governance system premised on notions of stewardship and sustainability is needed, and the timeframe for its creation is short. Given the pace of environmental change and increasing levels of interest—from the Arctic coastal states and other members of the global community—in management of the Arctic Ocean, whether for purposes of environmental conservation, tourism, resource exploitation, shipping or defense, there is an urgent need to create new institutional mechanisms for governing the area. Further, despite the difficult political and economic climate, it would be unwise to rule out the possibility of instigating multilateral treaty negotiations as an avenue for crafting a new governance framework. In the case of the Arctic, there are a series of distinct problems, involving questions of continental shelf claims, maritime access and environmental management that require immediate attention.

Yet, underlying these issue-specific questions is the need to define the overarching principles the global community will use to decide questions of Arctic governance. At the moment, these principles are undefined, and their absence impedes efforts to bridge the gaps and inconsistencies among the existing elements of the Arctic governance system.

To this end, the authors of the Arctic Governance Council Report suggest that the notion of stewardship should be adopted as the overarching goal guiding Arctic governance and that new gov-

109. See, e.g., *SPS Agreement Training Module: Chapter 5, Implementation—Dispute Settlement*, 5.2 *The SPS Disputes*, WORLD TRADE ORGANIZATION, available at http://www.wto.org/english/tratop_e/sps_e/sps_agreement_cbt_e/c5s2p1_e.htm (last visited Apr. 1, 2011) (detailing the various settled and pending disputes under the sanitary and phytosanitary measures (SPS), the majority of which involve questions of food safety).

110. See generally CLIMATE GOVERNANCE, *supra* note 66.

111. UNFCCC, *supra* note 101.

ernance institutions should be built using a “suite of distinct but interlocking arrangements that address a number of concerns simultaneously.”¹¹² The series of arrangements must also include the following fundamental elements:

[They] must respect the rights of those who have a unique and long-standing relationship with the region’s natural environment; be sensitive to the interests of future generations; make good use of traditional as well as mainstream scientific knowledge, and apply holistic or integrative methods (e.g. ecosystem-based management, spatial planning, comprehensive environmental impact assessment) as a basis for making decisions about using the Arctic’s natural resources in a responsible and sustainable manner.¹¹³

This piecemeal approach, the authors suggest, offers not only greater flexibility to address the host of issues plaguing the Arctic, but also greater consistency based upon the enunciation of a set of fundamental principles/norms of governance. Such an approach offers numerous benefits, including the ability to triage governance issues, taking the most pressing issues first while taking more time to consider issues raising more complex, long-term problems.

Further, by working on the basis of a suite of arrangements, the global community could begin by addressing more circumscribed, and less politically contentious, issues first and then use these arrangements as stepping stones for negotiating solutions to more complex governance questions. In addition, by utilizing a soft law approach—as opposed to trying to negotiate a framework convention and a series of protocols—the most directly affected members of the global community, that is, the indigenous peoples of the Arctic, could be more actively involved in the decisionmaking process.

Yet, such an approach also has drawbacks. To begin, the proposed system would lack the normative status of a legally binding agreement, enforceability and a high level of political visibility, as has been the case with the Arctic Council and other pre-existing soft governance institutions in the Arctic.

The authors of the Report are not oblivious to the differences between a system of governance based on a legally binding treaty

112. See ARCTIC GOVERNANCE, *supra* note 24, at 5.

113. *Id.* at 5–6.

versus one based on a “suite of arrangements.” They argue, however, that “there is little prospect that an integrated system of Arctic governance based on a comprehensive and legally binding treaty will emerge” in the near future and that given this reality, “[w]hat is needed is a strategy that builds on success and features a suitable division of labor in which individual bodies do what they are able to do best, functional overlaps are addressed, and gaps in the existing architecture of governance are filled.”¹¹⁴ Their position is not unreasonable.

For the reasons mentioned, the odds are against the global community building the momentum to negotiate a new Arctic treaty system, and the recent negotiation of the Ilulissat Declaration makes it clear that the five Arctic coastal states would be reluctant to abandon existing legal institutions and the principles they sustain (e.g., common heritage) to negotiate a new treaty system that, in all likelihood, would constrain their present level of dominion in the area.

Setting aside for a moment the inherent difficulties, there are significant benefits associated with efforts to create a new treaty system. Treaty negotiations offer the most effective forum for bringing together members of the global community to debate the long-term governance goals for the area and to develop a framework convention that establishes agreed-upon governance principles and lays the foundation for future international negotiations. Absent this traditional negotiating process, it is unlikely that the global community can formulate a comprehensive set of principles and goals for Arctic governance. And, absent consensus arrived at through international negotiations, key members of the global community would be unlikely to support the evolving governance system; the system would be vulnerable to violation or being rendered irrelevant.

If the global community were to pursue treaty negotiations, it could look to the Antarctic treaty system as a model of peaceful governance.¹¹⁵ The legal regime in the Antarctic is based upon a combination of several treaties specific to the peaceful utilization of the area and the sustainable management of its resources.¹¹⁶ The Antarctic

114. *Id.* at 10.

115. See, e.g., ROTHWELL, *supra* note 43, at 11. Rothwell argues that the Antarctic treaty system offers a helpful model because: (1) it did not seek to resolve existing sovereignty disputes, resulting in operating in harmony with other states; (2) it promoted freedom of scientific research and international cooperation; (3) it placed emphasis on the protection and management of the Antarctic environment; and (4) it used a bi-focal approach to sovereignty for contested claims and uncontested claims. *Id.*

116. See The Protocol on Environmental Protection to the Antarctic Treaty, Oct. 4, 1991, 12 U.S.T. 794, 30 I.L.M. 1455; The Convention on the Conservation of Antarctic

treaty system was developed shortly after World War II in an effort to designate the Continent as a place of common interest to the global community and to ensure it would be used exclusively for peaceful purposes.¹¹⁷ It was subsequently supplemented by two Protocols designed to ensure the continuing protection of the environment and the living resources in the area.

The divergent governance systems established for the Arctic and Antarctic reflect significant differences in terms of territorial abutment, i.e., unlike the Arctic, where eight states have territory—and sovereign jurisdiction—that extends into the Arctic, Antarctica does not directly overlap with the primary territory of any state.¹¹⁸ Thus, while the Antarctic treaty system offers a useful model, the value of the model is limited not only by geographic and jurisdictional distinctions but also by the fact that the two areas have historically followed divergent legal pathways.

Antarctica has been governed primarily by international law since World War II, but the Arctic is governed by a patchwork system of national, bilateral, regional and international agreements of varying legal character. For this reason, an Arctic treaty system would look appreciably different from the system that exists in Antarctica. For instance, such a treaty would have to protect clearly established, territorial claims.¹¹⁹ At the same time, it would have to

Marine Living Resources, May 21, 1980, 1329 U.N.T.S. 47; The Antarctic Treaty, Dec. 1 1959, 402 U.N.T.S. 71.

117. Following World War II, the interest of the global community in designating Antarctica as a peaceful territory vital to global scientific research and preservation trumped competing interests in pursuing jurisdictional claims over the territory for purposes of political maneuvering and resource extraction.

118. Nor does Antarctica contain any native peoples that live under the jurisdiction of a state. However, Antarctica is subject to increasing numbers of coastal state claims asserting jurisdiction over areas of the continental shelf in the Southern Ocean. By April 2009, the CLCS had received twenty-one submissions from coastal States making jurisdictional claims in the Southern Ocean. *The Continental Shelf and the UN Process*, U.K. FOREIGN & COMMONWEALTH OFFICE, Apr. 8, 2009, available at <http://www.fco.gov.uk/en/news/latest-news/?view=News&id=16346920>; see also Anna Homan, *Maritime Zones in Antarctica*, 20 AUSTRL. & N.Z. MARITIME L.J. 69 (2006), available at <https://maritimejournal.murdoch.edu.au/index.php/maritimejournal/article/viewFile/21/44> (offering a concise overview of the legal challenges associated with Coastal States' efforts to establish sovereignty over maritime zones in the Southern Ocean); *Annual Antarctic Treaty Conference Opens Monday in Uruguay*, MERCOPRESS (May 3, 2010), available at <http://en.mercopress.com/2010/05/03/annual-antarctic-treaty-conference-opens-monday-in-uruguay>; Owen Bocott, *Britain To Claim More than 1M Sq Km of Antarctica*, THE GUARDIAN (U.K.), Oct. 17, 2007, <http://www.guardian.co.uk/news/2007/oct/17/antarctica.sciencenews>.

119. ROTHWELL, *supra* note 43, at 12.

provide that actions occurring while the treaty is in force would not affect disputed territorial claims one way or another (e.g., continental shelf claims disputed under UNCLOS).¹²⁰ Further, as previously discussed, the treaty would have to establish guiding principles for issues ranging from conservation and resource usage to tourism and travel in order to guide future decision making. Additionally, given the need and desire for multilateralism in the context of Arctic governance, participation by the five Arctic coastal states would be central to the functioning of any treaty, but the treaty would necessarily have to be open to participation by other countries with interests in the area. Finally, the overlap with existing soft and hard law institutions would require extensive cooperation among the Secretariats or relative administrative units of these existing governance institutions to ensure the long-term success of the new regime.

If the global community were able to negotiate a framework treaty that established a series of fundamental guiding principles and addressed key questions of sovereignty, long-term governance and dispute resolution, it would provide a platform for making specific governance decisions in a transparent and accountable manner. Yet, as vividly demonstrated by the ongoing debate in the UNFCCC, the existence of a framework convention neither ensures that governance efforts will be successful, nor that the compromises necessary to achieve consensus will outweigh the benefits of multilateralism.

The herculean struggles within the climate arena to negotiate a collectively agreed response to climate change are testament to weaknesses within the larger system of international environmental law. As previously discussed, the international community must choose between two imperfect courses: (1) using the existing Arctic governance system as a platform for developing a flexible, joined but soft system of governance; or (2) attempting to begin a new global negotiating process with the end goal of creating a framework treaty.

A comprehensive, legally binding treaty that redefines the Arctic as an area of common concern to mankind and that establishes a set of commonly defined management goals and a strong institution to oversee the implementation and enforcement of the treaty offers an ideal pathway. Yet, history and common sense dictate that, at this particular moment in time, this is not a viable option. The political and economic stakes are too high for the Arctic coastal states to abandon the pathway laid out in the Ilulissat Declaration. The political deadlock in international climate negotiations has become too entrenched. It is unlikely that compromise and progress will be forth-

120. *Id.*

coming or that political ill-will will be limited to the parameters of the climate regime. Ongoing struggles to define a commonly accepted set of principles of international environmental law suggest that the principle of common concern continues to lack the normative status to be carried over into a contentious political context. Powerful private interests keen to exploit untapped reserves of natural resources continue to possess great sway over the political process in developed and developing countries alike. Finally, global politics are undergoing a transformative shift whereby the long-standing political order in place since World War II is in flux, and once powerful states, such as the United States and the United Kingdom, are increasingly ceding political and economic power to the rapidly developing economies.¹²¹ With the shift in both the global economy and political realities and with developed and developing countries using political trump cards in the global climate change regime, there is no longer a single state or bloc of states that has displayed either the ability or the willingness to lead a charge for a new Arctic treaty regime.

The possibility of an Arctic treaty regime should not be abandoned. However, the likelihood of such a regime coming into existence in the future should not delay efforts to improve Arctic governance in the short term. The physical, economic and social changes taking place in the Arctic are immediate and ongoing.¹²² For the Arctic, climate change is not a process to be anticipated; it is a reality of modern existence. The governance challenges the Arctic faces require immediate response. For this reason, the global community must take advantage of the institutions that exist, attempt to improve their consistency and expand upon them. In this regard, the suggested notion of stewardship offers a positive and realistic goal. Stewardship is neither inconsistent with sovereignty nor is it inconsistent with sustainability or a duty not to harm. If the global community cannot identify the Arctic as an area of common concern to mankind, perhaps it can agree to govern the Arctic based on the notion of stewardship and informed by a respect for sustainability and inter-generational rights.

121. Cinnamon Carlarne, *The Glue That Binds or the Straw That Broke the Camel's Back?: Exploring the Implications of U.S. Reengagement in Global Climate Change Negotiations*, 19 TUL. J. INT'L & COMP. L. 113 (2010).

122. ARCTIC REPORT CARD: UPDATE FOR 2010, TRACKING RECENT ENVIRONMENTAL CHANGES (J. Richter-Menge & J.E. Overland, eds., 2010), available at http://www.arctic.noaa.gov/reportcard/ArcticReportCard_full_report.pdf.

The governance challenges plaguing the Arctic are a product of geography and history exacerbated by the processes of climate change. In contrast, the governance challenges surrounding geoengineering involve novel questions of law, defy geographical boundaries and exist primarily because of climate change. Yet, in both cases, the global community is pressed to respond in real time. Both Arctic and geoengineering governance problems concern the entire global community, implicate sensitive questions of sovereignty, raise questions of inter-generational rights and involve vested private interests. In the case of geoengineering, the global community has the opportunity to develop a governance regime from scratch—a rare opportunity.

III. THE GEOENGINEERING GOVERNANCE GAP

Geoengineering is a term that refers to “planetary-scale, active interventions in the climate system to offset the build-up of greenhouse gases.”¹²³ While geoengineering is a very broad term that can be used to cover numerous techniques and technologies, most geoengineering techniques fall under one of two broad categories: (1) efforts to remove CO₂ from the atmosphere, e.g., carbon storage and sequestration, or (2) efforts to reduce the amount of sunlight reaching the earth, e.g., the injection of sulphate aerosols into the stratosphere.¹²⁴ The majority of existing geoengineering proposals emphasize the latter, i.e., efforts to reduce the amount of sunlight reaching the earth or to increase the reflectivity (albedo) of the planet.¹²⁵

123. David G. Victor, *On the Regulation of Geoengineering*, 24 OXFORD REV. ECON. POL’Y 322, 323 (2008). The UK House of Commons Science and Technology Committee similarly defines geoengineering as “activities specifically and deliberately designed to effect a change in the global climate with the aim of minimising or reversing anthropogenic (that is human caused) climate change.” SCIENCE & TECHNOLOGY COMMITTEE, *THE REGULATION OF GEOENGINEERING: FIFTH REPORT OF SESSION 2009–10, 2010*, H.C. 221, at 3 (U.K.) [hereinafter HOUSE OF COMMONS REPORT].

124. See, e.g., HOUSE OF COMMONS REPORT, *supra* note 123, at 13; Victor, *supra* note 123, at 323; see also Gareth T. Davies, Law and Policy Issues of Unilateral Geoengineering: Moving to a Managed World (Jan. 29, 2009) (working paper), available at <http://ssrn.com/abstract=1334625>. MacCracken would add a third group to these categories, that is, efforts to moderate the adverse impacts of human-induced climate change, i.e., impact intervention. Michael C. MacCracken, *Beyond Mitigation: Potential Options for Counter-Balancing the Climatic and Environmental Consequences of the Rising Concentrations of Greenhouse Gases* 30–33 (The World Bank, Policy Research Working Paper No. 4938, May 2009).

125. Victor, *supra* note 123, at 323 (discussing various techniques for increasing albedo, including “injecting particles into the stratosphere,” “putting diffraction gratings in outer space,” “installing machines on the ocean that could blow water vapor into the atmosphere,”

However, increasing attention is being paid to methods of geoengineering that attempt to remove CO₂ from the atmosphere, e.g., carbon sinks and iron fertilization of the ocean.

The research and the debate surrounding geoengineering are rapidly becoming increasingly complex and contentious. As the number of scientists in the public and private sector working on questions of geoengineering increases, and as the number of experiments taking place worldwide outside the scope of any type of regulatory regime proliferates, so too do the political stakes surrounding the regulation of geoengineering.

Rather than trying to review the numerous geoengineering techniques and technologies that are being explored,¹²⁶ this Article examines how and why geoengineering is becoming one of the most pressing governance questions that climate change has generated. This Section explores why the debate over geoengineering is suddenly attracting so much attention, before examining what, if any, geoengineering governance regimes currently exist. It also offers some initial thoughts on how the global community should approach geoengineering governance in the future.

A. Geoengineering Emerges

Geoengineering is not a new phenomenon. For years, humans have attempted to directly affect the climate system.¹²⁷ Most of these efforts, however, were small-scale and localized. In the context of global climate change, the scale and stakes of geoengineering are much grander. As the processes of global climate change progress

or “changing large land areas from dark to light by converting forests into more reflective grasslands.”).

126. For helpful reviews of geoengineering techniques and technologies, see HOUSE OF COMMONS REPORT, *supra* note 123, at 11–17; NAT’L ACAD. OF SCI., NAT’L RES. COUNCIL, CRITICAL ISSUES IN WEATHER MODIFICATION RESEARCH (2003); Philip W. Boyd, *Ranking Geo-Engineering Schemes*, 1 NATURE GEOSCIENCE 722, 722–24 (2008); Alan Carlin, *Global Climate Control: Is There a Better Strategy than Reducing Greenhouse Gas Emissions?*, 155 U. PA. L. REV. 1401 (2007); Roelof T. Brientjes, *Overview of Weather Modification Programs Around the World*, NAT’L CENTER FOR ATMOSPHERIC RES., available at http://www.rap.ucar.edu/general/press/presentations/wxmod_overview/index.html (last visited Apr. 1, 2011).

127. See, e.g., Morteza Khalili Sr. et al., *Results of Cloud Seeding Operations for Precipitation Enhancement in Iran during 1999–2007*, PLANNED & INADVERTENT WEATHER MODIFICATION/WEATHER MODIFICATION ASS’N (Apr. 22, 2008), available at http://ams.confex.com/ams/17WModWMA/techprogram/paper_139149.htm.

and as international political efforts to respond to climate change falter, scientists and policymakers worldwide increasingly seek innovative, unilateral ways to halt or deter the negative consequences of climate change. These efforts are attracting increasing attention from both the public and private sectors.

The recent attention paid to geoengineering both in the popular media¹²⁸ and in high-level political¹²⁹ and academic fora¹³⁰ is attributable to a series of factors. First and foremost, as previously discussed, increased understanding of the impacts of climate change in the Arctic, coupled with further research into problems associated with self-reinforcing loops and non-linear changes¹³¹ in the climate system have amplified fears about abrupt climate change and prompted scientists and policymakers to look for more extreme ways to halt or respond to climate change if political efforts fail—a Plan B.¹³² Although they initially appear to be distinct and unrelated, geoengineering and Arctic governance questions converge around questions of positive feedback and nonlinear responses to climate change. For example, for years, scientists and climate modellers have examined the possibility of climate change leading to the rapid melting of permafrost in the Arctic, allowing large quantities of methane to be released from methane hydrates under the seabed, further contributing to climate change.¹³³ Similarly, as climate change leads to the rapid melting of Arctic ice, the melting lowers the reflectivity of the ocean surface, allowing the ocean to absorb increased amounts

128. See, e.g., Eli Kintisch, *Mother Earth Has a Fever: Should Geoengineering Tests Be Governed by the Principles of Medical Ethics?*, SLATE (Apr. 22, 2010), <http://www.slate.com/id/2250462/>; Jeffrey Kluger, *A Quick Fix for Climate Change Falls Flat*, TIME (June 28, 2010), <http://ecocentric.blogs.time.com/2010/06/28/a-quick-fix-for-climate-change-falls-flat>; Gregory M. Lamb, *Should Geoengineering Be Used To Address Global Warming?*, CHRISTIAN SCI. MONITOR, (May 3, 2010), available at <http://www.csmonitor.com/Environment/2010/0503/Should-geoengineering-be-used-to-address-global-warming>; Lee Lane, *Geoengineering Experiments Shouldn't Require Global Agreement*, THE ENTERPRISE BLOG (Mar. 30, 2010), <http://blog.american.com/?p=11895>.

129. Press Release, U.S. House of Representatives, Comm. on Sci. & Tech., Subcommittee Examines Geoengineering Strategies and Hazards (Feb. 4, 2010), <http://sciencedems.house.gov/press/PRArticle.aspx?NewsID=2741>; HOUSE OF COMMONS REPORT, *supra* note 123.

130. See, e.g., STEVEN D. LEVITT & STEPHEN J. DUBNER, *SUPERFREAKONOMICS: GLOBAL COOLING, PATRIOTIC PROSTITUTES, AND WHY SUICIDE BOMBERS SHOULD BUY LIFE INSURANCE* (2009).

131. See Homer-Dixon, *supra* note 21, at 2–4.

132. HOUSE OF COMMONS REPORT, *supra* note 123, at 3.

133. See Homer-Dixon, *supra* note 21, at 3.

of energy, which in turn leads to ocean acidification and greater levels of warming—a self-reinforcing loop whereby warming leads to more warming.¹³⁴

Beyond fears of self-reinforcing loops exacerbating global warming, in a system as complex as the global climate system, there is also a risk of nonlinear behavior, that is, “a disproportionate relationship between cause and effect.”¹³⁵ In relation to the climate system, there are growing fears that seemingly small changes, such as the melting of Arctic sea ice, could ultimately cause rapid and irreversible changes in global circulation patterns.¹³⁶

As discussions of self-reinforcing loops and nonlinear changes filter into popular and political debate, fears grow that existing and proposed policy choices fall far short of offering effective solutions to climate change. As a result, amidst the reserved tone of the day-to-day domestic and international debates about climate change, there is an increasingly vocal minority of advocates arguing that conventional climate policy options are simply too conservative and incremental to work and that something new and different is needed.¹³⁷

In this regard, geoengineering offers the possibility of a more aggressive and immediate response to climate change. Fearing the limits of traditional policy options, there is a growing body of scientists, engineers and politicians who argue that the current taboo that envelops geoengineering in popular and political debate is not only unhelpful but also unrealistic.¹³⁸ The taboo is counterproductive: it prevents the global community from engaging in transparent political debate on the issue, it discourages research and small scale experiments that would reveal more about the pros and cons of different techniques and technologies¹³⁹ and it encourages clandestine behavior. Further, the argument goes, given that there is a very real possibility of geoengineering decisions being made unilaterally in the ab-

134. *Id.*

135. *Id.* at 4.

136. *Id.* at 4–5 (arguing that “[t]he extraordinary loss of sea ice during the summers of 2007 and 2008 suggest[s] that we may in fact be witnessing the first nonlinear ‘flip’ in a major feature of Earth’s climate system—the cryosphere [sic]—as a result of anthropogenic climate change.”).

137. *See id.* at 7–8.

138. *See, e.g.,* Victor, *supra* note 123, at 325.

139. *See, e.g.,* Mark G. Lawrence, *Editorial Comment: The Geoengineering Dilemma: To Speak or Not To Speak*, 77 CLIMATIC CHANGE 245, 246 (2006) (suggesting that if the global community does not engage in adequate research now, it will not have the tools to make good decisions later).

sence of any overarching norms or an applicable governance regime, the prevailing taboo against geoengineering is a dangerous policy because it constrains the countries that are most likely to be responsible in their decisionmaking while leaving the less responsible governments—and/or private parties—to control the development and deployment of the technologies.¹⁴⁰

Beyond offering a more aggressive option—a Plan B¹⁴¹—for responding to climate change in the case of abrupt climate change or the collapse of international policy efforts,¹⁴² at least four other reasons explain why geoengineering is receiving growing levels of attention: (1) possible cost savings, (2) the quick realization of benefits, (3) the reality that small-scale geoengineering experiments are already taking place and (4) the fear of significant and/or irreversible unilateral actions being taken in the near future.¹⁴³

First, in comparison to the costs of greenhouse gas abatement, the economics of geoengineering have been referred to as “incredible.”¹⁴⁴ Although the costs of different geoengineering techniques vary widely, there is a general perception that, in contrast to global mitigation options,¹⁴⁵ geoengineering can be used to halt climate change at a fraction of the cost.¹⁴⁶ As described by one commentator, “while [greenhouse gas] mitigation policies involve a substantial

140. See, e.g., Victor, *supra* note 123, at 325.

141. HOUSE OF COMMONS REPORT, *supra* note 123, at 3.

142. See, e.g., TIM FLANNERY, *THE WEATHER MAKERS: HOW MAN IS CHANGING THE CLIMATE AND WHAT IT MEANS FOR LIFE ON EARTH* 291 (2005) (suggesting that the global community “would have no choice” but to utilize geoengineering if confronted with the type of abrupt climate change discussed above). See also Eric Biber, *Climate Change and Backlash*, 17 N.Y.U. ENVTL. L.J. 1295, 1363–64 (2009) (arguing that we need to at least consider certain geoengineering techniques in our portfolio of policy options in order to hedge “against the risk of a ‘backlash.’”).

143. See generally MacCracken, *supra* note 124.

144. Scott Barrett, *The Incredible Economics of Geoengineering*, 39 ENVTL. & RES. ECON. 45, 45–46 (2008). But see Victor, *supra* note 123, at 327 (arguing that the perception of geoengineering as offering a cheap alternative to mitigation is based on single assessments of “silver-bullet” geoengineering techniques that are unlikely to be viable and that, in the end, we are likely to need to adopt a “cocktail” approach that will be considerably more expensive).

145. See, e.g., Thomas C. Schelling, *The Economic Diplomacy of Geoengineering*, 33 CLIMATIC CHANGE 303, 305–06 (1996) (describing the economics of geoengineering as “simple” and international mitigation as “exceedingly complicated”).

146. See, e.g., William Daniel Davis, *What Does “Green” Mean?: Anthropogenic Climate Change, Geoengineering, and International Environmental Law*, 43 GA. L. REV. 901, 925–26 (2009).

number of actors undertaking expensive policies that require highly decentralized implementation, geoengineering involves a small number of actors undertaking highly centralized, relatively inexpensive actions.”¹⁴⁷ The ability of single states—or even single actors—to fund and deploy geoengineering technologies offers a welcome change to the administrative complexity and financial nightmares associated with globally organized, economy-wide efforts to abate greenhouse gas emissions.

Furthermore, in contrast to the global politics of climate change, which involves entrenched battles over who should act first to mitigate greenhouse gas emissions and to what degree—i.e., a prisoner’s dilemma—geoengineering does not involve analogous competitive advantage/disadvantage calculations. That is, while one country may not find it politically or economically optimal to abate greenhouse gas emissions if another country abstains from doing so, that country still might find it both politically and economically beneficial to deploy geoengineering technologies to try to offset climate change regardless of the acts or omissions of its global counterparts.¹⁴⁸ And, while the costs of geoengineering are vastly understated—due to the associated costs related to the possibility of unforeseen climatic responses, localized harms and political conflict—the ability to closely quantify the costs of deploying a specific technology to halt climate change offers an attractive alternative to the political chaos and economic complexity that characterizes conventional policy choices.

Second, beyond the perceived economic benefits, geoengineering also offers the possibility of near-term results.¹⁴⁹ In contrast to the mitigation strategies supported by the UNFCCC and the Kyoto Protocol,¹⁵⁰ which ask the global community to make short-term sacrifices for long-term benefits, geoengineering offers low-cost opportunities to reap near-term benefits—an equation that is vastly more politically palatable than one that asks constituents to make sacrifices

147. *Id.* at 925–26.

148. This might be the case because the investment in geoengineering could offer both regional—here focusing on benefits to the investing country—and global benefits at a low price but with immediate improvements in local conditions, making it a popular political decision at the domestic level. See Sarah Polborn & Felix Tintelnot, *How Geoengineering May Encourage Carbon Dioxide Abatement 5–7* (Ctr. For Research on Int’l Fin. and Energy Sec., Working Paper, 2009), available at <http://crifes.psu.edu/papers/polbornpaper.pdf>.

149. See, e.g., Biber, *supra* note 142, at 1355–56.

150. Kyoto Protocol to the United Nations Framework Convention on Climate Change, Dec. 10, 1997, U.N. Doc FCCC/CP/1997/7/Add.1, 37 I.L.M. 22 (1998).

for benefits that they themselves may never see. Thus, if a state opts to deploy an albedo modification technology that leads to near-term reductions in global temperatures¹⁵¹ it may reap great political good-will along with the benefits of climate stabilization regardless of whether it is undertaking long-term efforts to abate greenhouse gas emissions. While there are significant uncertainties related to the ability of this or other techniques to halt long-term climate change, the promise of visible results, in real time, at minimal cost, increases interest in geoengineering options.

Although the potential benefits of geoengineering have attracted considerable debate in recent years, the primary reason why geoengineering is quickly becoming a critical governance question revolves around two pressing realities: (1) small-scale geoengineering experiments are already underway with little to no regulatory oversight, and (2) there are growing fears that in the absence of concerted efforts to develop guiding principles and/or a system of oversight, one or more actors might unilaterally deploy geoengineering technology with irrevocable consequences for the entire global community.¹⁵²

B. Geoengineering Governance, as it Exists

In contrast to the fragmented but congested collection of institutions relevant to Arctic governance, there is no targeted governance regime for geoengineering—fragmented or otherwise. Various international instruments include provisions that are relevant but not directly applicable to geoengineering. For example, the 1977 Environmental Modification Convention (ENMOD) prohibits climate manipulation for military or hostile use,¹⁵³ UNCLOS regulates pollution of the seas,¹⁵⁴ the Convention on the Prevention of Marine Pollu-

151. Paul J. Crutzen, *Albedo Enhancement by Stratospheric Sulfur Injections: A Contribution To Resolve a Policy Dilemma?*, 77 CLIMATIC CHANGE 211, 216 (2006).

152. See MacCracken, *supra* note 124, at 27.

153. Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques, May 18, 1977, 31 U.S.T. 333, 1108 U.N.T.S. 151, available at <http://www.un-documents.net/enmod.htm> [hereinafter ENMOD]. Committing State Parties, in relevant part, to “undertake[] not to engage in military or any other hostile use of environmental modification techniques having widespread, long-lasting or severe effects as the means of destruction, damage or injury to any other State Party.” *Id.* art. I.

154. UNCLOS thus may become relevant with regard to algae-fertilization if a party can show that algae-fertilization constitutes “pollution of the marine environment.” UNCLOS, *supra* note 4, art. 194.

tion by Dumping of Wastes and Other Matter (London Convention) prohibits the dumping of certain hazardous materials and requires a prior permit for the dumping of a number of other wastes and identified materials,¹⁵⁵ the Convention on Environmental Impact Assessment in a Transboundary Context (Espoo Convention),¹⁵⁶ alongside the International Law Commission's Draft Articles on the subject of the prevention of significant transboundary harm from hazardous activities¹⁵⁷ and the recent ICJ decision in *Pulp Mills on the River Uruguay*¹⁵⁸, establish a developing body of international law constraining domestic activities that cause transboundary harm, while the Convention on Biological Diversity provides for the conservation of biological diversity—which becomes relevant when geoengineering might pose a risk to one or more covered species.¹⁵⁹ Beyond specific treaty provisions, questions of State Responsibility may arise if geoengi-

155. The London Convention commits the state parties to

promote the effective control of all sources of pollution of the marine environment, and pledge themselves especially to take all practicable steps to prevent the pollution of the sea by the dumping of waste and other matter that is liable to create hazards to human health, to harm living resources and marine life, to damage amenities or to interfere with other legitimate uses of the sea.

Convention on the Prevention of Marine Pollution by Dumping of Waste and Other Matter art. I, Dec. 29, 1972, 26 U.S.T. 2403, 104 U.N.T.S. 120 [hereinafter London Convention]. The London Convention defines “dumping” as “any deliberate disposal at sea of wastes or other matter from vessels, aircraft, platforms or other man-made structures at sea” or “any deliberate disposal at sea of vessels, aircraft, platforms or other manmade structures at sea.” *Id.* art. III(1)(a). In relevant part, however, the London Convention excludes from the definition of dumping: the “placement of matter for a purpose other than the mere disposal thereof, provided that such placement is not contrary to the aims of this Convention.” *Id.* art. III(1)(b).

156. Convention on Environmental Impact Assessment in a Transboundary Context, Feb. 25, 1991, 30 I.L.M. 800, available at <http://www.unece.org/env/eia/documents/legaltexts/conventiontextenglish.pdf>.

157. Rep. of the Int'l Law Comm'n, 53rd Sess., Apr. 23–June 1, July 10–Aug. 10, 2001, U.N. Doc. A/56/10, at 370–436; GAOR, 56th Sess., Supp. No. 10 (2001), available at <http://www.un.org/documents/ga/docs/56/a5610.pdf>.

158. *Pulp Mills on the River Uruguay* (Arg. v. Uru.), Judgment, 2010 I.C.J. 20, ¶¶ 178–80 (Apr. 20), available at <http://www.icj-cij.org/docket/files/135/15877.pdf>; see also Cymie R. Payne, *Pulp Mills on the River Uruguay: The International Court of Justice Recognizes Environmental Impact Assessment as a Duty Under International Law*, ASIL INSIGHT (Apr. 22, 2010), <http://www.asil.org/insights100422.cfm> (discussing the implications of the case for notification, consultation and broadened EIA requirements in regards to activities that pose a risk of transboundary harm).

159. CBD, *supra* note 102.

neering techniques cause transboundary harm,¹⁶⁰ while existing and emerging principles of international law, e.g., the precautionary principle,¹⁶¹ the principle of permanent sovereignty over natural resources,¹⁶² and the interrelated principles of sustainable development¹⁶³ and intergeneration equity, offer alternative ways to approach the regulation (ex ante) or remediation (ex post) of geoengineering activities. As of yet, however, this body of vaguely applicable provisions and principles offers—at best—only a starting point for developing a set of guiding principles for geoengineering governance.

At least two multilateral international institutions, the London Convention and the Convention on Biological Diversity (CBD),¹⁶⁴

160. For example, if a state injected any type of material into the upper atmosphere and that material then spread to the lower atmosphere, which is under national sovereignty.

161. One of the most common definitions of the precautionary principle comes from the Rio Declaration, which holds that: “[w]here 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.” United Nations Conference on Environment and Development, Rio de Janeiro, Braz., June 3–14, 1992, *Rio Declaration on Environment and Development*, U.N. Doc A/CONF.151/26 (Vol. 1) (Aug. 12, 1992). For helpful works exploring the evolution of the precautionary principle, see James Cameron & Juli Abouchar, *The Precautionary Principle: A Fundamental Principle of Law and Policy for the Protection of the Global Environment*, 14 B.C. INT’L & COMP. L. REV. 1 (1991); David Freestone, *Caution or Precaution: ‘A Rose by Any Other Name. . .?’*, 10 Y.B. INT’L ENVTL. L. 25 (1999). Although the precautionary principle offers a helpful tool for governing geoengineering, there is also an argument that it may be ill-suited to address questions of geoengineering because of the necessity of balancing the risks of geoengineering against the risk of climate change. See, e.g., Davies, *supra* note 124, at 4–5.

162. In its earliest statement on the principle of permanent sovereignty the UN General Assembly declared that “each country has the right to formulate, in accordance with its own particular situation and in full enjoyment of its national sovereignty, its own national policies on the human environment” G.A. Res. 2849 (XXVI), at 71, U.N. Doc. A/RES/2849 (Dec. 20, 1971), available at <http://daccess-dds-ny.un.org/doc/RESOLUTION/GEN/NR0/328/65/IMG/NR032865.pdf?OpenElement>. The right of states to exercise permanent sovereignty over their own natural resources has been restated by numerous multilateral environmental agreements, including the UNFCCC and the CBD.

163. Defined by the *Brundtland Report* as development that “meets the needs of the present without compromising the ability of future generations to meet their own needs.” World Comm’n on Env’t and Dev., *Our Common Future, Transmitted by Note of the Secretary-General*, U.N. Doc. A/42/427 (Aug. 4, 1987), available at <http://daccess-dds-ny.un.org/doc/UNDOC/GEN/N87/184/67/IMG/N8718467.pdf?OpenElement>; see also EDITH BROWN WEISS, IN FAIRNESS TO FUTURE GENERATIONS: INTERNATIONAL LAW, COMMON PATRIMONY AND INTERGENERATIONAL EQUITY (1989); Igor Vojnovic, *Intergenerational and Intragenerational Equity Requirements for Sustainability*, 22 ENVTL. CONSERVATION 223, 223–28 (1995).

164. CBD, *supra* note 102; London Convention, *supra* note 155.

have taken concrete steps towards the regulation of one specific geoengineering technology—iron fertilization of the ocean. First, in 2007, the Scientific Group of the London Convention and the London Protocol released a *Statement of Concern Regarding Iron Fertilization of the Oceans to Sequester CO₂*.¹⁶⁵ In the statement, the Group acknowledges commercial interest in the technology of ocean-iron fertilization and declares “that knowledge about the effectiveness and potential environmental impacts of ocean iron fertilization currently [is] insufficient to justify large-scale operations.”¹⁶⁶ Citing the findings of the Inter-governmental Panel on Climate Change (IPCC) that while ocean-iron fertilization may offer “a potential strategy for removing carbon dioxide from the atmosphere” it “remains largely speculative, and many of the environmental side effects have yet to be assessed,”¹⁶⁷ the Group “note[s] with concern the potential for large-scale ocean iron fertilization to have negative impacts on the marine environment and human health.”¹⁶⁸ In light of these concerns, the Group “recommend[s] that any such operations be evaluated carefully to ensure, among other things, that such operations were not contrary to the aims of the London Convention and London Protocol”¹⁶⁹ and elaborates a set of factors that should be considered in evaluating ocean-iron fertilization.¹⁷⁰ Finally, the

165. Int'l Mar. Org. [IMO], *Statement of Concern Regarding Iron Fertilization of the Oceans To Sequester CO₂*, ¶ 1 IMO Ref. T5/5.01, LC-LP.1/Circ. 14 (July 13, 2007), available at www.imo.org/includes/blastData.asp/doc_id=8377/14.pdf; see also Ninth Meeting of the Conference of the Parties to Convention on Biological Diversity, Bonn, Germany, May 19–30, 2008, Decision IX/16: Biodiversity and Climate Change, § C, UNEP/CBD/COP/DEC/IX/16 (Oct. 9, 2008), available at <http://www.cbd.int/doc/decisions/cop-09/cop-09-dec-16-en.pdf>.

166. *Statement of Concern Regarding Iron Fertilization of the Oceans To Sequester CO₂*, *supra* note 165.

167. *Id.*

168. *Id.*

169. *Id.*

170. These factors include:

.1 the estimated amounts and potential impacts of iron and other materials that may be released with the iron; .2 the potential impacts of gases that may be produced by the expected phytoplankton blooms or by bacteria decomposing the dead phytoplankton; .3 the estimated extent and potential impacts of bacterial decay of the expected phytoplankton blooms, including reduced oxygen concentrations; .4 the types of phytoplankton that are expected to bloom and the potential impacts of any harmful algal blooms that may develop; .5 the nature and extent of potential impacts on the marine ecosystem including naturally occurring marine species and communities; .6 the estimated amounts and timescales of carbon sequestration, taking account of partitioning between sediments and water; and .7 the estimated carbon mass balance for the operation.

Group requests that the Parties to the Convention and the Protocol take up the issue of large-scale ocean-iron fertilization at its next meeting of the Parties in order to “ensur[e] adequate regulation of such operations.”¹⁷¹

Responding to this request, in November 2007, at the 29th Meeting of the Parties to the Convention and the Protocol, the Parties endorsed the Statement of Concern of the Scientific Groups,¹⁷² agreed that questions of ocean-iron fertilization fell within the remit of the Convention and the Protocol in view of their common objective of protecting and preserving the marine environment,¹⁷³ recognized that each State maintained the right to consider ocean iron fertilization proposal on a case-by-case basis but urged States to “use the utmost caution” when considering such proposals¹⁷⁴ and agreed on the legal and scientific issues that needed to be addressed during the intercessional period so that they could “take an informed decision on the regulation of this issue in 2008.”¹⁷⁵

Between 2008 and 2010, the Parties to the Convention and the Protocol engaged in a series of reviews of scientific data collated both by the Convention’s own Scientific Group¹⁷⁶ and by the Secretariat of the CBD.¹⁷⁷ In the most recent submission regarding ocean-iron fertilization,¹⁷⁸ the newly formed Correspondence Group on

Id. ¶¶ 2.1–2.7.

171. *Id.* ¶ 3.

172. IMO, *Report of the Twenty-Ninth Consultative Meeting and the Second Meeting of the Contracting Parties*, ¶ .3.1, LC 29/17 (Dec. 14, 2007).

173. *Id.* ¶ .3.2.

174. *Id.* ¶ .3.3.

175. *Id.* ¶ .3. In contrast, however, on November 2, 2006, the Parties to the Convention and the Protocol adopted a new rule allowing carbon sequestration under the ocean floor. See *New International Rules To Allow Storage of CO₂ Under the Seabed*, IMO (Feb. 9, 2007), http://www.imo.org/Newsroom/mainframe.asp?topic_id=1472&doc_id=7772.

176. See, e.g., IMO, Scientific Grp. of the London Convention, *Ocean Fertilization: Interim Report on Ocean Fertilization Science Overviews, Submitted by the Chairman of the SG Ocean Fertilization Correspondence Group*, LC 31/4 (Sept. 4, 2009) [hereinafter IMO, *Interim Report on Ocean Fertilization*].

177. IMO, Scientific Grp. of the London Convention, *Ocean Fertilization: Scientific Synthesis on the Impacts of Ocean Fertilization on Marine Biodiversity Secretariat of the Convention on Biological Diversity*, LC/SG 33/INF.2 (Jan. 11, 2010).

178. IMO, Scientific Grp. of the London Convention, *Ocean Fertilization: Development of Science Overviews on Ocean Fertilization Report of the Ocean Fertilization Correspondence Group, Submitted by the Chairman of the SG Ocean Fertilization Correspondence Group*, LC/SG 33/2/1 (Mar. 5, 2010) [hereinafter IMO, *Development of Science Overviews*].

Ocean Iron Fertilization¹⁷⁹ notes that it has been tasked with collating the views of the Parties and identifying any gaps in these views.¹⁸⁰ The report reviews existing scientific and policy documents of importance to the Parties' consideration of ocean-iron fertilization, noting in particular the report produced by the Secretariat to the CBD—"Scientific Synthesis on the Impacts of Ocean Fertilization on Marine Biodiversity"¹⁸¹—and the draft "Summary for Policymakers on Ocean Fertilization" currently under preparation by the UN Educational, Scientific and Cultural Organization's Intergovernmental Oceanographic Commission (UNESCO-IOC).¹⁸² The report then requests that the Scientific Group to the Convention review the evaluation of the CBD report and offer any further comments they deem necessary.¹⁸³ Thus, while the Parties to the Convention have not yet taken direct action to either condone or proscribe the practice of ocean-iron fertilization, the London Convention and Protocol are among the first international institutions to take up the issue of geoengineering.

Alongside the London Convention and the Protocol, the CBD is another institution that has taken up the issue of geoengineering. In common with the London Convention and Protocol, the CBD's focus is on ocean-iron fertilization. In 2008, the Conference of the Parties (COP) to the CBD issued a decision¹⁸⁴ noting the work of the London Convention and Protocol and welcoming their decision to urge caution in regards to proposals for large-scale ocean fertilization.¹⁸⁵ The COP then incorporates the question of iron fertilization into its own working agenda by requesting the Executive Secretary to bring the issue to the attention of the Joint Liaison Group.¹⁸⁶ In doing so, the COP urges Parties and non-Parties to the CBD to act in ac-

179. See IMO, *Interim Report on Ocean Fertilization*, *supra* note 176, ¶ 5.

180. See IMO, *Development of Science Overviews*, *supra* note 178, ¶ 3(1).

181. See generally IMO, *Interim Report on Ocean Fertilization*, *supra* note 176.

182. See IMO, *Development of Science Overviews*, *supra* note 178, ¶ 8.

183. *Id.* ¶ 13.1–13.2.

184. United Nations Convention on Biological Diversity, *Recommendations Adopted by the Subsidiary Body on Scientific, Technical and Technological Advice at its Thirteenth Meeting*, UNEP/CBD/COP/9/3, SBSTTA 13 Recommendation XIII/6, *Biodiversity and Climate Change: Options for Mutually Supportive Actions Addressing Climate Change Within the Three Rio Conventions* (Feb. 18–22, 2008), available at <http://www.cbd.int/doc/recommendations/sbstta-13/full/sbstta-13-rec-en.pdf>.

185. Ninth Meeting of the Conference of the Parties to Convention on Biological Diversity, Bonn, Germany, *supra* note 165.

186. *Id.* § C(1).

cordance with the decision of the London Convention,¹⁸⁷ which recognizes the need for better data on ocean fertilization.¹⁸⁸ In its decision, the COP:

requests Parties and *urges* other Governments, in accordance with the precautionary approach, to ensure that ocean fertilization activities do not take place until there is an adequate scientific basis on which to justify such activities, including assessing associated risks, and a global, transparent and effective control and regulatory mechanism is in place for these activities; with the exception of small scale scientific research studies within coastal waters.¹⁸⁹

The decision reaches considerably further than the 2007 Statement of the London Convention, declaring that “[s]uch studies should only be authorized if justified by the need to gather specific scientific data, and should also be subject to a thorough prior assessment of the potential impacts of the research studies on the marine environment, and be strictly controlled.”¹⁹⁰

Subsequently, in 2010, in one of the boldest political moves to date, with reference to geoengineering governance, the SBSTTA agreed to forward to the full COP a proposed temporary ban on all forms of climate-related geoengineering on the basis of the precautionary principle. In relevant part, the bracketed¹⁹¹ section of the SBSTTA report calls upon the COP to:

[e]nsure, in line and consistent with decision IX/16 C, on ocean fertilization and biodiversity and climate change, and in accordance with the precautionary approach, that no climate-related geo-engineering activities take place until there is an adequate scientific ba-

187. *Id.* § C(2).

188. *Id.* § C(3).

189. *Id.* § C(4).

190. *Id.* The relevant part of the decision ends by requesting “the Executive Secretary to disseminate the results of the ongoing scientific and legal analysis under the London Convention and London Protocol, and any other relevant scientific and technical information, to the fourteenth meeting of the Subsidiary Body on Scientific, Technical and Technological Advice,” thereby laying the grounds for cross-institutional cooperation and collaboration on the question of ocean-iron fertilization and other forms of geoengineering. *Id.* § C(5).

191. When a portion of text is bracketed it indicates that the text has not yet received full consensus from the drafting body.

sis on which to justify such activities and appropriate consideration of the associated risks for the environment and biodiversity and associated social, economic and cultural impacts¹⁹²

The SBSTTA recommendation represented the first time a UN body had directly addressed geoengineering governance since the adoption of the ENMOD Treaty in 1977.¹⁹³ The proposed ban was considered by the COP at its next full meeting, which took place in Nagoya, Japan in October 2010. In a turn of events that signaled a new phase in geoengineering governance efforts, the CBD COP voted to approve a decision *inviting*¹⁹⁴ Parties and other non-Party governments in accordance with national circumstances to:

[e]nsure, 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*¹⁹⁵ *that may affect biodiversity take place*, until there is an adequate scientific basis on which to justify

192. Convention on Biological Diversity, *Report of the Fourteenth Meeting of the Subsidiary Body on Scientific, Technical and Technological Advice*, § XIV/5(1)(8)(w), UNEP/CBD/COP/10/3, (June 20, 2010), available at <http://www.cbd.int/doc/meetings/cop/cop-10/official/cop-10-03-en.pdf>.

193. *UN Moves Towards Geoengineering Moratorium*, ENVTL. RES. WEB (May 26, 2010), <http://environmentalresearchweb.org/cws/art.icle/yournews/42736>; see also ENMOD, *supra* note 153.

194. Convention on Biological Diversity, Biodiversity and Climate Change: Draft Decision Submitted by the Chair of Working Group I, ¶ 8, UNEP/CBD/COP/10/L.36, (Oct. 29, 2010).

195. The decision specifies here that this decision is made

[w]ithout prejudice to future deliberations on the definition of geo-engineering activities, understanding that any technologies that deliberately reduce solar insolation 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.

Id. ¶ 8(w) n.2.

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.¹⁹⁶

The COP decision represents a critical step in efforts to formulate a governance system for geoengineering, not only because of its breadth—i.e., it calls for a ban on all climate-related geoengineering activities—but also because it forces not only the CBD but also other interested international institutions (both public and private) to consider both the appropriateness of the issue coming before the CBD and the substantive value of the ban itself. Despite the political significance of the ban, however, the substantive value remains untested. Due to the vague nature of the language, the meaning of the decision is open to debate. First, the Decision “invites” rather than mandates parties to disallow climate-related geoengineering activities. Second, the invited ban is limited to geoengineering activities that may affect biodiversity, begging the question of how these determinations are to be made. Third, the ban is temporally limited until the time at which there is “adequate scientific basis” and “appropriate consideration of the associated risks” to justify moving forward with geoengineering activities. These qualifying phrases are left undefined and underexplored, creating uncertainty as to the precise meaning and implications of the ban. Despite these uncertainties, however, the ability of the CBD COP to adopt this decision by consensus issued a decisive statement to the international community that concern over the unregulated use of geoengineering technologies is widespread and growing.

In both the case of the London Convention and Protocol and the CBD, the clear emphasis is on the need for precaution, given the depth of scientific uncertainty surrounding both the direct and indi-

196. *Id.* ¶ 8(w) (emphasis added). See also Convention on Biological Diversity, *New and Emerging Issues*, ¶ 4 (Oct. 29, 2010), UNEP/CBD/COP/10/L.26; Convention on Biological Diversity, *Marine and Coastal Biodiversity*, ¶ 13(e), 57–62 (Oct. 29, 2010), UNEP/CBD/COP/10/L.42 (containing language on research into and control of geoengineering techniques and technologies).

rect effects associated with geoengineering activities. In neither case do the institutions call for a permanent ban; rather, the dialogue in both fora emphasizes the need for further research and for a more organized decisionmaking process. The effect of the efforts in both fora is to force this issue.

The release of the SSBTA's initial proposal and subsequent ban followed shortly after a private meeting was held in California to discuss a "voluntary code of conduct" for geoengineering.¹⁹⁷ This meeting was sponsored by the Climate Response Fund, a group formed in 2009 to "foster discussion of climate intervention research (sometimes called geoengineering or climate engineering) and to decrease the risk that these techniques might be called on or deployed before they are adequately understood and regulated."¹⁹⁸ The Conference, entitled "The Asilomar International Conference on Climate Intervention Technologies," was coordinated with the intent of allowing all the participants—there by invitation only—to "develop norms and guidelines for controlled experimentation on climate engineering or intervention techniques."¹⁹⁹

The Conference modeled itself after the 1975 Asilomar Conference on Recombinant DNA, wherein the participants agreed upon a series of restrictions and conditions that would guide their research.²⁰⁰ The original Asilomar Conference in 1975 was widely heralded as a positive example of self-regulation and was used as a model for the 2010 Asilomar International Conference on Climate Intervention Technologies.

The 2010 Conference designated its aim as "minimiz[ing] the risks associated with scientific research on climate intervention or climate geoengineering, much as the 1975 Asilomar Conference on Recombinant DNA successfully modeled safe and appropriate labor-

197. Alexis Madrigal, *Climate Hackers Want To Write Their Own Rules*, WIRED SCI. (Mar. 23, 2010), <http://www.wired.com/wiredscience/2010/03/geoengineering-asilomar>.

198. THE CLIMATE RESPONSE FUND, <http://www.climateresponsefund.org/> (last visited Apr. 1, 2011). The Climate Response Fund defines as its goals to

[f]oster safe and responsible research on climate intervention by providing a neutral forum where norms and guidelines for climate intervention research can be discussed and developed [and] working with national and international partners to encourage appropriate organizations to incorporate the suggested norms and guidelines into their deliberations on climate intervention research, [and to w]ork with national and international partners to communicate information about climate intervention research to interested groups and the general public.

Id.

199. *Id.*

200. Madrigal, *supra* note 197.

atory management methodologies.”²⁰¹ The Asilomar Conference focused exclusively on the development of risk reduction guidelines for climate intervention experiments. The creation of the Climate Response Fund and the organization of the Asilomar Conference were prompted by the rapid onset of attention focused on geoengineering in the preceding years, including calls by the American Meteorological Society (AMS)²⁰² and the American Geophysical Union (AGU)²⁰³ for research into all aspects of geoengineering, the decision by the Royal Society of the United Kingdom to launch a major study into the governance of geoengineering²⁰⁴ and the imminent release of the U.S. National Academy of Sciences’ study of “America’s Climate Choices.”²⁰⁵ The attempt by the conveners of the Convention to encourage the rapid formulation of industry-originated regulations represented an attempt to preempt the imposition of externally imposed guidelines.

The Convention was juxtaposed against the recent statements from key epistemic communities, including the AMS and AGU, which declared that while it could not be a substitute for “aggressive mitigation or proactive adaptation,” geoengineering “could contribute to a comprehensive risk management strategy to slow climate change and alleviate some of its negative impacts.”²⁰⁶ In this regard, the societies called for “adequate research, appropriate regulation, and transparent deliberation” on the matter and recommended:

201. *Asilomar International Conference on Climate Intervention Technologies*, THE CLIMATE RESPONSE FUND, http://www.climateresponsefund.org/index.php?option=com_content&view=article&id=137&Itemid=81.

202. *Geoengineering the Climate System: A Policy Statement of the American Meteorological Society*, AM. METEOROLOGICAL SOC’Y (July 20, 2009), http://www.ametsoc.org/POLICY/2009geoengineeringclimate_amsstatement.pdf.

203. *Geoengineering the Climate System*, AM. GEOPHYSICAL UNION (Dec. 13, 2009), http://www.agu.org/sci_pol/positions/geoengineering.shtml.

204. *Royal Society Launches Major Study on the Governance of Geoengineering*, THE ROYAL SOC’Y (Mar. 18, 2010), <http://royalsociety.org/Royal-Society-launches-major-study-on-the-governance-of-geoengineering/>.

205. The Academy released its findings on May 19, 2010 in a series of three reports that detail why the Academy believes that the United States must act quickly to limit and adapt to climate change. See *LIMITING THE MAGNITUDE OF CLIMATE CHANGE* (2010), NAT’L ACAD. OF SCI., available at <http://dels.nas.edu/Report/Limiting-Magnitude-Climate-Change/12785>.

206. AM. GEOPHYSICAL UNION, *supra* note 203; AM. METEOROLOGICAL SOC’Y, *supra* note 202. The AGU adopted the policy statement of the AMS in full.

1. Enhanced research on the scientific and technological potential for geoengineering the climate system, including research on intended and unintended environmental responses.
2. Coordinated study of historical, ethical, legal, and social implications of geoengineering that integrates international, interdisciplinary, and intergenerational issues and perspectives and includes lessons from past efforts to modify weather and climate.
3. Development and analysis of policy options to promote transparency and international cooperation in exploring geoengineering options along with restrictions on reckless efforts to manipulate the climate system.²⁰⁷

Around the same time the AMS and AGU released their policy statements, Professor John Shepherd, the chair of the Royal Society's *Geoengineering the Climate* report,²⁰⁸ declared the need to "consider beforehand what legislative mechanisms and guidelines are needed, to ensure that any [geoengineering] research that is undertaken will be done in a highly responsible and controlled manner with full international agreement where necessary."²⁰⁹ To this end, the Royal Society initiated a study into the governance of geoengineering with the objective of agreeing upon a series of "[r]ecommendations for the governance of both research and possible deployment of SRM [solar radiation management] techniques," "[b]est practice guidelines for any emerging research into SRM techniques" and a "suggested framework for how SRM research could be undertaken through international cooperation."²¹⁰ The AMS, AMU and the Royal Society call for research, oversight, transparency and regulation, but the Royal Society takes this one step further, prefacing its governance study with the possible need for international agreement²¹¹—something that

207. AM. GEOPHYSICAL UNION, *supra* note 203; AM. METEOROLOGICAL SOC'Y, *supra* note 202.

208. THE ROYAL SOC'Y, *GEOENGINEERING THE CLIMATE: SCIENCE, GOVERNANCE AND UNCERTAINTY* (2009), *available at* <http://royalsociety.org/Geoengineering-the-climate/>.

209. *Policy Projects: SRM Governance Initiative*, THE ROYAL SOC'Y, <http://royalsociety.org/SRM-governance-initiative/> (last visited April 1, 2011).

210. *Id.*

211. THE ROYAL SOC'Y, *supra* note 208, at 40.

is likely to be resisted by many members of the regulated community, including the participants at the 2010 Asilomar Convention.

The Royal Society's new study was launched in response to the release, just ten days before, of a report on *The Regulation of Geoengineering*, which was published by the United Kingdom's House of Commons.²¹² In this report, the Science and Technology Committee to the House of Commons declared the need to develop a common regulatory regime for geoengineering. In calling for the "groundwork for regulatory arrangements to begin," the Committee determined that:

Geoengineering techniques should be graded with consideration to factors such as trans-boundary effect, the dispersal of potentially hazardous materials in the environment and the direct effect on ecosystems. The regulatory regimes for geoengineering should then be tailored accordingly. The controls should be based on a set of principles that command widespread agreement—for example, the disclosure of geoengineering research and open publication of results and the development of governance arrangements before the deployment of geoengineering techniques.²¹³

The House of Commons report offers a careful look at the risks and possibilities of geoengineering and concludes that there is a "gap in the regulatory framework for geoengineering techniques,"²¹⁴ a "need to develop a regulatory framework for geoengineering,"²¹⁵ and that—despite the risk and limitations involved²¹⁶—this frame-

212. HOUSE OF COMMONS REPORT, *supra* note 123.

213. *Id.* at 3 (Summary).

214. *Id.* at 49 (Conclusions and Recommendations).

215. *Id.* at 50.

216. See, e.g., Robert Hahn, *Climate Policy: Separating Fact from Fantasy*, 33 HARV. ENVTL. L. REV. 557, 557 (2009) (arguing against the wisdom of focusing on trying to negotiate a legally binding international agreement even for climate change "because such agreements are not likely to be workable. It makes sense, instead, for interested countries to take some action now to limit greenhouse gas emissions, including putting a price on emissions that may increase over time. It also makes sense to focus on research and development—including how best to adapt to climate change, improve the cost-effectiveness (such as improving carbon capture and storage techniques), and improve our understanding of geoengineering, and improve the cost effectiveness of carbon capture.").

work should be “top-down.”²¹⁷ The House of Commons report thus calls for an international framework for the regulation of geoengineering based on the need for “legitimacy; scientific standards; oversight mechanisms; and management of environmental and trans-boundary risks.”²¹⁸

Parallel to the House of Commons’ consideration of the governance challenges associated with geoengineering, the U.S. House of Representatives’ Committee on Science and Technology undertook an eighteen-month inquiry, including three public hearings, into the study of climate engineering. The results of this inquiry were published five months after the release of the House of Commons report and within days of the CBD’s decision to temporarily ban geoengineering. In contrast to the CBD’s call for a temporary moratorium on geoengineering, the Committee’s report, *Engineering the Climate: Research Needs and Strategies for International Collaboration* (House Report),²¹⁹ calls for a more comprehensive and formal research agenda. While not advocating the use of geoengineering, the House Report calls for an active and engaged debate on the science and policy of climate engineering. In releasing the report, Committee Chairman Bart Gordon, stated that the report was “in no way meant as an endorsement of climate engineering” before declaring that:

Climate engineering carries with it a tremendous range of uncertainties and possibilities, ethical and political concerns, and the potential for catastrophic side effects. I want to be absolutely clear that I am not in favor of deploying climate engineering; making firm commitments and taking real actions to reduce global greenhouse gas emissions should always be the priority. However, if we find ourselves passing an environmental tipping point, we will need to have done research to understand our options. Developing the science will take time, as will developing appropriate governance structures. We’ve started the conversation in Congress and with the UK House of Parliament; I hope that consideration of appropriate research in-

217. HOUSE OF COMMONS REPORT, *supra* note 123, at 50 (Conclusions and Recommendations).

218. *Id.*

219. CHAIRMAN BART GORDON, COMM. ON SCI. & TECH., 111TH CONG., *ENGINEERING THE CLIMATE: RESEARCH NEEDS AND STRATEGIES FOR INTERNATIONAL COLLABORATION* (2d Sess. 2010), available at http://democrats.science.house.gov/Media/file/Reports/EngineeringTheClimate_StaffReport.pdf.

vestments will follow. We need healthy debate, a transparent process, clear action on emission reductions, and sound scientific research to provide a solid foundation for the tough decision-making that climate change will demand in the future.²²⁰

The House Report offers background information on geoengineering, which it refers to as climate engineering, including information about existing capacity within the U.S. federal agencies to inform geoengineering science as well as information about ongoing exploratory research worldwide. The report then explores key research needs²²¹ and the tools needed to support this research at the federal level before offering models for how to organize future research. Finally, the House Report offers recommendations for how to proceed. Citing the need to understand the “most effective and risk-averse climate strategies” in advance of a potential “climate emergency,”²²² the Report declares that “it is the opinion of the Chair that broad consideration of comprehensive and multi-disciplinary climate engineering research at the federal level begin as soon as possible in order to ensure scientific preparedness for future climate events.”²²³ The House Report also offers a series of recommendations. For example, the House Report recommends that:

- “the global climate science and policy communities should work towards a consensus on

220. Press Release, Comm. on Sci. & Tech., Chairman Gordon Releases Report on Climate Engineering (Oct. 29, 2010), *available at* <http://sciencedems.house.gov/press/PRArticle.aspx?NewsID=2945>.

221. The research needs identified by the Report include: greenhouse gas monitoring, accounting and verification; hydrologic cycle modeling; water and air quality modeling and monitoring; atmospheric dynamics and physics; ocean and lake dynamics and physics; atmospheric chemical composition (e.g., carbon dioxide, ozone, moisture and other greenhouse gases such as methane); ocean and terrestrial biology and ecosystems; invasive plant and animal species; risk assessment and risk management; chemical, electrical and mechanical engineering; earth systems environmental sciences, including modeling; weather systems, including monsoon cycles; forces impacting the ozone layer; impacts of forestry and agricultural practices on greenhouse gas emissions; biochar; terrestrial carbon sequestration; phytoplankton; ocean acidification and chemistry; recyclable carbon absorbents; geologic/seismic imaging; radiation measurement; cloud microphysics; geochemical dynamics and carbon mineralization; sea ice dynamics and thermodynamics; genomic science and energy generation and use. GORDON, *supra* note 219, at 7–8.

222. *Id.* at 38.

223. *Id.*

what constitutes a ‘climate emergency’ warranting deployment of SRM technologies;”²²⁴

- “there must ultimately be an international consensus on climate engineering terminology that will best communicate the strategies and desired effects to the scientific community, policy makers and the public;”²²⁵
- “any federal climate engineering research program should leverage existing facilities, instruments, skills and partnerships within federal agencies;”²²⁶
- “governments should make public engagement a priority of any climate engineering effort;”²²⁷
- “further collaborative work between national legislatures on topics with international reach, such as climate engineering, should be pursued;”²²⁸ and
- “the U.S. Government should press for an international database of climate engineering research to encourage and facilitate transparency and open publication of results.”²²⁹

These recommendations support the ultimate conclusion of the Chair that “policymakers should begin consideration of climate engineering research now to better understand which technologies or methods, if any, represent viable stopgap strategies for managing our changing climate and which pose unacceptable risks.”²³⁰ In advocating an open and coordinated geoengineering research agenda, the Chair cautioned against the adoption of a moratorium on research suggesting that a ban on research would conflict with principles of scientific freedom and impede accountability. In declaring that “[a]

224. *Id.* at 40.

225. *Id.* at 39.

226. *Id.* at 8.

227. *Id.* at 11 (The report continues here by stating that “[f]urthermore, the National Science Foundation (NSF), with its institutional history of engaging the public on nascent technologies and funding research in the social and behavioral sciences, should play a critical role in informing public engagement strategies.”).

228. *Id.* at 44.

229. *Id.*

230. *Id.* at ii.

research moratoria that stifles science . . . is a step in the wrong direction and undercuts the importance of scientific transparency,”²³¹ the Chair advanced an approach to geoengineering that supports the governance approach outlined by the House of Commons but directly conflicts with the temporary moratorium approved by the CBD. The juxtaposition of the release of the House Report and the CBD ban combined to create a much more complex framework for future regulatory efforts.

Capped off by the release of the House Report and the CBD ban, the recent flurry of activity on the part of key epistemic communities and governmental actors reflects not only the heightening level of attention directed towards geoengineering, but also increasing levels of competition among the key players—scientists, industry, and the public sector—to define the parameters of the debate. On one hand, participants in the Asilomar Conference, for example, seek a system of self-regulation. On the other hand, the U.K. House of Commons recommends an international framework for regulation and the U.S. House of Representatives advocates a formal and organized research agenda, while the CBD along with various other international institutions propose *de facto* and outright moratoriums on geoengineering. The emerging parameters of the geoengineering governance debate reveal the vast expanses separating key players.²³²

C. *Geoengineering Governance in the Future*

Given the heightened stakes and growing power grabs, there is little doubt that the time is ripe for the international community to take up the question of geoengineering governance. The question that necessarily follows is what form the governance regime should take. The inevitable starting point must consider two stark realities:

231. *Id.*

232. Revealing the increasingly impassioned tone of the debate, Canadian author and anti-geoengineering activist, Naomi Klein, declared:

“How dare they claim the right to block the sun? To colour the clouds? To change the chemistry of the ocean? Look at the oil gushing into the Gulf of Mexico. If we learn one lesson from this disaster, let it be that we cannot control the effects of our technology, nor is our technology capable of fixing the Earth-disruptions that we unleash. It’s time for some collective humility in the face of awesome natural forces, not more eco-hubris.”

United Nations Science Body Calls for Halt on Climate-Hacking Experiments, HANDS OFF MOTHER EARTH (May 19, 2010), <http://www.handsoffmotherearth.org/2010/05/united-nations-science-body-calls-for-halt-on-climate-hacking-experiments/>.

first, humans have been interfering with the climate system for centuries via our consumption of fossil fuels, and second, absent the ability of the global community to agree upon a common set of guidelines, the risk of large-scale, unregulated, unilateral actions gradually increases over time. As the House of Commons report suggests, as with climate change, the inherent transboundary and intergenerational nature of geoengineering means that there is a distinct need for a top-down framework, even if that framework begins as a “soft” system emphasizing flexibility and norm formulation.

Yet, before any such framework can exist, certain fundamental questions must be asked and answered. First and foremost, what are the background norms framing the debate, e.g., precaution, intergenerational equity, permanent sovereignty over natural resources, sustainable development, common concern of mankind, common heritage of mankind? Second, what are the key questions the governance regime is trying to answer, e.g., what types of geoengineering are deemed permissible and what types are simply too risky to allow, what types of impact assessment are required prior to deployment, how will state sovereignty be balanced with global oversight, how will cases of transboundary harm be dealt with, what type of dispute-settlement system is needed, who has the veto power? Third, taking as a starting point the basic undesirability—and infeasibility—of simply banning all types of geoengineering, it becomes fundamentally important not only to begin clarifying the guiding principles and sorting through the underlying questions, but also to begin thinking about interim activities. For example, during the inevitable period during which the global community debates the framework for geoengineering governance, there is a need to develop a formal, transparent geoengineering research program that is globally engaged and to ensure that there are procedures in place for disclosing the results of independent geoengineering research in order to improve interim transparency and accountability and to facilitate norm formation.²³³ Fourth and finally, in thinking about geoengineering governance, it is fundamentally important, from the onset, to think in larger terms of global climate management in order to anticipate and prevent—either through prohibitions or other regulatory constraints—the domino effects geoengineering is likely to induce.²³⁴

233. See Victor, *supra* note 123, at 325.

234. Consider, for example, the effects on regional climate, continued ocean acidification, ozone depletion, the effects of these changes on ecosystem functioning, increased acid deposition, the loss of sun for solar power and rapid warming of the planet if geoengineering is employed and then suddenly stopped. See Timothy W. Luke, *An Emergent Mangle of Practice: Global Climate Change as Vernacular Geoengineering* 26

Before briefly considering basic starting points for moving forward with efforts to create a governance regime for geoengineering, it is worth considering whether there is public support for these efforts. There is a strong argument to be made that geoengineering—both in terms of its possible costs and benefits—is too important to be left stranded in a legal void, but as is being demonstrated in the United States with reference to climate change, regardless of its importance, little can be done unless there is widespread public interest and support for creating a geoengineering governance framework.

In common with climate change and global terrorism,²³⁵ climate geoengineering represents an emerging form of catastrophic risk. Except in this case, geoengineering also promises the hope—whether substantiated or not—of delivering significant benefits. In the case of terrorism, both the United States and the global community have been considerably more willing to take costly and aggressive steps to reduce the risk of terrorism than they have been to reduce the risk of climate change.²³⁶

Public willingness to support anti-terrorism activities could be largely attributable to the belief that short-term costs will reap short-term benefits. In contrast, short-term costs in the context of climate change only offer the possibility of intangible, long-term benefits.²³⁷ In the case of geoengineering, the willingness of the global community to support extensive research and regulatory efforts will depend on the ability of the public sector to demonstrate that the attendant costs are sufficiently low. Alternatively, the availability of new information or new events that suggest that the attendant risks are so high as to justify extensive and expensive research and regulation might also mobilize global support for geoengineering research and regulation. At the moment, it is not clear that either of these elements exist. However, as the pace of geoengineering research, small scale experiments and the attendant debate increases, the public profile of the debate will grow with the effect of eliciting more defined responses and clarifying whether there is widespread support for mounting an aggressive response to the possibility of climate geoengineering.

(Am. Political Sci. Ass'n Toronto Meeting Working Paper, 2009), *available at* <http://ssrn.com/abstract=1450783>.

235. Cass R. Sunstein, *On the Divergent American Reactions to Terrorism and Climate Change* 2 (John M. Olin Law & Economics Working Paper No. 295, 2d series, 2006), *available at* <http://ssrn.com/abstract=906889>.

236. *See generally id.*

237. *See id.*

1. Normative Framework

Existing and proposed geoengineering techniques and technologies vary so extensively that it is illogical to try to begin by thinking about how to create a uniform regulatory system for “geo-engineering” as a monolithic entity. To begin, certain techniques may fall within the remit of existing regulatory institutions, for example, the London Convention, the CBD, Espoo or the UNFCCC, while others are so novel as to defy even the outer reach of these or other institutions. With regards to comparing and assessing each individual geoengineering technique or project proposal, it is necessary to consider a range of factors²³⁸ before determining whether, how and by whom they should be regulated. This technical and regulatory complexity suggests that the starting point for moving forward with geoengineering governance must be discovering a set of widely supported principles to guide decisionmaking.

To this end, in 2010, in a memorandum to the House of Commons Science and Technology Committee in response to its enquiry into The Regulation of Geoengineering, a group of United Kingdom-based scholars²³⁹ proposed five draft principles for the conduct of geoengineering research.²⁴⁰ The scholars suggested that: (1) geoengineering should be regulated as a public good, based upon the argument 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 . . . regulation of such techniques should be undertaken in the public interest by the appropriate bodies at the state and/or international levels”;²⁴¹ (2) geoengineering decisionmak-

238. Relevant factors include, for example: (1) design and intended effect; (2) benefits and impacts, or whether the technique will be more or less harmful than global warming; (3) economic cost and phasing; (4) coupling to other problems and issues; (5) duration and impact on future generations; (6) uncertainties; (7) reversibility; (8) research and development needs and prospects (i.e. what needs to be done, at what cost and how long will it take) and (9) governance and international responsibility (i.e. how will it be undertaken and who has authority). See MacCracken, *supra* note 124, at 9–12.

239. The group included: Professor Steve Rayner (University of Oxford), Professor Catherine Redgwell (University College London), Professor Julian Savulescu (University of Oxford), Professor Nick Pidgeon (Cardiff University) and Mr. Tim Kruger (Oxford Geoengineering Institute).

240. Brief Memorandum on Draft Principles for the Conduct of Geoengineering Research from Professor Steve Rayner et al. to the House of Commons Sci. & Tech. Comm. Enquiry into the Regulation of Geoengineering (Dec. 10. 2009), available at <http://www.sbs.ox.ac.uk/centres/insis/Documents/regulation-of-geoengineering.pdf>.

241. *Id.* § 17.

ing should be informed wherever possible by public participation, including a duty “to notify, consult, and ideally obtain the prior informed consent of, those affected by the research activities”;²⁴² (3) research plans for geoengineering should be completely disclosed and results should be openly published;²⁴³ (4) the impacts of geoengineering research should be conducted by an independent body, this body being of a regional/international character where techniques are likely to have transboundary impact²⁴⁴ and (5) robust governance structures should be put in place before any technologies are deployed and these governance structures should make use of existing rules and institutes wherever possible.²⁴⁵

The subsequently issued House of Commons Report on the Regulation of Geoengineering focused extensive attention on these five principles, considering each one in turn and fully endorsing principles three through five.²⁴⁶

With regard to the first principle, “[g]eoengineering to be regulated as a public good,” the Committee expressed concerns that adopting this approach might raise difficult questions regarding the protection of intellectual property (IP) rights as well as stifle research and development. For this reason, the Committee determined that the idea needed “to be worked up in detail to define public good and public interest” and “framed in such a manner that it does not deter investment in geoengineering techniques.”²⁴⁷ The Committee’s attention to the perceived shortcoming in the proposed principle was not surprising given that questions over the protection of intellectual

242. *Id.* § 18. Principle 2 continues by stating that:

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.

Id.

243. *Id.* § 19. In full, Principle 3 declares that

[t]here should be complete disclosure of research plans and open publication of results in order to facilitate better understanding of the risks and to reassure the public as to the integrity of the process. It is essential that the results of all research, including negative results, be made publicly available.

Id.

244. *Id.* § 20.

245. *Id.* § 21.

246. HOUSE OF COMMONS REPORT, *supra* note 123, at 29–34.

247. *Id.* at 31.

property have plagued efforts to implement the CBD and the Biosafety Protocol to the CBD and have been dominant points of contention in the World Trade Organization over the past two decades. And, as the Asilomar Convention highlights, not only are IP questions central,²⁴⁸ there is already a burgeoning industry involved in geoengineering; the inability of any evolving governance regime to accommodate IP and industry interests would create potentially impenetrable barriers to achieving widespread support for the principles.

With regard to Principle 2, “[p]ublic participation in geoengineering decisionmaking,” the Committee expressed support for the principle but cautioned that it “needs to spell out in the explanatory text what consultation means and whether, and how, those affected can veto or alter proposed geoengineering tests.”²⁴⁹ The Committee’s concerns in this regard raise important questions concerning chains of decisionmaking with respect to not only how primary decisions will be made, but also to what types of impact assessment will be required and what types of remediation and dispute settlement systems will be established in order to address the direct and indirect consequences of geoengineering for specific groups of people, especially groups of people already disenfranchised (e.g., indigenous and low-income communities).

Beyond its consideration of the five principles proposed by the Oxford-led academics, the Committee also considered the applicability of one further principle—the precautionary principle.²⁵⁰ Noting that the academic proposal had failed to advocate the precautionary principle as a distinct guiding norm for geoengineering, the Committee considered the wisdom of utilizing a precautionary approach and determined that “the key principles should not include the precautionary principle as a discrete principle.”²⁵¹ The Committee determined that reliance on the five proposed principles—as amended and clarified—offered a precautionary approach but that the addition of a discreet precautionary principle might discourage the creation of “an appropriate, cautious regulatory regime” for genuine

248. For a helpful overview of the broader impact of intellectual property law on access to climate change technologies, see Abbe E.L. Brown, *Securing Access to Climate Change Technologies: Answers and Questions* (Univ. of Edinburg Sch. of Law, Working Paper No. 2010/21, 2010), available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1622024.

249. HOUSE OF COMMONS REPORT, *supra* note 123, at 31.

250. *Id.* at 34.

251. *Id.* at 35.

geoengineering research and, instead, encourage a “blanket ban”²⁵² on any such research with the effect of not only halting genuine research efforts but also hiding “from international and public scrutiny any research carried out by . . . bodies or states not playing by the rules.”²⁵³

For this reason, the Committee determined that the five Principles, as drafted, offered a sufficiently precautionary approach and that to adopt the precautionary principle as a discreet sixth principle would prove counterproductive to efforts to regulate geoengineering research and experimentation in an open, transparent and precautionary manner. The Committee’s findings reflect predominant concerns reflected by other geoengineering scholars regarding the ability of the precautionary principle to offer a valuable tool for undertaking comprehensive risk analysis of different geoengineering proposals rather than to merely advocate a moratorium on all research efforts.²⁵⁴

The five principles advocated by the U.K. academics and fleshed out by the Committee offer a valuable starting point for a wider global debate on the governance of geoengineering research and experimentation. The normative framework will inevitably evolve as the pool of participants in the debate expands and the depth of consideration increases. As the Committee attests, the fundamental components of any governance regime necessarily include open sharing of research results, transparency in decisionmaking and public participation; in addition, the normative framework must clarify the types of impact and risk assessments, dispute settlement and compensation systems that will be required and/or acceptable.²⁵⁵ Further, there is a genuine need to debate the applicability of existing and evolving principles of international law, to include questions of intergenerational equity—in regards to the maintenance of systems that are deployed, the long-term impacts of geoengineering experiments and permanent sovereignty over natural resources—with respect to the transboundary impacts of geoengineering experiments.

At a more basic level, as with Arctic governance, there is also a need to debate the overarching principles influencing governance of our oceans and the atmosphere and the relation between oceanic and atmospheric management and geoengineering governance. For example, the law of the sea designates the high seas as the common her-

252. *Id.* at 34 (citing J. Virgoe, *International Governance of a Possible Geoengineering Intervention To Combat Climate Change*, 95 CLIMATIC CHANGE 103, para. 3 (2009)).

253. *Id.* at 34–35.

254. *See, e.g.*, Davies, *supra* note 124, at 4–5.

255. *See* HOUSE OF COMMONS REPORT, *supra* note 123.

itage of mankind;²⁵⁶ there is an ongoing debate in the United Nations about whether Antarctica constitutes common heritage;²⁵⁷ the UNFCCC and the Kyoto Protocol designate the earth's climate as of common concern to humankind;²⁵⁸ the CBD designates the conservation of biological diversity as of common concern to humankind.²⁵⁹ The ideas of common heritage and common concern²⁶⁰ are not synonymous nor does either concept offer a clear governance path forward.

Yet, if the global community chooses to approach geoengineering governance as tied to larger questions of common heritage or common concern, it recognizes that questions of geoengineering are interrelated with principles of equitable utilization of resources²⁶¹ and it suggests that the question is of such importance as to be capable of transcending traditional conceptions of state sovereignty. These are difficult questions that do not lend themselves to definitive resolution and that the global community continues to struggle with in relation to the law of the sea and the global climate.

256. See UNCLOS, *supra* note 4, art. 87(1)(e); see also U.N. GAOR, 22nd Sess., 1516th plen. mtg. at 2–3, U.N. Doc. A/C.1/PV.1516 (Nov. 1, 1967) (Arvid Pardo of Malta, General Debate of Agenda Item 92 (continued)); INTERNATIONAL ENVIRONMENTAL LAW AND POLICY 482 (David Hunter et al. eds., 3d ed. 2007) (explaining that this principle tends to be limited to “those areas beyond the limits of national jurisdiction”).

257. See, e.g., Christopher C. Joyner, *The Antarctic Minerals Negotiating Process*, 81 AM. J. INT'L L. 888 (1987).

258. UNFCCC, *supra* note 101, pmbl. para. 1; see also A. Res. 43/53, pmbl. Para. 2, U.N. Doc. A/RES/43/53 (Dec. 6, 1988); Report of the Second Committee, Conservation of Climate as Part of the Common Heritage of Mankind, Agenda item 148, U.N. Doc. A/43/905 (Nov. 30, 1988).

259. CBD, *supra* note 102, pmbl. para. 3.

260. Alan E. Boyle, *The Rio Convention on Biological Diversity*, in INTERNATIONAL LAW AND THE CONSERVATION OF BIOLOGICAL DIVERSITY 33, 40 (Michael Bowman & Catherine Redgwell eds., 1996) (arguing that unlike “common heritage,” the concept of “common concern” does not internationalize ownership of resources. Rather, it acknowledges that states should manage their own resources with an eye toward the good of the international community at large).

261. Tania Voon, *Sizing up the WTO: Trade-Environment Conflict and the Kyoto Protocol*, 10 J. TRANSNAT'L L. & POL'Y 71, 86 (2000) (suggesting that “[t]he global ownership of and responsibility for the earth's atmosphere has been captured in such phrases as ‘common property,’ ‘common heritage,’ ‘common concern’ and ‘common interest.’ Where shared resources (such as the earth's atmosphere) are limited and expendable (or capable of suffering irreversible damage), principles of equitable utilization arise. To the extent that one country's use of these resources will limit or prevent their use by other countries, the interests of those other countries should be considered.”).

It is essential that geoengineering not be divorced from these underlying questions, because just as climate change poses tremendous threats to the global community as a whole regardless of the point of origin of greenhouse gas emissions, so does geoengineering pose the risk of transboundary or global harm regardless of the nationality of a particular project sponsor. Therefore, even though geoengineering does not easily lend itself to comprehensive international regulation in the short term due to the novelty of the field and the decentralized nature of research and development activities,²⁶² near-term efforts to develop a normative framework for geoengineering governance must recognize the linkages between geoengineering and pressing questions of international law.

Just as there is a need to carefully position geoengineering within the larger context of international law and to approach it as a pressing question of international governance, there is also a need for decentralized/bottom-up development of an industry-based system of norms and common practices. As with any specialized area of science or engineering, the experts in the discipline are not the politicians or the activists but the people working day in and day out in the lab and in the field. Evolving systems of geoengineering governance must facilitate the parallel development of a system of common practice.

Moving forward, one of the most critical elements in state-based and international efforts to develop the normative framework for geoengineering governance will be to find ways to improve communication and coordination between the epistemic communities working on the development of the technologies and the politicians working on the development of the governance system. In this regard, both the development of the international ozone regime and the international climate regime offer instructive lessons in ways to bridge gaps between epistemic communities and policymakers.²⁶³ Yet, policymakers will have to move beyond the framework offered by the IPCC to consider novel ways of linking science and policy due to the unique decisionmaking challenges attendant to geoengineering. Linking the epistemic and policymaking communities involved in geoengineering poses particular difficulties not only due to the novelty of the field but also because decisionmaking requires very different kinds of risk, environmental and cost-benefit analyses. The abil-

262. See, e.g., Victor, *supra* note 123, at 329–32.

263. See generally Laura Thoms, *A Comparative Analysis of International Regimes on Ozone and Climate Change with Implications for Regime Design*, 41 COLUM. J. TRANSNAT'L L. 795 (2003).

ity to create flexible and informed systems of geoengineering governance will depend not only upon creating a strong set of widely agreed upon normative principles but also upon successful efforts to link science and common practice to policy.²⁶⁴

2. Geoengineering in Context

As policymakers move forward with efforts to think through questions of geoengineering governance, it is crucial that the debate contextualize geoengineering in order to better evaluate its risks and possibilities. Not only must geoengineering be contextualized within existing international frameworks considering questions of trans-boundary harm and management of the global commons, but it must also be specifically contextualized within the context of our ongoing efforts to mitigate and adapt to climate change. In the two contexts, what are our comparative perceptions of risk and responsibility? Similarly, as we develop abatement policies, how does geoengineering compare to, for example, pervasive efforts to expand global nuclear energy capacity? In each of these three governance contexts, what assumptions are we making about risk and responsibility and what tools are we employing to evaluate risks, costs and benefits?

Do the respective governance regimes—of climate change, energy and geoengineering—employ comparable risk and impact analysis tools? Do they make common assumptions about responsibility? Do they offer tools for undertaking comparative analyses of other options? This Article does not seek to answer these questions, but it poses them in an effort to highlight the complexities integral to thinking through geoengineering governance.

With climate change, the global community is hemmed in by existing systems of law and is entrenched in a decades-long debate. Pre-existing norms, beliefs and practices limit creative thinking. With geoengineering, the slate is still clean. In the rush to establish a system of governance, policymakers should not scuttle the chance to approach geoengineering as an opportunity to tackle some of the harder normative questions that relate to larger questions of trans-boundary harm and management of the global commons. Policymakers should seek ways to utilize existing international institutions

264. See, e.g., Victor, *supra* note 123, at 329–30. Victor suggests that decentralized norm development is ideal and that a better approach to linking science to policy would be to “enlist multiple strong assessment institutions rather than a single, global, and weak institution.” *Id.* at 330.

and to create more flexible and joined-up systems of governance along the way.

As one scholar notes, our society is already “mangled.”²⁶⁵ Our addiction to fossil fuel binds us to an unsustainable path forward, and our fragmented system of international law hinders our ability to address issues that fall at the intersection between different fields of law.²⁶⁶ Geoengineering offers an opportunity to address anew questions of risk and responsibility that are equally relevant to the ongoing climate change and Arctic governance debate. Geoengineering thus is not only one of the most difficult governance challenges of our time, it is also one of the most important.

As with questions of Arctic governance, geoengineering requires a multilateral response. Geoengineering touches upon sensitive questions of sovereignty, raises fundamental questions of inter-generational rights and responsibilities and is complicated by tensions between the private and public sector. Unlike the situation in the Arctic, however, with geoengineering the relative absence of applicable pre-existing governance institutions allows policymakers great flexibility to test the boundaries of existing systems of law and to develop a novel governance regime. The progression of the geoengineering governance debate offers a window into the state of international law generally and international environmental law specifically. Geoengineering governance debates offer an opportunity to test our perceptions of rights and responsibilities in respect to management of the global commons.

Ultimately, geoengineering governance must be based on a commonly agreed upon set of principles, it must be treated as requiring a multi-generational commitment and it must be approached not as offering an alternative strategy or even a complement to mitigation, but rather “as a complement to adaptation and the building of resilience in that it might prevent the worst impacts, and . . . act as an insurance policy against the very worst impacts.”²⁶⁷ Most importantly, perhaps, it should be approached as an opportunity to refine existing approaches to global environmental governance.

265. See generally Luke, *supra* note 234.

266. See Carlarne, *supra* note 3, at 4.

267. MacCracken, *supra* note 124, at 34.

IV. CONCLUSION

The disparate yet interrelated governance challenges posed by the Arctic and geoengineering reveal the pervasive nature of global climate change. These two issues are part and parcel of climate change's collateral damage. As wicked as the core problem of climate change is, the secondary problems climate change spins-off are also dauntingly complex. The two issues examined here raise distinct but equally important governance questions that exist outside the parameters of existing law and reveal the degree to which gaps and fragmentation in international law continue to hamper effective policy choices. Questions of Arctic and geoengineering governance also reveal that there is urgent need to rethink the normative frameworks for governing the global commons and for responding to activities that pose risks of transboundary harm, as well as to locate the home of our governance efforts in this regard.

The disintegration of global climate change negotiations in Copenhagen in 2009 represented a low moment for global environmental governance and exposed the depth of disagreement over fundamental questions of rights and responsibilities with regard to management of our shared resources. Despite inherent difficulties, global efforts to address Arctic and geoengineering governance gaps pose discreet opportunities for the global community to debate, refine and advance the normative framework and institutional structures for management of the global commons. In both contexts, the questions asked and the answers offered will offer insight into larger questions of global environmental governance.