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The Problem of Shared Irresponsibility in International Climate Law

DANIEL H. COLE^{*}

1. Introduction

International climate governance represents a case of shared *irresponsibility*. The United Nations (UN) Framework Convention on Climate Change (UNFCCC),¹ the Kyoto Protocol,² and subsidiary agreements purport to establish both shared and common-but-differentiated responsibilities; yet the global community as a whole has yet to make credible and enforceable commitments that would actually accomplish the UNFCCC's stated goal of preventing 'dangerous anthropogenic interference with the climate system'.³ At Cancun in 2010, the parties to the framework convention agreed that increases in global mean temperatures should be restricted to no more than 2° (Celsius) above pre-industrial levels,⁴ which would require a reduction in annual global greenhouse gas (GHG) emissions of at least 80 per cent from 1990 levels by 2050.⁵ However, the

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¹ United Nations Framework Convention on Climate Change, New York, 9 May 1992, in force 21 March 1994, 1771 UNTS 107 (UNFCCC).

² Kyoto Protocol to the United Nations Framework Convention on Climate Change, Kyoto, 11 December 1997, in force 16 February 2005, 2303 UNTS 148 (Kyoto Protocol).

³ Article 2 UNFCCC, n. 1.

⁴ 'The Cancun Agreements: Outcome of the work of the Ad Hoc Working Group on Long-term Cooperative Action under the Convention', COP Decision 1/CP.16 (2010), at http://unfccc.int/meetings/cancun_nov_2010/session/6254/php/view/decisions.php.

⁵ Allianz Group and World Wildlife Fund, 'Climate Change & the Financial Sector: An Agenda for Action' (June 2005), at www.wwf.org.uk/filelibrary/pdf/allianz_rep_0605.pdf.

only existing multilateral mitigation agreement, the 1997 Kyoto Protocol, virtually guarantees continuing *net* increases in *global* emissions of greenhouse gases (GHGs).⁶ That Protocol was scheduled to expire at the end of 2012, but was extended as member states failed to agree on a successor mitigation agreement that might be even slightly effective. Consequently, the existing international regime for climate change does virtually nothing to avoid ‘dangerous anthropogenic interference with the climate system’.

This chapter describes the current state of ‘shared irresponsibility’ for climate change, and explores a couple of possible solutions including: first, a liability-based approach, which some international lawyers have been advocating;⁷ and second, an emerging interdisciplinary literature recommending various ‘polycentric’ approaches that would supplement or replace the UN process, which relies on global treaties among hundreds of state actors with varying interests and incentives. The key for any solution is to alter the existing incentives and/or interests of states so that they accept *and* share responsibility to mitigate greenhouse gas emissions.

Section 2 briefly explains climate change as a collective-action problem, which largely explains the lack of progress on climate change so far. Moving from ‘shared irresponsibility’ to shared responsibility on climate change is primarily a matter of resolving those collective-action problems. Obviously, that is no easy task, but it is a task upon which game theory sheds some light. Section 3 asks what type of ‘game’ international climate negotiations represent. The answer to that question is important because, if the climate ‘game’ is a prisoners’ dilemma (PD), as several scholars have suggested,⁸ then a cooperative solution – where ‘cooperation’ amounts to accepting and sharing responsibility – is not just unlikely but strictly impossible. I argue, however, that the climate ‘game’ is more in the nature of an Assurance Game with uncertain pay-offs (expected values), which has both cooperative and non-cooperative equilibria. If I am right about that, then

⁶ See, e.g., D.H. Cole, ‘Climate Change and Collective Action’ (2008) 61 CLP 229, at 230.

⁷ See, e.g., R. Verheyen, *Climate Change Damage and International Law: Prevention Duties and State Responsibility* (Leiden: Martinus Nijhoff, 2005); D.A. Grossman, ‘Warming Up to a Not-So-Radical Idea: Tort-Based Climate Change Litigation’ (2003) 28 Col JEL 1; J. Kilinski, ‘International Climate Change Liability: A Myth or a Reality?’ (2009) 18 JTLP 377.

⁸ G. Brennan, ‘Climate change: a rational politics view’ (2009) 53 AJARE 309; K. Pittel and D.T.G. Rübhelke, ‘Transitions in the negotiations on climate change: from prisoner’s dilemma to chicken and beyond’ (2012) 12 IEA 23; F. Grundig, H. Ward and E. R. Zorick, ‘Modeling Global Climate Negotiations’, in U. Luterbacher and D.F. Sprinz (eds.), *International Relations and Global Climate Change* (Cambridge, MA: MIT Press, 2001), 153. It is not clear, however, that those scholars were referring to the ‘Prisoners’ Dilemma’ in the strict sense in which I employ it. See section 3.

cooperative (shared-responsibility) solutions to the climate change problem are neither ruled-out *ab initio* nor ensured, but are contingent on circumstances, some of which might be within the control of state actors. Sections 4 and 5 consider alternative mechanisms for inducing greater cooperation among actors in the climate ‘game’. Section 4 considers and rejects the liability-based approach advocated by some international legal scholars because of legal and procedural hurdles. Moreover, using liability to promote mitigation of greenhouse gas emissions could prove counterproductive; rather than inducing cooperation, it might reduce incentives for states to participate in international regimes (i.e., to share responsibility). Section 5 explores, in a somewhat more optimistic vein, emerging ‘polycentric’ approaches to climate change. Such approaches are framed in various ways – as ‘regime complexes’, ‘building blocks’, ‘tipping sets’, etc. – but they share a supposition that sub-global (and even sub-national) processes could bring about a more effective and robust climate mitigation regime by altering the incentives and interests of (virtually) all states.

This chapter is more analytical than normative, but the analysis is informed by the following normative values: first, whatever we believe about the best (or second-best) climate policy is irrelevant if it is not feasible – normative assertions untethered to positive diagnoses of the problems we confront are likely to be unproductive or even counterproductive; second, the analyses in this chapter presume a welfare-consequentialist goal, which is, of course, fully consistent with the UNFCCC’s main objective of ‘avoiding dangerous anthropogenic interference with the climate system’; and third, ‘shared responsibility’ (as a reality rather than a mere concept) cannot simply be imposed from above but must be *accepted* or *taken* by parties. The allocation of costs and benefits of climate change or climate change prevention is a secondary, which is not to say an unimportant, consideration. Finally, the analysis, if it is sufficiently persuasive, could point us in certain normative directions and away from others.

2. Climate change as a collective-action problem

Climate change is the greatest collective-action problem the international community has confronted.⁹ This is true for several reasons, which I will list before briefly discussing:

⁹ This section provides a very brief treatment of issues discussed at length in Cole, ‘Climate Change and Collective Action’, n. 6. Cf. S. Barrett, *Why Cooperate? The Incentive to Supply Global Public Goods* (Oxford University Press, 2007), at 9: ‘Global climate change may or

1. It is an 'aggregate effort' problem that is truly global in scope, in that GHG emissions from anywhere contribute to climate change everywhere.¹⁰ In other words, for any solution(s) to the climate change problem to succeed, responsibility for mitigating greenhouse gas emissions must be widely shared.
2. Uneven distribution of costs and benefits expected from moderate climate change reduces incentives for wide sharing of responsibility.
3. Lingering scientific and social-scientific uncertainties about social-welfare effects from various emissions and atmospheric concentration levels of GHGs complicate determinations of how much mitigation is required.
4. Concerns about energy supply and the lack of sufficient quantities of affordable substitutes to fossil fuels for at least the next 20–30 years create countervailing incentives for most, if not all, states.

Climate change is a problem of truly global proportions because GHG emissions from any location in the world contribute to climate change everywhere. A stable climate, once thought of as a pure 'public good' (meeting both technical requirements of non-rivalrousness of consumption and inability to exclude),¹¹ has proven to be a 'common-pool resource',¹² as defined by Vincent and Elinor Ostrom.¹³ A 'common-pool resource' is a congestible or subtractable public good, where upon reaching some threshold point of congestion, overuse, or subtraction, consumption becomes rivalrous, though non-excludability persists. The combination of

may not be the most important problem facing us today, but it is almost certainly the hardest one for the world to address.'

¹⁰ Barrett, *Why Cooperate?*, *ibid.*, at ch. 3.

¹¹ See, e.g., P. Cramton and S. Soft, 'International Climate Games: From Caps to Cooperation', Global Energy Policy Center Research Paper No. 10-07 (20 August 2010), at www.cramton.umd.edu/papers2010-2014/cramton-stoft-international-climate-games.pdf.

¹² It is extremely important not to confuse or conflate a 'common-pool resource' (CPR) with a 'common-property regime' (also CPR). The former is a resource system defined by subtractibility/congestibility and non-exclusivity. The latter is a potential solution to problems of overuse arising from nature of common-pool resources. A common-property regime is a system of common-property rights/regulations created by local users/actors to restrict their own access to and use of the common-pool resource. In other words, a common-property regime is one mechanism (among others, including formal governmental regulation and privatisation) for introducing some exclusivity where exclusivity previously was absent. See generally E. Ostrom, *Governing the Commons: The Evolution of Institutions for Collective Action* (Cambridge University Press, 1990).

¹³ V. Ostrom and E. Ostrom, 'Public Goods and Public Choices', in M.D. McGinnis (ed.), *Polycentricity and Local Public Economies: Readings from the Workshop in Political Theory and Policy Analysis* (Ann Arbor: University of Michigan Press, 1999), 75, at 77–79.

rivalrousness in consumption and non-excludability leads ‘inexorably’ to Hardin’s ‘tragedy of the commons’, *unless* exclusivity can somehow be imposed *via* institutional mechanisms. Indeed, the purpose of climate mitigation law is to introduce some amount of exclusion by fiat, pursuant to a binding contract entered into by state actors.¹⁴

Before the Industrial Revolution, the climate system was for all practical purposes a global public good because aggregate human emissions of the GHGs were insufficient to push the climate system out of an equilibrium that was determined exclusively by natural forces. In other words, human use of the climate system was non-rivalrous and non-exclusive. But human emissions of GHGs since the onset of the Industrial Revolution (generally dated to around 1850) have increased exponentially, and atmospheric concentration levels of carbon equivalents have reached a threshold level at which the stability of the climate system is threatened.¹⁵ The climate system has reached a carbon-congestion point, which renders it a common-pool resource rather than a pure ‘public good’.

That the climate system is now a ‘common-pool resource’ rather than pure ‘public good’ is implicit in notions such as ‘carbon budgets’. A carbon budget is a scientific estimate of aggregate amounts of carbon dioxide equivalents humans (from all countries) can emit over a certain period time (usually, the middle of this century) without breaching a threshold at which the atmosphere, because of over-congestion of GHGs, might tip into a new and potentially dangerous equilibrium.¹⁶ If the global climate were completely non-rivalrous in consumption, like pure ‘public goods’, the carbon budget would be infinite.

As a matter of positive political-economy and game theory, the climate change problem is not just about living within a carbon budget to sustain

¹⁴ I take it as given that the option of privatisation of the climate is impossible (or, at least, infeasible). An international agreement could be conceived as taking the form either of Hardin’s state-regulatory solution or Ostrom’s common-property solution to avert the tragedy of open access.

¹⁵ See, e.g., Intergovernmental Panel on Climate Change (IPCC), *Climate Change 2007: Synthesis Report*, at 36–37.

¹⁶ I am using the phrase ‘carbon budgets’ as it is used in the climate policy literature, in contrast to the very different meaning that phrase has in the ecological literature. Compare, e.g., T. Kanitkar et al., ‘Carbon budgets for climate change mitigation – a GAMS-based emissions model’ (2013) 104 CS 1200, at 1201 (addressing issues of distribution of a global ‘carbon budget’ of 1000 CtCO₂ for 2000–2050 to prevent dangerous interference with the climate system); and G.M. Woodall et al., ‘Biota and the World Carbon Budget’ (1978) 199 *Science* 141, at 141 (referring to the ‘carbon budget’ as a scientific determination of net sources and sinks).

a common-pool resource. It is about doing that while securing reliable and affordable energy supplies for both developed and developing countries.¹⁷ The existence of such inconsistent goals (given current technologies) greatly complicates policy approaches to climate change. The main sources of GHG emissions, including energy production and consumption, industrial production, and transportation, are critical components of economic development and growth, which no country on earth, least of all those in the developing world, would willingly sacrifice, especially when any state's efforts to reduce emissions can so easily be offset by increasing emissions elsewhere – a problem known as 'leakage'. Any state that unilaterally reduced its GHG emissions, at substantial cost to its economy, to ameliorate the climate problem might be a 'sucker',¹⁸ as other states have incentives to free-ride on its efforts (i.e., not to share responsibility). Those incentives are what make climate change a collective-action problem in the first place.

If, for example, the United States, the world's leading *per capita* emitter of GHGs (and second to China in nominal annual emissions), unilaterally curtailed (that is, reduced to zero) its *net* carbon-dioxide emissions (emissions minus sinks that absorb carbon dioxide), those reductions would be completely offset within a few short years by increasing emissions from developing countries.¹⁹ The global climate would almost

¹⁷ See Cole, 'Climate Change and Collective Action', n. 6, at 238–239.

¹⁸ Elinor Ostrom often stated as a truism of positive political-economy that 'no one wants to be a "sucker"'. See, e.g., Ostrom, *Governing the Commons*, n. 12, at 44; S. Crawford and E. Ostrom, 'A Grammar of Institutions' (1995) 89 *APSR* 582, at 596.

¹⁹ In 2011, the United States was responsible for *net* carbon-dioxide emissions of 5.612.9 gigatons of CO₂ equivalents. See US EPA, 'Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2011', EPA 430-R-13-001 (12 April 2013), at 2–4, Table 2-1 'Recent Trends in U.S. Greenhouse Gas Emissions and Sinks (Tg CO₂ Eq.)'. Total global emissions that same year amounted to approximately 34 gigatons of CO₂ equivalents. See Planbureau voor de Leefomgeving Netherlands Environmental Assessment Agency, 'Trends in global CO₂ Emissions', Table 28 A1.2. Subtracting 2011 US emissions from that total would leave 27.4 gigatons of CO₂ equivalents. Thus, in 2011 the United States was responsible for 16.5 of global CO₂ emissions; it is, after all, a major emitting country. But developing country emissions increased in 2011 alone by one gigaton of CO₂ equivalents. At that rate, developing countries would offset a complete decarbonisation of the US economy in less than six years. This does not mean that unilateral decarbonisation of the US economy would not be a good thing from a climate change perspective. To estimate its overall effect, we would have to run the numbers through an 'integrated assessment model', combining emissions data and climate sensitivity models in Monte Carlo analyses to derive a probability density function of damages from various levels of change in global mean temperature. On the nature of integrated assessment models and variations among them, see, e.g., E.A. Parson and K. Fisher-Vanden, 'Integrated Assessment Models of Global Climate Change' (1997) 22 *AREE* 589.

Table 10.1 *Effects of 2.5°C GMT increase on GDP (mean estimates)*

Country	Net cost (or benefit) as per cent of GDP
USA	0.45
China	0.22
Japan	0.50
OECD Europe	2.83
Russia	-0.65
Eastern Europe	0.71
Africa	3.91
India	4.93

certainly benefit to a limited extent from the approximately six years' of grace provided by US decarbonisation, but it would merely delay by that amount of time an overall doubling of preindustrial concentration levels of greenhouse gases (unless the US example caused other countries to follow suit, as hopefully it would).

The political problem of climate change is compounded by the unequal distribution of costs and benefits that economists expect will result from changes in global mean temperatures, rising sea-levels, and other consequences. Moderate climate change is likely to create winners (at least relatively speaking, and perhaps nominally) as well as losers among nations. Those that expect to 'win' obviously have different incentives in climate change negotiations from those that expect to 'lose'. By way of illustration (the precise estimates of which should be taken with several pinches of salt),²⁰ consider Table 10.1, from a 2000 study by William Nordhaus and Joseph Boyer:²¹

On Nordhaus and Boyer's estimates, big losers from moderate climate change would include India and Africa. Western Europe would also

²⁰ This table is merely for illustration because Nordhaus's integrated assessment models of climate change have evolved since 2000, and it is unlikely that the damage estimates predicted by this particular study are spot on. Analysts using other integrated assessment models with differing parameter values yield much higher damage estimates for all countries, including the United States and China. See, e.g., N. Stern, *The Stern Review on the Economics of Climate Change* (Cambridge University Press, 2007). However, Nordhaus and Boyer's assessment of the *relative* allocation of harm among regions reflects a general consensus. No economic assessment of *moderate* climate change suggests that all areas of the world will be (more or less) equally harmed or benefited. All economists agree that the countries likely to suffer the most harm are precisely the countries that have historically emitted the least GHGs.

²¹ W.D. Nordhaus and J. Boyer, *Warming the World: Economics Models of Global Warming* (Cambridge, MA: MIT Press, 2000), at 91, Table 4.10.

suffer significant harm, while the United States, China, and Eastern Europe would suffer very little socio-economic harm. Russia would actually be a net beneficiary of moderate climate change, which goes some way toward explaining why Russia held out for ‘side payments’ (in the form of ‘hot air’ credits, which are emissions allowances unrelated to actual emissions) to sign and ratify the Kyoto Protocol.²²

Whenever some members of the international community expect to win while others lose, negotiating treaties that would distribute gains and losses while balancing conflicting imperatives, such as climate stability and energy security, becomes problematic. The equilibrium solution is overwhelmingly likely to be the lowest common denominator of all the parties – something like the Kyoto Protocol – which would not resolve the problem.²³ In other words, to the extent parties agree to share responsibility at all, the level of aggregate responsibility will be insufficient.

Just as importantly, we lack technological substitutes for fossil fuels that would allow states to decarbonise, if not painlessly, then at least at some reasonable cost.²⁴ According to the International Energy Administration’s *World Energy Outlook 2012*, fossil fuels (coal, gas, and oil) are expected to continue supplying the vast majority of the world’s energy needs at least through 2030, a period during which global energy demand is expected to increase by more than one-third.²⁵ During that same period we need to be in the process of reducing *global* emissions of GHGs by approximately 80 per cent to avoid exceeding a target concentration level of 450 parts per million by 2050.²⁶ It is a tall order, even assuming (perhaps heroically) that states quickly become more willing than they have been so far to cooperate.

Given the facts of the climate problem, it is not surprising that more than two decades of international negotiations have so far produced

²² D.H. Cole, ‘Regulatory Cost-Benefit Analysis and Collective Action’, Institute for Policy Integrity New York University School of Law, Working Paper No. 2009/1 20–22 (May 2009), at http://policyintegrity.org/files/publications/2009_1.pdf, at 21.

²³ Cole, ‘Climate Change and Collective Action’, n. 6, at 254; M. Inman, ‘The climate change game’ (2009) 3 NRCC 130, at 132.

²⁴ This is part of what makes the climate change problem so very different from, and so much more difficult than the ozone problem. Cole, ‘Climate Change and Collective Action’, n. 6, at 238–242.

²⁵ International Energy Agency, *World Energy Outlook 2012*, at www.worldenergyoutlook.org/publications/weo-2012/.

²⁶ IPCC, Fourth Assessment Report, Working Group III, Box 13.7, at www.ipcc.ch/index.htm.

disappointing results. Agreements have been few, and achievements modest at best. The agreements include

- a workable but weak framework convention, the United Nations Framework Convention on Climate Change;²⁷
- a frail and seriously flawed (but recently extended) mitigation treaty, the Kyoto Protocol,²⁸ which by design is fully consistent with a net increase in global GHG emissions;²⁹ and
- a mixed bag of (legally non-binding) add-ons to the Kyoto Protocol, including REDD+,³⁰ the Marrakech Accord,³¹ and the Copenhagen Accord.³²

Because the climate agreements, and their various problems, have been comprehensively canvassed in both scholarly and popular literatures,³³ this chapter will not review them except insofar as they relate directly to recommended mechanisms for enhancing shared responsibility in the sections that follow.

3. The nature of the climate change game

Climate change often is portrayed as a Prisoners' Dilemma - perhaps the ultimate PD.³⁴ Were that truly the case, no purpose would be served trying to conceive cooperative solutions because PDs, properly understood, do not allow for cooperative solutions.³⁵ Given the pay-off

²⁷ See <http://unfccc.int/2860.php>. ²⁸ Kyoto Protocol, n. 2.

²⁹ See, e.g., Cole, 'Climate Change and Collective Action', n. 6, at 230.

³⁰ REDD+ (Reducing Emissions from Deforestation and Forest Degradation) is an offset programme that developed separately from the UNFCCC process but has since been incorporated into it. See 'About REDD+', UN-REDD Programme, at www.un-redd.org/aboutredd/tabid/582/default.aspx.

³¹ 'The Marrakesh Accords' and 'The Marrakesh Declaration', at http://unfccc.int/cop7/documents/accords_draft.pdf.

³² Ibid.

³³ Cole, 'Climate Change and Collective Action', n. 6; D. Victor, *The Collapse of the Kyoto Protocol and the Struggle to Slow Global Warming* (Princeton University Press, 2001); Q. Scheirmeier, 'The Kyoto Protocol: Hot air' (2012) 491 *Nature* 656.

³⁴ P.J. Wood, 'Climate Change and Game Theory' (2011) 1219 *ANYAS* 153, at 168; D. Helm, 'Climate change policy: why has so little been achieved?' (2008) 24 *OREP* 211, at 234; T. Irwin, 'Implications for climate-change policy of research on cooperation in social dilemmas', World Bank Policy Research Working Paper No. 5006 (1 July 2009), at 3.

³⁵ Often, the label 'Prisoners' Dilemma' (PD) is used quite loosely to describe all manner of problems that might or might not have cooperative solutions. Indeed, it has become fashionable to talk about cooperative solutions to iterative PD games, but as I have pointed out before, any PD (single-play or iterative) that admits any cooperative solution is not strictly speaking a PD. The only way a cooperative solution to a PD can exist is to

structure of a PD (which is what makes a PD a PD), non-cooperation is a unique Nash equilibrium solution. The only way a cooperative solution can be achieved is by altering the pay-offs (which would make the PD no longer a PD, but some other kind of game).

However, the climate change game is not a PD because, like virtually all other common-pool resource problems,³⁶ it possesses multiple equilibria, which might be either cooperative or uncooperative. In other words, climate change is in the nature of what Amartya Sen has called an ‘Assurance Game’, which possesses uncertain, probabilistic pay-offs (expected values rather than certain values). Those pay-offs are determined by an array of variables, most notably levels of trust, which depend in turn on factors such as credibility of commitments and the ability to monitor performance and sanction non-compliers. Those factors affect the perceived probability that, if the first mover cooperates (e.g., accepts responsibility to mitigate GHG emissions), so then will subsequent movers.³⁷

In the Assurance Game, pay-offs are not certain values but expected values with probabilistic pay-offs, where p is a probability assigned to a pay-off. In its simplest form, the pay-off matrix appears as follows:³⁸

		Player 2	
		Cooperate	Defect
Player 1	Cooperate	$p_2 7, p_1 7$	$(1-p_2)-1, 5$
	Defect	$5, (1-p_1)-1$	5, 5

With expected values as specified in the matrix, cooperation (shared responsibility) is the dominant strategy for both parties so long as the probability of mutual cooperation remains above 0.75.³⁹ But if the probability of mutual cooperation falls to 0.74, then the expected value from cooperation falls to 4.92, which is lower than the pay-off from

change the pay-offs, in which case the problem is no longer (and may never have been) a true PD (which by definition entails a single non-cooperative solution as a Nash equilibrium). See D.H. Cole and P.Z. Grossman, ‘Institutions Matter! Why the Herder Problem Is Not a Prisoners’ Dilemma’ (2010) 69 TD 219.

³⁶ Ibid.

³⁷ Ibid. See also A. Sen, ‘Isolation, assurance, and the social rate of discount’ (1960) 81 QJE 112.

³⁸ From Cole and Grossman, ‘Institutions Matter! Why the Herder Problem Is Not a Prisoners’ Dilemma’, n. 35, at 228.

³⁹ $EV_1 = (.75) 7 + (.25)-1 = 5.$

defection (5). At that point (and at all probabilities lower than 0.75), non-cooperation on climate mitigation would become the dominant strategy – sometimes referred to as a ‘risk dominant’ strategy.⁴⁰ In reality, of course, the climate change game is iterative and long-form, involving many more than two parties; and the probabilistic pay-offs presented in the simple two-by-two matrix would only represent expected valuations of cooperation and non-cooperation at each decision node in the iterative game. In addition, the losses suffered from non-cooperation may not be symmetrical between the parties, as the pay-off matrix presupposes. However, the pay-off matrix does accurately illustrate the multiple equilibria of an Assurance Game.

In the climate change context, the probability of mutual cooperation is based largely on the credibility of commitments, which in turn reflect the relative ease of monitoring and enforcing those commitments.⁴¹ The greater the credibility of commitments to abate GHG emissions, the more likely major emitting countries would be to attain a more efficient (in the aggregate) equilibrium. The greater the level of distrust – the less countries believe that others would follow their lead in cooperating – and the greater their level of risk aversion (not for climate change itself but for investments to resolve the problem), the more likely the global community would remain at a globally inefficient equilibrium, possibly equivalent to the outcome of a PD. So, even if the climate change game is not, strictly speaking a PD, it might turn out like one.⁴² Indeed, such an outcome seems more likely than not at present, given the lack of progress on cooperative solutions. But unlike the strict PD that undesirable outcome is not preordained by the pay-offs, which in a PD are deliberately structured by the criminal justice system.⁴³ The current bad equilibrium in climate negotiations might be flipped to a better equilibrium, although just how this might be accomplished remains uncertain and contested.

⁴⁰ R. Gardner, *Games for Business and Economics* (New York: Wiley, 1995).

⁴¹ S. Barrett, ‘Credible Commitments, Focal Points, and Tipping: The Strategy of Climate Treaty Design’, in R.W. Hahn and A. Ulph, *Climate Change and Common Sense: Essays in Honour of Tom Schelling* (Oxford University Press, 2012), 29; S. Barrett, ‘Climate treaties and the imperative of enforcement’ (2008) 24 OREP 239.

⁴² Accord S. Barrett and A. Dannenberg, ‘Climate negotiations under scientific uncertainty’ (2012) 109 PNAS 17372. Barrett believes that the current pay-off structure of pay-offs to climate negotiations remain like those of a PD. See S. Barrett, ‘Climate treaties and approaching catastrophes’ (2013) 66(2) JEEM 235.

⁴³ Cole and Grossman, ‘Institutions Matter! Why the Herder Problem Is Not a Prisoners’ Dilemma’, n. 35, at 221, 223, 224.

4. Can liability motivate shared responsibility for climate change mitigation?

If the climate change game has at least the potential for a cooperative equilibrium, as I have suggested, the next task is to identify potential mechanisms that might shift players toward such an equilibrium solution from the current uncooperative equilibrium. This section assesses two general recommendations for improving the incentives of GHG emitting countries to cooperate in reducing their emissions: first, a liability-based regime under which countries harmed as a result of climate change might sue countries alleged to have *caused* the harm (*a la* the *Trail Smelter* arbitration); second, a ‘polycentric’ approach to climate policy-making that might (or might not) dispense with the UNFCCC process. Any polycentric approach (or set of such approaches) would allow for (relatively speaking) ‘bottom-up’ development of climate policies via unilateral, bilateral, or multilateral state, regional, and local actions. Such actions would provide an opportunity for experience-based learning about what works and does not work at various levels of climate governance. Recognising, of course, that no panacea (or one-size-fits-all) solutions exist for the climate change problem (excluding the negligible possibility of an unexpected short-term technological change that would immediately provide reliable and inexpensive substitutes for fossil fuels), experimentation with multiple potential solutions is more likely to prove fruitful (over time) than continuing down a singular, globally negotiated path that has been fruitless since its adoption more than 20 years ago.

One solution, promoted with increasing frequency, even desperation, by international legal scholars,⁴⁴ is litigation to establish state liability for extraterritorial harm resulting from the GHG emissions of major emitting countries, such as the United States. Harm from climate change already is manifest in various locales around the world, but nowhere more so than in low-lying islands and peninsulas, where climate change-induced sea-level rise is inundating land and displacing persons. For instance, the island of Kutubdia, off the coast of Bangladesh, is rapidly sinking into the Bay of Bengal. In just the last 20 years, the island’s total area has been halved, six of the island’s villages have been swamped, and 40,000 of its inhabitants have fled to higher

⁴⁴ See, e.g., Verheyen, *Climate Change Damage and International Law*, n. 7, at ch. 6.

ground.⁴⁵ The question is whether those poor climate refugees and the government of Bangladesh should be entitled to compensation from countries such as the United States and the European Union (EU) that are responsible for the lion's share of GHG emissions over the past 150 years? As a matter of simple justice, the answer to this question seems obvious: states should be liable for environmental harm, including climate harm, they cause to other states and their citizens. Very quickly, however, difficult legal, jurisdictional, and policy questions arise, which belie facile answers.

4.1 *The notion of 'state responsibility' in international law*

It has been argued, with substantial justification, that the international legal notion of state responsibility is 'not well adapted to the environmental field'⁴⁶ on several grounds, including (a) the absence of a consensus definition of 'environment' (not a trivial matter when the extent of state responsibility depends substantially on that term's definition); (b) the brute fact that 'in modern society, damage to the environment cannot be completely avoided',⁴⁷ but is 'inherent in industrial development';⁴⁸ and (c) the 'disgraceful solidarity of States in front of the degradation of the human environment to which they all contribute'.⁴⁹ Indeed, one might posit the existence of an international customary principle of environmental *abuse*. Nevertheless, state responsibility for international environmental harms is well established, if only in the minds of international lawyers.

Norms of international environmental protection have emerged since the early twentieth century primarily from two sources: first, treaties and other agreements, which are quasi-contractual arrangements establishing

⁴⁵ J. Vidal, 'Sea change: the Bay of Bengal's vanishing islands', *The Guardian*, 29 January 2013. Similar stories have been told about low-lying Pacific Island nations, such as Tuvalu. See, e.g., 'Tuvalu about to disappear into the ocean', *Reuters*, 13 September 2007. But according to recent reports several of those coral atolls have actually been growing in size, rather than shrinking. See N. Bryant, 'Low-lying Pacific islands "growing not sinking"', BBC News, 3 June 2010 (claiming that Tuvalu and other low-lying islands will 'still be there in 100 years' time', but might not be habitable). Disparate factual claims about whether or not islands are sinking highlights the kind of evidentiary problems that claimants of climate harm might confront before international courts and tribunals.

⁴⁶ C. Nègre, 'Responsibility and International Environmental Law', in J. Crawford, A. Pellet, and S. Olleson (eds.), *The Law of International Responsibility* (Oxford University Press, 2010), 803, at 803–804.

⁴⁷ *Ibid.* ⁴⁸ *Ibid.* ⁴⁹ *Ibid.*

mutual legal responsibilities among states (which may be shared equally or ‘common but differentiated’);⁵⁰ and second, the customary international legal principle of ‘no harm’, according to which states (supposedly) have a general duty to avoid engaging in acts causing substantial extraterritorial environmental harm.⁵¹ Breaches of treaty-based or customary law-based duties can give rise to state liability. However, even in the strongest factual circumstances imaginable, such as Bangladesh suing the United States for harm to Kutubdia and its residents, a negative outcome is predictable at a fairly high confidence level.

4.1.1 Potential liability under the UNFCCC and Kyoto Protocol

First, consider the source of potential legal liability. Bangladesh could try to sue the United States before the International Court of Justice (ICJ) under the UNFCCC or the customary no-harm rule, but not under the Kyoto Protocol. Because the United States has not ratified the Protocol, it is not legally bound by its terms. So, immediately, the most prominent source of legal climate mitigation obligations is off the table. Of course, other parties to the Kyoto Protocol might be sued (e.g., for violating emission-reduction obligations). But even assuming some parties are in violation of those very modest obligations, it is not clear that a basis for litigation exists because subsidiary agreements to the Protocol establish automatic (if ineffective) penalties for noncompliance,⁵² which could be read to preempt party-*v.*-party lawsuits, under the international legal doctrine of *lex specialis*.⁵³

⁵⁰ The UNFCCC imposes a shared obligation to avoid dangerous climate change, but the Kyoto Protocol creates ‘common but differentiated’ responsibilities with respect to mitigation: only developed countries (listed in Annex I of the UNFCCC) have specific emissions-reduction targets under the Protocol.

⁵¹ See section 4.1.2.

⁵² The primary penalty for failure to meet emission-reduction obligations under the Kyoto Protocol is a 30 per cent reduction in the emissions-reduction target for the following compliance period. Decision 27/CMP.1 (2005), Annex, ‘Procedures and mechanisms relating to compliance under the Kyoto Protocol’, FCCC/KP/CMP/2005/8/Add.3, at www.ciesin.columbia.edu/repository/entri/docs/cop/Kyoto_COP001_027.pdf. The penalty is much less significant than it appears because a penalised party is allowed to ‘borrow’ from one compliance period to the next, and so never actually has to suffer the penalty. X. Wang and G. Wiser, ‘The Implementation and Compliance Regimes under the Climate Change Convention and Its Kyoto Protocol’ (2002) 11 *RECIEL* 181, at 196.

⁵³ According to the doctrine of *lex specialis*, special rules of international law take precedence over more general rules governing state responsibility. Article 55 of the ILC’s Articles on State Responsibility provides that its ‘articles do not apply where and to the extent that the conditions for the existence of an internationally wrongful act or the content or

Moreover, suing co-parties of treaties hardly provides a solid basis for further cooperation in ongoing negotiations to develop a workable global mitigation regime. For example, a lawsuit against the EU, which arguably has taken more action to mitigate emissions than any other state actor, would do little to encourage it to take more action, and might actually discourage EU member states from cooperating.

But what about a theoretical lawsuit against the United States for violating its legal obligations under the UNFCCC, which the United States *has* ratified? A threshold question is whether the UNFCCC imposes *legally enforceable* obligations to reduce GHG emissions. Scholars have offered different answers to that question: on one view, the UNFCCC imposes only very limited legally enforceable obligations, which do not include actual emission-reductions,⁵⁴ on another view, the UNFCCC imposes actual, though not specific, emission-reduction obligations.⁵⁵ Probably the strongest case for a legally enforceable commitment to reduce emissions is found in Article 4(2)(a) of the UNFCCC, which provides that parties ‘shall adopt national policies and take corresponding measures on the mitigation of climate change, by limiting its anthropogenic emissions of greenhouse gases’.⁵⁶ As Michael Faure and André Nollkaemper have observed, this provision, though ‘still rather vague’, nevertheless ‘stipulate[s] a commitment’ and ‘arguably could be the basis of a liability claim’.⁵⁷

implementation of the international responsibility of a State are governed by special rules of international law.’ See Articles on Responsibility of States for Internationally Wrongful Acts, ILC *Yearbook* 2001/II(2) (ARSIWA). Scholars disagree about the applicability of *lex specialis* in the context of the climate treaties. Compare Verheyen, *Climate Change Damage and International Law*, n. 7, at 143 (arguing that *lex specialis* does not apply) and T. Thorp, ‘Climate Justice: A Constitutional Approach to Unify the Lex Specialis Principles of International Climate Law’ (2012) 8 *Utr LR* 7, at 15 (providing reasons to believe that *lex specialis* does apply to the climate treaties, preempting other remedies).

⁵⁴ D. Bodansky, ‘The United Nations Framework Convention on Climate Change: A Commentary’ (1993) 18 *YJIL* 451; S. Barrett and R. Stavins, ‘Increasing Participation and Compliance in International Climate Change Agreements’ (2003) 3(4) *IEA* 349, at 350 (referring to the UNFCCC’s goal of reducing GHG emissions from developed countries as ‘non-binding’).

⁵⁵ See, e.g., Verheyen, *Climate Change Damage and International Law*, n. 7. Some scholars seem caught in between these two groups. See M. Faure and P.A. Nollkaemper, ‘International Liability as an Instrument to Prevent and Compensate for Climate Change’ (2007) 26A *Stan ELJ* 123.

⁵⁶ Article 4(2)(a) UNFCCC, n. 1.

⁵⁷ Faure and Nollkaemper, ‘International Liability as an Instrument to Prevent and Compensate for Climate Change’, n. 55, at 143.

Obviously, if the UNFCCC does not create legally binding obligations, the inquiry is complete. But let us suppose, following Faure and Nollkaemper (among others), that Article 4(2)(a) creates a binding obligation on which liability might be based. Has the United States failed to 'adopt national policies and take corresponding measures on the mitigation of climate change, by limiting its anthropogenic emissions of greenhouse gases'? The US Environmental Protection Agency has imposed substantive regulations limiting power-plant and automobile emissions of greenhouse gases, under the Clean Air Act.⁵⁸ The federal government also has established by regulation a schedule for the social cost of carbon (SSC), which all executive branch agencies must factor into their regulatory analyses.⁵⁹ By raising the estimated costs of major federal regulations that might result in emissions of GHGs, the SSC presumably (at some point) would affect actual emissions.

Are those 'policies and measures' sufficient to meet the obligations created by Article 4(2)(a) of the UNFCCC? If not, do state and regional policies to reduce GHG emissions, including California's 'Global Warming Solutions Act',⁶⁰ also count as US measures to comply with UNFCCC obligations? Unfortunately, the Convention itself fails to specify any metric for judging the sufficiency of state efforts to reduce GHG emissions. It only calls on parties to implement policies and measures that would reduce GHG emissions as against business as usual, and that the United States has done.⁶¹ Even China, which has no obligations under Article 4 of the UNFCCC, has established policies and measures designed to reduce its GHG emissions as against business

⁵⁸ Clean Air Act of 1970, 42 USC. For descriptions of current EPA regulations relating to climate change, see www.epa.gov/climatechange/EPAactivities/regulatory-initiatives.html; www.whitehouse.gov/sites/default/files/omb/inforeg/social_cost_of_carbon_for_ria_2013_update.pdf. A rule regulating carbon emissions from new power plants currently is in the process of being finalised. The proposed rule can be read at www.regulations.gov/#!documentDetail;D=EPA-HQ-OAR-2011-0660-0001. In addition, the Obama Administration recently announced that it would promulgate a rule regulating carbon emissions from existing power plants. See Executive Office of the President, 'The President's Climate Action Plan' (June 2013), at www.whitehouse.gov/sites/default/files/image/president27sclimateactionplan.pdf.

⁵⁹ Interagency Working Group on Social Cost of Carbon, United States Government, Technical Support Document – Technical Update on the Social Cost of Carbon for Regulatory Impact Analysis – Under Executive Order 128666 (May 2013), at www.whitehouse.gov/sites/default/files/omb/inforeg/social_cost_of_carbon_for_ria_2013_update.pdf.

⁶⁰ Global Warming Solutions Act of 2006, Assembly Bill 32. ⁶¹ See n. 50 and 51.

as usual,⁶² which underscores just how easily any legal burden the UNFCCC actually creates might be satisfied.

Even accepting at face value the most optimistic interpretation of the UNFCCC for invoking liability, the practical wisdom of such a move is questionable. Given the strong disagreements that characterised the UNFCCC's negotiation, and the compromises necessary to create even a modest 'framework convention', imposing liability on member states for violating provisions of such a *framework* convention could well prove counterproductive. More than anything, sued parties might become inclined to simply withdraw from the treaty. And what recourse would that leave harmed states? Perhaps even more importantly, what would be the prospective effect on future negotiations of 'framework conventions' about sensitive, complex, and highly contentious issues? Would countries become more likely or less likely to sign on to documents they believe represent only a first step toward negotiating a fully-fledged regime, but which could later might be (re-)interpreted as a source of legal liability? The question would seem to answer itself.

The real possibility that states might withdraw from the UNFCCC to avoid liability, if an international tribunal used it as a basis for liability, reflects a more general problem with litigating violations of multilateral treaties. In most cases, states could avoid liability for violating treaties simply by exiting them.⁶³ Indeed, Canada withdrew from the Kyoto Protocol, which it previously had ratified, ostensibly for that reason.⁶⁴ The fact of free withdrawal underscores the fact that 'responsibility' cannot be imposed from above in the international climate regime but must be voluntarily accepted.

⁶² D.I. Stern and F. Jotzo, 'How ambitious are China and India's emissions intensity targets?' (2010) 38 EP 6776 (concluding that China will have to adopt ambitious carbon mitigation policies to achieve its voluntary carbon-intensity target).

⁶³ In rare cases, such as the Ozone Accords (Vienna Convention, Montreal Protocol, et al.) states cannot avoid the ban on production and sale of listed ozone-depleting substances simply by withdrawing from the accords because the treaties including trade sanctions to enforce compliance, including against non-parties. See, e.g., J.D. Werksman, 'Trade Sanctions Under the Montreal Protocol' (2006) 1 RECIEL 69. Trade sanctions do not appear, however, in most environmental treaties, including the UNFCCC and the Kyoto Protocol. And while their use in the Ozone Accords has not yet led to problems, the use of trade sanctions in international agreements can give rise to disputes before the World Trade Organization. See generally S. Barrett, 'The strategy of trade sanctions in international environmental agreements' (1997) 19 REE 345.

⁶⁴ 'Canada pulls out of Kyoto protocol', *The Guardian*, 12 December 2011.

4.1.2 Potential liability under the customary 'no-harm' rule

The overall weakness of the international climate treaty regime has led to the promotion of a liability-based regime, using the 'no-harm' rule of customary international law, not so much as a substitute but as a spur to international negotiations.⁶⁵ The basic idea is that if recalcitrant states, such as the United States, can be made to pay for the harm their GHG emissions cause in other countries, they will be incentivised to share responsibility by reducing their GHG emissions and engaging more positively with the rest of the international community in multilateral negotiations resulting, hopefully, in more effective climate treaties. But it remains to be seen whether litigation under the no-harm rule is a viable option; and even if it is, it might not create the positive incentives to share responsibility that its proponents anticipate.

In order to establish liability under the no-harm principle, following the lone precedent of the *Trail Smelter* arbitration, a claimant would have to prove by clear and convincing evidence that emissions originating in the defendant state caused it injury of 'serious consequence'.⁶⁶ Proponents of the liability-based approach to GHG mitigation, including Roda Verheyen, argue forcefully that these burdens are not especially onerous. In my view, the legal obstacles are more formidable than some international lawyers suppose, as evidenced by the fact that not a single harmed country has so far even attempted to bring a claim (even for declaratory judgment, which avoids the need for voluntary acceptance of jurisdiction by the defendant country or countries) against a major emitting country.

To illustrate the problems a climate plaintiff would confront, let us take as a hypothetical case *Bangladesh v. US*, for harm caused to the Island of Kutubdia and its residents. To give the complaining country the strongest possible case, assume that the facts, as stated, are true: the Island of Kutubdia's total area has been halved, six of the island's villages have been swamped, and 40,000 of its inhabitants have fled to higher ground. Further assume that the causal link between

⁶⁵ See, e.g., J. Gupta, 'Legal Steps Outside the Climate Convention: Litigation as a Tool to Address Climate Change' (2007) 16 RECIEL 76, at 85 (concluding that 'the potential threat of future litigation . . . might itself give strong incentives to governments to address climate change more seriously'); D. Hunter, 'The Implications of Climate Change Litigation for International Environmental Law-Making', in W. Burns and H. Osofsky (eds.), *Adjudicating Climate Change: State, National, and International Approaches* (Cambridge University Press, 2009), 357.

⁶⁶ *Trail Smelter (United States of America v. Canada)*, Award, (1938) 3 RIAA 1905, at 1965.

anthropogenic GHG emissions and rising global sea-levels is reasonably robust; and that Bangladesh and the United States both submit to the jurisdiction of the ICJ. The question presented to the ICJ is whether the United States has breached its duty towards Bangladesh to ensure that actions in its territory do not cause harm of ‘serious consequence’ to the territory of another state.

In order for Bangladesh to prevail on that question several elements must be established, including most prominently causation, foreseeability, and harm of ‘serious consequence’. Given the facts, there can be little doubt that the injuries suffered by Bangladesh from sea-level rise are of ‘serious consequence’. But to what extent did emissions from the United States *cause* those injuries? Put in a different way that more clearly highlights the problem, had the United States not emitted the GHGs that contributed to rising sea levels, would the consequences for the Island of Kutubdia be substantially less ‘serious’?

The question presumes that the United States could be held liable only for the damage caused by its own emissions. Some climate liability proponents suggest that international courts might adopt a rule of joint and several liability,⁶⁷ under which the United States could be held liable for the all the harm from global emissions of GHGs, but with a right to sue those other countries for contribution. Other scholars have observed that no such rule exists in international law.⁶⁸ Article 47 of the Articles on State Responsibility allows for liability of a ‘plurality of responsible States’.⁶⁹ The Commentaries to the Article make clear that each responsible state is liable only for the harm it individually causes.⁷⁰ In this case, we are concerned with the potential responsibility of the United States for damage to Bangladesh from sea-level rise; and under the ARSIWA, the United States will be held liable, if at all, only for the injuries arising from emissions emanating from its territories.

The scientific basis for resolving questions of attribution of climate damages remains soft. We possess a fair idea of historic US contributions to global GHG emissions since the middle of the nineteenth century:

⁶⁷ Verheyen, *Climate Change Damage and International Law*, n. 7, at 268–273.

⁶⁸ I. Brownlie, *System of the Law of the Nations: State Responsibility, Part I* (Oxford University Press, 1983), 189.

⁶⁹ ARSIWA, n. 53; J. Crawford, *State Responsibility: The General Part* (Cambridge University Press, 2013), 327.

⁷⁰ Commentary to the Articles on Responsibility of States for Internationally Wrongful Acts, ILC *Yearbook* 2001/II(2) (ARSIWA Commentary), Commentary to Article 47 ARSIWA.

approximately 29 per cent.⁷¹ But quantifying the overall human effect, independent of natural drivers, for purposes of establishing legal responsibility remains problematic.⁷² Scientists are ‘very confident that most of the observed large-scale changes in surface temperature over the twentieth century are externally driven’.⁷³ But ‘externally driven’ does not equate to human-caused.⁷⁴ Relevant external factors include anthropogenic aerosol cooling, solar activity, and volcanic activity, as well as anthropogenic GHG emissions.⁷⁵ Disentangling those factors is a tricky business. While the Intergovernmental Panel on Climate Change (IPCC) has concluded unequivocally that the climate is warming, and that ‘most of the observed increase in global average temperatures since the mid-twentieth century is *very likely* due to the observed increase in anthropogenic GHG concentrations’,⁷⁶ it has not yet attempted to quantify the human contribution to climate change in a way that would be useful for litigants and jurists.

Ten years ago, the Oxford physicist Myles Allen cautioned that more scientific research was required to resolve the problem of attribution before emitters could be held legally liable for the impacts of their emissions.⁷⁷ Arguably, that remains the case today for states as well as for private emitters. Liability proponent Roda Verheyen puts great stock in a single study attributing 60–70 per cent of observed warming to anthropogenic emissions with an extremely high level of certainty.⁷⁸ Whether the ICJ would put so much stock in a single study, when the IPCC itself has yet to provide a percentage attribution at *any* confidence level, is doubtful. And in the absence of an overall attribution level of global mean temperature increase to anthropogenic emissions, no one can assert with confidence how much of the global mean temperature increase can be attributed specifically to American emissions, let alone how much sea-level rise is attributable to emissions from the United States.

⁷¹ K.A. Baumert, T. Herzog, and J. Pershing, ‘Navigating the Numbers: Greenhouse Gas Data and International Climate Policy’ (World Resources Institute, 2005), at 32, Fig. 6.1.

⁷² See generally M. Allen et al., ‘Scientific Challenges in the Attribution of Harm to Human Influence on Climate’ (2007) 155 Penn LR 1353.

⁷³ *Ibid.*, at 1370. ⁷⁴ *Ibid.*, at 1371. ⁷⁵ *Ibid.*, at 1374.

⁷⁶ IPCC, 2007 Synthesis Report, n. 15, at 30, 39.

⁷⁷ M. Allen, ‘Liability for climate change’ (2003) 421 *Nature* 891, at 891–892.

⁷⁸ Verheyen, *Climate Change Damage and International Law*, n. 7, at 259, citing J. Grieser, T. Staeger and C.-D. Schönwiese, *Statische Analyse zur Früherkennung globaler und regionaler Klimaänderungen aufgrund des anthropogenen Treibhauseffektes. Berichte des Instituts für Meteorologie und Geophysik* (Frankfurt am Main: Eigenverlag des Instituts, 2000).

Even if we could determine state attribution with a degree of accuracy that might persuade the ICJ, the *foreseeability* of harm remains at issue. Liability proponents argue with substantial justification that at least since 1992 the potential harm from GHG emissions has been foreseeable.⁷⁹ But if state responsibility only dates from 1992,⁸⁰ then, as Roda Verheyen and co-author Richard Tol note, the ambit of the no-harm rule would envelope not just the United States and other developed countries, but also China, India, and other developing countries that have been emitting GHGs in increasing quantities since that date.⁸¹ As a consequence, the extent of potential US culpability would shrink. Based on data from the US Energy Information Administration,⁸² in 1990 the United States was responsible for approximately 23 per cent of global emissions (below its average of 29 per cent contribution from the mid-nineteenth century to 2002).⁸³ By 2011, the United States was responsible for just 16.5 per cent of global GHG emissions.⁸⁴ If we simply average those two figures, the United States would be responsible for 19.75 per cent of the foreseeable harm suffered by Kutubdia from *anthropogenic* GHG emissions (that is, minus natural forces driving global mean temperatures and sea-level rise). If human emissions are responsible for, say, 60 per cent of total increases in global mean temperatures *and* sea-level rise since 1992 (a significant assumption to be sure), then US responsibility for Kutubdia's harm would be 19.75 per cent of 60 per cent, or about 12 per cent. China's liability could turn out to be roughly similar.

One final, vitally important, procedural issue remains to be resolved: the standard of proof for the claimant to prevail. Roda Verheyen has called for a 'preponderance of the evidence' standard, according to which

⁷⁹ Verheyen, *Climate Change Damage and International Law*, n. 7, at 181. See also R.S.J. Tol and R. Verheyen, 'State responsibility and compensation for climate change damages – a legal and economic assessment' (2004) 32(9) EP 1109, at 1118.

⁸⁰ Tol and Verheyen, *ibid.* suggest earlier dates for establishing foreseeability, including 1827, when Fourier first posited a relationship between concentrations of carbon dioxide and radiative forcing in the atmosphere, and the 1950s, when monitoring data from Antarctica and Hawaii provided a basis for the first in-depth research on the implications for the global climate of increasing atmospheric concentration levels of GHGs. But given the extent of scientific uncertainty, 1992 seems a more reasonable date on which to base foreseeability.

⁸¹ *Ibid.*

⁸² See 'World Carbon Dioxide Emission by Region, Reference Case, 1990–2030', at http://photos.mongabay.com/09/forecast_co2.jpg.

⁸³ See n. 71 and accompanying text.

⁸⁴ D. Clark, 'Which nations are most responsible for climate change?', *The Guardian*, 21 April 2011.

the claimant only has to show that its injuries more likely than not resulted from the defendant's conduct.⁸⁵ But our only existing precedent, the 1935 *Trail Smelter* arbitration, expressly established a more burdensome 'clear and convincing evidence' standard. Scant reason exists to presume, especially in the absence of any test case, that the ICJ would abandon that precedent today. Assuming the ICJ followed the *Trail Smelter* tribunal in applying a 'clear and convincing' evidence standard, the consequences for Bangladesh's hypothetical case against the United States would be potentially fatal. Even the staunchest advocate of liability for climate harm would have a difficult time arguing that the existing scientific basis for assessing cause-and-effect relations between emissions from a specific country and specific harms somewhere else is sufficiently advanced to meet such a standard of proof.

In sum, a liability claim for harm from climate change based on the customary no-harm rule remains an uphill fight for any claimant. That could explain why we do not see climate claimants rushing to the ICJ, despite the encouragement of several international law scholars, who are like lawyers in search of clients.⁸⁶ Another reason is the virtual certainty that defendant states would not agree to be tried before the ICJ. Once again, they only have to share responsibility if they want to do so. In the absence of mandatory jurisdiction, a prospect no one considers realistic, any suggestion that a liability regime might play a significant role in ameliorating climate change seems pie-in-the-sky.

This conclusion might be tough to accept for lawyers, who are by training and temperament accustomed to look to the courtroom as a

⁸⁵ Verheyen, *Climate Change Damage and International Law*, n. 7, at 291, 331.

⁸⁶ In 2011, the governments of Palau and the Marshall Islands, small island nations in the Pacific, asked the United Nation's General Assembly (UNGA) to seek an advisory opinion from the ICJ, under Article 96 of the Charter of the United Nations, addressing the responsibility of GHG-emitting states to ensure that emissions arising within their boundaries do not harm other states. 'Palau seeks UN World Court opinion on damage caused by greenhouse gases', United Nations News Service, 22 September 2011. Individual countries cannot themselves request advisory opinions from the ICJ, but can ask the UNGA to do so. A UNGA request would be in the form of a resolution enacted by majority vote (of those states that cast votes), which is not easily obtained. So far, the UNGA has not acted on the request of Palau and the Marshall Islands. If it did so, the question would be submitted to the ICJ, but the Court would not necessarily be bound to answer the question submitted; and if it did answer the question, its advisory opinion would not be binding; nor would it provide any remedy. The only advantage of seeking an advisory opinion as Palau and the Marshall Islands have done, as opposed to filing a direct claim for harm, is that the UNGA resolution requesting an advisory opinion obviates the requirement of consent by 'defendant' states.

primary forum in which to redress grievances. We lawyers naturally react to unjust social and environmental insults by looking for some ‘wrongdoer’ to sue (even if it seems, as in the case of GHG emissions, that everyone is a ‘wrongdoer’ to some extent). And legal liability sometimes has proven a useful tool for environmental protection, at least in domestic courts (though not in the climate-change context).⁸⁷ The fact remains that we hardly ever see environmental claims brought before international tribunals. The *Trail Smelter* arbitration remains a unique exception (albeit one that seems to have spawned a vast rule). Scant reason exists for optimism about the prospects for spurring shared responsibility for climate change via litigation, let alone resolving the climate-change problem, one court case at a time.

5. Polycentric approaches to climate change: of ‘regime complexes’,⁸⁸ ‘building blocks’,⁸⁹ ‘bottom-up approaches’⁹⁰ and ‘tipping sets’⁹¹

If international courts are unable to contribute significantly to a global climate change solution, we are forced back onto a political process that so far has proven incapable of coming to grips with the problem. But the fact that global negotiations have made little progress so far does not mean progress is impossible. In the first place, and contrary to facile nostrums, such as ‘global problems require global solutions’,⁹² *global* agreements are not a *sine qua non* for progress. Scholars from diverse disciplines have, in recent years, started calling for more ‘polycentric’

⁸⁷ Even the strongest tort claims in domestic courts have failed. See *Native Village of Kivalina and city of Kivalina v. ExxonMobil Corp. and others*, 696 F. 3d 849 (9th Cir. 2012), (rejecting claim for relocation costs by tribal village in Alaska inundated by rising seas).

⁸⁸ R.O. Keohane and D.G. Victor, ‘The Regime Complex for Climate Change’, Harvard Project on International Climate Agreements, Discussion Paper 10–33 (January 2010).

⁸⁹ R.B. Stewart, M. Oppenheimer, and B. Rudyk, ‘Building Blocks for Global Climate Protection’, NYU Center for Law, Economics and Organization, Law and Economics Research Paper Series, Working Paper No. 12–43 (January 2013).

⁹⁰ R. Leal-Arcas, ‘Top-Down and Bottom-Up Approaches for Climate Change Negotiations: An Analysis’ (2011) 6 IUPJGPP 1.

⁹¹ G. Heal and H. Kunreuther, ‘Tipping Climate Negotiations’, in R.W. Hahn and A. Ulph (eds.), *Climate Change and Common Sense: Essays in Honour of Tom Schelling* (Oxford University Press, 2012), 50.

⁹² See, e.g., M. Grasso, ‘A normative ethical framework in climate change’ (2007) 81 *Climatic Change* 223, at 224.

approaches to climate governance, arguing that the UN process should not be (if it ever has been) the ‘only game in town’.⁹³

A diversity of polycentric approaches has been recommended, including, in brief:

- ‘Building blocks’, which are smaller-scale regional or sectoral policies that can be linked together.⁹⁴
- A ‘regime complex’, comprised of ‘highly fragmented collections of institutions, with no identifiable core and weak or nonexistent linkages between regime elements’.⁹⁵
- A ‘bottom-up approach . . . that begins with details and works up to the highest conceptual level’, as found for example in the field of investment protection, which relies on more than 2,700 bilateral investment protection agreements and virtually no multilateral agreements.⁹⁶

What do these various ‘polycentric’ approaches have in common, and how would they differ from the existing UNFCCC approach? All global or multilateral legal regimes are multi-scalar in the trivial sense that they inevitably rely on member states (sharing responsibility) for implementation and compliance. A ‘polycentric’ approach to climate change represents not only governance at multiple scales, but nodes of decision making at various levels of governance that are not necessarily hierarchical. Instead of lower-level government agencies simply carrying out orders from above, polycentrism envisions an array of government-service providers, interacting with one another and with consumers of public goods or ‘common-pool resources’. Some of those government-service providers may be organised in hierarchies *a la* business firms in markets for private goods. But they may also be competitive, in the sense that they offer alternative approaches to resolving similar problems. Thus, in a polycentric system providers of public goods and services both compete and cooperate in providing public goods and services

⁹³ E. Ostrom, ‘Nested externalities and polycentric institutions: must we wait for global solutions to climate change before taking action at other scales?’ (2012) 49 ET 353; D.H. Cole, ‘From Global to Polycentric Climate Governance’ (2011) 2 *Climate Law* 395. See also J.E. Aldy, S. Barrett, and R.N. Stavins, ‘Thirteen Plus One: A Comparison of Global Climate Policy Architectures’ (2003) 3 CP 373 (observing that ‘[e]nvironmentalists have supported the Kyoto Protocol partly because it has been “the only game in town”’).

⁹⁴ Stewart, Oppenheimer and Rudyk, ‘Building Blocks for Global Climate Protection’, n. 89.

⁹⁵ Keohane and Victor, ‘The Regime Complex for Climate Change’, n. 88, at 3–4.

⁹⁶ Leal-Arcas, ‘Top-Down and Bottom-Up Approaches for Climate Change Negotiations’, n. 90, at 4, footnote 19.

that private markets are likely to under-supply because of the inability to internalise sufficient private benefits.⁹⁷

The chief implication of a polycentric approach for climate change governance is not (necessarily) the abandonment of global negotiations under the UNFCCC, but reduced reliance on the UN process as the sole or even predominant mechanism for obtaining GHG emissions reductions from major emitting countries. The focus would not shift to any particular substitute process; rather, a multiplicity of processes, in the nature of policy experiments, would be encouraged. Experiments that prove promising would be emulated, scaled up (if feasible), and perhaps linked with other promising and compatible systems. While not strictly ‘bottom-up’ in the conventional economic (Hayekian) sense of that term,⁹⁸ polycentric climate institutions might be referred to as *relatively* bottom-up, in the sense that they *evolve* from national or even sub-national policy experiments, rather than global-level negotiations, which often crowd out national and sub-national experiments and learning.

The impetus toward a less centralised approach to climate change did not come from a single source but emerged over the course of a few years among a diverse group of scholars, including Elinor Ostrom, Robert Keohane, David Victor, Richard Stewart, and the present author. In some respects, their recommendations have been less normative than positive – recognising that climate policy already was becoming polycentric, as governance units at various levels, including some private actors, were implementing policies and measures of their own outside the purview of the UNFCCC process. In some cases, their actions reflected dissatisfaction with the pace of global negotiations; in other cases, lower-level actions were taken in anticipation of national or international developments (not all of

⁹⁷ On the polycentric approach generally, see V. Ostrom, C. Tiebout, and R. Warren, ‘The Organization of Government in Metropolitan Areas: A Theoretical Inquiry’ (1961) 55 *APSR* 831; V. Ostrom, ‘Polycentricity (Part 1)’, in M.D. McGinnis (ed.), *Polycentricity and Local Public Economies: Readings from the Workshop in Political Theory and Policy Analysis* (University of Michigan Press, 1999), 52; V. Ostrom, ‘Polycentricity (Part 2)’, in M.D. McGinnis (ed.) *Polycentricity and Local Public Economies: Readings from the Workshop in Political Theory and Policy Analysis* (University of Michigan Press, 1999), 119.

⁹⁸ See, e.g., W. Easterly, ‘Institutions: Top Down or Bottom Up?’ (2008) 98 *AER* 95 (referring to ‘bottom up’ in the traditional economic sense of spontaneous emergence of institutions from social norms, customs, traditions and values of individuals, as opposed to the ‘top-down’ imposition of institutions by political leaders). In the climate policy context, ‘bottom-up’ typically refers to institutional mechanisms deployed at the sub-global level by political leaders (or entrepreneurs). See Leal-Arcas, ‘Top-Down and Bottom-Up Approaches for Climate Change Negotiations’, n. 90.

which have materialised). Whatever their impetus, the various policies and measures introduce at different levels of public and private governance are, in effect, experiments in climate policy, which scholars and policy analysts might assess for potential emulation, scaling up, and linkage.

Following is a select (and far from complete) list of policies and measures adopted at national and sub-national levels over the past several years, but not as Kyoto Protocol compliance mechanisms:

- US EPA regulations of greenhouse gases.
- China's unilateral promise (now codified) to reduce its carbon-intensity of production.
- California's 'Global Warming Solutions Act'.
- The Regional Greenhouse Gas Initiative (RGGI).
- Portland, Oregon's plan to reduce GHG emissions by 20 per cent below 1990 levels by 2010.
- Berkeley, California's FIRST programme (to finance residential solar-heating systems).
- The Cement Sustainability Initiative (CSI), created in 2002 by ten large cement manufacturers to reduce GHG emissions in production.
- The now-defunct Chicago Climate Exchange, a private emissions-trading market.⁹⁹
- British Petroleum's early efforts to reduce carbon emissions from pipeline leaks.¹⁰⁰

These are all examples of public and private governance units at various levels *accepting* responsibility for reducing GHG emissions, in most cases without any direct connection to UN-based structures. Jouni Paavola has provided a handy table (Table 10.2) illustrating the variety of sub-global mechanisms that are already in use (somewhere) to mitigate GHG emissions:¹⁰¹

Even the EU's Emissions Trading System (EU ETS),¹⁰² which started as a Kyoto compliance mechanism, has attained an identity distinct

⁹⁹ For details on this programme and the others listed above, see Cole, 'From Global to Polycentric Climate Governance', n. 93, at 406–409. See also J. Paavola, 'Climate Change: The Ultimate Tragedy of the Commons?', in D.H. Cole and E. Ostrom (eds.), *Property in Land and Other Resources* (Cambridge Massachusetts: Lincoln Institute of Land Policy Press, 2012), 417, at 426 (discussing the Cement Sustainability Initiative).

¹⁰⁰ See J. Browne, 'Beyond Kyoto: The Carbon Challenge', FA, July/August 2004.

¹⁰¹ Paavola, 'Climate Change: The Ultimate Tragedy of the Commons?', n. 99, at 428, Table 14.1.

¹⁰² See e.g. http://ec.europa.eu/clima/policies/ets/index_en.htm.

Table 10.2 *Institutional Diversity in Polycentric Climate Change Governance*

Type and Level	Conventional	Hybrid	Voluntary
Global	Kyoto Protocol; post-Kyoto targets; adaptation funding	Carbon markets; REDD	Business sector initiatives
Regional	EU ETS	Regional carbon markets; insurance provision and underwriting	Adaptation clearinghouses
National	Climate change, energy, and other legislation	Carbon markets; public-private partnerships in carbon capture & storage; insurance provision and underwriting	Adaptation networks of local governments
Local	Climate-proofed zoning; property tax regimes; joint mitigation and adaptation	Public-private partnerships	Carbon-neutral communities

from the Kyoto Protocol, offering an alternative path to climate mitigation. Elsewhere,¹⁰³ I have written about the EU ETS's more modest, careful, and altogether superior approach to emissions trading, compared to the Kyoto Protocol. The EU Commission, which designed the ETS, learned lessons (that the Kyoto parties ignored) about conditions (and limits) for successful emissions trading from earlier US experiments, such as the Clean Air Act's acid rain programme. Although the EU ETS suffers from some well-known design flaws of its own, including the lack of an allowance price-floor to avert financial collapse of carbon markets in the wake of economic recession,¹⁰⁴ its dominant

¹⁰³ Cole, 'From Global to Polycentric Climate Governance', n. 93, at 409–411.

¹⁰⁴ See, e.g., European Commission, Report from the Commission to the European Parliament and the Council, 'The State of the European carbon market in 2012', COM(2012)

position as the world's largest and most well-developed market provides an opportunity, at least, for it to serve as a more reliable and replicable alternative to Kyoto's irredeemably flawed trading and offset programmes. In fact, when it designed the ETS, the European Commission fully intended to influence the future development of global carbon markets.¹⁰⁵ That is to say, it was *taking responsibility* for promoting a more effective global carbon market.

Because the EU and its member states are such large players in virtually all emissions markets (mostly as buyers), they can and have *de facto* amended the Kyoto Protocol via domestic legislation to improve the environmental integrity of trading markets. For example, when the EU amended the ETS in 2009 to prohibit member states from complying with ETS targets by using Clean Development Mechanism (CDM) credits from fraud-ridden HFC-23 projects in China, that unilateral act (which took effect in 2013) has pretty much ended China's scam, which was facilitated by inherent defects (e.g., reliance on counterfactual emissions) in the design of the CDM programme. The EU also has unilaterally adopted an ambitious emissions-reduction target of 20 per cent by 2020, offering to increase that emissions-reduction target to 30 per cent if other major emitting countries *shared responsibility* by committing to emissions reductions of 20 per cent.¹⁰⁶ So far, other major emitting countries have not followed suit. The EU has also tried to cajole major emitting countries into sharing responsibility for GHG emission reductions by unilaterally imposing carbon taxes on international flights to and from EU destinations.¹⁰⁷ That effort has not worked, either. But the main point is that the EU has demonstrated how actions taken at a regional or domestic level can have a salutary effect on GHG emissions.

To the extent other countries replicate the EU ETS or design something even better, which can be linked with the ETS and other, similar

652 final 10 (14 November 2012), at http://ec.europa.eu/clima/policies/ets/reform/docs/com_2012_652_en.pdf (discussing a price floor as one option to reduce volatility and to prevent price drops resulting from temporary economic disruptions).

¹⁰⁵ Cole, 'From Global to Polycentric Climate Governance', n. 93, at 410.

¹⁰⁶ European Commission, 'EU greenhouse gas emissions and targets', at http://ec.europa.eu/clima/policies/g-gas/index_en.htm. See also J. Cludius, H. Forster and V. Graichen, 'Greenhouse Gas Mitigation in the European Union: An Overview of the Current Policy Landscape', World Resources Institute Working Paper, November, 2012, at www.wri.org/publication/ghg-mitigation-eu-policy-landscape.

¹⁰⁷ See, e.g., 'EU freezes controversial aviation carbon tax', EUbusiness, 13 November 2012.

trading markets, a global carbon market might emerge (though not spontaneously) from ‘bottom-up’. Such formal linkages would amount to an actual *sharing of responsibility* for climate change mitigation. The EU’s recent agreement to link its ETS with Australia’s new trading scheme is one small step in that direction. The EU has also held preliminary talks with California about linking the world’s two largest carbon trading markets.¹⁰⁸ Should that happen, those linked national- and sub-national-level schemes could completely supplant the Kyoto Protocol’s fatally flawed mitigation programmes, yielding a net improvement for global climate policy.

Perhaps even more importantly, combined efforts of major emitting countries (taking and sharing responsibility) could *tip* global climate negotiations into a more cooperative equilibrium.¹⁰⁹ As Geoffrey Heal and Howard Kunreuther have explained, a ‘tipping set’ of countries taking action on climate change could create a ‘net return to the choice of this strategy for other agents’.¹¹⁰ In other words, they could alter the incentives of other states to favour a broader distribution and sharing of responsibility for reducing emissions. This has happened before, for example in the global switch from leaded to unleaded gasoline. That switch involved three major incremental costs: first, innovating a reliable and cost-effective anti-engine-knock alternative to lead-based gasoline; second, adapting refineries to produce the new fuel; and third, modifying auto engines to use it. The United States led in innovating and mandating alternatives, which other countries could then easily adopt. Once the United States mandated lead-free gasoline (domestically), American automakers were required to adjust car designs accordingly. Automakers in other countries could not, of course, be required to play by American rules except on American soil. But the United States is such an important export market for most Japanese and European car-makers that those companies had market incentives to modify their engines accordingly. Once the alternative gasoline formulas and engines to burn it were widely available, the costs to all other countries of moving to unleaded fuel were ‘negligible’.¹¹¹ In this case, shared responsibility for reducing atmospheric lead levels was spurred

¹⁰⁸ F. Carus, ‘EU plans to link emissions trading scheme with California’, *The Guardian*, 7 April 2011.

¹⁰⁹ On the idea of ‘tipping points’ generally, see T.C. Schelling, *Micromotives and Macrobehavior* (New York: W.W. Norton & Company, 1978).

¹¹⁰ Heal and Kunreuther, ‘Tipping Climate Negotiations’, n. 91, at 55. ¹¹¹ *Ibid.*, at 53.

by the unilateral acceptance of responsibility by a single country, the United States.

Climate change undoubtedly represents a more difficult problem to solve than taking the lead out of gasoline – not least because of the lack of available substitutes for fossil fuels. Indeed, all of Heal and Kunreuther's examples of successful tipping sets involve technological substitutions that are not on the near-term horizon for carbon-based fuels.¹¹² However, Heal and Kunreuther demonstrate generally that

the climate negotiation game has a tipping set if (a) the cost of joining a treaty drops as the number of joiners rises; (b) there is a cost to not joining that is constant or rising with the number who have joined; and (c) if once a sufficient number have joined this cost exceeds the cost of joining for those who have not yet joined.¹¹³

A group of cooperating countries (sharing responsibility) is far more likely to constitute a 'tipping set' if they are 'strategically important countries', defined as those having 'the largest reinforcing effects on others'.¹¹⁴

We already know that the EU cannot be a tipping set of one in climate negotiations, despite its proven ability to amend *de facto* elements of the existing global regime. Whether the eventual combination of carbon trading schemes in the EU, Australia, and California might provide a 'tipping set' is uncertain. Indeed, there is reason to doubt the existence of tipping set for climate policy that does not include either China or the United States. However, those two countries recently began bilateral negotiations on GHG reductions, which potentially could lead to a 'tipping set'.¹¹⁵ Simply put, if a relatively small set of countries cannot

¹¹² For a non-technological example of a tipping mechanism, see Barrett, 'Credible Commitments, Focal Points, and Tipping', n. 41, at 45, noting that, if a critical mass of countries join a treaty with trade restrictions as a compliance enforcement mechanism, other countries will have an incentive to join and comply. The Ozone Accords successfully used trade restrictions as a tipping mechanism. Even in that case, however, the availability of technological substitutes to ozone-depleting substances (ODSs) were crucial to the successful negotiations, including presumably the agreement to impose trade sanctions as an enforcement device against both parties and non-parties. It is extremely unlikely that the Montreal Protocol would have been agreed to, with or without trade sanctions, but for the existence of reliable and not-too-costly ODS substitutes. See Cole, 'Climate Change and Collective Action', n. 6, at 239–241.

¹¹³ Heal and Kunreuther, 'Tipping Climate Negotiations', n. 91, at 57. ¹¹⁴ *Ibid.*

¹¹⁵ See, e.g., H. Schneider, 'U.S., China agree on climate steps to curb emissions', *Washington Post*, 10 July 2013.

tip global climate negotiations towards a potential welfare-improving equilibrium, little hope exists for global climate negotiations to find a better equilibrium. Either way, shared responsibility cannot be *imposed* but must be *accepted*.

6. Conclusion

Global climate negotiations have made little progress since the adoption of the Kyoto Protocol in 1997, which itself marked no real progress towards resolving the climate change problem. Despite the well-meaning efforts of climate negotiators and the intellectual contributions of international lawyers, global negotiations have become so paralysed that even marginal improvements to the Kyoto Protocol's ineffectual regime have remained out of grasp. In frustration, some legal scholars have begun calling for litigation against perceived recalcitrant states, such as the United States. At best, litigation is unlikely to do much good; at worst, it could create disincentives for major emitting states to take on any treaty-based obligations. Even if liability might be imposed (which seems unlikely), responsibility must be accepted or taken voluntarily.

Another option is to broaden the focus of attention from the global roving cocktail party of climate negotiations, with their thousands of participants, to smaller-scale efforts currently arising all over the world to actually reduce carbon emissions. Rather than dismissing those efforts as meaningless for a global problem like climate change, scholars and policy makers ought to be studying the actions of those who are actually taking responsibility to see which lower-level programmes are effective and might be emulated, scaled-up, and/or linked with other programmes to create a 'regime complex' or a 'tipping set' that could lead to a broader sharing of responsibility for climate change mitigation. Such efforts are not a quick fix, let alone a panacea solution for climate change. After all, the Assurance Game of climate change does not guarantee cooperative solutions. But less formal and more consistent communication and trust-building efforts between individual, major emitting countries could hardly yield worse results than the formal, global negotiations of the UN process. Hardly a ringing endorsement or a prediction of great success for polycentric approaches, but it realistically reflects the daunting nature of the collective-action problem we confront.