

Basic Compensation for Victims of Climate Change

by Daniel Farber

Editors' Summary: Prof. Daniel Farber argues that compensation for harm caused by climate change is a moral imperative, and he surveys various mechanisms that have been used in other circumstances to compensate large numbers of victims for environmental and other harms. In response, Professor Feinberg cautions that significant hurdles remain before any realistic compensation system could be considered, but suggests that the most effective approach may be evolving parallel tracks of civil litigation and government action to address climate harm. Peter Lehner and William Dornbos argue that using common-law doctrines to find greenhouse gas (GHG) emitters liable for harm is a more pressing concern than creating a compensation system. Finally, Raymond Ludwizewski and Charles Haake claim that the basic elements of liability are not readily discernable with climate change and that it would be more productive to invest in curtailing GHG emissions.

This Article concerns the problem of global warming. I will focus on a part of this problem that has not gotten much attention: who should pay for the harms caused by global warming? My answer is that the companies and countries that caused climate change should pay for at least some of the harm.¹ Designing a fair and efficient system of compensation for climate change damage poses great challenges and even a modest effort at compensation may be politically infeasible. Although it is unlikely that we could provide a system of complete compensation, countervailing for some of the harms is a desirable and practical goal.

As most people now realize, society can no longer postpone serious consideration of how to respond to climate change. Most public attention has been focused on the issue of mitigation—that is, how to reduce greenhouse gas (GHG) levels and by how much. Society also needs to consider methods of adapting to climate change, such as building higher walls to hold back the sea. Adaptation is not going to be cheap. It is too early to make confident cost estimates, but the expense for the United States alone is clearly going to be

in the billions of dollars every year. In addition, some of the impacts of climate change cannot be avoided by adaptation, and these too may be expensive. Thus, the total harm consists of adaptation costs and unavoidable climate impacts, with at least arguably the addition of the heightened mitigation costs some countries must now undertake because others engaged in unrestrained emissions of GHGs in the past.

The most immediate question is *what* to do about climate change, but not far behind—perhaps not behind at all—is the question of *who* should pay. Past emissions remain in the atmosphere and were emitted from different sources or in different proportions between sources. The harms of climate change may occur elsewhere in the world, or in parts of a country that do not contribute very much to emissions. The people of Bangladesh, for example, contribute very little to causing global warming, but they will be severely affected.² Who should pay for their harm?

The first question to ask is this: who caused the harm? Not every country has contributed equally to climate change. For example, the United States was responsible for 20% of the world's emissions in 2000, about equal to its share of the world's economy (but far in excess of its share of the world's population). With an economy of about the same size, the European Union was responsible for only 14% of the emissions.³ Emissions are not equally attributable to all economic sectors: over 60% come from energy consumption.⁴ Globally, motor vehicles account for about 10% of total

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1. For a more extensive discussion, see Daniel A. Farber, *Basic Compensation for Victims of Climate Change*, 155 U. PA. L. REV. 1605 (2007). Other aspects of the compensation issue are dealt with in related articles: Daniel A. Farber, *Adapting to Climate Change: Who Should Pay?*, 23 FLA. ST. U. J. LAND USE & ENVTL. L. 1 (2007); Daniel A. Farber, *Apportioning Climate Change Costs Among Emitters*, 26 UCLA ENVTL. L. & POL'Y REV. 21(2007) [hereinafter Farber, *Apportioning Costs*]; and Daniel A. Farber, *The Case for Climate Compensation*, 2008 UTAH L. REV. (forthcoming 2008) [hereinafter Farber, *Case for Compensation*].

2. NICHOLAS STERN, *THE ECONOMICS OF CLIMATE CHANGE: THE STERN REVIEW* 17 (2007).

3. See KEVIN A. BAUMERT ET AL., *NAVIGATING THE NUMBERS: GREENHOUSE GAS DATA AND INTERNATIONAL CLIMATE POLICY* 110, tbl. 1 (2005).

4. *Id.* at 41.

emissions, while power generation accounts for 25%.⁵ So a short answer is that rich countries are the primary causes of climate change, at least until today, and the United States has been more responsible than others. Within the rich countries, energy producers and users have the largest share of responsibility. In the future, the balance may shift toward rapidly developing countries such as China and India, and they too may be faced with claims for compensation.

This Article will begin with some background about climate change and the harm it will cause. Then it will turn to the obligation of countries and companies that are causing climate change to provide some kind of compensation to the people who are harmed by climate change. Existing systems for compensating for environmental and related harms provide some guidance about how to design a practical compensation system.

I. Background on Climate Change

In a few years, it will probably no longer be necessary to begin an article of this kind with a general discussion of climate change and its impacts. Hopefully, individuals will be exposed to this information at increasing levels of sophistication from the time they are children. But climate change is still a new issue for many people, and some background is still in order before discussing more technical issues.

A. The Reality of Climate Change Today

Skepticism about climate change seems to be disappearing rapidly, but some readers may still be unsure about the solidity of the evidence. Thus, it behooves us to start by asking how sure we can be that climate change is a genuine threat.

The most reliable source is the Intergovernmental Panel on Climate Change's (IPCC's) 2007 report, which explains the scientific consensus:

Global atmospheric concentrations of carbon dioxide, methane and nitrous oxide have increased markedly as a result of human activities since 1750 and now far exceed pre-industrial values determined from ice cores spanning many thousands of years. The global increases in carbon dioxide concentration are due primarily to fossil fuel use and land-use change, while those of methane and nitrous oxide are primarily due to agriculture.⁶

The IPCC report is the result of an exhaustive review process. Its conclusions represent the best we have on hand in terms of "sound science," and to demand more than that is to give up on the idea of reality-based social policy entirely. Governments, firms, and individuals have to make the best decisions they can today on the basis of available information.

Thus, it is a mistake to hide behind uncertainty and use it as an excuse for ignoring the issue of climate change. That

5. *Id.* at 57.

6. IPCC Working Group I, *Summary for Policymakers*, in CLIMATE CHANGE 2007: THE PHYSICAL SCIENCE BASIS 1 (2007), available at http://ipcc-wg1.ucar.edu/wg1/Report/AR4WG1_Print_SPM.pdf [hereinafter IPCC]. As the IPCC explains:

The understanding of anthropogenic warming and cooling influences on climate has improved since the Third Assessment Report (TAR), leading to *very high confidence* that the globally averaged net effect of human activities since 1750 has been one of warming, with a radiative forcing of +1.6 [+0.6 to +2.4] W m².

has been the strategy of President George W. Bush in the United States.⁷ But that time is ending, even in the United States. The odds are high that soon we will see the United States take action on climate change. Even today, some American state governments are beginning to address it.⁸

Even those who know that there is indeed evidence for climate change may not realize how extensive the damage already is. Climate change is not just in the future. It is happening today. Also, many may be unaware that more climate change is inevitable in the next few decades. Although it cannot be stopped, we can limit the amount of climate change that takes place after 2040. The reality is that whatever mitigation measures are adopted, a significant degree of climate change seems unavoidable. As the IPCC explains, warming and sea-level rise "would continue for centuries due to the timescales associated with climate processes and feedbacks, even if greenhouse gas concentrations were to be stabilized."⁹

How much climate change can we expect by 2100? The evidence indicates that a doubling of carbon dioxide (CO₂) from pre-industrial levels would result in a temperature increase between 1.5 degrees Celsius (°C) and 4.5 °C by the end of this century.¹⁰ For this reason, even in the best-case scenario, we will be faced with a number of adverse impacts from climate change—and indeed, we may already be experiencing them:

Examples of observed changes caused by human releases of GHG include shrinkage of glaciers, thawing of permafrost, later freezing and earlier break-up of ice on rivers and lakes, lengthening of mid- to high-latitude growing seasons, poleward and altitudinal shifts of plants and animal ranges, declines of some plant and animal populations, and earlier flowering of trees, emerging of insects, and egg-laying in birds.¹¹

These changes are already happening, and they are likely to accelerate.

B. The Rising Sea

Sea-level rise is one of the most direct (and to some extent unavoidable) consequences of climate change. As the IPCC explains:

Id. at 3.

7. For a discussion of the limited federal role to date, see John C. Dernbach, *U.S. Policy*, in GLOBAL CLIMATE CHANGE AND U.S. LAW 61-100 (Michael B. Gerrard ed., 2007).

8. State efforts are described in David Hodas, *State Initiatives*, in GLOBAL CLIMATE CHANGE AND U.S. LAW, *supra* note 7, at 343-70; Robert B. McKinstry, *Laboratories for Local Solutions for Global Problems State, Local, and Private Leadership in Developing Strategies to Mitigate the Causes and Effects of Climate Change*, 12 PENN. ST. ENVTL. L. REV. 15 (2004).

9. IPCC, *supra* note 6, at 17.

10. See Richard A. Kerr, *Latest Forecast: Stand By for a Warmer, but Not Scorching, World*, 312 SCIENCE 351 (2006). For an up-to-date source of information on climate science, go to <http://www.realclimate.org/>.

11. See Donald A. Brown, *The U.S. Performance in Achieving Its 1992 Earth Summit Global Warming Commitments*, 32 ELR 10756 (July 2002). For further details on climate change effects in the United States, see CAMILLE PARMESAN & HECTOR GALBRAITH, *OBSERVED IMPACTS OF GLOBAL CLIMATE CHANGE IN THE U.S.* (2004), available at http://www.pewclimate.org/docUploads/final_ObsImpact.pdf.

Observations since 1961 show that the average temperature of the global ocean has increased to depths of at least 3000 m and that the ocean has been absorbing more than 80% of the heat added to the climate system. Such warming causes seawater to expand, contributing to sea level rise.¹²

Moreover, the IPCC reports that “[m]ountain glaciers and snow cover have declined on average in both hemispheres. Widespread decreases in glaciers and ice caps have contributed to sea level rise (ice caps do not include contributions from the Greenland and Antarctic ice sheets).”¹³ Thus, sea-level rise is at the opposite end of the scale from being speculative. Instead, it is almost certain. The only uncertainty is about the amount, which will be significant in any case but could be huge if ice in Greenland or Antarctica were to melt unexpectedly rapidly.

This rise in sea level will result in loss of coastal lands, flooding of some estuary systems with salt water, salt water intrusions into some drinking sources, and increased exposure to flood damage. Sea-level change may have drastic effects on island populations. For example, the small island state of Tuvalu is seeking ways to evacuate its entire population.¹⁴ Sea-level rise could also cause dramatic losses in wetlands in the United States. Because the slope of coastal areas on the Atlantic and Gulf Coasts is low, a 40 centimeter rise in sea level could result in as much as 60 meters of beach erosion, at a cost in the billions of dollars.¹⁵

C. Economic Effects of Climate Change

To get a sense of the potential economic impact, consider the following estimates regarding sea-level rise: “A half-meter sea level rise would place \$185 billion of property and infrastructure in jeopardy by 2100, and . . . the financial cost of protecting all developed areas from a half-meter sea-level rise would be \$50 to \$66 billion . . .”¹⁶ The IPCC found that it “is *very likely* that hot extremes, heat waves, and heavy precipitation events will continue to become more frequent.”¹⁷ It also says that we are likely to see changes in tropical storms such as hurricanes: “Based on a range of models, it is *likely* that future tropical cyclones (typhoons and hurricanes) will become more intense, with larger peak wind speeds and more heavy precipitation associated with ongoing increases of tropical [sea surface temperatures].”¹⁸

The nearly inevitable impacts of climate change will force society to invest in costly adaptation measures. Adap-

tation has not received nearly as much attention as mitigation, but we can already begin to see the outlines of adaptation needs. Of course, the scale of adaptation required is related to the degree of mitigation: if we do nothing to limit emissions, climate change will be more drastic and the costs of adaptation will be correspondingly higher.

The Pew Foundation collected much of the available information about adaptation strategies in a 2004 report.¹⁹ We will need to develop new agricultural plant varieties to deal with changing temperatures, rainfall, and pests. Farmers will have to make risky decisions about when the climate has changed enough to justify switching to new varieties and growing methods. Agricultural production is likely to shift northward, perhaps not good news for southern parts of the United States such as Florida. Other areas where adaptation may be required include forestry, health hazards from heat stress, and conservation management.

The *Stern Review* by the British government contains the most extensive discussion of adaptation costs. The review estimates that

[i]nfrastructure is particularly vulnerable to heavier floods and storms The additional costs of adapting this investment to a higher-risk future could be \$15-150 billion each year . . . with one-third of the costs borne by the US and one-fifth in Japan. This preliminary cost calculation assumes that adaptation requires extra investment of 1-10% to limit future damages from climate change.²⁰

These amounts are not huge in comparison to the size of the economies involved, but they are nevertheless very substantial. To these must be added the possible costs of harms that cannot be prevented through adaptation.

For present purposes, there are two key implications of the scientific evidence: climate change is almost certain, and it will impose heavy costs on society. We can let these costs fall where they may, or we can shift at least some of them. Next I will discuss the question of who should bear these costs and conclude that at least some should be shifted to emitters.

II. Holding Emitters Responsible

As we have seen, climate change will involve large costs in various forms: for emissions, for adaptation, and for harms that cannot be avoided through either method. This section considers whether it is desirable to hold emitters responsible for any of these costs and whether it would be feasible to do so. There are good reasons for holding emitters responsible for at least some climate costs and it would be administratively feasible to do so.

A. Should Emitters of GHGs Pay?

Why do we require the people who caused harm to compensate the victims who suffer injury? The most important reasons are that we want to deter people from causing harm in the future, and that we want to provide justice to the victims.²¹

12. IPCC *supra* note 6, at 5.

13. *Id.* at 7.

14. Denis Culley, *Global Warming, Sea-Level Rise and Tort*, 8 OCEAN & COASTAL L.J. 91-93, 106 (2002).

15. David Grossman, *Warming Up to a Not-So-Radical Idea: Tort-Based Climate Change Litigation*, 28 COLUM. J. ENVTL. L. 1, 12-14 (2003).

16. WILLIAM E. EASTERLING III ET AL. PEW CTR. ON GLOBAL CLIMATE CHANGE, *COPING WITH GLOBAL CLIMATE CHANGE: THE ROLE OF ADAPTATION IN THE UNITED STATES 14* (2004), available at <http://www.pewclimate.org/reports>. This estimate may be on the high side, but even if we discount by a factor of two, the figures are still impressive. On the other hand, given the Hurricane Katrina experience, we may be entitled to wonder whether flood control systems will necessarily be effective.

17. IPCC, *supra* note 6, at 15 (emphasis added).

18. *Id.* at 19 (emphasis added).

19. EASTERLING ET AL., *supra* note 16.

20. STERN, *supra* note 2, at 78-79.

21. For discussion of these goals, see KENNETH S. ABRAHAM, *THE FORMS AND FUNCTIONS OF TORT LAW* 14-20 (2d ed. 2002).

We are at the beginning of a debate about whether justice requires emitters of GHGs to compensate the victims of climate change. The problem is somewhat analogous to the diffuse issues raised by those seeking reparations for slavery and past racial discrimination. Reparations have not gained widespread support (which may not be a promising sign for climate change compensation). On the other hand, emissions of GHGs involve much more recent history, rather than claims for compensation based on events a century or more in the past.

In assessing the moral issues, we must begin with the question of culpability. Emissions of GHGs were not made with the desire to cause harm to others. Prior to the last quarter of the 20th century, emitters may not have had strong grounds for believing that their conduct would cause serious harm. So, in most cases, the harm was not the result of bad intentions.

Nevertheless, the fact remains that emitters have caused harm. They have also made a lot of money by using fossil fuels. Corporations such as oil companies and oil-producing countries have made many, many billions of dollars from selling fossil fuels. These fuels will cause equally large damage in other parts of the world. Other countries, such as the United States, with high numbers of automobiles contribute to the change in the world's climate.

Some of this activity was innocent, because the reality of climate change was not known at the time. For those concerned about culpability, apportioning responsibility on the basis of emissions after some cutoff date would be an appropriate response. One possible cutoff date is 1992, when the United States and other nations entered a framework agreement to reduce GHGs. At that point, the international community had clearly identified the harm; any source of emissions after that date was at least on notice of the damaging nature of the conduct.

It seems arguable that at some point it became negligent not to take reasonable precautionary measures to reduce emissions. Given the amount of misinformation that has been spread by industry-sponsored groups, as well as efforts within the U.S. government during the past six years to suppress information, there is also at least the possibility of deliberate misrepresentations to the public, as turned out to be the case in the American tobacco industry concerning the risks of cigarettes. So at least some of the responsible parties may have actively worked to prevent control of GHGs because they preferred to make profits rather than help the world face a serious problem. If a company or country tried to prevent the world from stopping climate change, that should be a basis for liability.

Another justification for compensation is that the countries causing climate change are generally much richer than the countries that suffer harm. Relatively affluent nations, like the United States, are heavy emitters, and impacted victims are poorer countries, such as Bangladesh. As the *Stern Review* says:

The poorest in society are likely to have the least capacity to adapt Given that the greatest need for adaptation will be in low-income countries, overcoming financial constraints is also a key objective. This will involve transfers from rich countries to poor countries. The argument is strongly reinforced by the historical responsibility of rich countries for the bulk of accumulated stocks of GHGs. Poor countries are suffering and will suffer from

climate change generated in the past by consumption and growth in rich countries.²²

A related concern is that of contributory negligence. Nearly everyone on the planet, in some small way, contributes to the generation of GHGs. Some contribute more than others, but in nearly every case, it is at least possible to imagine that the claimant's personal conduct might be used as a basis for avoiding or reducing compensation. In other words, the claimant's own activities may be relevant to the availability or amount of compensation. This argument can play out in several different ways. In practice, it should not be difficult to take these considerations into account. The percentage of world GHG emissions produced by the claimant could be used as a multiplier, with that proportion of the compensation claim being reduced. Alternatively, the deduction could be based on the amount of emissions over the optimum control level for the claimant, so that claimants who took feasible steps to reduce emissions would receive a greater reward. Except for the very largest emitters, it should make little difference which offset is used, since the claimant's emissions will be insignificant compared to the global level. Simply to reduce administrative costs, it might be useful to preclude claims by large emitters whose share of GHGs is larger than their share of climate damages. Such a rule would be analogous to a common variant of the contributory fault system in the United States in which parties who are more than 50% at fault for an accident cannot recover.²³ At the international level, for example, claims between China and the United States might be largely offsetting, and hence it might be easier simply to eliminate them from consideration.²⁴

I am sure that these questions of justice will be debated for years to come.²⁵ We should also keep in mind, however, that if we provide compensation to the victims of climate change, we help create an incentive for countries to get serious about ending their emissions.

One response to my argument is to say that compensation is unrealistic. The amount of harm is just too big, and we cannot expect countries to agree to pay hundreds of billions of dollars in damages. This is a very real concern. However, it is a mistake to give it too much significance. First, even if countries are unwilling to pay for the full amount of damage, they may be willing to pay for part of the damages. Partial justice is better than no justice. Second, it may be possible to devise methods of payment that are not too painful. For example, countries might be required to license new energy technologies for free or below the market price. There may be other clever ways to reduce the financial pain, but still provide some assistance to climate change victims. Third,

22. STERN, *supra* note 2, at 37.

23. See RESTATEMENT (THIRD) OF TORTS: LIABILITY FOR PHYSICAL HARM §25 cmt. d (reporter's note) (Proposed Final Draft No. 1 2005) ("[M]any states . . . have adopted comparative responsibility in a modified form, pursuant to which the plaintiff's contributory negligence continues to operate as a full defense if it is greater than the defendant's negligence.").

24. There are several arguments against eliminating claims by large emitters. First, there might be considerable dispute about where to draw the line. Second, emitters of equal size might not be equally at fault. Third, one emitter might be much more vulnerable to climate change than the other, so the damages would not be offsetting. On balance, having a special rule for large emitters is probably not advisable, but the problem deserves further consideration.

25. For a more extensive discussion of these issues, see Farber, *Case for Compensation*, *supra* note 1.

even though the amounts of money seem large in the abstract, they are not large when compared with the total economic wealth of rich countries such as the United States. In addition, allocating responsibility to emitters, even in the absence of any provision for payment can put pressure on emitters to engage in voluntary transfer payments, highlight and particularize the harm done by climate change, and produce a degree of “moral clarity” about responsibility for harm.

It is also worth noting that the United States and other countries have already agreed in principle to take some responsibility for adaptation measures in less developed countries. Article 4.4 of the United Nations Framework Convention on Climate Change (UNFCCC) states that “developed country Parties . . . shall also assist the developing country Parties that are particularly vulnerable to the adverse effects of climate change in meeting costs of adaptation to those adverse effects.”²⁶ Article 4.1(e) also calls on countries to “[c]ooperate in preparing for adaptation to the impacts of climate change”; countries are also directed to “develop and elaborate appropriate and integrated plans for coastal zone management, water resources and agriculture, and for the protection and rehabilitation of areas, particularly in Africa, affected by drought and desertification, as well as floods.”²⁷

This cooperation mandate in the UNFCCC amounts to a requirement of in-kind contribution to adaptation measures. Thus, at least in principle, the United States and other signatories to the framework agreement already seem to have agreed to compensation at the international level. It is also worth noting that the Parties to the Kyoto Protocol have embraced the use of an adaptation fund, which is financed by a share of the proceeds generated by the Clean Development Mechanism.²⁸

Demands for compensation made further progress at Bali during the United Nations Climate Change Conference. The negotiators, including U.S. representatives, agreed to strengthen an existing adaptation fund. The fund will receive the proceeds from a 2% tax on transactions within the Clean Development Mechanisms (whereby wealthier countries pay for emission reductions in developing countries). The fund will be overseen by a 16-member board with representatives from developed and developing countries.²⁹ Thus, the international regime clearly recognizes a duty of compensation.

B. Designing a System to Shift Costs to Emitters

The idea that emitters should pay for some of the harm caused by their actions may seem appealing in the abstract. It is appropriate, however, to ask whether shifting costs to emitters is really practical, or whether attempting to do so would simply ensnarl the global legal system in interminable litigation.

One model for avoiding the complexities and transaction costs of litigation is provided by the 9/11 Compensation Fund. In the aftermath of the terrorist attacks on September

11, 2001, Congress established a special victim’s compensation fund.³⁰ Compensation was limited to individuals who were present at one of the crash sites and who suffered “physical harm or death.”³¹ The statute covers economic loss, which is defined as including, among other things, medical expenses, loss of earnings, and “loss of business or employment opportunities . . . to the extent recovery for such loss is allowed under applicable State law”; it also covers non-economic loss such as “physical and emotional pain.”³² The law gives victims the alternative of going through the tort system, but tort recoveries against airlines are limited to the insurance coverage of the defendants.³³

A special master was appointed to administer the fund. The special master issued regulations to govern claims³⁴ that in some instances seemed to go significantly beyond the statutory language. Although the statute called for an offset for life insurance and pension benefits, the special master reduced the offset to the extent of the individuals’ policy payments or pension contributions.³⁵ The special master also set an approximate \$250,000 floor on economic recoveries, and established a presumptive schedule covering economic loss, based on age, family size, and recent earnings, with a cap for the highest level incomes.³⁶ Additionally, the special master created a schedule for non-economic losses, with \$250,000 to each victim, and \$100,000 each to close relatives.³⁷ Apparently, the special master’s strategy was to “closely enough approximate the range of tort compensation to make no-fault benefits under the Fund an offer that could not be refused by most eligible parties.”³⁸ As it turned out, 97% of the nearly 3,000 surviving families applied to the fund, with only 70 families opting out.³⁹

The 9/11 scheme is clearly distinguishable in important respects from the problems posed by climate change compensation. The September 11 terrorist attack was a distinct event that caused indisputable harm to affected individuals. People caught in the collapse of the twin towers died; those nearby may have experienced immediate injuries. Thus, screening claimants was not a major problem. Also, unlike the events of September 11th, causation remains a big obstacle for potential plaintiffs to overcome in climate change litigation. Finally, the 9/11 compensation scheme may have had a partially patriotic motive.

Nevertheless, a couple of lessons may be drawn from the 9/11 fund. Clearly, the threat of tort liability pervaded the construction of 9/11 compensation, and the potential for tort liability also will likely prompt climate change compensation in other forms. Also, the 9/11 fund illustrates the impor-

26. United Nations Framework Convention on Climate Change, art. 4.4, May 9, 1992, 1771 U.N.T.S. 107 (1992), available at <http://unfccc.int/resource/docs/convkp/conveng.pdf>. Note that the United States joined the framework agreement but not the later Kyoto Protocol.

27. *Id.*

28. See Dean Scott, *U.N. Climate Talks Make Some Progress on Adaptation, Joint Implementation*, 29 INT’L ENVTL. REP. 867 (2006).

29. See Peter Gelling, *Focus at Climate Talks Shifts*, N.Y. TIMES, Dec. 13, 2007, at A31.

30. Air Transportation Safety and System Stabilization Act, Pub. L. No. 107-42, tit. iv, §§401-409, 115 Stat. 230, 237-41 (2001) (codified as amended at 49 U.S.C. §40101 (Supp. II 2002)). For an overview of the scheme, see Robert L. Rabin & Suzanne A. Bratis, *United States, in FINANCIAL COMPENSATION FOR VICTIMS OF CATASTROPHES: A COMPARATIVE LEGAL APPROACH* 303, 335-41 (Michael Faure & Ton Hartlief eds., 2006).

31. Pub. L. No. 107-42, §405(c)(1)-(c)(2)(A), 115 Stat. at 239.

32. *Id.* §402(5), (7), 115 Stat. at 237.

33. *Id.* §408(a), 115 Stat. at 240.

34. 28 C.F.R. §104 (2006).

35. *Id.* §104.47.

36. *Id.* §§104.21(b)(5), .41, .43, .45.

37. *Id.* §§104.44, .46.

38. Rabin & Bratis, *supra* note 30, at 341.

39. *Id.*

tance of providing standardized damage measures in the interests of efficient dispute resolution and fairness among victims. Moreover, the fund is a useful reminder, given the litigation orientation of American lawyers, that under some circumstances, administrative compensation schemes may provide a more efficient and even fairer alternative to the court system which may lack democratic legitimacy.

Although a perfect system is unattainable, it seems feasible to design a workable cost-shifting scheme for climate change. We might imagine a system along the following lines. Consider a possible international compensation commission. The commission would receive claims from countries that have incurred adaptation expenses such as strengthening sea walls or providing alternative sources of ecosystem services to replace lost wetlands. The commission would determine which adaptation expenses were reasonable, and would schedule them for compensation. Compensation might be directly from an international fund.

An alternative funding system might be more appealing if an international trading system for GHGs was in place. In this alternative way of financing compensation, a set number of GHG allowances could be set aside for the commission's use. The commission would use these allowances to pay claims; in turn, the claimants could sell them to greenhouse gas emitters on the open market. The sources doing the least to reduce their emission levels would have the greatest need to purchase additional emission permits. In purchasing these permits, they would indirectly provide compensation for the expenses of adaptation.

It is easy to imagine a similar program being established within the United States, or compensation might proceed through a grant program rather than through adjudication. No plausible system will precisely measure harm and match victims with historic GHG emitters, but some form of rough justice seems plausible.

C. Existing Models for Compensating Environmental Harm

Compensation of this kind is not a utopian dream. The best international precedent for such a system is the United Nations Compensation Commission (UNCC). The UNCC was established after the first Iraq War to handle claims against Iraq for war-related damages.⁴⁰ The United Nations Security Council held that Iraq "is liable under international law for any direct loss, damage, including environmental damage and the depletion of natural resources, or injury to foreign Governments, nationals and corporations, as a result of Iraq's unlawful invasion and occupation of Kuwait."⁴¹

Compensation can be given for several categories of environmental harm. The first category is "prevention of environmental damage, such as expenses directly related to fighting oil fires and stemming the flow of oil in coastal and international waters." A second category is "reasonable measures already taken to clean and restore the environment or future measures which can be documented as reasonably necessary to clean and restore the environment." A third category is "depletion of or damage to natural resources."⁴²

These provisions gave rise to intense dispute about compensation for damage environmental resources and for interim damages to those resources prior to restoration. The UNCC ultimately held that these damages were compensable.⁴³ One method used to measure the value of resources was the cost of mitigation measures—for example, creating new wetlands to replace those that were destroyed by oil spills.⁴⁴ This was used as a way to measure the loss of ecosystem services. The UNCC awarded approximately \$5 billion dollars for 109 successful claims.⁴⁵

There seems to be growing international recognition that "environmental damage will often extend beyond that which can be readily quantified in terms of clean-up costs or property devaluation."⁴⁶ Thus, harm to "environmental values (biodiversity, amenity, etc.—sometimes referred to as 'non-use' values) is, as a matter of principle, no less real and compensable than damage to property, though it may be difficult to quantify."⁴⁷

The UNCC dealt with the fallout from a discrete and readily identifiable human event, where moral blame was clear. Climate change is not so simple. Nevertheless, the UNCC has useful lessons for climate change. The environmental impacts of the Gulf War were numerous and varied, presenting considerable difficulty in terms of damage assessment. The UNCC's approach to determining damages also may provide a workable model in the context of climate change. By focusing on the expense of correcting the environmental harm, the UNCC has avoided difficult problems of identifying long-term environmental effects and valuing the resulting harms.

U.N. Doc. S/AC.26/2001/16 (June 22, 2001), available at <http://www2.unog.ch/uncc/reports/r01-16.pdf>.

43. Cymie Payne, *UN Commission Awards Compensation for Environmental and Public Health Damage From 1990-91 Gulf War*, INSIGHTS, Aug. 10, 2005, ¶ 7, available at <http://www.asil.org/insights/2005/08/insights050810.html>.

44. The application of this method of damage assessment is described in a recent overview of the UNCC's decisions:

Several claimants put a value on their temporary natural resource losses by proposing environmental projects designed to compensate for the loss of ecological services that the natural resources would have provided, had they not been damaged. Although the Panel viewed the proposed valuation methods using compensatory restoration projects as "relatively novel," it was willing to apply them "where there is sufficient evidence that primary restoration will not fully compensate for any identified losses." Accordingly, the Panel made awards that were quantified according to the cost of various compensatory projects: a cooperative rangeland management program to restore rangeland and wildlife habitat damaged by the influx of refugees into Jordan, and shoreline preserves in Kuwait and Saudi Arabia. In another case—Iran's claim for damage to rangelands from the presence of refugees—the Panel found it more appropriate to use the price of fodder to calculate an award rather than the value that Iran derived from lost ecological services.

Payne, *supra* note 43, ¶ 8 (footnotes omitted) (quoting UNCC, *Report and Recommendations Made by the Panel of Commissioners Concerning the Fifth Installment of "F4" Claims*, U.N. Doc S/AC.26/2005/10 (June 30, 2005)).

45. Cymie R. Payne, *Environmental Damage at the United Nations Compensation Commission 4* (unpublished manuscript, on file with author).

46. U.N. Int'l Law Comm'n, *Report of the International Law Commission on the Work of Its 53d Session*, cmt. art. 36, at 252, ¶ 15, U.N. Doc. A/56/10 (2001).

47. *Id.*

40. For information about the UNCC, see UNCC, *Homepage*, <http://www2.unog.ch/uncc> (last visited May 8, 2008, 2007).

41. S.C. Res. 687, ¶ 16, U.N. Doc. S/RES/687 (Apr. 3, 1991).

42. UNCC, *Report and Recommendations Made by the Panel of Commissioners Concerning the First Installment of "F4" Claims*, ¶ 10,

Within domestic law, the most successful compensation mechanism focuses on cleanup expenses and harm to natural resources. Pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA),⁴⁸ responsible parties, such as waste site owners, operators, or waste transporters, can be liable for injury to, destruction of, or loss of natural resources resulting from releases of hazardous waste.⁴⁹ The scope of this liability includes the reasonable cost of assessing such injury, destruction, or loss.⁵⁰ Section 101(16) of CERCLA defines “natural resources” to mean

land, fish, wildlife, biota, air, water, ground water, drinking water supplies, and other such resources belonging to, managed by, held in trust by, appertaining to, or otherwise controlled by the United States (including the resources of the fishery conservation zone established by the Magnuson-Stevens Fishery Conservation and Management Act), any State or local government, any foreign government, any Indian tribe, or, if such resources are subject to a trust restriction on alienation, any member of an Indian tribe.⁵¹

Under §107(f) of CERCLA, compensation for injury to natural resources is payable to the following entities: the U.S. government, any state for resources “within the State or belonging to, managed by, controlled by, or appertaining to such State,” and any Indian tribe in specified situations.⁵² The statute creates no private cause of action for natural resource damage. Authority to sue is vested in the president—when suing on behalf of the United States—or in the “authorized representative of any State,” who “shall act on behalf of the public as trustee of such natural resources.”⁵³ Sums recovered must be retained by the trustee “for use only to restore, replace, or acquire the equivalent of” the natural resources injured, destroyed, or lost.⁵⁴

CERCLA provides compensation for injury to an important but limited category of natural resources. Section 101(16) speaks of resources “belonging to, managed by, held in trust by, appertaining to, or otherwise controlled by” the government.⁵⁵ This language seems to encompass not only resources *owned* by a government, but also those subject to the “public trust,” such as navigable waters, wetlands, and parklands.⁵⁶

The CERCLA regulations are echoed by a separate legal scheme relating to oil spills. The Oil Pollution Act of 1990

48. Pub. L. No. 96-510, 94 Stat. 2767, amended by Superfund Amendments and Reauthorization Act (SARA), Pub. L. No. 99-499, 100 Stat. 1613 (1986) (codified as amended at 42 U.S.C. §§9601-9675 (2000)).

49. 42 U.S.C. §9607(a).

50. *Id.* §9607(a)(4)(C). Note that the statutory scheme imposes strict liability; no proof of culpable mental state or negligence is needed to support a compensation claim.

51. *Id.* §9601(16) (citation omitted).

52. *Id.* §9607(f).

53. *Id.*

54. *Id.*

55. *Id.* §9601(16).

56. See Barry Breen, *CERCLA's Natural Resource Damage Provisions: What Do We Know So Far?*, 14 ELR 10304 (Aug. 1984) (discussing the “nexus requirement” of CERCLA’s “natural resources” definition). Another possible analogy for climate change compensation might be liability for cleanup of hazardous waste, which is covered elsewhere in CERCLA. See, e.g., 42 U.S.C. §9621 (providing cleanup standards for “hazardous substances, pollutants, and contaminants”).

provides that the measure of natural resource damages is: “(A) the cost of restoring, rehabilitating, replacing, or acquiring the equivalent of, the damaged natural resources; (B) the diminution in value of those natural resources pending restoration; plus (C) the reasonable cost of assessing those damages.”⁵⁷ These costs are to be assessed with respect to restoration plans, which are to be promulgated by federal or state trustees.⁵⁸ Double recoveries are precluded.⁵⁹ The president must issue damage assessment regulations, and, pursuant to those regulations, a rebuttable presumption of correctness applies to damage determinations.⁶⁰

Another fairly natural analogy to climate change liability can be found in tort law. The prevailing approach to medical monitoring is illustrated by *In re Paoli Railroad Yard PCB Litigation*.⁶¹ The U.S. Court of Appeals for the Third Circuit held that a medical monitoring claimant must prove four elements:

1. Plaintiff was significantly exposed to a proven hazardous substance through the negligent actions of the defendant.
2. As a proximate result of exposure, plaintiff suffers a significantly increased risk of contracting a serious latent disease.
3. That increased risk makes periodic diagnostic medical examinations reasonably necessary.
4. Monitoring and testing procedures exist which make the early detection and treatment of the disease possible and beneficial.⁶²

In most medical monitoring cases, “litigants pursued or courts awarded the traditional common-law lump sum of monetary damages.”⁶³ In a few toxic exposure cases, however, litigants have requested, or courts have expressed their preference, that the defendant “pay the expenses [of medical surveillance] on a periodic basis out of a court-supervised trust fund or similar mechanism.”⁶⁴ Medical monitoring seems analogous to compensating for the costs of reasonable adaptation efforts, which like monitoring are intended as precautions against foreseeable harm caused by the party that created the risk.

Another problem in toxic tort litigation is establishing a link between a specific defendant and the release of the substance. For example, many hazardous waste generators may have shipped similar materials to the site in question. Estab-

57. 33 U.S.C. §§2701-2761, §2706(d)(1), ELR STAT. OPA §§1001-7001, §1006(d)(1).

58. *Id.* §2706(c)(1)-(2).

59. *Id.* §2706(d)(3).

60. *Id.* §2706(e).

61. 916 F.2d 829, 21 ELR 20184 (3d Cir. 1990).

62. *Id.* at 852.

63. Amy B. Blumenberg, *Medical Monitoring Funds: The Periodic Payment of Future Medical Surveillance Expenses in Toxic Exposure Litigation*, 43 HASTINGS L.J. 661, 665 (1992) (footnotes omitted).

64. *Id.* at 666. The leading case on medical surveillance is *Ayers v. Township of Jackson*, which held that “the cost of medical surveillance is a compensable item of damages . . . where such surveillance to monitor the effect of exposure to toxic chemicals is reasonable and necessary.” 525 A.2d 287, 312, 17 ELR 20858 (N.J. 1987). For a case rejecting a cause of action for medical monitoring, see *Hinton ex rel. Hinton v. Monsanto Co.*, which held that Alabama law does not recognize a “distinct cause of action for medical monitoring in the absence of a manifest physical injury or illness.” 813 So. 2d 827, 828 (Ala. 2001).

lishing ownership of the leaked containers or the quantities they leaked may be quite difficult. A similar issue can arise in products liability cases. In *Sindell v. Abbott Laboratories*,⁶⁵ the plaintiff's mother was administered the drug diethylstilbestrol (DES) during pregnancy. Although DES was, at that time, routinely given to prevent miscarriage, it is now known to cause a rare form of cancer in some daughters of women who took the drug. After developing that cancer, the plaintiff in *Sindell* sued 11 of the more than 200 manufacturers of DES.⁶⁶ Although the plaintiff was unable to identify the manufacturer of the particular DES product that her mother took, the court held that she had stated a cause of action against manufacturers of the drug that all used an identical formula.⁶⁷ Resting this holding on a broad social policy, the court noted that the defendants were "better able to bear the cost of injury resulting from the manufacture of a defective product."⁶⁸ The *Sindell* court then adopted a novel theory of liability by making each defendant liable for a share of the plaintiff's damages, based on the particular defendant's share of the DES market.⁶⁹ *Sindell* has been followed by a number of other courts, with some variations.⁷⁰ It is obviously impossible to link any specific GHG emissions with any specific injury from a particular company or governmental entity due to the cumulative nature of the GHG effect. Thus, some form of *Sindell*-like apportionment seems to be the only workable solution to allocate financial responsibility among a wide variety of responsible parties, although this approach may draw considerable dispute about where to draw the compensatory line.

None of these analogies can be considered more than suggestive. They do, however, show that it is possible to design compensation systems for major environmental harms if we have the desire to do so. In the next section, we consider some forms that a climate compensation scheme might take.

D. Implementing the Scheme

There is a natural tendency to fine-tune the system in order to come as close as possible to the optimum level of compensation. This is probably a mistake. We should not try to create a perfect system. Determining exactly the right level of compensation in every case would be extremely expensive and time-consuming. It would eat up expertise that could be more usefully employed to design mitigation and adaptation measures. It would also probably delay compensation to the point of diminishing its value to victims. It is better to have a rough system of compensation that provides at least partial justice and operates efficiently.

An *ex ante* approach delivers compensation earlier, more efficiently, and with less uncertainty. The compensation scheme should emphasize remedial measures such as monitoring, protecting, restoring, or providing substitutes for existing resources. There is precedent for such *ex ante* measures of damages in U.S. laws governing oil spills and haz-

ardous waste releases. Emitter agreements to grant remedial measures or changes by tax benefits, subsidies, or litigation settlements are also beneficial. However, an *ex post* system similar to toxic tort compensation is unmanageable and unworkable, because damages imposed after the resulting harm has occurred are among the hardest to prove. The system should involve restricting the class of compensable harms and carefully designing payment mechanisms—such as an agreed-upon hierarchy of injuries—in order to efficiently manage compensation and distribute damages only to the most likely victims. Of course, the system must rely upon the assumption of full information, where cases are identified by actual present harm.

Such a scheme could be implemented in many institutional forms. It could be the basis for liability determinations by domestic courts or international tribunals. Alternatively, an administrative compensation scheme might be used. Or the system could be given a more voluntary dimension. Emitters might voluntarily agree to finance grants for remedial measures (perhaps as settlement of litigation or with the encouragement of tax benefits or subsidies).

The problem of allocating responsibility among emitters presents serious difficulties. I have argued elsewhere that allocation should be based on the following principles.⁷¹ First, cost apportionments should be based on "excess" emissions—that is, emissions that would have been eliminated through imposition of an optimum carbon tax—determined to whatever limited degree of precision is feasible. Second, the climate change costs at any given time should be allocated on the basis of an emitter's current share of total atmospheric loadings at that time (meaning the use of average rather than marginal harm, and of historic rather than current emissions). To minimize risks due to future insolvencies, emitters should also be required to purchase insurance covering their projected future share of costs. All of these issues warrant further, more detailed investigation; the principles that I have outlined are merely meant to be starting points for consideration.

The difficulties of establishing any compensation system at all are formidable. It is better to begin with something unambitious and manageable than to aim for a possibly unattainable ideal. My proposal involves a very large amount of money. Diverting massive financial resources to compensation might leave too little for adaptation or mitigation. I am also very much aware that there are powerful political and economic forces on the side of the emitters of GHGs. Nevertheless, there is still hope that we can make the emitters accept some responsibility for the harm they have done.

III. Conclusion

In conclusion, I want to emphasize that climate change is already happening and that many people around the world will be harmed by sea-level rise and other effects. In my view, the companies and countries that caused this problem have a moral responsibility to help the victims of climate change. Not everyone will agree with this moral argument, but I believe that in time the world will come to view compensation as a requirement of justice.

The problem of providing compensation is very complex. We cannot possibly provide compensation for all harm re-

65. 607 P.2d 924 (Cal. 1980).

66. *Id.* at 925-26.

67. *Id.* at 928.

68. *Id.* at 936.

69. *Id.* at 936-37.

70. A good review of the early cases can be found in: *In re Agent Orange Prod. Liab. Litig.*, 597 F. Supp. 740, 820-28 (E.D.N.Y. 1984). Note that the most successful use of the doctrine has been in the highly unusual DES cases.

71. Farber, *Apportioning Costs*, *supra* note 1.

sulting from climate change. Also, we cannot precisely measure the share of responsibility of each source of GHGs. But we can create a system that will provide compensation for at least some of the harms. It is better to have some justice, even if it is not complete, rather than having no justice.

Of course, compensating the victims is not the only problem posed by climate change. It is even more important to control the causes of climate change. Otherwise, our children and our grandchildren may live in a world that is irreversibly damaged in many ways. I believe that we can stop causing climate change at a reasonable cost by making sen-

sible use of existing technologies and by investing in creating new technologies. But that is a subject for another time.

Even after we reduce our emissions, the scientists say that climate change and its impacts will be with us for the foreseeable future. Thus, reducing emissions through agreements like the Kyoto Protocol will not eliminate all harm. The question of who should pay for the harm remains. I am trying to make only a very small point: not *all* of the cost should be paid by the individuals and countries that suffer the harm. *Some* of the cost, I contend, should be paid by the businesses and countries that caused the harm.