The Case for Climate Compensation: Justice for Climate Change Victims in a Complex World

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I. INTRODUCTION

The United States, the wealthiest country in the world, contributes far more than its share of greenhouse gases.¹ It is now clear that these emissions have caused serious risks to the world as a whole, particularly the poorest nations.² This raises two questions. First, does the United States have a moral duty to impose reasonable curbs on its future emissions? Second, does the United States have a moral duty to make amends for its past excesses—for example, by providing financial assistance to poorer nations that are now faced with the need to adapt to climate change?³

It seems obvious to many people that the answer to both questions is yes. But these are important issues, deserving of more careful consideration. And indeed, two of the nation’s leading legal scholars, Eric Posner and Cass Sunstein, have recently questioned whether corrective justice or distributive justice have any relevance to climate change policy.⁴ Their writing provides a useful occasion for further reflection on these issues. Their arguments were developed most fully in a working paper which is still posted online.⁵ The published version of the paper restates the same basic conclusions with more abbreviated support.

* Sho Sato Professor of Law and Director, California Center for Environmental Law and Policy, University of California, Berkeley. I would like to thank David Anderson for his assistance and Michael Hanemann, Cymie Payne, and Amy Wildermuth for their comments on earlier drafts. This Article was presented as the Quinney Distinguished Lecture at the University of Utah S.J. Quinney College of Law.

¹ See infra Part II.B for statistics.
² See infra Part II.A.
³ See generally CHUKWUMERIE OKEREKE, GLOBAL JUSTICE AND NEOCLASSICAL ENVIRONMENTAL GOVERNANCE: ETHICS, SUSTAINABLE DEVELOPMENT, AND INTERNATIONAL CO-OPERATION 32–56 (2008) (surveying concepts of justice as they apply in the international realm); J. TIMMONS ROBERTS & BRADLEY C. PARKS, A CLIMATE OF INJUSTICE: GLOBAL INEQUALITY, NORTH-SOUTH POLITICS, AND CLIMATE POLICY (2007) (discussing scientific measures of climate change inequality); see also Leslie Pickering Francis, Global Systemic Problems and Interconnected Duties, 25 ENVTL. ETHICS 115, 115–16 (2003) (arguing that if locals have a duty to preserve their local environments, outsiders have a duty not to interfere with these efforts through causing global environmental disruptions).
To be fair, Posner and Sunstein's position from the start has had some complexities and ambiguities. They do not oppose regulation of greenhouse gases, and they seem to be open to the argument that the United States should curb emissions in the interest of global welfare. At one point, they say that they do not "question the proposition that an international agreement to control greenhouse gases, with American participation, is justified, and all things considered, the United States should probably participate even if the domestic cost-benefit does not clearly justify such participation." Thus, if the effect on the United States is neutral, they seem favorable toward giving assistance to the rest of the world.

On the other hand, Posner and Sunstein say that the situation is different if the costs to the United States of a climate change agreement would not be justified by domestic U.S. benefits—in others words, if the U.S. cost-benefit analysis is negative. In that situation, the "standard resolution of the problem" indicates that "the United States should be given side-payments" in return for agreeing to participate in a global climate change agreement. I should note that this assumption regarding the absence of U.S. benefits from climate change regulation is open to question, particularly in light of more recent analyses of climate risks. Nevertheless, this assumption most strongly raises the question of our moral duties to other nations, and therefore I will indulge the assumption in most of what follows.

Why should the rest of the world compensate the United States for controlling our emissions if doing so is to our own disadvantage? The "reason for this conclusion is straightforward," they say. If a climate change agreement is in the interests of the world but not the United States,

To the extent that the United States is a net loser, the world should act so as to induce it to participate in an agreement that would promote the welfare of the world's citizens, taken as a whole. With side-payments to the United States, of the kind that have elsewhere induced reluctant nations to join environmental treaties, an international agreement could be designed so as to make everyone better off and no one worse off. Who could oppose . . . [such] an agreement?

abstract_id=1008958 [hereinafter PAS]. To avoid confusion, I will cite the online version as PAS and will generally use the past tense in referring to it.

Posner & Sunstein, supra note 4, passim.  
Id. at 1572 (citations omitted).  
Id.  
Id.  
Id.  
Elizabeth Burleson, Multilateral Climate Change Mitigation, 41 U.S.F. L. REV. 375, 373 (2007) (emphasizing that a "single country does not benefit from investing in climate protection unless doing so becomes a collective effort").  
Posner & Sunstein, supra note 4, at 1569.  
Id. at 1570.
Some readers may find disconcerting the thought of the Indians, Africans, and South Americans being dunned in order to bribe the United States into reducing emissions. Posner and Sunstein, however, profess to be puzzled by the fact that "almost everyone" rejects this idea. But later, they suggest that it might be "commendable" for the United States to forego such compensation in the interest of world welfare. What is at stake, then, is whether Americans have a duty to bear the domestic costs of reducing emissions or whether doing so would merely reflect a commendable sense of generosity.

What is at stake may be something of a family disagreement among those of us who agree that the United States should participate in an international climate change agreement. In accord with Posner and Sunstein's apparent view, I believe that the United States should join an agreement even if its net benefits to Americans are unclear. I also agree that it would be commendable for the United States to do so even if the net benefits to the United States are negative. But I would go further and say that the United States has a duty to bear some net costs as a result of climate change because of its responsibility for causing the problem. This might take the form of shouldering an increased portion of the cost for mitigating future greenhouse emissions, but I will focus on the possibility that the United States (and other developed countries) could contribute to the cost of adaptation to unavoidable climate change elsewhere in the world, particularly in developing countries.

In this Article, I will explore the issues concerning American responsibility for climate change. I will argue that the United States has a moral obligation to be accountable for its contribution to the climate change problem. I will also explain how a practical mechanism for providing climate change compensation could be established. My goal is in part to respond to Posner and Sunstein, but

13 Id.
14 Id. at 1584.
15 In both iterations, the Posner and Sunstein paper seems most concerned with rebutting the argument that the U.S. share of greenhouse mitigation costs should be proportional to the American contribution to total atmospheric loadings of greenhouse gases. Their argument also implies, however, that there is no duty to compensate poorer countries for adaptation costs or other climate impacts. This Article argues to the contrary regarding the compensation issue.
16 I will not discuss whether the duties to future generations create an additional moral obligation to reduce greenhouse gases. For a discussion of the issues, see EDWARD A. PAGE, CLIMATE CHANGE, JUSTICE AND FUTURE GENERATIONS 9 (2006).
equally importantly, to fill in an important gap in my own earlier discussions of climate compensation. My prior work has focused on the design of a compensation scheme while taking the justice of compensation more or less for granted, but that is a fundamental question that obviously must be faced.

This Article will focus on the moral responsibilities of the United States in part because I am an American and hence most directly focused on U.S. climate policy. More importantly though, this focus is justified by the unique role the United States has played in climate change. Its total contributions to current greenhouse gas concentrations are twice that of any other single nation, and its per capita emissions are the highest in the world except for Kuwait. So considering America’s moral responsibilities is an obvious place to start. I do not mean to imply, however, that America alone bears such responsibilities.

Nor do I wish to suggest that Americans should engage in an orgy of mutual recrimination and guilt-mongering. For at least the past two decades, we have engaged in short-sighted and self-centered behavior in the past, to the detriment of other people (at least some of whom are very poor or otherwise vulnerable). We need to make amends for that past behavior and move on.

The question of compensation is far from being merely academic. The United States and other developed countries will be the subject of demands for compensatory action for some years to come. The demands have already begun. For example, in the run-up to the Kyoto Protocol, Brazil proposed that emissions targets be set on the basis of each country’s responsibility for global temperature increase. Prior to the Bali conference, India announced that “costs of drought survival programs, flood shelters, malaria control, support to farmers, and other measures needed to help India’s more than one billion people adapt to climate change come to a significant two percent of India’s gross domestic product.”

Demands for compensation made significant progress at Bali. The negotiators, including U.S. representatives, agreed to strengthen an existing adaptation fund. The fund will receive the proceeds from a two per cent 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 sixteen-member board with representatives from developed and developing countries.

Compensation claims can arise in different ways. They might come in the form of domestic or international litigation. In the political arena, they might take the form of demands for compensation for the costs of adaptation measures,

18 See ROBERTS & PARKS, supra note 3, at 141 fig. 5.1.
22 Id.
23 Id.
especially by poorer countries. Or they might take the form of demands that we help subsidize insurance coverage for risks that are augmented by climate change. Or, alternatively, they might take the form of demands that bear an additional portion of the financial burden of reducing future emissions through contributions to mitigation efforts in other countries. Although not involving compensation as such, similar arguments may be made that we have a duty to reduce future emissions beyond what our own national interest would dictate in order to avoid further imposing climate harms on other countries.

Regardless of the forms the demands might take, we surely have not heard the last of the compensation issue, domestically or internationally, and we should be able to consider its substantive merits in an intelligent fashion. At the same time, of course, we must realize that politics is a messy process, and that even if we can agree on the right outcome, getting there is another matter. And of course, we also have to be realistic about the extent to which we can expect moral considerations to influence policy, especially where large amounts of money are involved. Nevertheless, unless we at least identify the right approach, we cannot expect to make any progress. This Article attempts to advance that process.

II. CLIMATE CHANGE IMPACTS AND RESPONSIBILITY

Some initial background on climate change and its sources is appropriate before turning to the ethical issues. We first consider the impacts of climate change and then the contribution of the United States.

A. Impacts

There is now little doubt that climate change is real or that it is caused by human activities, particularly emissions of CO₂ from fossil fuels. The most reliable source on climate change is the 2007 report of the International Panel on Climate Change (IPCC), which explains the scientific consensus that:

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.  

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The IPCC report is the result of an exhaustive review process. Notably, because of improvements in modeling and data, the 2007 Report was able to eliminate some questions that had previously been raised about the evidence for climate change.

Even those who are aware of the strength of the evidence for climate change may not realize that it has already begun, nor may they be aware of the inevitability of further change in the next decades. Mitigation may affect the degree of adaptation that is ultimately required, but in the short run it will have little effect in reducing climate change. The reality is that, whatever mitigation measures are adopted, a significant degree of further climate change seems unavoidable. As the IPCC explains, "[a]nthropogenic warming and sea level rise would continue for centuries due to the time scales associated with climate processes and feedbacks, even if greenhouse gas concentrations were to be stabilized."

The evidence indicates that a doubling of CO₂ from preindustrial levels would result in a temperature increase between 1.5°C and 4.5°C (3.0–8.1°F) by the end of this century. 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 are already experiencing them. The changes seem to be occurring faster than expected, as shown by the alarming meltdown of Arctic sea ice.

Sea level rise is one of the most predictable (and to some extent least avoidable) consequences of climate change. According to the IPCC:

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.

since 1750 has been one of warming, with a radiative forcing of +1.6 [+0.6 to +2.4] W m⁻².” Id. at 3 (citation omitted) (emphasis in original).

25 See Richard A. Kerr, Scientists Tell Policymakers We’re All Warming the World, 315 SCI. 754, 754 (2007).

26 IPCC Physical Science Summary, supra note 24, at 16.


28 See David Perlman, New Alarm is Raised Over Melting Polar Ice; Scientists Dismayed to See Record Warm Water Temperatures in Arctic Regions, S.F. CHRON., Dec. 13, 2007, at A22.

29 See e.g., K. Hasselmann et al., The Challenge of Long-Term Climate Change, 302 SCI. 1923, 1924 fig. 1 (2003) (predicting a two meter increase in sea level under a “business as usual” scenario by 2100; but only twenty centimeters under an optimum regulatory strategy).

30 IPCC Physical Science Summary, supra note 24, at 5.
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)." Thus, sea level rise is the opposite of being speculative. This rise in sea level will result in significant loss of coastal lands.

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 in jeopardy by 2100, and the cost of protecting developed areas from a half-meter rise would be $115 to $974 billion. Sea level rise is not the only near-term impact. The IPCC found that it "is very likely that hot extremes, heat waves and heavy precipitation events will continue to become more frequent." It also concurs that we are likely to see changes in tropical storms such as hurricanes: "[b]ased 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 [SSTs]."

Other adverse changes are also likely. According to the IPCC, drought-affected areas will increase. Moreover, impacts will be more severe if the temperature increase is greater than 2–3°C. At 4°C, losses could be one to five percent of global GDP. This is a global average, so impacts in some areas would be much more severe, while others may still receive small net benefits.

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

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31 Id. at 7.
32 See A. BARRIE PITTOCK, CLIMATE CHANGE: TURNING UP THE HEAT 262–78 (2005) (providing examples of coastal lands that will be lost, including China, India, Pakistan, Bangladesh, and the United States).
33 WILLIAM E. EASTERLING III, BRIAN H. HURD & JOEL B. SMITH, COPING WITH GLOBAL CLIMATE CHANGE: THE ROLE OF ADAPTATION IN THE UNITED STATES 14 (2004), available at http://pewclimate.org/docUploads/Adaptation.pdf. This estimate may be on the high side, but even if we discount by a factor of two, the figures are still impressive.
34 IPCC Physical Science Summary, supra note 24, at 15.
35 Id. at 19.
37 Id. at 17.
38 Id. at 17.
39 Id.
The Pew Foundation collected much of the available information about adaptation strategies in a 2004 report. This report indicated that we will need to develop new agricultural plant varieties to deal with changing temperatures, rainfall, and pests. Since 1980, federal expenditures for agricultural research have been flat, but substantial increases will probably now be needed. 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 Florida. Other areas where adaptation may be required include forestry and health hazards from heat stress.

The Stern Report contains a particularly extensive discussion of adaptation costs and estimates that:

Infrastructure is particularly vulnerable to heavier floods and storms, in part because OECD economies [the nations belonging to the Organization for Economic Co-operation and Development] invest around 20% of GDP or roughly $5.5 trillion in fixed capital each year, of which just over one-quarter typically goes into construction ($1.5 trillion—mostly for infrastructure and buildings). The additional costs of adapting this investment to a higher-risk future could be $15–150 billion each year (0.05–0.5% of GDP), 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.

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

In the non-developed world, adaptation may be beyond the capacity of local economies. The IPCC estimates that by the end of the century, projected sea level rise could involve much higher adaptation costs of five to ten percent of GDP in Africa. Even by 2020, 75–250 million Africans will be subject to increased difficulty in obtaining water. Similarly, "coastal areas, especially heavily-populated mega delta regions in South, East, and South-East Asia, will be at

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40 EASTERLING, HURD & SMITH, supra note 33 (presenting the Pew Foundation 2004 report).
41 See id. at 8–13.
42 Id. at 20.
43 See id.
44 Id. at 21.
45 Id. at 3 tbl. 1.
47 IPCC ADAPTATION SUMMARY, supra note 36, at 13.
48 Id.
greatest risk due to increased flooding from the sea, and in some megadeltas, flooding from the rivers.\textsuperscript{49}

\textbf{B. Climate Change Responsibility}

Emission levels differ greatly between sources. For example, the United States was responsible for twenty percent of the world's emissions in 2000, about equal to its share of GDP.\textsuperscript{50} By contrast, the European Union was responsible for only fourteen percent of the emissions (but received about as much of the world’s GDP as the United States.).\textsuperscript{51} Thus, our high share of emissions is not solely due to our high economic level. As of 2003, the United States was responsible for about thirty percent of cumulative \( CO_2 \) emissions.\textsuperscript{52} The reason for discrepancy between current and cumulative percentages is that \( CO_2 \) is persistent in the atmosphere, and the United States accounted for an even higher share of emissions in the past.\textsuperscript{53} \( CO_2 \) persists in the atmosphere for long periods: about half of the \( CO_2 \) emitted in 1907 is still in the atmosphere.\textsuperscript{54}

Emissions are not equally attributable to all economic sectors: over sixty percent come from energy consumption.\textsuperscript{55} Globally, motor vehicles (and hence petroleum derivatives) account for about ten percent of total emissions, while power generation accounts for twenty-five percent.\textsuperscript{56} To complicate matters, as noted above, past emissions remain in the atmosphere and were emitted from different sources or in different proportions between sources.

Even within the United States, there are important variations. In considering the role of the states, it is important to keep in mind the large contributions that some states make to emissions and the varied trajectories of the states. From 1990–2001, the largest emitter (Texas) increased its emissions by 178 percent; while the second largest (California) increased by only 85 percent.\textsuperscript{57} Florida, although only fifth on the list, showed a 347 percent increase; on the other hand, New York, with a similar level of baseline emissions, actually showed a slight decrease.\textsuperscript{58} There is plenty of room for further progress. Some American states rank with the least efficient energy users in the world such as Qatar.\textsuperscript{59} The good news is that there seems to be a lot of low-hanging fruit. If U.S. per capita emissions were the same

\textsuperscript{49} Id.
\textsuperscript{50} See BAUMERT, HERZOG & PERSHING, supra note 19, at 110 tbl. 1.
\textsuperscript{51} See id.
\textsuperscript{52} See Posner & Sunstein, supra note 4, at 1578 tbl. 4.
\textsuperscript{53} See id. at 1579.
\textsuperscript{54} See id.
\textsuperscript{55} BAUMERT, HERZOG & PERSHING, supra note 19, at 4–5 fig. 1.3.
\textsuperscript{56} Id. at 57 fig. 10.2.
\textsuperscript{57} Michael B. Gerrard, Introduction and Overview, in GLOBAL CLIMATE CHANGE AND U.S. LAW 1, 10 (Michael B. Gerrard ed., 2007).
\textsuperscript{58} Id.
\textsuperscript{59} David Hodas, State Initiatives, in GLOBAL CLIMATE CHANGE AND U.S. LAW 343, 345 (Michael B. Gerrard ed., 2007).
as California’s per capita emissions, total U.S. emissions would be nearly cut in half.\textsuperscript{60} In any event, the large variation among states in the trajectories of emissions since 1990 suggests strongly that available methods to limit emissions did exist but were not used in some places.

As we will see, the temporal pattern of U.S. emissions is also potentially relevant. The following table gives emissions by decade.\textsuperscript{61}

\begin{table}
\centering
\caption{U.S. CO\textsubscript{2} Emissions by Decade}
\begin{tabular}{|c|c|}
\hline
Decade & Total Fossil Fuel CO\textsubscript{2} Emissions Per Decade (in thousand metric tons) \\
\hline
1800-09 & 897 \\
1810-19 & 1,625 \\
1820-29 & 3,190 \\
1830-39 & 10,695 \\
1840-49 & 30,040 \\
1850-59 & 93,002 \\
1860-69 & 169,487 \\
1870-79 & 364,865 \\
1880-89 & 748,407 \\
1890-99 & 1,307,514 \\
1900-09 & 2,553,862 \\
1910-19 & 3,928,812 \\
1920-29 & 4,669,836 \\
1930-39 & 4,141,926 \\
1940-49 & 6,117,256 \\
1950-59 & 7,327,215 \\
1960-69 & 9,344,693 \\
1970-79 & 12,282,447 \\
1980-89 & 12,325,868 \\
1990-99 & 14,306,218 \\
2000-04 & 8,127,919 \\
\hline
\end{tabular}
\end{table}

The pattern, obviously, is a sharp upward movement in the amount of emissions. Emissions growth reversed itself only during the Great Depression (though only slightly even then) and slowed only in the 1980s (perhaps due to the energy crisis and recession triggered by OPEC oil price increases). With the exception of those two decades, emissions have grown substantially in every decade.

\textsuperscript{60} Id. at 346.

\textsuperscript{61} These figures were derived from http://cdiac.ornl.gov/ftp/trends/emissions/usa.dat by adding the annual data for total CO\textsubscript{2} emissions.
decade in U.S. history. The degree of increase can be seen by comparing the total amount of emissions in U.S. history (about eighty billion tons) with the emissions from 2000–2004—which shows that about ten percent of all the CO₂ the United States has ever produced came from the first term of George W. Bush’s presidency. This fact bears repetition: in the four years of Bush’s first term, the United States emitted a tenth of all the CO₂ of the preceding two centuries. Or to put it another way, the United States is on track to emit as much this decade as it did for the entire period from 1900 to 1940.

Even if we were to stabilize the level of CO₂ in the atmosphere, climate change would continue for several decades and to a lesser extent thereafter. On the other hand, if we were able to reduce greenhouse gas emissions sharply, global temperature increases would moderate within a decade. Thus, despite the existence of considerable inertia in the climate system, there is only a short lag before changes in greenhouse gas concentrations affect climate. The greenhouse gases emitted by the United States in the past will cause harm regardless of what further steps we now take to reduce climate change. This makes the increasing levels of U.S. emissions over the past decades significant in terms of near-term climate impacts as well as their long-term effects. It will not take long for our post-1990 emissions to come back to haunt us in the form of additional adverse climate impacts and adaptation needs.

III. THE KEY MORAL ISSUES

It may seem painfully obvious to some readers that countries that cause substantial harm should have a duty to make amends, particularly when the harmful conduct was negligent and many of the victims are much poorer than the countries causing the harm. Compensation for harm caused by unreasonable conduct is, after all, one of the key purposes of our tort system. But this view is not universal. Posner and Sunstein conceded in their working paper that “[i]t is true that many people in poor nations are at risk because of the actions of many people in the United States,” but they insisted that “the idea of corrective justice does not easily justify any kind of transfer from contemporary Americans to people now or eventually living in (say) India and Africa.” This Part will explore various moral issues raised by climate justice skeptics.

The arguments against climate justice take various forms. One argument is that the United States should not be considered culpable because of the possibility that its contribution to climate change will be swamped by China and therefore result in no independent harm—or at least too little independent harm to allow the United States to be considered negligent. A related argument is that compensation would be funded by today’s taxpayers, rather than by earlier generations of

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63 Id.
64 PAS, supra note 5, at 5.
Americans who are responsible for the climate problem. I will suggest that these arguments, while seemingly powerful, have shaky factual foundations.

More fundamentally, climate justice skeptics raise questions about the concept of collective responsibility. Since nations are merely collections of individuals, they argue, to hold the United States responsible as a nation for harm to other nations would burden individuals who are not to blame in order to provide compensation to others who might not actually be victims.\(^6\) I agree that it is not possible to precisely match the burden of compensation with individual fault, but I argue that the degree of mismatch is limited and worth bearing given that the alternative is to allow many individuals to undeservedly evade liability.

These arguments go to the issue of corrective justice, that is, the principles that people should not benefit from their wrongdoing and should compensate those who have suffered as a result. Distributive justice is a separate issue. Here, Posner and Sunstein are ambivalent. At one point, they seem to dismiss distributive justice as a relevant concern and indeed they call for poor nations to compensate the United States for foregoing the benefits of unrestrained emission of CO\(_2\).\(^6\) But elsewhere, they seem to concede that distributive justice is relevant, though not determinative.\(^6\) I agree with the latter position, although I believe that it has greater moral force than Posner and Sunstein seem to believe.

Posner and Sunstein have performed an important service by articulating so cogently the various arguments against the existence of a moral duty to compensate victims of climate change. In the course of responding to these arguments, I will be making the affirmative moral case for compensation.

A. Culpability and Unjust Enrichment

Posner and Sunstein argue that greenhouse emissions could not have been negligent until at least 1990, and that the case for finding negligence at all is weak.\(^6\) The 1990 date for liability has been proposed by others.\(^6\) It seems

\(^{65}\) See Posner & Sunstein, supra note 4, at 1585 ("Nations are not people; they are collections of people. Redistribution from wealthy countries to poor countries is not the same as redistribution from wealthy people to poor people.").

\(^{66}\) See id. at 1569.

\(^{67}\) Id. at 1569–71

\(^{68}\) Id. at 1598 n.146.

\(^{69}\) See David Hunter & James Salzman, Negligence in the Air: The Duty of Care in Climate Change Litigation, 155 U. PA. L. REV. 1741, 1773 (2007) (at least after 1990, breach of duty of care by particular defendant should be considered jury question). There are two arguments for using this date. First, it is roughly the time of the first Framework Convention on climate change, which the United States joined, so it marks international acknowledgement of the problem. Second, our emissions data before 1990 is less adequate. According to the World Resource Institute’s report, “[p]olicy proposals that rely on historical emissions prior to 1990 face considerable barriers related to data quality and availability.” BAUMERT, HERZOG & PERSHING, supra note 19, at 10 The greatest uncertainties relate to CO\(_2\) production from land use change and forestry. Id. at 7.
plausible as a date for attributing awareness of climate harms to emitters, because by 1992 the United States had agreed to “take corresponding measures on the mitigation of climate change, by limiting its anthropogenic emissions of greenhouse gases and protecting and enhancing its greenhouse gas sinks and reservoirs.”70 (More generally, there is a general principle of international law that states have an obligation not to harm the environment of other states,71 but perhaps the United States could claim it had insufficient knowledge of the potential harm before 1990.) By the 1990s, then, it would be hard for emitters to claim that they were not on notice of the harmful effects of their actions.

In arguing against negligence, Posner and Sunstein made an argument in the online version of their paper that really goes to the question of whether U.S. actions have a causal link with climate harms, or whether U.S. actions can only be considered a culpable cause of harm if other countries are trying to address the issue. Posner and Sunstein argued that if most people around the world fail to cut back on their emissions to an optimal level, then the contribution of Americans to climate change will be “close to nil,” and so “it cannot be considered negligent for Americans to fail to engage in cutbacks of greenhouse-gas emitting activities.”72

This is true, they say, even if we assume that the optimum carbon tax for the world as a whole would be $35 per ton of CO₂, an estimate by two economists.73 (The carbon tax ideally should be set to equal the harm caused by CO₂ emissions). The reason is that it should not be considered negligent if we merely “fail to contribute to a public good” if others fail to do so.74

Posner and Sunstein also argued that “there is probably no action that the United States [government] could have taken unilaterally that would have created benefits for the rest of the world greater than the cost to the United States.”75 Moreover, they contended that members of the public cannot be blamed for their government’s failures, and hence should not have to pay taxes or assume other

72 PAS, supra note 5, at 28.
73 Id. at 27–28.
74 Id. at 28.
75 Id. at 28.
burdens to correct the harms caused by their governments’ wrongful acts. Neither argument seems sound given our current knowledge of climate change and of the U.S. contribution to the problem.

When Posner and Sunstein said that there is no unilateral action by the United States that would be beneficial, they mean that the benefits of energy use by the United States exceed the harm caused by the resulting CO\textsubscript{2}. Hence, no carbon tax is appropriate—a carbon tax would cause reductions in emissions, which by hypothesis would not be justified on a cost-benefit basis. In effect, Posner and Sunstein were positing that if China does not restrict emissions, the optimum carbon tax for the United States (and the rest of the world) is zero. This appears to be at least debatable, and probably incorrect. Regardless of what China does, U.S. emissions will continue to cause incremental harm, and a tax would be justified to internalize that cost.

In part, there may be some confusion between the total level of harm and the marginal level of harm. It is true that if other nations such as China do not reduce emissions, the total level of harm would be much higher than if everyone controlled emissions, but this does not mean that the marginal global harm from the incremental contribution of the United States suddenly becomes zero. If the incremental net harm is above zero,\footnote{See id. at 28–29.} the optimal carbon tax should also be set at this level.\footnote{It is important to use the net harm because climate change may also cause some benefits, which need to be netted out.} The incremental harm from U.S. emissions could be driven to zero only if there is a saturation effect, so that climate change “maxes out” from the contribution of other countries and emissions from the United States become irrelevant.

Even if there were a saturation effect, it would by no means follow that individual emitters would be exempt from liability. Consider a group of polluters, all of them discharging a chemical into a lake. The pollution from any single polluter, let us suppose, is enough to ruin the lake, kill the fish, and kill anyone who drinks the water. Moreover, assume that the harm to the lake exceeds the total cost of ending the pollution (and therefore clearly exceeds the cost to any one polluter of cleaning up). \textit{A la} Posner and Sunstein, each polluter argues that it should escape liability—the marginal effect of its discharges was zero because the lake would have been saturated with poison anyway. Yet the polluters would
collectively have caused the situation with some degree of over-determination. Should the polluters escape responsibility via this argument?

This seems like an apt situation to apply a principle from tort law:

The rule that has evolved is that, at least where both causes involve comparable blameworthiness, both actors are liable, even though the conduct of either one was not a *sine qua non* of the injury because of the conduct of the other. There is no reason why a polluter should be insulated from responsibility in a case where a traditional tortfeasor would not be.\(^7\)

As the Ninth Circuit has explained:

Take the philosophers’ example ... of the kitchen with a light switch at each end. When two people simultaneously flip both switches on, the light goes on. Neither person’s conduct is a *sine qua non*, because the light would have gone on anyway. Neither individual’s conduct made a difference to the outcome. [This] analysis would compel the conclusion that neither person caused the light to go on.

[This] argument that liability can only attach to conduct that is a *sine qua non* of the harm, even for causally overdetermined harm, cannot be right, as the kitchen light hypothetical case shows. The problem with [this] argument is that where the result is overdetermined, each person’s argument is as strong as the other’s identical argument. If we accept one person’s argument that he did not cause the light to go on, then we have to accept the identical and equally valid argument of the other person that he did not cause the light to go on. Each accurately points out that his switching the light on was not a *sine qua non* of its going on. It is true that the light would have gone on anyway because of the other person’s conduct. If conduct had to be a *sine qua non* even for this overdetermined result, then neither person’s conduct caused the light to go on. But the light went on. And it did so by human agency, not spontaneously. So the conclusion that [defendant’s] argument compels, that *no one* caused the light to go on, is false. Because the correct answer has to be the same for the two individuals, by eliminating the false answer we have left only one possible answer which must be true: Each of the two persons caused the light to go on.\(^8\)

Consequently, the court held that polluters could not escape liability with this argument.

The classic example of this over-determination effect is the destruction of property by two simultaneous negligent fires. The courts consistently hold that

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\(^7\) Boeing Co. v. Cascade Corp., 207 F.3d 1177, 1183 (9th Cir. 2000).

\(^8\) *Id.* at 1184–85.
both are liable, dismissing arguments that neither one should be considered culpable because the property would have been destroyed by the other fire anyway.\footnote{See \textit{Kenneth S. Abraham, The Forms and Functions of Tort Law} 111 (3d ed. 2007) (stating that this is the “universal” outcome and that it would be “absurd” to relieve either negligent party of liability). This position is also taken by the Third Restatement of Torts, which states that “[i]f multiple acts exist, each of which alone would have been a factual cause under § 26 of the physical harm at the same time, each act is regarded as a factual cause of the harm.” \textit{Restatement (Third) of Torts: Liability for Physical Harm} § 27 (Proposed Final Draft No. 2, 2005). “Conduct is a factual cause of harm when the harm would not have occurred absent the conduct.” \textit{Id.} § 26. Courts have consistently applied this role in toxic tort cases where the plaintiff has been exposed to the same toxic substance by multiple defendants. None of the defendants is allowed to escape liability on the grounds that the other exposures would have been enough to cause liability. \textit{Id.} § 27 cmt. g. A related rule in § 28 provides that when multiple actors wrongfully exposed the plaintiff to a risk of physical harm and that the “tortious conduct of one or more of them caused the plaintiff’s harm but the plaintiff cannot reasonably be expected to prove which actor caused the harm, the burden of proof, including both production and persuasion, on factual causation is shifted to the defendants.” \textit{Id.} § 28. It should be noted that an actor making only a trivial contribution to causing the risk is exempted from these rules. \textit{Id.} § 36. There is no reason to think that Chinese emissions would dwarf the U.S. contribution to such an extent as to make the U.S. emissions trivial in comparison.} For the same reason, when a group of emitters contributes to saturating the atmosphere with a gas, all of them should be considered causal factors, even if the marginal contribution to the harmful effect is zero because of the saturation effect.

Thus, even if a saturation effect did exist, it would not excuse the United States from reducing emissions or relieve it of responsibility for past emissions. More importantly, there is no reason to believe in the existence of such a saturation effect.

Past some atmospheric concentration of CO$_2$, additions might not have any additional effect in terms of temperature increases, but such a physical saturation effect does not seem likely in the range of concentrations considered by climate scientists. Climate models show increased temperature effects with increased CO$_2$ emissions over a broad range of assumptions.\footnote{The IPCC synthesis of the physical science for policymakers shows that shows that differences in CO$_2$ concentrations at the point where concentrations are stabilized from 350 ppm to 700 ppm translate into temperature changes from around 2.0°C to the neighborhood of 5°C. See IPCC, \textit{Climate Change 2007: Synthesis Report} 20 tbl. 6 (2007), available at \url{http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_spm.pdf}. There is no sign of any saturation effect in the sense that marginal increases in concentration result in declining contributions to temperature. In fact, that contrary is true. A 50 ppm difference at the low end of the concentration scale results in about a 0.4°C marginal increase in temperature, while a 50 ppm difference at the high end of the concentration scale results in about a 0.9°C. Thus, the marginal effect of CO$_2$ concentrations increases as the level of concentration is higher. \textit{Id.} For example, the difference between The IPCC results are presented in a nice graph in the Stern Report. \textit{Stern, supra} note 46, at 69 fig. 3.1. The higher emission scenarios all show higher temperatures resulting. Moreover, as CO$_2$
Nor is there any reason to think that once temperature increases reach a certain level, further increases will not cause additional harm. The assumption that there is a sort of saturation effect in terms of harm is contrary to the general view of economic modelers. A common assumption by economists is that damages are a quadratic function of temperature increase past a certain point. What this means is that the damages are a parabola rather than a straight line, mapped against the temperature change. So the greater the temperature increase, the larger the slope of the graph, meaning the higher the marginal effect of adding another small temperature increase on top of the existing temperature. The Nordhaus model, which seems to be particularly well regarded by American economists, assumes "that the cost of climate change will increase faster than global mean temperature, so that the aggregate loss in global GDP almost doubles as global mean temperature increases from 4°C to 6°C above pre-industrial levels." One reason for the nonlinearity is that Nordhaus posits an increasing possibility of abrupt climate shifts at higher average global temperatures. Other models posit either increasing or constant marginal harm depending on total emissions.

Indeed, in terms of the level of the carbon tax, it is possible that the saturation argument is exactly backwards. If there is a quadratic damage function or similar nonlinear effect and if temperature increases are proportional to increases in CO₂ concentrations, then the optimal carbon tax (in terms of global welfare) for the United States may be higher if China fails to control emissions than if China does so. Under other assumptions, the optimal tax may be lower if China fails to control emissions. But in any event, there is no reason to think the optimal tax would be zero. Thus, regardless of whether other countries do so, countries that chose to reduce their CO₂ emissions help reduce the ultimate level of harm (or risk of harm) from climate change. In fact, perhaps counterintuitively, failure to control emissions by one country may become even more harmful if other countries are also failing to do so. This is the opposite of the kind of saturation effect contemplated by critics of climate justice.

emissions accumulate over time, temperatures continue to rise higher at least through the year 2100. Id.

See, e.g., Mendelsohn et al., Country-Specific Market Impacts of Climate Change, 45 CLIMATIC CHANGE 553, 558 (2000), available at http://www.springerlink.com/content/wj835313u172j412/fulltext.pdf (developing new climate impact models and stating that "[m]ost of the response functions imply that the net productivity of sensitive economic sectors is a quadratic function of temperature"); see also STERN, supra note 46, at 166, fig. 6.2 (discussing the various models).

See STERN, supra note 46, at 167.

See id. 166–67.


If other countries increase their emissions to exactly counterbalance U.S. emission cuts, then U.S. activities might be futile, but it is unclear why we would expect such perfect offsetting emission increases. Even if we assume that U.S. emission cuts would result in
Thus, the “China argument” does not offer a valid excuse for the United States. Even if China fails to control its emissions—in which case we are all admittedly in a lot of trouble—the United States remains responsible for its own past and future emissions, and for the incremental harm that they cause.

B. Collective Responsibility Versus Purely Individual Fault

In the context of climate change, the biggest question regarding corrective justice is that it involves nations, rather than directly holding individuals accountable. When we look past nation states to the individuals, applying corrective justice to the climate change problem becomes more complex, as Posner and Sunstein correctly pointed out. Nevertheless, an appreciation of the facts of the climate issue suggests that broad accountability for Americans is appropriate.

In the earlier version of their paper, Posner and Sunstein relied heavily on the argument that the current generation should not be held responsible for the sins of the past. In particular, Posner and Sunstein argue that “[h]olding Americans today responsible for the activities of their ancestors is not fair or reasonable on corrective justice grounds, at least not unless contemporary Americans can be said to have benefited from the actions of their ancestors.” In their view, “to the extent that the United States was involved” in causing climate change harms, “much of the contribution was due to people who died many years ago; in all likelihood, little or none was due to people who engage in greenhouse gas activities today.” Prior to this observation, Posner and Sunstein state:

The current stock of greenhouse gases in the atmosphere is due to the behavior of people living in the past. Much of it is due to the behavior of people who are dead. The basic problem for corrective justice is that dead wrongdoers cannot be punished or held responsible for their behavior, or forced to compensate those they have harmed. Holding Americans today responsible for the activities of their ancestors is not fair or reasonable on corrective justice grounds, at least not unless...
contemporary Americans can be said to have benefited from the actions of their ancestors (an issue to which we shall return). 91

Although the published version of the paper drops this analysis, they continue to reiterate their conclusion that any argument for corrective justice is undermined by the fact that "many of the relevant actors are long dead." 92 They also maintain that damage claims would be undermined by the fact that "much of the contribution was probably due to people who died years ago." 93

Although many of the relevant actors may indeed be long dead, the contribution of living Americans to the problem should not be underestimated. Consider the following table:

<table>
<thead>
<tr>
<th>Time Period of Emissions</th>
<th>Amount</th>
<th>Percentage of total U.S. emissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emitted After 1950 (1950–2004)</td>
<td>63,714,360</td>
<td>72.5%</td>
</tr>
<tr>
<td>Emitted After 1970 (1970–2004)</td>
<td>47,042,052</td>
<td>53.5%</td>
</tr>
<tr>
<td>Emitted After 1990 (1990–2004)</td>
<td>22,434,137</td>
<td>25.5%</td>
</tr>
<tr>
<td>Total Emissions (1800–2004)</td>
<td>87,855,374</td>
<td>100%</td>
</tr>
</tbody>
</table>

As the Table 2 indicates, seventy-six percent of all U.S. emissions took place after 1950, fifty-three percent after 1970, and twenty-five percent after 1990.

A large number of living Americans were alive during these time periods. Indeed, as noted earlier, about ten percent of all the emissions in U.S. history came from 2000–2004, a period when all current Americans above kindergarten age were alive. 96 The following demographic statistics may be helpful. Out of a total 2006 U.S. population of 299,398,485:

91 Id. at 27. Perhaps Posner and Sunstein were misled by the analogy sometimes drawn between climate justice and slavery reparations, an instance in which the intergenerational aspect of the problem is indeed central.
92 Posner & Sunstein, supra note 4, at 1611.
93 Id. at 1597. Posner and Sunstein hedge on their rejection of culpability. They admit that probabilistic liability for harm might be justified if the relevant scientific evidence can be obtained, id., and that liability might be warranted “in principle” under the risk-utility test, id. at 1598 n.146.
94 This table was derived simply by cumulating the data from Table 1 over the relevant time periods.
95 Amounts are in thousands of metric tons.
96 See supra note 61 and accompanying text (Table 1).
16 years and over make up 78.2% of total;
18 years and over make up 75.4%;
35 years and over (born after 1971) make up 52.10%;
40 years and over (born after 1966) make up 45%;
55 years and over (born after 1951) make up 23%;
60 years and over (born after 1941) make up 17%.97

Thus, to think of harmful CO₂ emissions as only a historical phenomenon, unconnected with the lives of current-day Americans, is clearly mistaken. Roughly one-quarter of Americans were alive during the entire post-1950 period in which three-quarters of the emissions took place. Because of age, they are also likely to have higher assets and income than younger Americans, and hence would probably bear an even larger share of the tax burden. Eighty percent of Americans were alive during the more recent (post-1990) period in which the dangers of global warming were already acknowledged, when roughly a quarter of the emissions took place. Certainly, in many contexts, holding the present generation accountable for past wrongs is problematic:

[W]hile injustice has a long life, remedy has a short one; and the general case for complete repair, through monetized reparations, diminishes quickly over time and across generations, especially when the injurers have departed the scene, and given that reparations are in competition with the other claimants on scarce social resources.98

But this attrition problem does not seem severe in the context of climate change, given the relatively recent vintage of most emissions and the relatively small scale of the compensatory payments relative to U.S. wealth.

More fundamentally, climate justice skeptics challenge the general applicability of corrective justice to climate change regardless of whether the culpable conduct was recent or old. Posner and Sunstein contended that the corrective justice model is a poor fit for climate change "because the consequence of tort-like thinking would be to force many people who have not acted wrongfully to provide a remedy to many people who have not been victimized."99 Thus, they argue, "crude state-to-state remediation scheme results in innocents being punished and non-victims being compensated."100 In particular, those who are "currently

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97 See U.S. CENSUS BUREAU, DATA SET: 2006 AMERICAN COMMUNITY SURVEY, available at http://factfinder.census.gov/servlet/STTable?_bm=y&-geo_id=01000US&-qr_name=ACS_2006_EST_G00_S0101&-ds_name=ACS_2006_EST_G00_.
99 PAS, supra note 5, at 21.
100 Id. at 25.
injured would gain absolutely nothing from reduced American emissions," which would have an effect only in the future.\textsuperscript{101}

There is clearly a grain of truth to this argument. If we cannot improve on random chance in awarding compensation from culpable individuals to victims, there is little point in thinking about compensation. But the objection is overdrawn in two ways. First, it goes more to the form of compensation than its desirability— if Posner and Sunstein are right, then we might want to avoid state-to-state compensation efforts in favor of something more tailored. And second, it greatly exaggerates both the need for precision in matching victims and compensators and the degree to which compensation would impose burdens on wholly innocent parties.

In a classic tort situation—say an automobile accident—the victim and injurer are clearly identified, and we can guarantee that compensation will flow only from the culpable party to the injured one. If this sort of precision in matching individual wrong doing with individual harm is necessary to support a moral case for compensatory measures, climate change is indeed a poor candidate for corrective justice. But we should hesitate before we accept the demands for such a high level of precision. We live in a much more complex world where harms lack the simplicity of automobile collisions. If we demand a high level of precision to establish a moral claim, we also render morality irrelevant to the most serious harms created by modern society.

Perhaps a nineteenth century court would have required precise matching as a basis for finding liability. But there seems to be no reason why our concepts of justice should remain stuck in the nineteenth century. Nor is it clear why our sense of our own moral accountability should be subject to the same limitations as a court’s finding of legal liability.

Assuming that complete precision in matching individual victims and wrongdoers is not needed, we need to look more closely to see if the degree of matching is sufficient to generate a moral claim. I will postpone until later the question of whether we can design a compensation system that is reasonably well targeted to address the needs of climate change victims. In moral terms, the more serious question seems to the extent of responsibility for causing climate change. This requires an assessment of how Americans have contributed to climate change through excessive emissions of CO\textsubscript{2} and they have benefited from their failure to address the issues. Whether emissions are excessive is relevant, although not necessarily determinative, in assessing moral responsibility;\textsuperscript{102} by excessive, I mean that the emissions causing activity resulted in greater harm than benefit to

\textsuperscript{101} Id.; see Myles Allen et al., Scientific Challenges in the Attribution of Harm to Human Influence on Climate, 155 U. Pa. L. Rev. 1353, 1398 (2007) (suggesting that the effects on climate would be very similar to the current situation if CO\textsubscript{2} emissions had not begun until 1935 and had then risen steadily to their current rate).

\textsuperscript{102} I do not consider in this Article whether there might be some obligation to make compensation even for emissions prior to the time that the harmfulness of greenhouse emissions was understood.
global social welfare. Benefit is relevant to the general principle that a “person is not permitted to profit by his own wrong at the expense of another.”

The short-run benefits received by many Americans of ignoring climate change are clear. As consumers, millions of Americans have had the benefit of cheap gasoline and low mileage standards, allowing them to drive SUVs, pick-up trucks, and other vehicles that produce unduly high greenhouse emissions. They obtain electrical power from cheap coal rather than more expensive renewable sources. In the meantime, major American corporations have profited—American automobile companies from low mileage standards, as well as American coal companies and oil companies from high sales. Americans who own stock in these corporations, or whose pension plans own stock, have correspondingly benefited. As we have already seen, these benefits were derived from actions that a reasonable person knew or should have known were harmful to others (at least since 1990). Short-term personal advantages, understandably enough, outweighed harms to others that were actually larger but were harder to perceive because they were longer term and diffuse. This does not seem to be a difficult case in which to apply the concept of unjust enrichment.

It is also relevant that Americans had the capacity to limit these harms, not only as consumers but also as citizens. The United States government has stood virtually alone among industrialized countries in opposing serious action on climate change. In a democracy, voters must bear some of the responsibility for the actions of their governments. It is true that any individual voter has little power considered in isolation, but that “little” is not zero (otherwise the cumulative power of all voters would also be zero, since a hundred million times zero is still zero). Moreover, as citizens, they were engaged in a collective activity of governance from which they hoped to benefit and on average did receive substantial benefits such as protection from foreign threats. Holding citizens responsible for their pro rata share is not unreasonable.

Investors who purchase shares in corporations, or who authorize others to purchase shares on their behalf, as through a mutual fund, do have control over their exposure to the risk that the enterprise’s activities will go awry. Their intentional participation in the collective endeavor does not make them blameworthy—they have done nothing wrong by purchasing stock, nor have they failed in any way in their duties as shareholders (whatever those might be).
Of course, individual cases vary. Some Americans conserved energy and used public transportation; others fought for government action on climate change. Some were children or not yet born during the relevant time periods. (Even children may have benefited from a carbon-squandering lifestyle, however, while the unborn may have received indirect economic benefits from parents who themselves profited from America’s large carbon footprint.) These individuals ideally should shoulder less of the burden of compensation.

In an ideal world, we could fashion a remedy that was responsive to differences in individual responsibility. We could imagine assessing retroactive taxes for past owners of gas guzzlers or high penalties for past oil executives. Alternatively, we might impose even higher taxes for inhabitants of states or congressional districts whose representatives resisted emissions regulation or for states with histories of high per capita energy consumption. We could have citizens fill out elaborate questionnaires about their past connections with energy companies, their use of home insulation, what cars they drove and how many miles, whether they supported environmental groups or pro-environmental candidates or the reverse. Thus, if imprecision is the problem, we can imagine mechanisms to target responsibility more precisely. Notably, climate justice skeptics do not champion these mechanisms, and for good reason: the mechanisms are probably outside the range of political possibility, and they might well have transaction costs that exceed their value anyway. In the real world, we have to be content with a degree of mismatch.

In assessing the seriousness of the mismatch, we have to consider the magnitude of the burden that climate compensation would place on individual Americans. Properly tailored measures of liability would place a significant burden on Americans, clearly less than the cost of the Iraq war. A practical system of compensation is not likely to be nearly so comprehensive, and is likely to translate into a more modest per capita expenditure. It does not seem fatal to a compensatory scheme that some burden is placed on a minority that ideally would be left alone. Moreover, if we take the simplest route and provide compensation through the normal taxation and budgeting process, the tax system itself provides some degree of tailoring. Because more affluent taxpayers pay larger income taxes, the burden falls most heavily on individuals who are most likely to have had high levels of energy consumption or to have benefited from owning stock in corporations that were themselves responsible for high energy use. The costs of improving on this degree of tailoring do not seem worth the added expense.

Two important points should be made about the argument I have made for the relevance of corrective justice to climate change. The first is that my argument relies on individual fault or individual receipt of benefit as a basis for moral

But it does render them accountable in the domain of repair for the company’s accidents, when the company cannot meet its warranted claims.


107 See generally Posner & Sunstein, supra note 4, at 1611–12.
responsibility. The existence of corporations or governments is relevant in my analysis, but not because corporations and governments are considered to be independent moral actors. Rather, they are relevant because shareholders and voters have the potential to control them and thereby prevent harm; they therefore have a moral duty to attempt to do so. In the case of corporations, Americans may also have benefited as shareholders. "Innocent" members of the group are included in the compensation scheme only because the injustice to them (of having to pay a small amount of compensation that they do not really owe) is smaller than the injustice to victims if no compensation is paid.

There are moral theories of various stripes that go beyond this kind of individualistic approach and hold groups liable regardless of the individual situations of their members.\(^{108}\) We might think, for example, that citizens accept moral responsibility for the actions of their governments in return for the right to receive the benefits of those actions, or that nation states themselves should be considered to have moral rights and responsibilities, or that they suffer from a moral taint from being associated with their government's wrongful acts. These theories would obviously strengthen the case for climate compensation, but they are controversial and I do not rely on them here.

The second point to be made is that accountability at the individual level is most relevant in terms of compensation. The question of individual accountability is less relevant to whether the United States has a moral duty to reduce its future emissions if doing so is in the interest of the rest of the world. Reducing future emissions does not involve these perplexities about collective action. The burden of reducing future emissions falls in the first instance on those who are responsible for the emissions rather than potentially "innocent" third-parties. Thus, the collective responsibility issue is essentially irrelevant to the question of whether the United States has a duty to reduce future emissions.\(^{109}\) It is only relevant as a second-order consideration regarding whether the United States should bear a higher cost than it would otherwise for reducing future emissions because of its contribution to past emissions. Regardless of past emissions, however, if the United States is emitting excessive emissions now, it has a duty to reduce those emissions.

C. Causation and Risk

Emissions by the United States may have been higher than the optimum level, but this fact does not give rise to a claim for compensation unless there is a causal connection between those emissions and some compensable harm. We have


\(^{109}\) It could, however, be relevant to the question of whether the United States should help finance emissions reductions elsewhere in the world as a form of compensation for its past emissions.
already considered the argument that there is no causal connection because the actions of third-parties (especially China) make U.S. actions irrelevant. It can also be argued that the causal connection between any particular source or set of sources and any specific harmful event is too speculative to support a moral claim for compensation. For instance, Posner and Sunstein argued that the “statistical relations are not the same as causation, and at some point they become too weak to support a claim sounding in corrective justice.”

Specific disastrous events from climate change are not necessarily below that threshold of acceptable statistical proof. For instance, a heat wave in 2003 caused over $10 billion in economic losses and up to 35,000 deaths in Europe. Scientists estimate that climate change increased the odds of such an event by a factor of four to ten. The IPCC has also concluded that “the excess deaths of the 2003 heatwave in Europe are likely to be linked to climate change.” Thus, it seems quite possible to link at least some specific adverse effects with climate change with considerable confidence.

For a duty of compensation to exist, we need not only link adverse effects to climate change, but also to find a morally significant connection between the multiple sources of emissions and climate change. One might question whether the linkage between any one source of greenhouse gases and the ultimate harms of climate change is too remote to support a moral claim for responsibility. In addition, since any change in emission levels would be incremental—no one is suggesting that no emissions should ever have taken place or that they should be brought down to zero immediately—it might seem harder to link the excess increment in emissions with any negative consequences.

Measuring the impact of incremental emissions may be difficult, but there is no reason to view the impacts as too speculative to have moral (or even legal) significance. The Supreme Court recently rejected a similar argument in the course of determining whether impacts like sea level rise are individualized and fairly traceable to the government’s failure to regulate CO₂ from automobiles. The analysis used in standing law tracks, though obviously it is not identical with, the analysis used in tort law to determine whether a defendant can fairly be held liable.

One question that might be asked, both in terms of entitlement to compensation and in terms of standing, is whether the effects of climate change are so diffuse that claims of individual injury are foreclosed. In finding the existence of an individualized injury, the Court said:

The harms associated with climate change are serious and well recognized. Indeed, the NRC Report itself—which EPA regards as an

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111 See Allen, supra note 101, at 1388–89.
112 Id. at 1392.
"objective and independent assessment of the relevant science,"—identifies a number of environmental changes that have already inflicted significant harms, including "the global retreat of mountain glaciers, reduction in snow-cover extent, the earlier spring melting of rivers and lakes, [and] the accelerated rate of rise of sea levels during the 20th century relative to the past few thousand years . . . .\footnote{Id. at 1455 (quoting NATIONAL RESEARCH COUNCIL, CLIMATE CHANGE: AN ANALYSIS OF SOME KEY QUESTIONS 16 (2001)).}

The Court noted that these effects posed a particular threat to the state’s interests: "If sea levels continue to rise as predicted, one Massachusetts official believes that a significant fraction of coastal property will be ‘either permanently lost through inundation or temporarily lost through periodic storm surge and flooding events.’"\footnote{Id. at 1456 (quoting Brief of Petitioner at 172, Massachusetts v. E.P.A., 415 F.3d 50 (D.C. Cir. 2005) (No. 03-1361)).} "Remediation costs alone, petitioners allege, could run well into the hundreds of millions of dollars.”\footnote{Id. at 1457.}

As to causation, EPA did “not dispute the existence of a causal connection between man-made greenhouse gas emissions and global warming.”\footnote{Id. at 1457.} EPA did contend, however, that the particular government action that the plaintiffs sought would not have a significant impact, because automobiles are only one source of greenhouse gases and because the United States as a whole accounts for only a portion of these gases.\footnote{Id.} The Court rejected this “erroneous assumption that a small incremental step, because it is incremental, can never be attacked in a federal judicial forum.”\footnote{Id. at 1458.} Instead, the Court stressed that “[a]gencies, like legislatures, do not generally resolve massive problems in one fell regulatory swoop” but “whittle away at them over time, refining their preferred approach as circumstances change and as they develop a more-nuanced understanding of how best to proceed.”\footnote{Id. (citing Williamson v. Lee Optical of Okla., Inc., 348 U.S. 483, 489 (1955)).}

Moreover, this particular first step would be far from insignificant: “Considering just emissions from the transportation sector, which represent less than one-third of this country’s total carbon dioxide emissions, the United States would still rank as the third-largest emitter of carbon dioxide in the world, outpaced only by the European Union and China.”\footnote{Id.} Thus, the Court had little difficulty in identifying a sufficient connection between emissions controls in the United States and the foreseeable harm of sea level rise. A connection that suffices for legal standing should be a sufficient basis for at least some sense of moral responsibility.

In any event, even if we could not sufficiently link specific adverse impacts on individuals with climate change, we could still identify indirect costs incurred by victims that result from climate change. Examples might be the cost of

\footnote{Id. at 1457.}
constructing higher dikes and levees, anti-disease efforts required by the spread of malaria and other diseases, and improvements in irrigation and water storage required by the prospect of more frequent droughts. Adaptation costs thus provide a natural way of measuring at least some of the harm caused by climate change, without the difficulties posed by trying to determine whether a specific flood, drought, or wildfire resulted from climate change.

D. Is Wealth Relevant?

Climate change will have the cruelest impact on the poorest nations. Posner and Sunstein indicate that sub-Saharan Africa will lose an estimated twenty-six million years of life due to climate change, with the large majority coming from malaria. In the worst case scenario—substantial melting of the Antarctic ice—the global consequences could be even more dire. As the economist Thomas Schelling explains regarding this possibility, “dikes can’t save Bangladesh: not only is there too much coastline, but dikes would produce fresh water floods. (Rivers cannot rise up over a dike to reach the sea.) And tens of millions of Bangladeshis would have to migrate or die.” Climate change is not only a threat to current income levels in poor countries but also impairs their prospects for economic growth. Growth in poor countries is affected by severe weather events and by rainfall variability (especially droughts), which are likely to increase with climate change.

Poorer countries seem to have a strong moral case against conduct that impairs their already low economic status. Climate justice skeptics, however, challenge this argument. Posner and Sunstein argue that “in principle, redistribution through greenhouse gas cuts is most unlikely to be the best way to help poor people or poor nations.” Posner and Sunstein suggest that the “more sensible kind of redistribution would be a cash transfer, so that poor nations can use the money as they see fit.” Again, their conclusions are not completely unambiguous. They do observe that, given institutional weaknesses of governments in many developing countries, a “legitimate argument for cutting greenhouse gas emissions is that it bypasses the governments of poor states more completely than other forms of development aid do.” They also qualify their argument in the end by saying that “if the United States does spend a great deal on emissions reductions as part of an international agreement, and if the agreement

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123 Posner & Sunstein, supra note 4, at 1581 (citing WILLIAM D. NORDHAUS & JOSEPH BOYER, WARMING THE WORLD: ECONOMIC MODELS OF CLIMATE CHANGE 81 (2000)).
125 See STERN, supra note 46, at 133.
126 Id. at 123–24.
127 Posner & Sunstein, supra note 4, at 1584–85.
128 Id. at 1585.
129 Id. at 1591.
does give particular help to disadvantaged people, considerations of distributive justice support its action, even if better redistributive mechanisms are imaginable.\textsuperscript{130} As noted earlier, this final observation seems to be in tension with their seeming endorsement of the idea that poorer countries should pay the United States for reducing emissions.

In any event, their ultimate conclusion—that considerations of distributive justice do support control of greenhouse gases by the United States and other wealthy nations—is a reasonable one. It does not, however, go far enough because it treats the harms of climate change on poor countries as a problem for which the United States bears no moral responsibility. Rather, we would be acting as good Samaritans, trying to increase global welfare and along with it the welfare of poor countries.

One fundamental question is whether controlling greenhouse gases should be considered a “redistributive mechanism.” It can only be considered redistributive if unrestricted emission—and therefore, unlimited climate change—is considered to be the baseline. Compared to this baseline of unrestricted emissions, restricting emissions makes poor countries better off and costs rich countries money, so it can be considered a redistribution of wealth. If, instead, we consider the baseline to be a world in which climate is stable, then the shoe is on the other foot. Starting with that baseline, we would say that the United States and other wealthy emitters are redistributing income to themselves at the expense of poor countries by their ongoing damage to the planetary climate system. If we start with this baseline, reducing emissions is not a redistribution of income; it merely leaves the distribution of income where it would be in the baseline state. The question, in other words, is whether we should think of pollution as a right—so that limitations on polluters are seen a redistribution of wealth to their victims—or whether we should view freedom from pollution as a right, which would imply that the polluters are unjustly prospering at the expense of others.

Another weakness of the position taken by climate justice skeptics is that it compares emissions reductions with “imaginable” redistributive mechanisms without any real effort to specify these alternatives, except for large cash transfers to foreign governments. Climate justice skeptics have made no effort to establish the effectiveness of such large cash transfers in combating poverty, or for that matter, to show that they are politically feasible. The merits of this approach are certainly not obvious. It is not at all clear that the governments of the poorest countries have the institutional capacity to spend the unrestricted funds effectively, as Posner and Sunstein partially acknowledge.\textsuperscript{131} Nor is the macroeconomic effect on the local economy of large infusions of foreign currency necessarily benign. In order to purchase local goods, the dollars would need to be translated into local currency, which could cause an immediate inflationary effect on local prices and

\textsuperscript{130} Id.

\textsuperscript{131} See Paul Collier, The Bottom Billion: Why the Poorest Countries Are Failing and What Can Be Done About It 100–04 (2007).
wages, while also encouraging imports and discouraging exports. As to the other “imaginable” mechanisms, it will not do to fault a serious policy proposal by comparison to other nebulous alternatives, when we do not even know what these alternatives are, let alone whether they would be effective and politically feasible.

Finally, the climate justice skeptics have a limited target: greenhouse gas reductions as a method of dealing with global poverty. Their argument does not speak to the corrective justice point that the emitters such as the United States have a duty to make financial recompense to climate change victims. This recompense would have a significant distributional benefit to the extent that it would flow to some of the poorest countries in the world. Assisting these countries to adapt to climate change would directly advance human welfare. For instance, Posner and Sunstein point to the projected increase in malaria mortality in Africa as an effect of climate change. It does not seem too much to ask the wealthiest countries, who have caused much of this impact, to support anti-malarial efforts as a form of recompense.

IV. A PRACTICAL APPROACH TO ACCOUNTABILITY

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 disputes. Before addressing the issue of mechanism design, it’s well to begin by considering the issue of scale. Just how much money are we talking about here?

A. The Scale of Climate Compensation

It would probably take a fairly sophisticated economic analysis to come up with firm figures about the possible scale of climate change compensation. We can at least get a sense of the order of magnitude, however, with a very rough calculation.

As noted earlier, cumulative U.S. CO₂ emissions as of 2004 amounted to roughly ninety billion tons of carbon. Posner and Sunstein suggest a possible tax of $34 dollars per ton of CO₂. This is not an ungenerous estimate. To be even

132 The adverse macroeconomic effects of large cash influxes is known to economists as the Dutch Disease, named after the side-effects of oil money on the Dutch economy. Id. at 38–39; JOSEPH E. STIGLITZ, MAKING GLOBALIZATION WORK 147–49 (2007).
133 See supra Part II.B.
135 About one-third of the weight of CO₂ is carbon, so this translates into a carbon tax of about $100 per ton of carbon. Compare Nordhaus’s estimate that an optimal carbon tax is in the $5–10 range. See WILLIAM D. NORDHAUS & JOSEPH BOYER, WARMING THE WORLD: ECONOMIC MODELS OF CLIMATE CHANGE 175 (2000). The Stern Review suggests
more generous, let's up the estimate to $50. Now, let us assume that all of the CO₂ was emitted at once this year, rather than worrying about the complexities posed by slow release over a period of time. This would give us a total CO₂ tax bill of about $4.5 trillion for all of the damage caused by our past emissions. This is a very rough measure of the total amount of harm our past emissions will cause (in present-value terms). It is obviously no small sum, amounting to $15,000 per American. Of course, the amount might be paid over a number of years, reducing the financial impact.

Note, however, that $4.5 trillion is a high-side estimate of American financial responsibility for three reasons. First, it includes all of the harm that the United States does to itself through climate change, which needs to be deducted to get an estimate of the potential compensation internationally. Second, it assumes strict liability. If we adopted a negligence standard for compensation, than we would only be worried about the excess carbon—that is, the carbon emissions in excess of the amount the United States would have emitted under optimal controls. Reasonable care would have required reducing past emissions, but not to zero. Moreover, the duty of reasonable care might not have kicked in until around 1990, which would reduce the total to $1.1 trillion even without other adjustments. Third, it also ignores the status of the claimant. If our primary concern is distributional, we would want to limit compensation to the poorest countries. If our concern is corrective justice, we would want to eliminate compensation to other equally culpable emitters, at least to the extent that they were equally negligent, or at least we would want to offset our payments by the amount of harm that their emissions have caused to us.

What about compensation for future emissions? Here, the answer depends partly on our future emissions trajectory, on how the optimal carbon tax might shift over time, and on how our actual trajectory relates to the trajectory that is globally optimal. There are obviously some technical complexities here, but at least we can get a sense of the order of magnitude. Consider the near term so that the carbon tax is likely to be stable. Also assume strict liability with no limitations based on the identity of the victim, and ignore the part of the tax attributable to domestic U.S. harm. If our emissions remain at two billion tons per year, we would be talking about $100 billion annually, or about $300 per person—assuming strict liability, no deduction for internal U.S. harms, and no limitations based on victim status.

These figures indicate the seriousness of the harm caused by climate change. They also suggest, however, that significant limitations on the scope of liability are called for, in order to prevent the burden from being excessive. First, these figures strongly reinforce the argument for a negligence standard, which would reduce the liability to cover only the damage caused by excess emissions over an optimal control level. Second, if we eliminate damages to developed countries that are

an average social cost of about $85/t CO₂ in 2000 prices. STERN, supra note 46, at 322. This would translate into a carbon dioxide tax of about $30 per ton, still below the number that I used for illustrative purposes in the text.
contributorily responsible because they are also large CO\textsubscript{2} emitters, we can reduce the damages by another substantial fraction. Third, if we limit damage awards to harm that can be linked to climate change with reasonable certainty, such as the adaptation expenses discussed earlier, we can take another big chunk out of the bill for climate change. I have not attempted an exact calculation, but it seems reasonable to assume that the compensable damages would be reduced to about 10\% of the total harm, or $450 billion for past damages and another $10 billion per year. The past damage award remains large, but not beyond our capacity to pay—even twice that amount would be comparable with the total estimated cost of the Iraq war.\textsuperscript{136} The lower figures come to about $1500 per American for past damage and then $30 per year. (These are present value figures—in fact, damages would accrue over a long period of time.) Keep in mind that these calculations all used the $50 per ton estimate of harm, which is probably on the high side.

Even with these reductions, the figures are not insubstantial. But we should think of this not only as an indicator of the burden on Americans, but as indicating the scale of harm that we have negligently inflicted on the rest of the world. Moreover, these figures represent the present value of all future harm, so the actual compensation might be spread over time and hence be less burdensome.

\textit{B. Frameworks for Providing Compensation}

Although a perfect system is unattainable, it seems feasible to design a workable compensation scheme. 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. By using adaptation costs rather than trying to attribute harm to specific adverse events such as floods, the commission would avoid much of the need to make complex and highly contestable causation findings.

The commission’s activities might be funded directly by cash contributions by governments, but an alternative payment system might be more appealing if an international trading system for greenhouse gases was in place. In this alternative way of financing compensation, a set number of greenhouse gas allowances could be set aside for the commission. 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 net effect would be that the sources doing the least to reduce their emission levels, which would have the greatest need to purchase additional emission permits, would indirectly provide compensation for the expenses of adaptation. Thus, a wealth transfer would take place from poorly controlled sources of greenhouse gases to the victims of climate change. An alternative, along the lines of the Bali agreement, would derive funding by taxing the purchase of emissions offsets via the Clean Development Mechanism. The question is whether this source of funding would be sufficient.

One objection to awarding compensation for the cost of adapting to climate change is that this in effect compensates for the unrealized risk of future harm rather than for any material current harm. This objection might have some foundation in traditional formulations of corrective justice, but it is hard to see how it makes any sense in this context. The need for adaptation is certain rather than contingent, at least for the next few decades. Moreover, where current emissions have created risks of events such as extreme floods, a prudent person would protect against those risks in advance, perhaps with a stronger levee, and it seems peculiar to say that creator of the risk has no responsibility for the need for the precautions. It seems entirely reasonable that someone who would be liable if a risk materialized should also be liable for the costs needed to avoid the risk. If my neighbor is a sniper, why should he be liable only if he actually hits me, but not for the expense of my Kevlar vest? Or, to take another example, if my neighbor pollutes the lake where we both get our drinking water, why should he be liable only if I go ahead and drink the water but not if I buy bottled water instead? (Worse yet, why should he be able to claim that I failed to mitigate my damages if I don’t buy the bottled water, while also forcing me to pay for the water?) A person who wrongfully creates a risk and thereby forces others to make prudent investments in precautionary measures should not be able to foist off the costs of precaution onto the victim.

Another, related objection is that corrective justice only requires compensation for harm to privately owned property. Harm to the natural environmental, however, is not a protected interest. This argument also seems unconvincing, in part because of the possibility that governments can receive compensation on behalf of the public interest in these resources. Like the objection that adaptation funding would compensate for unrealized risks, this objection seems based on an unduly crabbed view of moral accountability.

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137 This is only one possible way that we might go about arranging compensation—for example, 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 greenhouse emitters, but some form of rough justice seems possible and attractive.


139 Adler, supra note 78, at 1861.

140 Adler views this as at least a promising approach to the problem. Id. at 1861–62.
Practical concerns are probably more important than these theoretical quibbles. The practical issues are not insurmountable. The best international precedent for such a system is the United Nations Claims Commission (UNCC), established after the first Iraq War to handle claims against Iraq for war-related damages. The U.N. 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."142

These provisions gave rise to intense dispute about compensation for damage to pure (non-marketable) environmental resources and for interim damages to those resources prior to restoration.143 The UNCC ultimately held that these damages were compensable.144 One method used to measure the value of resources was the cost of mitigation measures such as providing alternative resources, which was used as a way to measure the loss of ecosystem services.145 The UNCC awarded approximately $5 billion dollars for 109 successful claims.146


(a) Abatement and prevention of environmental damage, such as expenses directly related to fighting oil fires and stemming the flow of oil in coastal and international waters;
(b) 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;
(c) Reasonable monitoring and assessment of the environmental damage for the purposes of evaluating and abating the harm and restoring the environment;
(d) Reasonable monitoring of public health and performing medical screenings for the purpose of investigating and combating increased health risks as a result of the environmental damage; and
(e) Depletion of or damage to natural resources.

143 Id.
145 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
There seems to be growing international recognition that "environmental damages will often extend beyond that which can be readily quantified in terms of clean-up costs or property devaluation." 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."

The UNCC dealt with the fallout from a discrete and readily identifiable human event, where moral blame could be unambiguously assigned. Nevertheless, it has useful lessons for climate change. The environmental impacts of the Gulf War were multitudinous and varied, presenting considerable difficulty in terms of damage assessment. The UNCC's decisions are good precedent for extending compensation beyond harm to marketable resources to include environmental amenities. 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 mitigating the environmental harm, the UNCC has avoided difficult problems of identifying long-term environmental effects and valuing the resulting harms.

Closer to home, CERCLA (also known as the Superfund statute) provides a precedent for a rigorous cost-recovery system. CERCLA imposes liability for the costs of cleaning up hazardous waste sites. It covers a range of potentially responsible parties: waste disposers and transporters, waste generators, and site owners. Liability includes the cost of clean-up and under certain circumstances, damages to natural resources owned by governmental entities. Liability is strict 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.

Id.  

148 Id.  
(not based on fault) and is joint and several (each defendant is potentially liable for the entire cost). Thus, CERCLA goes well beyond the sort of moral accountability that I am suggesting. Notably, CERCLA is also retroactive. Proof of causation is minimal: it is enough if a generator's waste was sent to the site, without any showing that that generator's waste has been part of the leakage problem. If this statute was followed as a model, entities at all stages of the carbon process from extraction through consumption would be jointly and severally liable for climate change "clean-up," retroactively and without any showing of fault. Whether we would want to follow this model is of course another question, but at least there is a clear precedent in our domestic legal system for assigning costs to emitters.

Providing redress is a central purpose of a compensation system, but it is not the only purpose. Avoiding moral hazard is another factor in designing a compensation system—in other words, we do not want the availability of compensation to encourage adaptation projects that are unnecessary or unnecessarily expensive. Avoiding moral hazard might involve making an independent assessment of whether adaptation measures were reasonably necessary in light of alternatives or whether the injured party unduly exposed itself to risk. The UNCC process provides a model here. In principle, this provides a complete solution. In practice, of course, it increases the complexity and expense of proceedings, as well as the risk of error.  

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. 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 and ready system of compensation that provides at least partial justice and operates efficiently.

Such a scheme could be implemented in many institutional forms. It could be the basis for liability determinations by domestic courts or international tribunals.

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150 It is generally thought that the transaction costs of the CERCLA litigation model have been unduly high. It should be possible to provide more categorical rules about the amount of compensation that would reduce the need for case-by-case disputes.

151 Establishing techniques to ensure that compensation is limited to reasonable adaptation measures is part of the larger question of how to efficiently establish damages. In an administrative setting, the best solution might be a schedule of presumptive adaptation expenses, with a limited right for either side to introduce evidence of special circumstances. A damage schedule is unlikely to be perfectly accurate since it will reflect a compromise between precision and administrability. As a result, it may lead to under- or over-compensation. Either mistake has clear fairness implications, and might also create either an insufficient incentive for emissions controls or some degree of moral hazard for victims. But workability is probably more important in this context than precision.

152 If the amount of adaptation compensation required is large in terms of the size of the affected nation's economy, it might be preferable to require the work to be bid out to third-party nations whose currencies are more robust.
Alternatively, an administrative compensation scheme might be used. Or the system could be given a more voluntary dimension through agreements by responsible parties to finance grants for remedial measures (perhaps as settlement of litigation or with the encouragement of tax benefits or subsidies).

Another alternative would be to use existing multilateral organizations. For instance, the World Bank might administer adaptation grants from a special fund established by developed countries. Contributions to the fund could be apportioned on the basis of accumulated CO$_2$ emissions by each country (the strict liability model) or excess CO$_2$ emissions (the negligence model). I have previously suggested that the negligence model is more appropriate, although this issue deserves further consideration.$^{153}$

Working out the details of a compensation system clearly would be complex. The key points, however, are these. First, the amount of compensation would be based on excess emissions (emissions over the globally optimal level), and would be limited to the time after the harms of climate change were known (probably around 1990). Moreover, compensation would be keyed to adaptation measures. As we have seen, there is no reason to expect the amount of compensation to be a crippling burden for wealthy countries such as the United States.

Second, although the details would be complex, it seems clear that a feasible system could be designed. Feasibility, in this setting, would mean a rough but defensible determination of liability, precautions against moral hazard by recipients, and reasonably low transaction costs. Thus, the real question is not whether such a system would be practical, but whether we have the will to establish it.$^{154}$

V. CONCLUSION

The issue of climate justice is admittedly a complex one. Commentators have raised important questions about culpability, causation of harm, and collective responsibility. It seems fairly clear, however, that Americans—not just our ancestors but ourselves—are responsible for a disproportionate amount of greenhouse gases and that we have benefited, at least in the short run, from uncontrolled greenhouse emissions that have enabled our energy-intensive lifestyle and corporate profits; that these gases are causing harm, particularly to the poorest and most vulnerable segments of the global population; and that we have failed to take reasonable measures to limit our emissions. I have argued that these facts form an adequate basis to hold ourselves morally accountable for some share of the

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$^{153}$ See Farber, Apportioning Climate Change Costs, supra note 17.

harm caused by climate change. In particular, we should support the creation of a system for compensating climate change victims for the costs of adaptation, to the extent that our excessive past emissions and those of other developed countries have created the need for adaptation. It is no excuse that such a system would be expensive or imperfect. Even more clearly, I believe, we have a moral obligation to limit future emissions, not merely in our own benefit (which is likely) but also because of a moral duty to refrain from causing unreasonable harm to others. (As do others, including developing countries, though what conduct is unreasonable may not be the same for every country.) Contrary to the views of commentators such as Posner and Sunstein, climate justice is an imperative, not a quixotic quest for a delusive quarry.

Considerations of justice might, in an ideal world, be a sufficient basis for action. In reality, concerns about future social welfare are likely to dominate among policy analysts, while politicians will be influenced by political advantage and national self-interest—hopefully leavened by substantive concerns about welfare and justice. To raise claims of justice is not to be naïve about their prospects in the political rough and tumble. But the least we can do is to try.