

*Global Justice and Climate Change: How
Should Responsibilities Be Distributed?*

DAVID MILLER

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DAVID MILLER is Professor of Political Theory at the University of Oxford and Official Fellow in Social and Political Theory at Nuffield College, Oxford. He graduated from Cambridge University, then went on to receive his B.Phil. and D.Phil. in Politics at Balliol College, Oxford. He has been a Lecturer in Politics at the University of Lancaster and the University of East Anglia. He is a fellow at the British Academy. He is the author of numerous publications, including *Principles of Social Justice* (1999), *Citizenship and National Identity* (2000), *Political Philosophy: A Very Short Introduction* (2003), and *National Responsibility and Global Justice* (2007).

I

What can a political philosopher contribute to the current debate about climate change, and how to prevent its reaching catastrophic levels? One might think that this was a matter, in the first place, for scientists, whose job it is to study the causes of humanly induced global warming, and the effects of different degrees of warming on the natural environment and the human societies that depend on it; in the second place for economists, who can work out the most efficient way for humanity as a whole to adjust its behavior so that the warming can be brought under control and kept within acceptable levels; and finally for political leaders and statesmen, whose task it is to take the economists' recommendations, turn them into concrete policies, and then persuade ordinary citizens to do what is required of them. The problem is both urgent and difficult to solve, politically at least. Do we need philosophers, with their fine distinctions and their skeptical questioning of taken-for-granted assumptions, poking their noses into it?

I believe that the answer to this question is a very definite yes. We need political philosophers to think and talk about climate change, not as an alternative to the work of the other three groups but as an essential complement to it—indeed as a bridge between the empirical researches of climate scientists and economists and the practical work of politicians. What philosophers are uniquely positioned to do is to spell out the reasons we have to change our behavior to avoid damaging climate change, in other words to ground the ethical and political obligations that we will have to accept if a solution is to be found. Although there is now widespread acceptance that humanly induced climate change is a reality (there are still a few pockets of climate-change denial, in the United States especially, but their number is dwindling by the day), people can respond to that fact in very different ways. Consider some of the most frequently heard responses: “What’s so bad about climate change? I like the warmer summers.” “We may have a problem now, but we’ll soon find a technical fix that sorts it out.” “Global warming may be bad, but there’s nothing we can do about it—look at the rate at which China is building power stations.” “I agree there’s a problem, but there are others we should tackle first—global poverty, for instance.” These responses may often be self-serving, but they are not *obviously* wrong—they deserve to be taken seriously and

rebutted if the aim is to show that we are all of us under an obligation to help combat climate change.

My aim here is not to answer all of the philosophical questions about climate change. I am simply going to assume, in particular, that if we continue to pump greenhouse gases (carbon dioxide and methane especially) into the atmosphere at the rate we are now doing, we will inflict serious harm on many human beings, harm that we have a basic ethical obligation to avoid. It is known that the damaging effects of global warming will be quite unevenly distributed across societies. The broad picture is that it will hit hardest those societies that are currently poor and already most vulnerable to natural disasters such as drought and flood. This is partly a matter of simple geography, and partly a result of the fact that these societies have fewer resources with which to combat the effects of global warming—for example, by erecting defenses against rising sea levels. The effects on human beings in those societies will be severe—they will starve as food production dwindles, fall prey to waterborne diseases, and so forth. If we do nothing to prevent this from happening, we can properly be charged with violating their human rights—not directly, as happens when we intend death and injury by waging war, but indirectly by virtue of failing to act when we had the opportunity to do so.¹

This underlying assumption has been spelled out and defended more fully by others, and I am not going to say any more about it here, because the task I have set myself is narrower, if no less important. It concerns the “we” in the last paragraph: who exactly are the agents on whom the obligation falls to act so as to prevent damaging climate change? If we simply say “human beings collectively” and leave it at that, we fall into the familiar trap whereby no particular person or group of persons has a defined obligation, and each can excuse him- or herself from taking steps to combat climate change by passing the responsibility to someone else. My task, then, is to discover principles that can distribute the responsibility in such a way that each person or group knows what they have to do in order to produce the collective result that we want to achieve—namely, a greenhouse-gas regime that keeps emissions below the level at which damaging climate change occurs.²

1. For a good statement of the view that we will be violating the rights of vulnerable people if we do not act to prevent global warming, see S. Caney, “Cosmopolitan Justice, Rights, and Global Climate Change,” *Canadian Journal of Law and Jurisprudence* 19 (2006): 255–78.

2. For simplicity’s sake I shall be focusing on this aspect of the climate-change question, although a full treatment would need to look not only at cutting back on greenhouse-gas emissions (usually referred to as “mitigation”) but also at the measures needed to help societies

I want to narrow the question down still further by arguing that these principles apply, in the first place, to nation-states as the collective agents capable of coordinating individual behavior on a scale that can meet the challenge of climate change. That is, we should see the problem of distributing responsibility as occurring in two stages. First, the costs of combating global warming are distributed to states in the form of required reductions in greenhouse-gas emissions or actions they must take to offset the effects of the warming that will nonetheless occur or both. Second, states distribute these costs among their citizens according to guidelines that are agreed internally (and that may be expected to vary somewhat from one state to the next). For example, they may decide to control emissions by taxing the industries that mainly produce them, or they may decide to give each individual citizen a carbon budget that limits their use of emission-generating resources to a total that they can exceed only by buying a slice of somebody else's. The reasons for this two-stage approach are partly practical: I can see no other way to tackle climate change than through an international agreement that first of all sets an overall target in the form of a cap on greenhouse emissions worldwide, and then breaks that down into targets for each nation individually, so that each country has an obligation to reduce its level of emissions to the figure and by the date specified in the agreement.³ In other words, we must have an improved version of the Kyoto agreement, and we must ensure that all nations are brought under its aegis. Were we to try to move directly to the individual level, then even if we could perform the necessary calculations and give each person an emissions target, we would simply have created a massive collective-action problem with no agency capable of solving it. Each person would have an incentive to overshoot their target, and there would be no effective constraint to stop them from doing so.

There is also a more principled reason for preferring a two-stage approach. We should want our climate-change policies to encroach as little as possible on national self-determination. Rather than imposing policy solutions from above, it is far better to agree upon targets for each nation,

adapt to the effects of the emissions that have already occurred. The distinction between adaptation and mitigation is highlighted in S. Caney, "Cosmopolitan Justice, Responsibility, and Climate Change," *Leiden Journal of International Law* 18 (2005): 747–75; and S. Caney, "Climate Change, Justice, and the Duties of the Advantaged," in *Critical Review of International Social and Political Philosophy* (forthcoming).

3. I shall not discuss the further question whether, once emission targets have been allocated in this way, countries should be allowed to engage in "emissions trading" whereby those nations that wish to exceed their targets can buy additional allowances from other societies. This is a complex subject that deserves closer investigation than I can give it here.

and then to allow policies for meeting those targets to be decided internally, ideally through a process of democratic debate. Practical changes of the kind required to combat global warming have significant implications for other areas of national policy, especially economic development and employment. They impinge also on questions of social justice, since if individuals are going to be asked to bear certain costs when climate-change policies are implemented, decisions have to be made about how those costs will be distributed. If, for example, energy prices rise substantially when new cleaner forms of energy generation such as wind power are introduced, should vulnerable groups such as pensioners be given protection in the form of subsidies? Such questions will be answered differently in different societies, according to prevailing conceptions of social justice. Since climate-change policies can be successfully implemented only if there is general consent to their introduction, allowing nations to map their own route within the constraints on emissions set internationally not only respects their rights of self-determination but is likely to produce a higher level of compliance in the long run.

In saying this, I am taking issue with pessimists about climate change, who believe that the problem cannot be tackled unless a collective policy to combat global warming can be coercively enforced, and for that you would need something like a world government. According to this view, societies that fail to meet their assigned targets must be punished, and that implies an authority willing and able to impose the appropriate sanctions. Since no such authority exists, nor is one likely to come into existence, the climate-change problem is at present insoluble. Perhaps, if things get sufficiently bad, and the ability of the human race to survive on earth at all comes into question, people will be willing to sign a Hobbesian contract to create a global Leviathan with the power to enforce its environmental policy. Appealing to rights of self-determination, in this context, simply misses the nature and gravity of the problem we are facing.

In my view, such pessimism is unjustified. A global Leviathan is not necessary in order to combat global warming effectively, nor indeed is there any reason to think it would succeed: there would be massive resistance once it began to impose conditions on hitherto independent nation-states. What we need instead is a climate-change regime based on voluntary cooperation between states, where the role of an international authority is to help coordinate the actions of these states by setting emission targets and other policy goals, and then to monitor compliance with these targets and identify defaulters. My assumption here is that so long as

agreement can be reached on a fair policy for tackling climate change—fair in the sense that it allocates the costs of adjustment according to principles that all can understand and accept—then it is reasonable to expect the signatories to implement the measures that are needed for them to comply with the targets that have been set. Monitoring is important, because each party to the agreement must be able to see that others are indeed doing what the agreement requires of them. In addition, there may have to be some sanctioning of defaulters that goes beyond naming and shaming—for example, it would be reasonable for states that are compliant to make trade agreements and other such measures conditional on agreed-upon greenhouse-gas emission targets being met. But in general, where a fair agreement has been reached, we can expect those who are party to it to comply, so long as they believe that others are complying as well. Coercive enforcement, even if it could be made to work, is unnecessary.

Some readers might question my emphasis on fairness here. Even if we knew what it was, why suppose that it can play any real part in negotiations on preventing climate change, or on any similar issue where there are costs to be allocated? Won't there just be bargaining between states driven by self-interest? And does this matter so long as an agreement is eventually reached? I believe that it does matter, for the following two reasons. First, given that the agreement cannot be coercively enforced, in the absence of a global authority with sufficient power at its disposal, individual states are unlikely to comply unless they believe that the costs they are having to bear are fair ones. And, second, the governments who signed the agreement have also to convince their own populations to do what is needed, including making some significant changes in their lifestyles. They, of course, can wield coercive power if necessary in certain areas of public policy. They can enact legislation forcing factories and power stations to cut their emissions, for instance. But in general they need to rely to a considerable extent on individuals voluntarily making small sacrifices, changing their behavior in ways that may not always be welcome. And to make a persuasive case for these changes, they need to be able to show that the targets that have been set by the international community are fair.

Students of international relations have in any case noted the place that principles of justice and fairness play in international negotiations.⁴ The idea that such negotiations are driven simply and openly by self-interest

4. See, for example, C. Albin, *Justice and Fairness in International Negotiation* (Cambridge: Cambridge University Press, 2001); and T. Franck, *Fairness in International Law and Institutions* (Oxford: Clarendon Press, 1995).

is a mistake. A more accurate picture is that claims are advanced in the name of fairness, but the negotiating parties tend to choose the particular principles of justice that best serve their interests—since in many cases there are indeed different principles that can plausibly be advanced. This is not merely hypocrisy, however, because by moving to the level of principle in the first place, you rule out a number of possible solutions, including almost certainly the ones that are most to your advantage. In the case of climate change, no country can put forward the principle “We do nothing, but everybody else does something” in that crude form and expect others to see this as a potentially fair proposal.

That, I hope, is enough to motivate the investigations that follow, into the principles of fairness that might be used in future agreements on combating climate change. Given that the costs have to fall somewhere, how should they be allocated between different nation-states? How much responsibility for preventing further global warming should each of the world’s peoples be asked to carry? Of course, I am by no means the first to raise this question: various positions have been powerfully argued for. But there is some danger, I think, of principles being evaluated too much in terms of where they point by way of solutions and too little in terms of their own plausibility. To speak more concretely, many commentators start from the assumption that the lion’s share of the costs of combating climate change should be borne by the developed West, and by the United States above all. Since these countries are by a long head the biggest emitters of greenhouse gases, on a per capita basis at least, it may seem obvious that they should carry most of the burden of change. Now perhaps that answer is correct, and therefore the one that should follow an investigation of principles. But there is a danger that the validity of certain principles will be assumed too readily because they seem to point in that direction. The principles are not properly scrutinized and assessed in the way that they might be in other contexts. I shall give some examples in due course. For now, I want to emphasize that we should be looking for principles of fairness that are independently valid, not just ones that give us the answers we were hoping to get in the first place.

Let me now indicate the direction my investigation will take over these two essays. I want to begin by examining two principles for the fair distribution of climate-change costs that are regularly cited in both academic and political debate on the issue. The first is the principle of historic responsibility, which assigns costs according to the past contribution each society has made to present-day atmospheric levels of carbon dioxide and

other greenhouse gases. It is well known that these levels are the cumulative effects of emissions going back for at least a century or so, the side effects of industrialization in those countries that are now the most economically developed. The much cited “polluter pays” principle—the principle that those who pollute the environment should pay to clean up the mess they have caused—seems to suggest that the past should matter in this way. But is this really so?

Next I want to examine an intuitively plausible principle for limiting greenhouse-gas emissions, namely, the principle that each person has an equal right to emit such gases. Applying this principle to the problem of global warming would mean first setting a ceiling on overall emissions at the point where no further warming (or more strictly no warming that imposes unacceptable costs) will take place, and then dividing that total equally among the world’s inhabitants. Every country with excess levels of emissions per capita would then be required to reduce them until the excess was eliminated; conversely, nations that currently fall short of their emissions entitlement would be permitted to emit more greenhouse gases up to that point. This, of course, would be very costly for most of the developed societies, but it might nonetheless seem fair. But is it?

I will argue that neither principle can carry the weight that it is being asked to bear in the debate over climate change. The main burden must fall upon another principle, which I will call the principle of equal sacrifice. This first of all draws a line between societies in which poverty is endemic and those that either do or could lift their members above the global poverty threshold, and then requires people in the latter group of societies to reduce emissions to the agreed global ceiling in such a way that the per capita cost of mitigation is the same for each society. Costs, I will argue, should be measured in terms of economic growth forgone. Having accepted its emissions reduction target, calculated on this basis, it would then be up to each nation-state to decide whether to share the resulting burden equally among its members, or to ask some citizens to pay a larger per capita cost.

After defending equal sacrifice as the main principle that should guide the distribution of responsibilities in an international agreement on climate change, I turn finally to the problem of partial compliance. Suppose that such an agreement has been negotiated: what if some countries refuse to sign, or some, having signed, fail to do what is required of them under the agreement? This, only too obviously, is not just a hypothetical question. What does fairness then require of the societies that have signed the agreement? Must they do precisely what the agreement says, or more than

that, taking up the slack as it were, or less than that, since others are not playing fair?

I begin, then, with the principle of historic responsibility, which not surprisingly is popular among developing-society advocates, to whom it seems obvious that the main burden of adjustment to climate change must fall on those societies that have been the biggest emitters of greenhouse gases in the past. But we need to look closely at the principle that is being appealed to here. As I noted above, it is often said to be an application of the “polluter pays” principle, which holds that if an agent does something that is harmful to others—pollutes a river with chemicals, for example—then that same agent should bear the costs of remedying the harm, either by removing the pollution, if that is possible, or compensating the victims. That principle seems sound enough in its own right. It acts as a disincentive to would-be polluters, but also and perhaps more fundamentally it acknowledges the fact that we are agents who make an impact on our surroundings, and who should be held responsible for that impact, both in cases where the impact is a positive one—we should reap where we have sown—and in cases where it is negative, in the sense of being harmful to others.⁵ This applies in the first place to individual people, but it can also be extended, under certain conditions, to collectives. If I work hard as part of a team that produces some collective good, then I am partly responsible for that good and deserve to have some share in it. But equally if the team imposes external costs on others, by damaging the common environment, for example, then I share in responsibility for those costs and can properly be made to pay compensation.

So far, so good. But now the first problem we face in applying the polluter-pays principle to historic emissions of greenhouse gases is that the people responsible for the emissions themselves have mostly left the scene—once we look back beyond a generation or so—and it is their descendants who are being asked to pay the costs. Many people find it objectionable to hold people today responsible for what their predecessors have done, as it seems they are here being required to. Now it is true current people can’t be blamed for what their ancestors did—that seems evident. But perhaps they can nonetheless be held responsible for failing to make appropriate redress. Take a very simple case. Suppose my grandfather stole a valuable picture from your grandfather, and that picture remains hang-

5. For a particularly good statement of the rationale for this principle, see H. Shue, “Global Environment and International Inequality,” *International Affairs* 75 (1999): 531–45, at 533–45.

ing in my hall today, even though I know about the circumstances of its acquisition. By failing to return the picture to its rightful owner—you, your grandfather's only surviving heir—I am responsible for perpetuating an injustice. And this idea can be applied not only to individuals but also to collectives. Suppose two neighboring villages have organized themselves as farming co-operatives. Sometime in the past, members of one village raided the other and stole a valuable piece of farm machinery that they continue to use to this day. Even though the present-day inhabitants were not themselves involved in the raid, by holding on to the machine, they are perpetuating an injustice. Their responsibility now is to return the machine to the first village, and probably also provide some compensation for the losses its inhabitants have suffered in the meantime.

Can this reasoning be applied to the case of greenhouse-gas emissions? To reach that conclusion, a number of difficulties have to be surmounted. The first is to identify the continuing agent who bears the responsibility. In the two examples I have just given, continuity was provided by the family in one case, and by the farming co-operative in the other. Individuals bear responsibility as members of these transhistorical units. Can we point to anything analogous where climate change is at stake? Critics point out that in the developed societies that historically have contributed most to emissions, the actual emitters have been individual people, independent corporations, public companies, and so forth—in other words, there is no single agent but a whole variety of agents, many of them no longer in existence today, who have been causally responsible for present-day levels of atmospheric CO₂ and so forth.⁶

Should we respond to this problem by pinning responsibility onto *states*, on the grounds that states bear responsibility for whatever happens within their borders, whether or not they directly initiated the activity in question? If a state allows a polluting factory to send sulfur dioxide or other harmful chemicals into the air, it then becomes responsible for that pollution even if, as seems likely, it played no direct role in generating it. And states typically survive over many generations, so in that sense they are transhistorical units of the kind we are looking for. But there are some difficulties with identifying states as the bearers of responsibility in this way. What are we to say about cases where regimes have changed, perhaps by revolutionary means, or cases in which state boundaries have been

6. See, for example, S. Caney, "Environmental Degradation, Reparations, and the Moral Significance of History," *Journal of Social Philosophy* 37 (2006): 464–82.

altered so that different groups of people, and different means of production, now fall under their auspices? Should we hold the present German state responsible for the pollution produced by heavy industry under the German Democratic Republic, for example? If so, on what grounds? Furthermore, if we hold states responsible for rectifying the damage caused by earlier generations occupying the same territory, ultimately the costs of rectification have to fall on the people they govern. Taxes have to be raised, for example, to pay for the costs of cleaning up pollution, or compensating its victims. The state itself does not have an independent stock of resources that can be used for this purpose. So now we have to ask questions about the relationship between states and the nations they govern, questions that become particularly sharp in cases where the state is not democratic, and where its actions, therefore, cannot be attributed to the popular will. Is it reasonable to ask people today to bear responsibility for what their states have done, or failed to do, by way of limiting greenhouse-gas emissions if neither they nor their predecessors have had any control over state policy?

For this reason, someone who wants to appeal to historic responsibility as a principle of fairness when allocating the costs of combating present-day global warming would do better to look beyond states as governing institutions to the nations they govern. Nations are transhistorical units of the right kind if we want to assign present-day members responsibility for what their predecessors have done, and to make them liable for the consequences. Despite the fact that their membership is undergoing continual replacement, by natural births and deaths, and by immigration and emigration, there is continuity between the generations, both in the form of national identity—people think of themselves as belonging to the same cultural group as their forebears, and take pride in the historic achievements of their country—and in the form of practices and institutions that persist over time and play an influential part in determining people's life chances today. If we were to ask what explains the very different sets of opportunities that confront people living in different parts of the world, a large part of the answer must concern national inheritance. By virtue of being born in a developed society, in particular, you are able to take advantage of material conditions that result from past practices and institutions. By parity of reasoning, if you inherit the benefits of economic development, and claim the right to enjoy these benefits, by virtue of membership then you should also be held responsible for the associated costs, which might take the form of damage inflicted on third parties. There is more that needs to be said here to ward off objections to the idea of national inheritance, but I am going to

assume that the basic idea is sound.⁷ So if we return now to the specific case of greenhouse-gas emissions, a person could not exempt himself merely by pointing out that he played no part in producing these emissions in the past and therefore bears no special responsibility to take corrective action now. To such a person, it would be relevant to point out that he forms part of a national unit that did play such a part, and that he benefits from the practices and institutions that allowed the emissions to occur, not just in some accidental way but by virtue of his membership itself.

That, however, does not settle the matter, as I shall now try to show. The real problems with the historic responsibility principle in the context of global warming are not that we cannot find relevant transhistorical units to serve as the bearers of responsibility—as I have just suggested, nations are, in general, communities through which historic responsibilities can be inherited. The problems concern, rather, the particular phenomenon we are investigating, namely, global warming caused by gas emissions. Look back for a moment to the two examples that I used to introduce the idea of inherited responsibility—your grandfather’s painting and the stolen item of farm machinery. In each case responsibility relates to a clear historic wrong. The examples rely on the fact that stealing the picture in one case and stealing the machine in the other were acts of injustice of which the original parties were culpable. Take that fact away—suppose that the picture was stolen because your grandfather refused to acknowledge a debt of comparable magnitude owed to mine—and the argument falls down. So can we say that a similar wrong occurred in the case of historic greenhouse-gas emissions? What kind of injustice was involved?

Attempts are sometimes made to exonerate past emitters of greenhouse gases on the grounds that they did not know that their actions were liable to cause global warming, nor did they have any reason to know. There is some debate in the literature about the date after which it became no longer reasonable to deny the link between humanly produced gas emissions and rises in average global temperature. Most commentators believe that by the mid-1980s climate science had advanced to the point where the existence of such a link was overwhelmingly probable (though it is noteworthy that the first IPCC report published in 1990 still sounds some very distinct notes of caution about this).⁸ Let us then say that the

7. For a fuller defense, see my *National Responsibility and Global Justice* (Oxford: Oxford University Press, 2007), chap. 6.

8. See the passages cited in R. Malnes, “Climate Science and the Way We Ought to Think about Danger,” *Environmental Politics* 17 (2008): 660–72, esp. 663.

risk that anthropogenic gas emissions would cause harmful global warming had become common knowledge by about 1985. What of nations whose members emitted significant quantities of greenhouse gases before this time? They cannot be held morally responsible, or blamable, for these emissions—moral responsibility and blame require that the agent in question either knew or was in a position where he or she should have known that the action in question was harmful. But these nations might nonetheless be held responsible in a wider sense that carries with it responsibilities to counteract the damage caused.⁹ Think of a case of pollution where initially the polluter has no reason to think that the waste he is pouring into the river is damaging to the environment. Subsequently it is shown that lasting damage has occurred. The polluter then becomes responsible for rectifying the damage, or providing compensation. This might be defeasible in certain cases—for example, if the causal connection between the waste and the resulting damage is very indirect, or if the polluter could show that there were large compensating benefits, not only to himself but to the wider community, from the process that produced the waste. But otherwise the infliction of damage is sufficient to create remedial responsibility even if the agent could not have foreseen it at the time of action.

The problem here, once again, is not with the idea of historic responsibility itself. It is rather, I suggest, with the analogy that is being drawn between greenhouse-gas emissions and pollution proper—for example, the release of chemicals that reduce the fertility of the land or are damaging to human health.¹⁰ To show that historic gas emissions were wrongful in a way that would create remedial responsibilities, we would need to explain in what sense they were harmful to human interests. At this point we have to make some assumptions about the cumulative effects of different levels of greenhouse-gas emission over time. Without trying to resolve any complex scientific questions, let me suggest three possible accounts of the relationship between gas emissions and the damage they cause to the human environment. The first is that the relationship is linear: each quantum of carbon dioxide, say, released into the atmosphere causes the same incremental increase in surface temperature, and each degree of warming

9. In *National Responsibility and Global Justice*, I call responsibility in this sense “outcome responsibility” in order to distinguish it from the narrower idea of moral responsibility—see especially chapter 4

10. For a fuller discussion of the limitations of the “polluter pays” principle in discussions of climate change, see Caney, “Cosmopolitan Justice, Responsibility, and Climate Change.”

causes approximately the same amount of harm, measured in terms of human deprivation, displacement, death, and so forth. The second is that the relationship is progressive: each additional quantum of greenhouse gas causes slightly more damage than the one before. The third is that there are threshold effects: emissions up to a certain point have little significant effect, but then the impact of further emissions suddenly becomes very sharp.

When one looks more closely at these possibilities, the first of the three—a linear relationship between gas emissions and the harm they cause—does not seem plausible. Even if there were no physical factors causing temperatures to rise more quickly as emissions increased, the limited capacity of many human societies to adapt to such changes would mean that the extent of the resulting damage was progressive. It seems far more likely that the truth lies somewhere between answers two and three. We should expect there to be physical threshold effects because of much publicized feedback effects caused by the melting of the polar ice caps, the unfreezing of the Siberian tundra, and so forth, and there will be human threshold effects when, for example, a low-lying community is suddenly destroyed by rising sea levels overwhelming its defenses.¹¹

The science matters here, because if the cumulative effect of greenhouse gas emissions is *not* linear, then it becomes open to question how harmful historic emissions occurring before my suggested cutoff date of the mid-1980s were, considered in themselves and without taking into account their interaction with later emissions.¹² Suppose, then, that greenhouse-gas emissions had stopped altogether in about 1985, when reliable evidence about global warming first became available. What would have been the overall impact of the emissions occurring before then? The answer here must be somewhat speculative, but we know that global temperatures had already risen by about 0.5° Celsius since the beginning of the twentieth century, and that some further rise was in the pipeline, mainly because the oceans acted as a heat sink, drawing heat from the atmosphere that would later be exchanged back. Models using 2000 as the baseline and examining what would occur if there were no further increases in atmospheric concentrations of greenhouse gases project further long-term

11. See S. Schneider and J. Lane, "Dangers and Thresholds in Climate Change and the Implications for Justice," in *Fairness in Adaptation to Climate Change*, edited by W. Adger, J. Pasavola, S. Huq, and M. Mace (Cambridge: MIT Press, 2006).

12. There is a helpful overview of the current state of climate science in N. Stern, *The Economics of Climate Change: The Stern Review* (Cambridge: Cambridge University Press, 2007).

temperature increases averaging about 0.6° Celsius.¹³ Presumably, this figure would be somewhat lower if 1985 gas levels were used as the baseline. So let us say that the long-term effect of greenhouse-gas emissions up to 1985 would not exceed a 1° Celsius rise in surface temperature (this in fact is likely to be an overestimate, because it attributes all of the temperature rise to human activity, whereas the models find that natural factors such as solar activity are also important). This is certainly not a trivial rise, but from the historic responsibility perspective what interests us is the amount of human damage that would be caused by these emissions alone. Discussions of global warming usually focus on the harm that will be done when past and future emissions are combined to yield temperature rises of 2° Celsius or more. In this respect, the pollution model that I sketched above to explain historic responsibility provides a misleading analogy. In the pollution model there is real harm from the waste that is discharged, although this is discovered only sometime after the discharge occurs. But in the global warming case, what chiefly matters is the combined and progressive effect of cumulative greenhouse-gas emissions, not the early emissions taken by themselves.

What does this imply for ascriptions of responsibility? In some circumstances, the fact that my contribution will combine with later contributions to create a collective harm does implicate me in responsibility. Suppose that ten of us are taking a trip across the desert and we have foolishly hired only one camel between us to carry our heavy belongings. The fact that my bags when strapped on top of the camel cause no problems does not relieve me of responsibility, because it is quite predictable that when the ninth person, say, adds her bags to the load the camel will collapse, and that person has no alternative but to increase the load. We are all symmetrically placed, and the order in which we add the bags does not alter the share of responsibility that each carries. But the climate-change case is not like that.¹⁴ The early emitters knew little about the causes and

13. See T. Wigley, "The Climate Change Commitment," *Science* 307 (2005): 1766–69; and G. Meehl et al., "How Much More Global Warming and Sea Level Rise?" *Science* 307 (2005): 1769–72.

14. In his commentary on my original Tanner Lecture, Joseph Chan introduced the following example to show that climate change is more like the case of the overloaded camel. There are two groups of people living in a remote area whose only means of access to the wider world is to cross a ravine over which, fortuitously, a large tree trunk has fallen, serving as a natural bridge. Members of group A regularly use this bridge for purposes of trade, whereas members of group B do so only very occasionally, to get medical help. At a certain point in time, however, group B starts to begin to trade as well, and it becomes apparent that the bridge has been weakened to the point where it needs to be replaced. Should the two groups contribute equally to the cost of making a new bridge, or should group A bear most of the cost, by virtue of

effects of climate change, and they did not know what their successors would do once those facts became known. It would after all have been possible to cut back sharply on fossil-fuel burning, air travel, and so forth. We chose not to do this, of course, but it would be wrong to say that we had no alternative.

So the argument about historic responsibility, in the earlier years, would have to be made differently. If the effects of early greenhouse-gas emissions were not significantly damaging in themselves, then to attribute responsibility to the emitters we need to show that they were behaving unfairly by denying later generations the chance to emit. In other words, were it not for them, we would not be facing the problems that we now face from future global warming, or at least not such severe problems. The unfairness is not to be found in anything directly harmful that the early emitters did, but in the inequality between early emitters and later generations, who now have to choose between allowing global warming to proceed apace, with potentially devastating results, and cutting back sharply and at considerable cost on emissions now and in the future.

The argument is indeed sometimes made in this form. It can be expressed in terms of equal opportunities. Given that the emission of greenhouse gases becomes costly above a certain level, but the activities made possible by this emission are beneficial to the emitter, everyone should have an equal opportunity to benefit from emissions.¹⁵ Early generations, however, were emitting at a level that could not be extended to everybody, so they were denying others their equal opportunities. They were using more than their fair share of the atmosphere's absorptive capacity, and so they were incurring what is sometimes called a natural or ecological debt.

For political philosophers, this argument inevitably brings to mind John Locke's well-known theory of property acquisition. Asking how private ownership was possible in a world originally given by God to man in common, Locke claimed that a person in the state of nature is entitled to

its much greater historical use of (and benefit from) the bridge? Chan supposes the latter, and argues that this provides a good model for thinking about how to allocate the costs of combating climate change. Appealing though this analogy is, it depends on the assumption that each crossing of the tree trunk slightly weakens it, together with the assumption that the bridge is a jointly owned asset. I have argued, however, that we should not think of earlier greenhouse-gas emissions in these terms. Suppose instead that the trunk would last indefinitely under its original pattern of use; it is only when group B starts to use it for trade that it begins rapidly to weaken. Under these circumstances, it would seem natural for groups A and B to agree to share the costs of the new bridge, perhaps on the basis of the relative future benefit that each group expects to derive from it.

15. This argument is made explicitly in E. Neumayer, "In Defence of Historical Accountability for Greenhouse Gas Emissions," *Ecological Economics* 33 (2000): 185–92, at 188.

remove resources from the commons for his own use as private property, so long as “there is enough, and as good left in common for others.” The person, Locke says, who takes a parcel of land as his private property does no injury to others, any more than a person who drinks from a stream injures a second person “who had a whole River of the same Water left him to quench his thirst.”¹⁶ The principle here seems to be that where a resource is potentially scarce, people can make use of it on the condition that others coming after them have an equivalent opportunity.¹⁷ This is the principle that early emitters of greenhouse gases are said to have breached. They did not leave their successors “a whole River of the same Water” to drink from.

Locke, however, went on to qualify this argument in one important way. Perhaps recognizing that opportunities to acquire property, in land especially, were no longer equal, in a world in which most resources were already privately owned, he proposed that this was acceptable provided that those whose opportunities to acquire were smaller or nonexistent were benefited in other ways, so that overall their position was improved. He famously remarked that although land was still relatively plentiful in the Americas, “a King of a large fruitful Territory there feeds, lodges and is clad worse than a day Labourer in *England*.”¹⁸ In other words, the English day laborer has not been injured by his inability to appropriate land, because his employment by those who have done so has led to an increase in his overall standard of living, using the position of a native American as a benchmark. The idea here, then, is that when evaluating the extent of opportunity, one should not look narrowly at any specific opportunity such as the opportunity to appropriate unowned land, but at what the opportunity is meant to lead to, namely, a certain standard of life.

Could Locke’s important qualification to his original principle of acquisition be used to get early emitters of greenhouse gases off the hook? Could it be shown that although people in the present day no longer have the same opportunity to emit greenhouse gases—that is, they can no longer do so without seriously damaging effects, whereas their predecessors

16. J. Locke, *Two Treatises of Government*, edited by P. Laslett (New York: Mentor, 1963), 329, 333.

17. Jeremy Waldron has argued that Locke did not, in fact, impose this as a necessary condition, even though he concedes that Locke went to some lengths to point out that this condition was indeed satisfied in the state of nature. See “Enough and as Good Left for Others,” *Philosophical Quarterly* 29 (1979): 319–28. If Waldron’s reading of Locke is correct, the position I am discussing is Lockean in spirit but not quite Locke’s own.

18. Locke, *Two Treatises of Government*, 339.

could—they have nonetheless been adequately compensated in other ways, so their overall opportunity set is at least as large as their predecessors'? Just as Locke relied on the productivity of labor once private property was established to lift the position of the propertyless day laborers, so it might be argued that the process of industrial development that the early emission of greenhouse gases made possible provides technological benefits to the current generation, including in particular technologies of energy generation that reduce or virtually eliminate levels of carbon emission. Of course, that wasn't the intention of the early industrializers, but then neither was it the intention of the first property appropriators in Locke's story that later generations should be more than compensated for their lack of opportunities to appropriate.

The key question, then, is whether it is acceptable for inequality of opportunity to be compensated for in this way. Critics have disputed the force of the Lockean story. The day laborer may be comfortably fed and clothed, but he has lost the independence and self-direction that earlier property appropriators enjoyed. Even if we as outside observers judge his situation to be preferable to that of a native ruler in America, does he not have rights that include the opportunity to acquire property in the same way as others have? In this spirit, spokesmen for developing countries in particular may and do argue that the nations that have been responsible for the bulk of the historic gas emissions had, by virtue of the industrial processes that these emissions made possible, an opportunity to develop economically that is now being denied to their successors. If it is said that developing countries today have access to technologies (including cleaner technologies of energy generation) that earlier industrializing societies did not have, and that this compensates them if they are forced to restrict their gas emissions in the future, the reply is that they are asking only for their fair share of one particular resource, namely, the atmosphere as a finite global sink into which emissions must pass. And in calculating that fair share, historic emissions must be taken into account, so that entitlements to future emissions must be heavily weighted toward the developing countries. If they then choose to trade off some part of that entitlement for technology transfers or other benefits, that is permissible, but the baseline must be set in such a way that the historic emitters of greenhouse gases have a sharply reduced entitlement that reflects their previous use of a globally scarce resource.

The language of rights has crept into this debate, as inevitably it will. In the next essay I will examine the idea of a right to emit greenhouse gases,

which might then be used to defend the equal-opportunity claim in the form we are considering. Without prejudging that inquiry, how plausible is the claim that developing societies should have the same opportunities to emit greenhouse gases as were available to the countries that have already industrialized? Not very plausible, if one thinks about it carefully. One reason is that, because of their relative population sizes, countries such as China and India would have a far larger impact on greenhouse-gas levels than the already developed nations have had, if they followed the same energy policies on the road to development. To put it bluntly, they would be creating an environmental disaster by themselves regardless of what others had done previously. Another reason is that, along every dimension, opportunities to acquire and use valuable resources vary historically: our generation has an opportunity to extract and use oil, for example, that our predecessors did not have, and our successors also will not have. This is not of concern unless denying some generation the resource in question imposes a serious handicap. Of course, it would be a serious handicap if developing countries were permitted no greenhouse-gas emissions in circumstances when such emissions were necessary for their further development. But this points us toward having a *sufficient* opportunity to emit these gases, not necessarily an equal opportunity projected forward and backward in time.

I have been examining the idea that the costs of combating global warming should be allocated on the basis of historic responsibility for current atmospheric levels of greenhouse gases, so that those who have emitted most in the past should now make the biggest reductions. My argument has been that, although the principle of requiring nations to make redress for historic acts of injustice is sound in general, it does not apply to the particular case of greenhouse-gas emissions—unless one can defend the claim that having an equal opportunity, over time, to emit such gases is itself a matter of justice. Global warming is not like slavery, where there was a clear historic wrong that required, and may still require, redress. This argument, however, was developed to apply to historic emissions occurring before the mid-1980s—the approximate date, I suggested, at which the fact of global warming (and the harms it was likely to create) became commonly acknowledged and understood. Emissions after that point have to be treated somewhat differently, because it was sufficiently clear by then that an international agreement was needed to control the rising level of atmospheric greenhouse gases. Of course, no such agreement was actually reached, for political reasons; even the Kyoto Protocol, formally

signed a decade later by a number of leading countries, was not ratified until quite recently by several signatories (and has still not been ratified by the United States). But where the need for an agreement to control some activity that will be damaging if left uncontrolled has been recognized, carrying on regardless does constitute a form of harm. Thus, it is reasonable to conclude that those countries that have contributed to present and future global warming by continuing to emit greenhouse gases above the limits that were set at Kyoto (assuming that these limits were themselves reasonable) must pay a heavier share of the resulting costs, whether this means cutting their emissions more sharply in the future than would otherwise be required, or providing more resources to compensate for the damage that will occur in the future.

I concede, then, that the historic responsibility principle may have some traction if we are considering relatively recent emissions of greenhouse gases in circumstances where the need for a fair agreement to regulate these emissions was widely recognized. But I do not think that it can be made into the centerpiece of an international agreement to tackle global warming generally, as many of its supporters would wish. Let me stress that my arguments against the historic responsibility principle are not motivated by a desire to let the rich industrialized nations off the hook when it comes to taking action against climate change. It may well be that the correct principle of fairness, once we have discovered it, obliges these countries to take the biggest share of responsibility now. But I cautioned earlier against letting our evaluation of principles be driven by the conclusions that we would like to reach on independent grounds. This, I think, may account for the continuing popularity of the historic responsibility principle in climate-change debates. Because the countries that are wealthiest now are also generally countries whose historic emissions have been among the highest, it is tempting to think that their contribution to tackling global warming should be based on this fact. But if the underlying thought is that it is these countries that have the greatest *capacity to adapt* by reducing their emissions, or could do so at the smallest *cost*, in real terms, it would be better to say so explicitly rather than to dress the argument up in claims about historic responsibility that will not survive close inspection. In the following essay I shall try to develop such an approach to distributing responsibilities for climate change, after critically interrogating the idea of an equal per capita entitlement to emit greenhouse gases.

II

My purpose in these essays is to find principles that could help us to tackle the urgent problem of global warming by reaching an international agreement to cut the emission of greenhouse gases—an agreement, I have argued, that must be seen to be fair to all parties in order to be effective. As the UN Framework Convention signed by 152 countries at Rio in 1992 puts it, nations should “protect the climate system for the benefit of present and future generations of mankind, on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities.”¹ My task, then, is to decide what equity means in this context, and how these differentiated responsibilities should be allocated.

I argued in the first essay that relying on the historic responsibility principle, which would require the costs of mitigation to be allocated according to each country’s historic record as an emitter of greenhouse gases, was far more problematic than is usually supposed. Although it is often claimed that these historic emissions constitute a harm in the same way as, say, pollution in the form of dumping hazardous waste, in fact the claim goes through only if one appeals to something like a principle of equal opportunity to emit greenhouse gases. The charge would have to be, to use language borrowed from John Locke, that these early greenhouse-gas emitters did not leave “enough and as good for others” in the form of an atmosphere capable of absorbing humanly produced gases without generating harmful climate change. This introduces the first issue to be addressed here, namely, whether a claim on the part of political communities today to an equal opportunity to emit greenhouse gases might be grounded upon their members’ *equal human right* to emit such gases. If such a right could be established, it would presumably not necessarily be one that each person exercised individually. Instead, the implication of recognizing an equal per capita right to emit greenhouse gases would be that each society’s permissible level of emissions would be a direct function of its population size. By mutual consent, the internal allocation of emission rights could proceed on a different basis. But a fair international agreement to control global warming would be one that first set a global cap on emissions and then allocated targets to each political community on the basis simply of the number of people who belonged to it.

1. Cited in M. Grubb, “Seeking Fair Weather: Ethics and the International Debate on Climate Change,” *International Affairs* 71 (1995): 463–96, at 463.

This principle has won widespread support in the literature on climate change, and it is easy to see why.² It is a simple principle, and intuitively it seems fair: why should one person have a greater greenhouse-gas entitlement than another just because, say, he or she happens to live in a developed country? There may be practical problems in applying it—problems, for example, in working out each nation's net level of emissions, since some proportion of the gases that are generated, carbon dioxide especially, will be reabsorbed by vegetation and water—and most commentators recognize that it would not be politically feasible to introduce the principle at once, given that we are starting from a position where some nations have per capita emissions many times higher than others (the United States emits almost twenty times as much CO₂ per head as India, for example). So it should be treated as a target we should move toward over time. But is the principle itself sound?

Let me begin by making a few remarks about principles of equality generally. When we have some scarce resource to distribute, equality often seems to be the fairest principle to use. But we need to distinguish between shallow and deep reasons for favoring equality. This can best be explained by means of an example. Suppose that our department decides to host an annual party for its members, and that at the end of the party, the partygoers having been rather abstemious (this is clearly a *hypothetical* example), there are a number of unopened bottles of wine left over. The wine can't be returned to the shop, let's assume, so what are we to do? The obvious answer is to divide the bottles up equally between the remaining guests, each getting one or two to take home. Why is this answer obvious? It has two merits: one is simplicity (we just need to count the bottles and count the party guests and divide—no other information is needed), and the other is the avoidance of arbitrariness (if we divide the bottles equally, nobody can be accused of favoritism). Now I call these shallow reasons for favoring equality. It's not that the party guests have some grounded claim on an equal share of the wine, or that we would be doing something unfair if we used another principle to distribute the bottles—giving more wine to those with

2. Advocates include G. Bertram, "Tradeable Emission Permits and the Control of Greenhouse Gases," *Journal of Development Studies* 28 (1991–1992): 423–46; Grubb, "Seeking Fair Weather"; Neumayer, "In Defence of Historical Accountability"; D. Jamieson, "Climate Change and Global Environmental Justice," in *Changing the Atmosphere: Expert Knowledge and Environmental Governance*, edited by C. Miller and P. Edwards (Cambridge: MIT Press, 2001); and P. Baer, "Equity, Greenhouse Gas Emissions, and Global Common Resources," in *Climate Change Policy: A Survey*, edited by S. Schneider, A. Rosencranz, and J. Niles (Washington, D.C.: Island Press, 2002).

the lowest incomes, for example, or presenting all the remaining bottles as a thank-you present to the person who organized the party. Equal division is just a simple, nondiscriminatory way of allocating the surplus wine.

But there are other cases in which we have deeper reasons for using equality as our distributive principle. Among them are cases in which departing from equality would involve disrespect to those who receive less, because it would fail to recognize them as members in good standing of some social group. A paradigm case is the allocation of voting rights to adult citizens. Even if we had the information that would allow us to use some other principle—votes proportional to political expertise, for example—it would be wrong to do so. It would undermine the equal status of the citizens, and treat those who got fewer votes with disrespect. Here, then, what matters is not so much the value of the resource that is being allocated—having one vote in an electorate of many millions is after all not of great instrumental value to the voter—but the message that is conveyed by distributing it in one way or the other.

Another circumstance in which equality is required by more than shallow reasons is one where people have a right to some good, and the quantity of good available is only just sufficient to meet all of their claims. The underlying principle here is not itself a principle of equality³—the normative work is being done by the idea of rights—but in the special circumstance just described, and perhaps by extension in certain cases where there are insufficient resources to meet all claims, equality in distribution becomes mandatory. Thus, bread must be distributed equally in a famine, in the absence of differential claims of need, and to fail to do this would be to infringe upon the rights of those who get smaller portions.⁴

If we return to the case of greenhouse-gas emissions, however, it seems that there are only shallow reasons for favoring an equality rule. Such a rule is relatively simple to apply, setting aside for the moment the difficulties in calculating net emissions, and it seems that nobody can claim they are being discriminated against if such a rule is employed. These are obviously important considerations when complex international negotiations are being undertaken, and may help to explain why the rule has enjoyed the level of popularity in the academic literature that it has. But there do

3. This is shown by the fact that if more of the good becomes available, the surplus need not be distributed equally.

4. This is not intended as an exhaustive discussion of the circumstances in which the equal distribution of some resource is required as a matter of justice—see my fuller treatment in *Principles of Social Justice* (Cambridge: Harvard University Press, 1999), chap. 11. Here I have taken cases that might appear relevant to the emission of greenhouse gases.

not seem to be any deeper reasons to support it. Insofar as this question is addressed in the literature, the rule is treated as self-evidently fair. But how could this be shown?

One possibility is to present the emission of greenhouse gases as a natural or human right, which, therefore, belongs equally to all human beings. But could gas emissions have that kind of fundamental status? I assume that human rights are justified by showing that they correspond to basic human needs: if the rights are not respected, people will be unable to lead minimally decent lives.⁵ Thus, food, shelter, and access to basic medical care would all qualify as human rights in this approach. Could we somehow bring gas emissions into this picture? Human beings plainly have the right to breathe, and therefore the right to emit the quantity of carbon dioxide that breathing produces. But moving beyond this, the greenhouse-gas emissions produced by energy generation, transport, and so forth are at most instrumental to basic human rights; that is, depending on the circumstances, a certain level of energy generation might be necessary to produce sufficient food, heating, and so on for a particular group of people. But this would indeed depend on the circumstances, and therefore on previous choices that have been made about technology and human labor. Consider a very simple example. A nation with enough land to produce food to meet the needs of all its inhabitants might decide instead to import most of its food in exchange for manufactured items. So, contingently, it requires the greenhouse-gas emissions produced by air, sea, or road transport in order to fulfill the human right to food. But because this has come about as a result of a political choice, these emissions cannot themselves be presented as matters of human rights. People have human rights to whatever is necessary to meet their basic needs as human beings, but they cannot claim a right to whatever means they themselves prefer to use to meet those needs.⁶ Rights, it is important to remember, always impose obligations on others, who have to limit their own behavior to meet the demands of the right holder. So we should not inflate them without thinking about the consequences of doing so. In a situation in which global warming has become a major problem for humanity at large, it may be necessary for countries that currently import large quantities of food to stop doing so and go back to being more self-sufficient. To object to such a

5. For a full statement, see my *National Responsibility and Global Justice*, chap. 7.

6. On this point, see also T. Hayward, "Human Rights versus Emissions Rights: Climate Justice and the Equitable Distribution of Ecological Space," *Ethics and International Affairs* 21 (2007): 431–50.

policy on the grounds of an alleged human right to emit greenhouse gases would be to mistake the means for the end.

So we cannot derive an equal right to emit greenhouse gases by starting with the idea that such emissions, beyond breathing itself, are a basic human right. But might we instead focus on the equality claim—whatever level of overall gas emissions we can allow to occur without damaging results, why should any one person's share of the total be any greater than another's? In other words, there may be no fixed quantum of emissions that individual people are entitled to, but whatever the permissible global total turns out to be, it should be allocated on an equal basis. That seems intuitively fair. But is it in fact, given that we are looking for deep and not merely shallow reasons in favor of equality?

Let's ask why the capacity to emit greenhouse gases should matter in the first place. It matters, obviously, because of what it enables people to do. In other words, it is a resource, in the sense that it is a component of many of the activities that people want to engage in, such as producing manufactured goods. And because of its consequences in terms of global warming, it has become a scarce resource: the more that one person uses, the less remains for others to use, once we have set a ceiling on total emissions. So an equal right to emit greenhouse gases might be justified as part of a wider principle than several political philosophers have found convincing, namely, equal access to scarce resources.

I do not find such a justification persuasive, for several reasons. The first is that if equality of resources is a valid principle, what it requires is not that people should have equal access to each resource taken separately, but that the overall bundle has the same value for each person, measured in terms of the opportunities it provides for them. In other words, there is no reason not to allow trade-offs whereby a person who has less of resource A is compensated by having more of resource B. To think otherwise is to make a fetish out of particular resources, which matter not in themselves but for what they enable people to do. So there is no reason a person who has a lesser opportunity to emit greenhouse gases should not be compensated by having more resources of another kind—access to land, say—so long as the overall bundles are of equivalent value. I am not defending global equality of resources, which is open to objections that I have no space to detail here.⁷ My point is that even if you think that equal access to scarce resources is what global justice requires, it does not make

7. See my *National Responsibility and Global Justice*, chap. 3.

sense to interpret this as requiring equality in access to any one particular resource, such as the opportunity to emit greenhouse gases.

Is it perhaps wrong to treat an equal right to emit greenhouse gases simply as one part of the wider ideal of equality of resources? Might this right be somehow special? One reason for thinking this is that, whereas with resources generally (land, valuable minerals, and so forth) their “distribution” has come about in arbitrary ways over the course of history, in the case of greenhouse gases, once we recognize the need for an international agreement to control their emission, we have to *decide* on a distribution—we have to allocate emission rights according to some principle or other. It might then seem wrong to use any principle other than equality. Someone who receives a less than equal share could say that she was not being treated with equal respect, as a human being with an essential need to engage in activities involving the emission of these gases.

This argument would have some force if all human beings were in the same situation as regards their need to engage in these gas-generating activities. But plainly this is not the case. Everyone needs the right to emit *some* level of greenhouse gases over and above breathing, but the level required is going to vary considerably according to the conditions of the society in which she lives. It will depend first of all on climatic conditions such as the need for heat in winter and cooling in summer, then on how the society produces its means of subsistence—how reliant it is on agriculture, for example, and the form that the agriculture takes—and then on the availability of different forms of energy generation, whether emission-generating fossil fuels such as coal and gas or low-emission technologies such as wind and hydroelectric power. So it is perfectly reasonable to say to the member of any particular society: what per capita entitlement to emit is actually essential in order for you to engage in the activities that allow you to fulfill your human rights, given that the resource in question is globally scarce? To insist on an equal allocation of emission rights under these circumstances might well mean leaving some people with an allocation that was inadequate for this purpose.

Henry Shue develops this point in a telling way in an article in which he contrasts “luxury emissions” with “subsistence emissions.”⁸ It does not make sense to treat gas emissions that are necessary only to support affluent lifestyles in the developed world in the same way as gas emissions

8. H. Shue, “Subsistence Emissions and Luxury Emissions,” *Law and Policy* 15 (1993): 39–59. See also H. Shue, “Climate,” in *A Companion to Environmental Philosophy*, edited by D. Jamieson (Oxford: Blackwell, 2001), 449–59.

that are used to meet basic needs in developing countries. The problem with a simple equality rule is that it draws no such distinction. A unit of carbon dioxide or methane emitted counts for the same no matter what it is being used to produce. It might, of course, turn out that a regime of equal per capita emissions gave all countries an adequate opportunity to provide their citizens with minimally decent lives. But given the very different background circumstances in which countries find themselves, as noted above, that is a risky assumption to make. Some nations can reasonably claim a greater allowance on the grounds that, even if they choose the technology for energy generation that produces the lowest level of emissions, they still cannot meet subsistence needs under an equality rule.

There is one final point about the principle of an equal right to emit greenhouse gases that deserves to be made here. Those who favor allocating national emissions quotas on an equal per capita basis notice immediately that this rule makes the size of the quota susceptible to changes in population size. A country whose population increases gets more emission permits as a result, and this gives it no incentive to adopt policies of population control, which must surely form part of the broader strategy of environmental protection, as well as that of combating global warming. To avoid this perverse result, it is routinely proposed that the quotas be based on population numbers in some arbitrarily chosen year—1990, for example.⁹ But now, if we let the clock run forward, this means that at some later time people will not in fact have an equal right to emit greenhouse gases. If you happen to live in a country whose population has increased since the chosen date, your entitlement will be reduced. This consequence does not seem to disconcert advocates of the equal per capita rule. But if there were deep reasons in favor of equality, it surely should. If there is something fundamentally unfair about one person having less of an entitlement than another to emit greenhouse gases, then it is wrong for individual entitlements to depend on changes in population size for which they were not personally responsible. What this confirms is that the case for the equality rule is almost entirely a pragmatic one; its advocates think that it could form the basis for an agreement between sovereign countries because of its simplicity, and from that point of view fixing quotas according to population size at some historic moment is just another aspect of simplicity. But once we look more carefully at the rule, we see that it overlooks important considerations of fairness between people and between nations.

9. See, for example, Jamieson, "Climate Change and Global Environmental Justice," 301.

So far my discussion of how to allocate responsibilities for combating climate change fairly has mainly been negative. I have been looking critically at two principles—the historic responsibility principle and the equal entitlement principle—and attempting to show two things: that the first principle relies on the second, at least if we are considering the earlier periods of history rather than the recent past, and that whatever can be said in favor of the second principle from a pragmatic point of view, it does not capture a deeper sense of fairness. But I have also been preparing the ground for an alternative approach, which I now want to propose as a better way of thinking about justice and climate change.¹⁰

It can perhaps best be summed up in the famous old slogan, now much out of fashion, “From each according to his abilities, to each according to his needs.” This slogan needs interpretation, and I am not proposing it as a general theory of justice for all seasons—I don’t think there is such a theory—but it may point us in the right direction in the case of the particular problem we are addressing. That problem, just to remind ourselves, is how to allocate the burden of cutting greenhouse-gas emissions between nation-states: how much each society can be asked to do, given that the reductions required will in almost all cases be costly in terms of forgone economic growth and personal consumption.

A first step is to draw a line between societies in which poverty is endemic and those in which it is not.¹¹ I am assuming here that we can converge on a reasonable definition of global poverty, understood as people’s inability to lead a minimally decent life. The UN has developed simple indicators of poverty, such as gross domestic product (GDP) per capita and life expectancy, which may need refining, but will be adequate for the line-drawing exercise I have in mind. The reference to poverty being *endemic* is meant to separate cases in which the society’s overall level of economic development is simply too low to enable all of its members to be lifted above the poverty line, and cases in which there are small pockets

10. There are, of course, a range of other possibilities that I shall not consider. For a helpful discussion, see M. Grubb, J. Sebenius, A. Magalhaes, and S. Subak, “Sharing the Burden,” in *Confronting Climate Change*, edited by I. Mintzer (Cambridge: Cambridge University Press, 1992).

11. The need to differentiate in this way is emphasized by Shue in “Subsistence Emissions and Luxury Emissions,” and in H. Shue, “Avoidable Necessity: Global Warming, International Fairness, and Alternative Energy,” in *Nomos XXXVII: Theory and Practice*, edited by I. Shapiro and J. DeCew (New York: New York University Press, 1995). See also E. Schokkaert and J. Eyckmans, “Greenhouse Negotiations and the Mirage of Partial Justice,” in *Global Environmental Economics: Equity and the Limit to Markets*, edited by M. Dore and T. Mount (Oxford: Blackwell, 1999).

of poverty that could be remedied by better redistributive policies within (again there may be borderline cases here). I now propose that no society in which poverty is endemic should be asked to cut its gas emissions, and indeed that it be allowed to increase emissions where these can be shown to be a necessary by-product of economic growth aimed at eradicating poverty. To this we should add the important rider that the right to increase greenhouse-gas emissions should be accompanied by the responsibility to use the cleanest technology available. There may be trade-off problems here, if a choice has to be made between a technology that involves higher emissions but delivers a faster rate of growth and one that involves lower emissions and slower development. Such problems can be resolved only on a case-by-case basis. But the general principle is that the imperative to abolish poverty is so strong that it can justify some increase in emissions on the part of poor societies. That is the “to each according to his needs” half of the slogan.

If emissions are going to increase in societies suffering from endemic poverty, there must obviously be correspondingly greater reductions on the part of the group of societies that stand comfortably above the poverty line. It is clear that there is ample room for making these reductions without any society having to dip below the line. The question now is of the principle to be used in making these reductions. What could “from each according to his ability” mean in this case? I propose that we should interpret it as a principle of equal sacrifice. In other words, targets for reducing gas emissions should be set in such a way that the costs of meeting these targets are allocated on an equal per capita basis among the members of the better-off societies. These costs will typically take the form of a reduction in projected living standards as a result of changes in methods of energy generation, personal lifestyle, and so forth. As I noted in the first essay, once the target has been set for a particular society, it is then up to the members of that society to decide how to distribute the costs internally—a society might decide to implement a carbon tax that forced its better-off members to bear most of them, for example. What global justice requires is a fair allocation of responsibilities between nations; it does not prescribe which principles of social justice a society should use to distribute the resulting costs between its individual members.

Some clarification of this proposal is required. First, how are costs to be calculated? The simplest solution is to measure them in terms of reductions in GDP projected forward in time as a result of the measures necessary to reduce emissions by the required amount. The actual costs

might be higher than this if the society chose to achieve its reductions by a different policy route, but the calculation should be based on the cheapest way of cutting emissions. It might be argued, however, that using such an economic measure of costs overlooks large differences between societies in existing GDP levels: in human terms, somebody who belongs to a middle-income society faces higher costs from any given percentage reduction in economic growth than somebody who belongs to a high-income society.¹² The argument here parallels the argument often made in defense of the progressive income tax in domestic contexts, namely, that because the marginal utility of income diminishes, the real cost to rich people of an income reduction via tax is smaller than the same reduction would involve for poorer people. I am not convinced that this intrasocietal argument transfers easily to intersociety cases when we are thinking of societies all of whose members are comfortably above the absolute poverty line I am assuming we can identify. Notice that we are talking here not about actual *reductions* in existing per capita incomes but about quite modest cuts in projected increases.¹³ So the question is whether we have any reason to think that such cuts will be more burdensome for people in middle-income societies than for people in rich societies. Suggestive evidence to the contrary can be found by looking at “happiness studies,” which show very little relationship between a society’s average per capita income and the felt happiness of its members once the income figure rises beyond a certain point.¹⁴ A stronger case for progressivity can be made for societies whose GDP puts them only a short distance above the global poverty line, so we could envisage a more complex scheme of cost distribution where costs were zero for members of societies with endemic poverty, then rose in line

12. This seems to be the view taken in M. Traxler, “Fair Chore Division for Climate Change,” *Social Theory and Practice* 28 (2002): 101–34. Traxler supports “equal burdensomeness” as the fair principle for allocating the costs of preventing climate change, but argues that “burdensomeness” should be measured not in monetary terms but in terms of human welfare. Apart from the familiar problems with using welfare as the “currency” of justice, I am not convinced, for the reasons given in the text, that switching from monetary costs to welfare costs will produce the result that Traxler wants, namely, that more will be required of the rich societies.

13. The authoritative *Stern Report* on climate change estimates that the overall costs of the measures needed to mitigate global warming are about 1 percent of the GDP, within a range of -1 to 3.5 percent. This is against a background in which economic output in OECD countries is predicted to rise by more than 200 percent by 2050, and by 400 percent in developing countries. See Stern’s *Economics of Climate Change*, esp. chaps. 9–10.

14. See, for example, R. Lane, *The Loss of Happiness in Market Democracies* (New Haven: Yale University Press, 2000), esp. chap. 4; R. Layard, *Happiness—Has Social Science a Clue?* (London: Centre for Economic Performance, LSE, 2003); and A. Offer, *The Challenge of Affluence* (Oxford: Oxford University Press, 2006), esp. chap. 2.

with GDP until we reach middle-income societies, at which point they would be shared between all remaining societies on an equal per capita basis. Although harder to implement, this might seem to be fairer than drawing a single dividing line between poor and nonpoor societies.

It is important to be clear that what different societies would be required to do under an equal per capita cost principle will vary considerably. Societies may be quite varied in terms of their ability to switch from activities that generate high levels of greenhouse gases to environmentally friendly alternatives. If we consider energy generation, for example, societies that currently rely mainly on burning fossil fuels may have different opportunities to switch to renewable energy sources such as wind power or solar energy, where opportunity is measured by the cost of making the change. That's why "from each according to his abilities" seems to me a good headline way of capturing the principle being used here. Each society is being asked: how *capable* are you of reducing your current level of greenhouse-gas emissions, where "capability" in turn is interpreted to mean "How much would it cost you to switch to alternative forms of energy generation, transport, consumption, and so on?" Notice also that the results of applying the equal-cost principle will almost certainly be sensitive to a society's past performance in combating global warming. For it is reasonable to assume that societies that have already taken steps to reduce their greenhouse-gas emissions by, for example, investing heavily in renewable energy sources will now find it more difficult, in the sense of costly, to make further reductions. So the burden of change would fall mainly on heavy emitters who have the capacity to cut emissions but have so far done little about it. Of course, every society above the poverty line would be required to contribute to the cuts, but the physical magnitude of the changes required would vary considerably. It is important not to confuse the equal-cost principle I am proposing with the very different principle that each society should be required to reduce its per capita emissions by the same percentage. This latter principle takes no account of societies' differential capacity to reduce their emissions, and it is unfair for that reason.

What objections might be raised to the equal-cost principle? One practical objection is that it will be impossible to come to an international agreement on the capability of each society to reduce its emissions, using the measure proposed. Whereas current emission levels and the current GDP, for example, are essentially matters of fact, albeit matters of fact over which there is still some scope for disagreement, what the pro-

posal involves are counterfactuals: how much *would* it cost a society to reduce its emissions by such and such an amount, assuming it chose the most economical path to doing so? Any agreement, clearly, will depend on some independent body being entrusted to make such a calculation and present the results, and this may be a practical obstacle in the face of national self-interest. At the same time, nation-states are currently producing costed plans for reducing greenhouse-gas emissions, primarily in order to convince their own citizens of the possibility of change, and in these exercises there is no incentive to exaggerate the cost involved. Furthermore, if emissions trading between societies is allowed—a topic I shall not discuss here—this would also reveal the cost to any particular society of the emissions reduction it is bidding to avoid. So reaching an agreement on targets using this approach may be difficult but not impossible, so long as its fundamental fairness is accepted.

But is it in fact fair? Another objection, more normative in character, is that the outcome of the agreement, understood as the set of emission targets for each society once the adjustments have been made, will depend on the starting point. That is to say, societies that currently have high levels of greenhouse-gas emissions may be asked to do more than others by way of reductions, but they are still likely to end up having greater per capita entitlements to emit, having borne equal costs. So it may look as though societies are in some sense being rewarded for their past misbehavior.¹⁵ That is not the intention, of course, but it seems to be the result of applying an equal-cost principle starting where we are now, taking current levels of greenhouse-gas emissions as the baseline.

In reply to this objection, I think we need to be clear about what we are trying to achieve in these debates about emission quotas. We are trying to bring about a world in which total emissions are reduced to the point where they no longer cause harmful global warming. We are not trying to achieve any particular distribution of per capita emissions among societies. There is nothing wrong in principle with a world in which different societies emit different quantities of greenhouse gases per capita, so long as total emissions are capped at a suitable level. Indeed, as I argued earlier, such inequalities are perfectly reasonable given differences in aggregate

15. This is sometimes referred to in the literature as “grandfathering.” However, if we understand this literally, it would mean that states had an ongoing entitlement to continue emitting greenhouse gases at the level they had achieved at some specific point in history. There is no such entitlement in the proposal being advanced here. All but the poorest states will be required to make reductions, which in the case of the heaviest emitters may turn out to be quite large. The historical starting point matters only as a basis for calculating the costs of mitigation.

need and capability created by, for example, a society's physical environment. Our question is to find a fair way of allocating responsibilities that will get us to that final position. The equal-costs principle answers that question. It does not assume that the status quo in terms of current emission levels is somehow sacrosanct—as we have seen, it may require some societies to make significant cuts in those levels. What it says to the peoples of the world is something like this: Global warming is a problem that is likely to have very serious effects for all of us unless we take action now. The action that is required involves some sacrifice, and all those who can contribute without harm to their vital interests should do so on an equal basis. Some will need to do more than others physically, but the sacrifice, in terms of income or consumption forgone, should be the same for all.

After all this has been said, it may still be felt that it is somehow fair for the richest states to make the biggest contribution to combating global warming, and some proposals follow precisely this logic by, for example, allocating the costs of change according to per capita GDP, or more radically still, according to a measure that also takes account of the degree of income inequality within each society, with unequal societies paying proportionately more.¹⁶ (The thought behind this more radical proposal is that some costs should be made to fall on rich individuals in poor societies.) I believe that such proposals overshoot the mark by trying to advance a wider egalitarian agenda under the guise of a mechanism for tackling global warming.¹⁷ They will be resisted by societies that feel that they have collectively “earned” their present levels of GDP and do not see why they should bear more costs per capita simply on account of their relative economic success. No one can object in this way to the equal-sacrifice principle as applied to nonpoor societies, nor, unless they are indifferent to global poverty, can they object to the companion idea that endemically poor societies should be allowed to increase their emissions where this is essential for their economic development. Given that the aim of the

16. See, for example, P. Baer, T. Athanasiou, and S. Kartha, “The Right to Development in a Climate Constrained World: The Greenhouse Development Rights Framework” available online at <http://www.ecoequity.org/GDRs>. The authors of this document advocate an overall approach to burden sharing that combines historic responsibility with capacity, but their definition of “capacity” modifies national per capita income with a domestic income-inequality measure.

17. For the argument that “redistribution through greenhouse gas cuts is most unlikely to be the best way to help poor people or poor nations,” see E. Posner and C. Sunstein, “Climate Change Justice,” a working paper available at <http://www.law.uchicago.edu/Lawecon/index.html>.

principle is to set the terms of a fair international agreement on climate change, this counts heavily in its favor.

If we accept that the equal-sacrifice principle should form the cornerstone of such an agreement, there remains the problem of how to accommodate historical responsibility for greenhouse-gas emissions in the recent past—given that this cannot be set aside completely, as I conceded in the first essay. Here there seem to be two possibilities. One would be to link historic responsibility to adaptation costs rather than mitigation costs. That is, we would total the damage to vulnerable groups caused by the warming effects of recent emissions and then allocate the costs of making redress for this damage on the basis that societies that had been the heaviest emitters would contribute most. This would allow future emission targets to be set entirely on the basis of the equal-sacrifice principle. The second approach is to use only the latter principle but to backdate the starting point from which equal costs are calculated. In other words, we would look at emission levels in 1985 or 1990, say, work out what overall reduction from those levels is necessary to curb global warming, and then distribute costs among societies according to the equal-sacrifice principle. The effect would be that (nonpoor) societies whose emissions have increased since the chosen starting date would face higher per capita costs (they would have to eliminate the emissions increase and then in addition make whatever further cuts the backdated equal-sacrifice principle required them to make), whereas societies whose emissions have decreased in the meantime would have to do less, since they would already have made some of the sacrifice that the principle requires of them. Establishing the relevant counterfactuals would be harder, of course—we would need to know what the cost of emission cuts *would have been* for each society given their technological capabilities and so forth at the chosen date—and this might rule out using the second approach as the basis for a practical agreement.

I have argued that a fair distribution of responsibilities for combating climate change should be guided mainly by the principle of equal sacrifice rather than by two of its popular rivals, historic responsibility and an equal per capita right to emit greenhouse gases. Having defended this principle as the basis of a future international agreement, I want finally to address a second issue of fairness that such an agreement would raise, one concerning obligations and responsibilities in circumstances in which there is less than full compliance with its terms. Assume, in other words, that through lengthy international negotiations we have arrived at

greenhouse-gas targets for each society that are recognized to be fair, by whatever standards command assent—whether the equal per capita sharing of costs among richer societies as proposed above or some other criterion. These targets are encapsulated in an international agreement. However, compliance with this agreement is patchy. Some states may refuse to sign; others may sign but then drag their feet when it comes to implementing the agreement. For present purposes it is not crucial whether a particular state signs. What matters is that responsibilities have been allocated in a way that is agreed is fair. In these circumstances, how far should any one state's obligations to comply depend on what other states decide to do?

This is obviously not just an academic question. In the present round of negotiations over climate change, key participants have declared that they will cooperate only conditionally—the United States, for example, has recently indicated that it is now ready to enter a binding international agreement on greenhouse-gas emissions, but only if China and India do likewise. From the other side of the fence, China has stated that it is willing to fulfill its commitments under the existing Kyoto Protocol, but conditionally on the developed countries taking the lead in reducing their own emissions and also on making agreed-upon technology transfers.

How to break this deadlock is a practical challenge for the international negotiators. What concerns me is the underlying question of fairness. Is it permissible for one nation to make its compliance with the agreement conditional in this way? Let's consider, then, a situation of partial compliance with a fair agreement on climate change. This could take different forms—for example, some nations could be fully compliant, while others hardly modify their behavior at all. It is more likely, however, that compliance levels will spread evenly across the range from low to high, with the result that the total greenhouse emissions remain considerably above the figure judged to be acceptable from the point of view of global warming. Now consider the position of the citizens of any one state having to decide what their obligations are in these circumstances. There are broadly three possibilities: (1) they should do what the agreement requires them to do, in other words reduce their emissions to the point where, if others complied too, harmful global warming would cease; (2) they should cut their emissions more radically than this, to compensate for the failure of other states; or (3) they should do less than the agreement specifies—for example, cutting emissions to the point where they are roughly at the

mean level of compliance across all states. What does fairness require them to do?¹⁸

Consider option 2 first. This says that in situations of partial compliance, those who are able to do so should take up the slack. Assume here that although further cuts in greenhouse-gas emissions would be costly, they would not have deeply damaging effects on a society whose members are already comfortably above the poverty line. What are the arguments against doing so? First, that it is simply unfair to ask one party to do more than their share of what is recognized to be a common task—in this case, cutting gas emissions to an agreed-upon overall total. Particularly if the agreement is based on the equal sharing of costs, as I have proposed, there is no reason for one party to bear greater costs simply because others refuse to carry their own fair share. Second, if one or more states show a willingness to take up the slack in this way, this creates a perverse incentive for other states, already in default, to do less still by way of compliance.

These arguments seem sufficient to me to rule out option 2, in general. An exception might occur if it became clear that the world was rapidly approaching a crucial tipping point such that unless further cuts in gas emissions were made quickly, an environmental disaster would follow. Under these circumstances, fairness across nations might be outweighed by a simple calculation of consequences, or as it might be claimed justice between those responsible for causing global warming and those who would be its victims if the disaster occurred. Whether we might be in such a situation today is deeply contested. But unless we are, option 2 is not an acceptable way of assigning additional responsibilities.

What then about option 3, namely, that what fairness requires is only that we should do as much as others, on average, are doing, even though this is less than is needed to solve the problem? The argument in its favor is obviously that it preserves horizontal equity between societies and their members: the per capita costs of adjustment are being equalized, or at least approximately so.¹⁹ But again there are two arguments against. The first is that acting on this principle is liable to provoke a race to the bottom. If

18. This is a particular instance of the more general question of what fairness requires in circumstances of partial compliance, which I tackle at greater length in “Taking Up the Slack? Responsibility and Justice in Situations of Partial Compliance,” in *Justice and Responsibility*, edited by C. Knight and Z. Stemplowska (Oxford: Oxford University Press, forthcoming). See also L. Murphy, *Moral Demands in Nonideal Theory* (New York: Oxford University Press, 2000).

19. This would be so if most societies are doing, say, about half of what the agreement requires them to do. The argument is less strong if compliance rates vary widely.

societies that are more compliant with their greenhouse-gas obligations begin to reduce compliance levels toward the existing mean, then this will have the effect of lowering the mean, and so on until every society finds itself in the position of the least-compliant society.²⁰ Second, any society that does less than it is required to do under the terms of the fair agreement is guilty of wrongdoing by virtue of the harm that it is inflicting on those who will suffer the effects of climate change. We are assuming that the agreement, if complied with, produces an overall level of gas emissions that avoids harmful warming. Any nation that complies fully can justifiably claim that its remaining emissions are not harmful—that the harm caused by the excess emissions of noncompliant nations is their responsibility alone. But this cannot be claimed by a nation that complies only partially, even if its behavior matches those of others.

So we are left with option 1: that even if compliance with the terms of a fair agreement is only partial, each party nonetheless has a responsibility to comply fully. The point to note is that once we have identified a fair way of distributing the costs of combating climate change, and encapsulated this in an agreement that sets clear, publicly observable targets for each society, this makes a moral difference to the position of the parties. Although there is a weak, causal sense in which we can say that any greenhouse-gas emission on anyone's part contributes to the harm brought about by global warming, there is a clear difference between emissions that are in excess of national quotas and those that are not. Only those excess emissions are wrongful, and in violation of global justice. As I noted earlier, there may still be a reason for fully compliant societies to reduce their emissions further if disaster looms. But they could not be criticized for failing to do so in the way that noncompliant societies can for failing to comply with the agreement.

Does that mean that it is wrong for societies to make their own compliance with international climate-change agreements conditional on the compliance of other parties? In principle the answer to this must be yes, but there are a couple of important riders to add. First, it is sometimes justifiable to threaten to do things that you would not, in fact, be justified in doing, if issuing the threat has sufficiently good consequences. In other words, it may be justifiable to bluff, in certain circumstances. If a leading nation's declaring that it will cooperate only conditionally with a climate-

20. In theory, of course, there could be a race to the top, if societies with lower levels of compliance decided to adjust upwards to the mean, but readers can judge for themselves how likely such a scenario is in the context of climate change.

change agreement has the effect of bringing other reluctant parties into the agreement, this might be justified. So might a strategy of conditional cooperation whereby country A cuts its emissions somewhat but not by the full extent required, waits for country B to reciprocate, and then cuts its emissions further. Whether such tactics are justifiable depends on the case. The underlying point, however, is that if they fail, full compliance is what global justice requires.

The second rider is that if we compare the stated positions of the United States and China as I described them earlier, they are different in one important respect. The United States, a rich developed society and a major emitter of greenhouse gases, intends apparently to make its compliance with a new international agreement on climate change conditional on the participation of developing countries, and this I have suggested is indefensible unless it is simply a tactical move to bring China and India to the negotiating table. China, by contrast, is a leading member of the group of countries for whom some increase in greenhouse-gas emissions can be justified in terms of tackling poverty, and whose responsibility therefore is primarily to minimize the increase by using suitable technology wherever possible. But if China is asked to adopt less polluting but more costly forms of energy generation as part of an overall greenhouse-gas package, it may need to receive technology transfers and maybe other financial adjustments, in trade agreements and so forth, if the poverty target is to be achieved. It is no part of my remit to say what it is reasonable for China to ask for in this area and what it is not. The general implication, however, is that although China should be willing to accept firm emission targets as part of an international agreement, it is reasonable for the Chinese government to make complying with those targets conditional on receiving the material assistance specified in the agreement. Conditionality of this kind is very different from unwillingness to enter an agreement at all unless all other countries do likewise.

My aim in these two essays has been to reflect on the normative questions raised by climate change and our collective responsibility to combat it. This seems to me an area in which political philosophy is still lagging far behind both physical science and economics. That is, we have a reasonably good understanding of both the physical causes and the consequences of global warming; we also have some good economic models of the policies we might use to mitigate it. If we put those two sciences together, we can

readily reach the conclusion that the problem of global warming is soluble, in principle. We know what needs to be done to keep atmospheric concentrations of carbon dioxide and other greenhouse gases at acceptable levels, within the range 450–550 parts per million of CO₂, which observers would regard as the highest we can allow without serious damage to our planet. We also know that this outcome can be achieved without significant sacrifice to other goals, especially the economic development needed to overcome world poverty. But the solution requires coordination among independent nation-states that guard their independence and sovereignty jealously, and therein lies the real obstacle. Unless we can agree on some fair way of dividing up the responsibility, no one will be willing to take the necessary steps. Justice is supposed to be the special subject of moral and political philosophers, and what I have been attempting in these essays is to bring that idea to bear on this most important of contemporary issues.

NOTES

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