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One Atmosphere

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from
Climate Ethics
ed by Gardner et al,
Oxford 2010

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The Problem

There can be no clearer illustration of the need for human beings to act globally than the issues raised by the impact of human activity on our atmosphere. That we all share the same planet came to our attention in a particularly pressing way in the 1970s when scientists discovered that the use of chlorofluorocarbons (CFCs) threatens the ozone layer shielding the surface of our planet from the full force of the sun's ultraviolet radiation. Damage to that protective shield would cause cancer rates to rise sharply and could have other effects, for example, on the growth of algae. The threat was especially acute to the world's southernmost cities, since a large hole in the ozone was found to be opening up each year over Antarctica, but in the long term, the entire ozone shield was imperiled. Once the science was accepted, concerted international action followed relatively rapidly with the signing of the Montreal Protocol in 1985. The developed countries phased out virtually all use of CFCs by 1999, and the developing countries, given a 10-year period of grace, are now moving toward the same goal.

Getting rid of CFCs has turned out to be just the curtain raiser: the main event is climate change, or global warming. Without belittling the pioneering achievement of those who brought about the Montreal Protocol, the problem was not so difficult, for CFCs can be replaced in all their uses at relatively little cost, and the solution to the problem is simply to stop producing them. Climate change is a very different matter.

The scientific evidence that human activities are changing the climate of our planet has been studied by a working group of the Intergovernmental Panel on Climate Change (IPCC), an international scientific body intended to provide policy makers with an authoritative view of climate change and its causes. The group released its *Third Assessment Report* in 2001, building on earlier reports and incorporating new evidence accumulated over the previous five years. The report is the work of 122 lead authors and 515 contributing authors, and the

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research on which it was based was reviewed by 337 experts. Like any scientific document it is open to criticism from other scientists, but it reflects a broad consensus of leading scientific opinion and is by far the most authoritative view at present available on what is happening to our climate.

The *Third Assessment Report* finds that our planet has shown clear signs of warming over the past century. The 1990s were the hottest decade, and 1998 the hottest year, recorded over the 140 years for which meteorological records have been kept. As 2001 drew to a close, the World Meteorological Organization announced that it would be second only to 1998 as the hottest year recorded. In fact nine of the ten hottest years during this period have occurred since 1990, and temperatures are now rising at three times the rate of the early 1900s.¹ Sea levels have risen by between 10 and 20 centimeters over the past century. Since the 1960s snow and ice cover has decreased by about 10 percent, and mountain glaciers are in retreat everywhere except near the poles. In the past three decades the El Niño effect in the southern hemisphere has become more intense, causing greater variation in rainfall. Paralleling these changes is an unprecedented increase in concentrations of carbon dioxide, methane, and nitrous oxide in the atmosphere, produced by human activities such as burning fossil fuels, the clearing of vegetation, and (in the case of methane) cattle and rice production. Not for at least 420,000 years has there been so much carbon dioxide and methane in the atmosphere.

How much of the change in climate has been produced by human activity, and how much can be explained by natural variation? The *Third Assessment Report* finds “new and stronger evidence that most of the warming observed over the last fifty years is attributable to human activities,” and, more specifically, to greenhouse-gas emissions. The report also finds it “very likely” that most of the rise in sea levels over the past century is due to global warming.² Those of us who have no expertise in the scientific aspects of assessing climate change and its causes can scarcely disregard the views held by the overwhelming majority

of those who do possess that expertise. They could be wrong—the great majority of scientists sometimes are—but in view of what is at stake, to rely on that possibility would be a risky strategy.

What will happen if we continue to emit increasing amounts of greenhouse gases and global warming continues to accelerate? The *Third Assessment Report* estimates that between 1990 and 2100, average global temperatures will rise by at least 1.4°C and perhaps by as much as 5.8°C.³ Although these average figures may seem quite small—whether tomorrow is going to be 20°C or 22°C isn't such a big deal—even a 1°C rise in average temperatures would be greater than any change that has occurred in a single century for the past 10,000 years. Moreover, some regional changes will be more extreme and are much more difficult to predict. Northern landmasses, especially North America and central Asia, will warm more than the oceans or coastal regions. Precipitation will increase overall, but there will be sharp regional variations, with some areas that now receive adequate rainfall becoming arid. There will also be greater year-to-year fluctuations than at present—which means that droughts and floods will increase. The Asian summer monsoon is likely to become less reliable. It is possible that the changes could be enough to reach critical tipping points at which the weather systems alter or the directions of major ocean currents, such as the Gulf Stream, change.

What will the consequences be for humans?

- ▶ As oceans become warmer, hurricanes and tropical storms that are now largely confined to the tropics will move further from the equator, hitting large urban areas that have not been built to cope with them. This is a prospect that is viewed with great concern in the insurance industry, which has already seen the cost of natural disasters rise dramatically in recent decades.⁴
- ▶ Tropical diseases will become more widespread.
- ▶ Food production will rise in some regions, especially in the high northern latitudes,

and fall in others, including sub-Saharan Africa.

- ▶ Sea levels will rise by between 9 and 88 centimeters.

Rich nations may, at considerable cost, be able to cope with these changes without enormous loss of life. They are in a better position to store food against the possibility of drought, to move people away from flooded areas, to fight the spread of disease-carrying insects, and to build seawalls to keep out the rising seas. Poor nations will not be able to do so much. Bangladesh, the world's most densely populated large country, has the world's largest system of deltas and mudflats, where mighty rivers like the Ganges and the Brahmaputra reach the sea. The soil in these areas is fertile, but the hazards of living on such low-lying land are great. In 1991 a cyclone hit the coast of Bangladesh, coinciding with high tides that left 10 million people homeless and killed 139,000. Most of these people were living on mudflats in the deltas. People continue to live there in large numbers because they have nowhere else to go. But if sea levels continue to rise, many peasant farmers will have no land left. As many as 70 million people could be affected in Bangladesh, and a similar number in China. Millions more Egyptian farmers on the Nile delta also stand to lose their land. On a smaller scale, Pacific island nations that consist of low-lying atolls face even more drastic losses. Kiribati, placed just to the west of the International Date Line, was the first nation to enter the new millennium. Ironically, it may also be the first to leave it, disappearing beneath the waves. High tides are already causing erosion and polluting fragile sources of fresh water, and some uninhabited islands have been submerged.

Global warming would lead to an increase in summer deaths due to heat stress, but these would be offset by a reduced death toll from winter cold. Much more significant than either of these effects, however, would be the spread of tropical diseases, including diseases carried by insects that need warmth to survive. The *Third Assessment Report* considers several attempts to model the spread of diseases like malaria and dengue but finds that the research

methodology is, at this stage, inadequate to provide good estimates of the numbers likely to be affected.⁵

If the Asian monsoon becomes less reliable, hundreds of millions of peasant farmers in India and other countries will go hungry in the years in which the monsoon brings less rain than normal. They have no other way of obtaining the water needed for growing their crops. In general, less reliable rainfall patterns will cause immense hardship among the large proportion of the world's population who must grow their own food if they want to eat.

The consequences for nonhuman animals and for biodiversity will also be severe. In some regions plant and animal communities will gradually move further from the equator, or to higher altitudes, following climate patterns. Elsewhere that option will not be available. Australia's unique alpine plants and animals already survive only on the country's highest alpine plains and peaks. If snow ceases to fall on their territory, they will become extinct. Coastal ecosystems will change dramatically, and warmer waters may destroy coral reefs. These predictions look ahead only as far as 2100, but even if greenhouse-gas emissions have been stabilized by that time, changes in climate will persist for hundreds, perhaps thousands, of years. A small change in average global temperatures could, over the next millennium, lead to the melting of the Greenland ice cap, which, added to the partial melting of the West Antarctic Ice Sheet, could increase sea levels by six meters.⁶

All of this forces us to think differently about our ethics. Our value system evolved in circumstances in which the atmosphere, like the oceans, seemed an unlimited resource, and responsibilities and harms were generally clear and well defined. If someone hit someone else, it was clear who had done what. Now the twin problems of the ozone hole and climate change have revealed bizarre new ways of killing people. By spraying deodorant at your armpit in your New York apartment, you could, if you use an aerosol spray propelled by CFCs, be contributing to the skin-cancer deaths, many years later, of people living in Punta Arenas, Chile. By driving your car, you could be

releasing carbon dioxide that is part of a causal chain leading to lethal floods in Bangladesh.⁷ How can we adjust our ethics to take account of this new situation?

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Rio and Kyoto

That seemingly harmless and trivial human actions can affect people in distant countries is just beginning to make a significant difference to the sovereignty of individual nations. Under existing international law, individuals and companies can sue for damages if they are harmed by pollution coming from another country, but nations cannot take other nations to court. In January 2002, Norway announced that it would push for a binding international "polluter pays" scheme for countries. The announcement followed evidence that Britain's Sellafield nuclear power plant is emitting radioactive wastes that are reaching the Norwegian coastline. Lobsters and other shellfish in the North Sea and the Irish Sea have high levels of radioactive technetium-99.⁸

The Sellafield case has revealed a gap in environmental legislation on a global basis. Norway is seeking an international convention on environmental pollution, first at the European level and then, through the United Nations, globally. The principle is one that is difficult to argue against, but if Norway can force Britain to pay for the damage Britain's leaking nuclear plant causes to Norway's coastline, will not nations like Kiribati be able to sue America for allowing large quantities of carbon dioxide to be emitted into the atmosphere, causing rising sea levels to submerge its island homes? Although the link between rising sea levels and a nation's emissions of greenhouse gases is much more difficult to prove than the link between Britain's nuclear power plant and technetium-99 found along the Norwegian coast, it is hard to draw a clear line of principle between the two cases. Yet accepting the right of Kiribati to sue for damages for American greenhouse-gas emissions makes us "one world" in a new and far more

sweeping sense than we ever were before. It gives rise to a need for concerted international action.

Climate change entered the international political arena in 1988, when the United Nations Environment Program and the World Meteorological Office jointly set up the Intergovernmental Panel on Climate Change. In 1990 the IPCC reported that the threat of climate change was real, and a global treaty was needed to deal with it. The United Nations General Assembly resolved to proceed with such a treaty. The United Nations Framework Convention on Climate Change was agreed to in 1992 and opened for signature at the Earth Summit, or, more formally, the United Nations Conference on Environment and Development, which was held in Rio de Janeiro in the same year. This "framework convention" has been accepted by 181 governments. It is, as its name suggests, no more than a framework for further action, but it calls for greenhouse gases to be stabilized at safe levels, and it says that the parties to the convention should do this "on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities." Developed nations should "take the lead in combating climate change and the adverse effects thereof". The developed nations committed themselves to 1990 levels of emissions by the year 2000, but this commitment was not legally binding.⁹ For the United States and several other countries, that was just as well, because they came nowhere near meeting it. In the United States, for example, by 2000, carbon dioxide emissions were 14 percent higher than they were in 1990. Nor was the trend improving, for the increase between 1999 and 2000 was 3.1 percent, the biggest one-year increase since the mid-1990s.¹⁰

The framework convention builds in what is sometimes called the "precautionary principle," calling on the parties to act to avoid the risk of serious and irreversible damage even in the absence of full scientific certainty. The convention also recognizes a "right to sustainable development," asserting that economic development is essential for addressing climate change. Accordingly, the Rio Earth Summit

did not set any emissions-reduction targets for developing countries to meet.

The framework convention set up a procedure for holding "conferences of the parties" to assess progress. In 1995, this conference decided that more binding targets were needed. The result, after two years of negotiations, was the 1997 Kyoto Protocol, which set targets for 39 developed nations to limit or reduce their greenhouse-gas emissions by 2012. The limits and reductions were designed to reduce total emissions from the developed nations to a level at least 5 percent below 1990 levels. The national targets vary, however, with the European Union nations and the United States having targets of 8 percent and 7 percent, respectively, below 1990 levels and other nations, such as Australia, being allowed to go over their 1990 levels. These targets were arrived at through negotiations with government leaders, and they were not based on any general principles of fairness, nor much else that can be defended on any terms other than the need to get agreement.¹¹ This was necessary since under the prevailing conception of national sovereignty, countries cannot be bound to meet their targets unless they decide to sign the treaty that commits them to do so. To assist countries in reaching their targets, the Kyoto Protocol accepted the principle of "emissions trading," by which one country can buy emissions credits from another country that can reach its target with something to spare.

The Kyoto conference did not settle the details of how countries could meet their targets, for example, whether they would be allowed credits for planting forests that soak up carbon dioxide from the atmosphere, and how emissions trading was to operate. After a meeting at the Hague failed to reach agreement on these matters, they were resolved at further meetings held in Bonn and Marrakech in July and November 2001, respectively. There, 178 nations reached a historic agreement that makes it possible to put the Kyoto Protocol into effect. American officials, however, were merely watching from the sidelines. The United States was no longer a party to the agreement. Later, Prime Minister John Howard announced

that Australia would follow the lead set by the United States and refuse to ratify the agreement, despite his nation having received more generous terms in the protocol than any other developed nation.

The Kyoto agreement will not solve the problem of the impact of human activity on the world's climate. It will only slow the changes that are now occurring. For that reason, some skeptics have argued that the likely results do not justify the costs of putting the agreement into effect. In an article in the *Economist*, Bjørn Lomborg writes:

Despite the intuition that something drastic needs to be done about such a costly problem, economic analyses clearly show that it will be far more expensive to cut carbon-dioxide emissions radically than to pay the costs of adaptation to the increased temperatures.¹²

Lomborg is right to raise the question of costs. It is conceivable, for example, that the resources the world is proposing to put into reducing greenhouse-gas emissions could be better spent on increasing assistance to the world's poorest people, to help them develop economically and so cope better with climate change. But how likely is it that the rich nations would spend the money in this manner? Their past record is not encouraging. A comparatively inefficient way of helping the poor may be better than not helping them at all.¹³

Significantly, Lomborg's highly controversial book, *The Skeptical Environmentalist*, offers a more nuanced picture than the bald statement quoted above. Lomborg himself points out that, even in a worst-case scenario in which Kyoto is implemented in an inefficient way, "there is no way that the cost will send us to the poorhouse." Indeed, he says, one could argue that whether we choose to implement the Kyoto Protocol or to go beyond it and actually stabilize greenhouse gases:

the total cost of managing global warming *ad infinitum* would be the same as deferring the [economic] growth curve by less than a year. In other words we would have to wait until 2051 to enjoy

the prosperity we would otherwise have enjoyed in 2050. And by that time the average citizen of the world will have become twice as wealthy as she is now.¹⁴

Lomborg does claim that the Kyoto Protocol will lead to a net loss of \$150 billion (U.S.). This estimate assumes that there will be emissions trading within the developed nations but not among all nations of the world. It also assumes that the developing nations will remain outside the protocol—in which case the effect of the agreement will be only to delay, by a few years, the predicted changes to the climate. But if the developing nations join in once they see that the developed nations are serious about tackling their emissions, and if there is global emissions trading, then Lomborg's figures show that the Kyoto pact will bring a net benefit of \$61 billion (U.S.).

These estimates all assume that Lomborg's figures are sound—a questionable assumption, for how shall we price the increased deaths from tropical diseases and flooding that global warming will bring? How much should we pay to prevent the extinction of species and entire ecosystems? Even if we could answer these questions, and agree on the figures that Lomborg uses, we would still need to consider his decision to discount all future costs at an annual rate of 5 percent. A discount rate of 5 percent means that we consider losing \$100 today to be the equivalent of losing \$95 in a year's time, the equivalent of losing \$90.25 in two years' time, and so on. Obviously, then, losing something in, say, 40 years' time isn't going to be worth much, and it wouldn't make sense to spend a lot now to make sure that you don't lose it. To be precise, at this discount rate, it would only be worth spending \$14.20 today to make sure that you don't lose \$100 in 40 years' time. Since the costs of reducing greenhouse-gas emissions will come soon, whereas most of the costs of not doing anything to reduce them fall several decades into the future, this makes a huge difference to the cost-benefit equation. Assume that unchecked global warming will lead to rising sea levels, flooding valuable land in 40 years' time. With an annual discount rate of 5

percent, it is worth spending only \$14.20 to prevent flooding that will permanently inundate land worth \$100. Losses that will occur a century or more hence dwindle to virtually nothing. This is not because of inflation—we are talking about costs expressed in dollars already adjusted for inflation. It is simply discounting the future.

Lomborg justifies the use of a discount rate by arguing that if we invest \$14.20 today, we can get a (completely safe) return of 5 percent on it, and so it will grow to \$100 in 40 years. Though the use of a discount rate is a standard economic practice, the decision about which rate should be used is highly speculative, and assuming different interest rates, or even acknowledging uncertainty about interest rates, would lead to very different cost-benefit ratios.¹⁵ There is also an ethical issue about discounting the future. True, our investments may increase in value over time, and we will become richer, but the price we are prepared to pay to save human lives, or endangered species, may go up just as much. These values are not consumer goods like TVs or dishwashers, which drop in value in proportion to our earnings. They are things like health, something that the richer we get, the more we are willing to spend to preserve. An ethical, not an economic, justification would be needed for discounting suffering and death, or the extinction of species, simply because these losses will not occur for 40 years. No such justification has been offered.

It is important to see Kyoto not as the solution to the problem of climate change but as the first step. It is reasonable to raise questions about whether the relatively minor delay in global warming that Kyoto would bring about is worth the cost. But if we see Kyoto as a necessary step for persuading the developing countries that they, too, should reduce greenhouse-gas emissions, we can see why we should support it. Kyoto provides a platform from which a more far-reaching and also more equitable agreement can be reached. Now we need to ask what that agreement would need to be like to satisfy the requirement of equity or fairness.

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What Is an Equitable Distribution?

In the second of the three televised debates held during the 2000 U.S. presidential election, the candidates were asked what they would do about global warming. George W. Bush said:

I'll tell you one thing I'm not going to do is I'm not going to let the United States carry the burden for cleaning up the world's air, like the Kyoto treaty would have done. China and India were exempted from that treaty. I think we need to be more even-handed.

There are various principles of fairness that people often use to judge what is fair or "even-handed". In political philosophy, it is common to follow Robert Nozick in distinguishing between "historical" principles and "time-slice" principles.¹⁶ A historical principle is one that says we can't decide, merely by looking at the present situation, whether a given distribution of goods is just or unjust. We must also ask how the situation came about; we must know its history. Are the parties entitled, by an originally justifiable acquisition and a chain of legitimate transfers, to the holdings they now have? If so, the present distribution is just. If not, rectification or compensation will be needed to produce a just distribution. In contrast, a time-slice principle looks at the existing distribution at a particular moment and asks if that distribution satisfies some principles of fairness, irrespective of any preceding sequence of events. I shall look at both of these approaches in turn.

A Historical Principle: "The Polluter Pays" or "You Broke It, Now You Fix It"

Imagine that we live in a village in which everyone puts their wastes down a giant sink. No one quite knows what happens to the wastes after they go down the sink, but since they disappear and have no adverse impact on anyone, no one worries about it. Some people consume a lot, and so have a lot of waste, while others, with more limited means, have barely any, but the capacity of the sink to dispose of our

wastes seems so limitless that no one worries about the difference. As long as that situation continues, it is reasonable to believe that in putting waste down the sink, we are leaving "enough and as good" for others, because no matter how much we put down it, others can also put as much as they want, without the sink overflowing. This phrase "enough and as good" comes from John Locke's justification of private property in his *Second Treatise on Civil Government*, published in 1690. In that work Locke says that "the earth and all that is therein is given to men for the support and comfort of their being." The earth and its contents "belong to mankind in common." How, then, can there be private property? Because our labor is our own, and hence when we mix our own labor with the land and its products, we make them our own. But why does mixing my labor with the common property of all humankind mean that I have gained property in what belongs to all humankind, rather than lost property in my own labor? It has this effect, Locke says, as long as the appropriation of what is held in common does not prevent there being "enough and as good left in common for others."¹⁷

Locke's justification of the acquisition of private property is the classic historical account of how property can be legitimately acquired, and it has served as the starting point for many more recent discussions. Its significance here is that, if it is valid and the sink is, or appears to be, of limitless capacity, it would justify allowing everyone to put what they want down the sink, even if some put much more than others down it.

Now imagine that conditions change, so that the sink's capacity to carry away our wastes is used up to the full, and there is already some unpleasant seepage that seems to be the result of the sink being used too much. This seepage causes occasional problems. When the weather is warm, it smells. A nearby waterhole where our children swim now has algal blooms that make it unusable. Several respected figures in the village warn that unless usage of the sink is cut down, all the village water supplies will be polluted. At this point, when we continue to throw our usual wastes down the sink, we are no longer leaving "enough and as good"

for others, and hence our right to unchecked waste disposal becomes questionable. For the sink belongs to us all in common, and by using it without restriction now, we are depriving others of their right to use the sink in the same way without bringing about results none of us wants. We have an example of the well-known "tragedy of the commons."¹⁸ The use of the sink is a limited resource that needs to be shared in some equitable way. But how? A problem of distributive justice has arisen.

Think of the atmosphere as a giant global sink into which we can pour our waste gases. Then once we have used up the capacity of the atmosphere to absorb our gases without harmful consequences, it becomes impossible to justify our usage of this asset by the claim that we are leaving "enough and as good" for others. The atmosphere's capacity to absorb our gases has become a finite resource on which various parties have competing claims. The problem is to allocate those claims justly.

Are there any other arguments that justify taking something that has, for all of human history, belonged to human beings in common, and turning it into private property? Locke has a further argument, arguably inconsistent with his first argument, defending the continued unequal distribution of property even when there is no longer "enough and as good" for others. Comparing the situation of American Indians, where there is no private ownership of land, and hence the land is not cultivated, with that of England, where some landowners hold vast estates and many laborers have no land at all, Locke claims that "a king of a large and fruitful territory there [i.e., in America] feeds, lodges, and is clad worse than a day labourer in England."¹⁹ Therefore, he suggests, even the landless laborer is better off because of the private, though unequal, appropriation of the common asset, and hence should consent to it. The factual basis of Locke's comparison between English laborers and American Indians is evidently dubious, as is its failure to consider other, more equitable ways of ensuring that the land is used productively. But even if the argument worked for the landless English laborer, we cannot defend the private appropriation of the global sink in the same

way. The landless laborer who no longer has the opportunity to have a share of what was formerly owned in common should not complain, Locke seems to think, because he is better off than he would have been if inegalitarian private property in land had not been recognized. The parallel argument to this in relation to the use of the global sink would be that even the world's poorest people have benefited from the increased productivity that has come from the use of the global sink by the industrialized nations. But the argument does not work, because many of the world's poorest people, whose shares of the atmosphere's capacity have been appropriated by the industrialized nations, are not able to partake in the benefits of this increased productivity in the industrialized nations—they cannot afford to buy its products—and if rising sea levels inundate their farmlands, or cyclones destroy their homes, they will be much worse off than they would otherwise have been.

Apart from John Locke, the thinker most often quoted in justifying the right of the rich to their wealth is probably Adam Smith. Smith argued that the rich did not deprive the poor of their share of the world's wealth, because:

The rich only select from the heap what is most precious and agreeable. They consume little more than the poor, and in spite of their natural selfishness and rapacity, though they mean only their own conveniency, though the sole end which they propose from the labours of all the thousands whom they employ, be the gratification of their own vain and insatiable desires, they divide with the poor the produce of all their improvements.²⁰

How can this be? Because, Smith tells us, it is as if an "invisible hand" brings about a distribution of the necessities of life that is "nearly the same" as it would have been if the world had been divided up equally among all its inhabitants. By that Smith means that in order to obtain what they want, the rich spread their wealth throughout the economy. But while Smith knew that the rich could be selfish and rapacious, he did not imagine that the rich

could, far from consuming "little more" than the poor, consume many times as much of a scarce resource as the poor do.

The average American, by driving a car, eating a diet rich in the products of industrialized farming, keeping cool in summer and warm in winter, and consuming products at a hitherto unknown rate, uses more than 15 times as much of the global atmospheric sink as the average Indian. Thus Americans, along with Australians, Canadians, and to a lesser degree Europeans, effectively deprive those living in poor countries of the opportunity to develop along the lines that the rich ones themselves have taken. If the poor were to behave as the rich now do, global warming would accelerate and almost certainly bring widespread catastrophe.

The putatively historical grounds for justifying private property put forward by its most philosophically significant defenders—writing at a time when capitalism was only beginning its rise to dominance over the world's economy—cannot apply to the current use of the atmosphere. Neither Locke nor Smith provides any justification for the rich having more than their fair share of the finite capacity of the global atmospheric sink. In fact, just the contrary is true. Their arguments imply that this appropriation of a resource once common to all humankind is not justifiable. And since the wealth of the developed nations is inextricably tied to their prodigious use of carbon fuels (a use that began more than 200 years ago and continues unchecked today), it is a small step from here to the conclusion that the present global distribution of wealth is the result of the wrongful expropriation by a small fraction of the world's population of a resource that belongs to all human beings.

For those whose principles of justice focus on historical processes, a wrongful expropriation is grounds for rectification or compensation. What sort of rectification or compensation should take place in this situation?

One advantage of being married to someone whose hair is a different color or length from your own is that when a clump of hair blacks the bath outlet, it's easy to tell whose hair it is. "Get your own hair out of the tub"

is a fair and reasonable household rule. Can we, in the case of the atmosphere, trace back what share of responsibility for the blockage is due to which nations? It isn't as easy as looking at hair color, but a few years ago researchers measured world carbon emissions from 1950 to 1986 and found that the United States, with about 5 percent of the world's population at that time, was responsible for 30 percent of the cumulative emissions, whereas India, with 17 percent of the world's population, was responsible for less than 2 percent of the emissions.²¹ It is as if, in a village of 20 people all using the same bathtub, one person had shed 30 percent of the hair blocking the drainhole and three people had shed virtually no hair at all. (A more accurate model would show that many more than three had shed virtually no hair at all. Indeed, many developing nations have per capita emissions even lower than India's.) In these circumstances, one way of deciding who pays the bill for the plumber to clear out the drain would be to divide it up proportionately to the amount of hair from each person that has built up over the period that people have been using the tub, and has caused the present blockage.

There is a counterargument to the claim that the United States is responsible for more of the problem, per head of population, than any other country. The argument is that because the United States has planted so many trees in recent decades, it has actually soaked up more carbon dioxide than it has emitted.²² But there are many problems with this view. One is that the United States has been able to reforest only because it earlier cut down much of its great forests, thus releasing the carbon into the atmosphere. As this suggests, much depends on the time period over which the calculation is made. If the period includes the era of cutting down the forests, then the United States comes out much worse than if it starts from the time in which the forest had been cut but no reforestation had taken place. A second problem is that forest regrowth, while undoubtedly desirable, is not a long-term solution to the emissions problem but a temporary and one-shot expedient, locking up carbon only while the trees are growing. Once the forest is mature and an

old tree dies and rots for every new tree that grows, the forest no longer soaks up significant amounts of carbon from the atmosphere.²³

At present rates of emissions—even including emissions that come from changes in land use like clearing forests—contributions of the developing nations to the atmospheric stock of greenhouse gases will not equal the built-up contributions of the developed nations until about 2038. If we adjust this calculation for population—in other words, if we ask when the contributions of the developing nations per person will equal the per person contributions of the developed nations to the atmospheric stock of greenhouse gases—the answer is not for at least another century.²⁴

If the developed nations had had, during the past century, per capita emissions at the level of the developing nations, we would not today be facing a problem of climate change caused by human activity, and we would have an ample window of opportunity to do something about emissions before they reached a level sufficient to cause a problem.

So, to put it in terms a child could understand, as far as the atmosphere is concerned, the developed nations broke it. If we believe that people should contribute to fixing something in proportion to their responsibility for breaking it, then the developed nations owe it to the rest of the world to fix the problem with the atmosphere.

Time-slice Principles

The historical view of fairness just outlined puts a heavy burden on the developed nations. In their defense, it might be argued that at the time when the developed nations put most of their cumulative contributions of greenhouse gases into the atmosphere, they could not know of the limits to the capacity of the atmosphere to absorb those gases. It would therefore be fairer, it may be claimed, to make a fresh start now and set standards that look to the future rather than to the past.

There can be circumstances in which we are right to wipe the slate clean and start again. A case can be made for doing so with respect to cumulative emissions that occurred before

governments could reasonably be expected to know that these emissions might harm people in other countries. (Although, even here, one could argue that ignorance is no excuse and a stricter standard of liability should prevail, especially since the developed nations reaped the benefits of their early industrialization.) At least since 1990, however, when the Intergovernmental Panel on Climate Change published its first report, solid evidence about the hazards associated with emissions has existed.²⁵ To wipe the slate clean on what happened since 1990 seems unduly favorable to the industrialized nations that have, despite that evidence, continued to emit a disproportionate share of greenhouse gases. Nevertheless, in order to see whether there are widely held principles of justice that do not impose such stringent requirements on the developed nations as the “polluter pays” principle, let us assume that the poor nations generously overlook the past. We would then need to look for a time-slice principle to decide how much each nation should be allowed to emit.

An Equal Share for Everyone

If we begin by asking, “Why should anyone have a greater claim to part of the global atmospheric sink than any other?” then the first and simplest response is “No reason at all.” In other words, everyone has the same claim to part of the atmospheric sink as everyone else. This kind of equality seems self-evidently fair, at least as a starting point for discussion, and perhaps, if no good reasons can be found for moving from it, as an end point as well.

If we take this view, then we need to ask how much carbon each country would be allowed to emit and compare that with what they are now emitting. The first question is what total level of carbon emissions is acceptable. The Kyoto Protocol aimed to achieve a level for developed nations that was 5 percent below 1990 levels. Suppose that we focus on emissions for the entire planet and aim just to stabilize carbon emissions at their present levels. Then the allocation per person conveniently works out at about one metric ton per year. This therefore becomes the base

equitable entitlement for every human being on this planet.

Now compare actual per capita emissions for some key nations. The United States currently produces more than five metric tons of carbon per person per year. Japan, Australia, and western European nations have per capita emissions that range from around 1.6 to 4.2 metric tons, with most below 3.0. In the developing world, emissions average 0.6 metric tons per capita, with China at 0.76 and India at 0.29.²⁶ This means that to reach an "even-handed" per capita annual emissions limit of one metric ton of carbon per person, India would be able to increase its carbon emissions to more than three times what they now are. China would be able to increase its emissions by a more modest 33 percent. The United States, on the other hand, would have to reduce its emissions to no more than one-fifth of present levels.

One objection to this approach is that allowing countries to have allocations based on the number of people they have gives them insufficient incentive to do anything about population growth. But if the global population increases, the per capita amount of carbon that each country is allocated will diminish, for the aim is to keep total carbon emissions below a given level. Therefore a nation that increases its population would be imposing additional burdens on other nations. Even nations with zero population growth would have to decrease their carbon outputs to meet the new, reduced per capita allocation.

By setting national allocations that are tied to a specified population, rather than allowing national allocations to rise with an increase in national population, we can meet this objection. We could fix the national allocation on the country's population in a given year, say 1990, or the year that the agreement comes into force. But since different countries have different proportions of young people about to reach reproductive age, this provision might produce greater hardship in those countries that have younger populations than in those that have older populations. To overcome this, the per capita allocation could be based on an estimate of a country's likely population at some given future date. For

example, estimated population sizes for the next 50 years, which are already compiled by the United Nations, might be used.²⁷ Countries would then receive a reward in terms of an increased emissions quota per citizen if they achieved a lower population than had been expected, and a penalty in terms of a reduced emissions quota per citizen if they exceeded the population forecast—and there would be no impact on other countries.

Aiding the Worst-off

Giving everyone an equal share of a common resource like the capacity of the atmosphere to absorb our emissions is, I have argued, a fair starting point, a position that should prevail unless there are good reasons for moving from it. Are there such reasons? Some of the best-known accounts of fairness take the view that we should seek to improve the prospects of those who are worst off. Some hold that we should assist the worst-off only if their poverty is due to circumstances for which they are not responsible, like the family, or country, into which they were born or the abilities they have inherited. Others think we should help the worst-off irrespective of how they have come to be so badly off. Among the various accounts that pay special attention to the situation of the worst-off, by far the most widely discussed is that of John Rawls. Rawls holds that when we distribute goods, we can only justify giving more to those who are already well off if this will improve the position of those who are worst off. Otherwise, we should give only to those who are, in terms of resources, at the lowest level.²⁸ This approach allows us to depart from equality, but only when doing so helps the worst-off.

Whereas the strict egalitarian is vulnerable to the objection that equality can be achieved by "leveling down", that is, by bringing the rich down to the level of the poor without improving the position of the poor, Rawls's account is immune to this objection. For example, if allowing some entrepreneurs to become very rich will provide them with incentives to work hard and set up industries that provide employment for the worst-off, and there is no other way to

provide that employment, then that inequality would be permissible.

That there are today very great differences in wealth and income among people living in different countries is glaringly obvious. It is equally evident that these differences depend largely on the fact that people are born into different circumstances, rather than because they have failed to take advantage of opportunities open to them. Hence if we were to follow Rawls's principle, in distributing the atmosphere's capacity to absorb our waste gases safely, we could only accept a distribution that improves the situation of those who, through no fault of their own, are at the bottom of the heap. We would have to reject any distribution that reduced the living standard in poor countries, at least as long as the rich countries are clearly better off than the poor countries.²⁹ To put this more concretely, if, to meet the limits set for the United States, taxes or other disincentives are used that go no further than providing incentives for Americans to drive more fuel-efficient cars, it would not be right to set limits on China that prevent the Chinese from driving cars at all.

In accordance with Rawls's principle, the only grounds on which one could argue against rich nations bearing *all* the costs of reducing emissions would be that to do so would make the poor nations even worse off than they would have been if the rich nations were not bearing all the costs. It is possible to interpret President Bush's announcement of his administration's policy on climate change as an attempt to make this case. Bush said that his administration was adopting a "greenhouse-gas intensity approach" which seeks to reduce the amount of greenhouse gases the United States emits per unit of economic activity. Although the target figure he mentioned—an 18 percent reduction over 10 years—sounds large, if the U.S. economy continues to grow as it has in the past, such a reduction in greenhouse-gas intensity will not prevent an *increase* in the total quantity of greenhouse gases that the United States emits. But Bush justified this by saying "economic growth is the solution, not the problem" and "the United States wants to foster economic growth in the developing world, including the world's poorest nations."³⁰

Allowing nations to emit in proportion to their economic activity—in effect, in proportion to their gross domestic product—can be seen as encouraging efficiency, in the sense of leading to the lowest possible level of emissions for the amount produced. But it is also compatible with the United States continuing to emit more emissions, because it is producing more goods. That will mean that other nations must emit less, if catastrophic climate change is to be averted. Hence for Bush's "economic growth is the solution, not the problem" defense of a growth in U.S. emissions to succeed as a Rawlsian defense of continued inequality in per capita emissions, it would be necessary to show that United States production not only makes the world as a whole better off but also makes the poorest nations better off than they would otherwise be.

The major ethical flaw in this argument is that the primary beneficiaries of U.S. production are the residents of the United States itself. The vast majority of the goods and services that the United States produces—89 percent of them—are consumed in the United States.³¹ Even if we focus on the relatively small fraction of goods produced in the United States that are sold abroad, U.S. residents benefit from the employment that is created, and, of course, U.S. producers receive payment for the goods they sell abroad. Many residents of other countries, especially the poorest countries, cannot afford to buy goods produced in the United States, and it isn't clear that they benefit from U.S. production.

The factual basis of the argument is also flawed: the United States does not produce more efficiently, in terms of greenhouse gas emissions, than other nations. Figures published by the U.S. Central Intelligence Agency show that the United States is well above average in the amount of emissions per head it produces in proportion to its per capita GDP (see figure 10.1). On this basis the United States, Australia, Canada, Saudi Arabia, and Russia are relatively inefficient producers, whereas developing countries like India and China join European nations like Spain, France, and Switzerland in producing a given value of goods per head for a lower-than-average per capita level of emissions.³²

Because the efficiency argument fails, we must conclude that a principle that requires

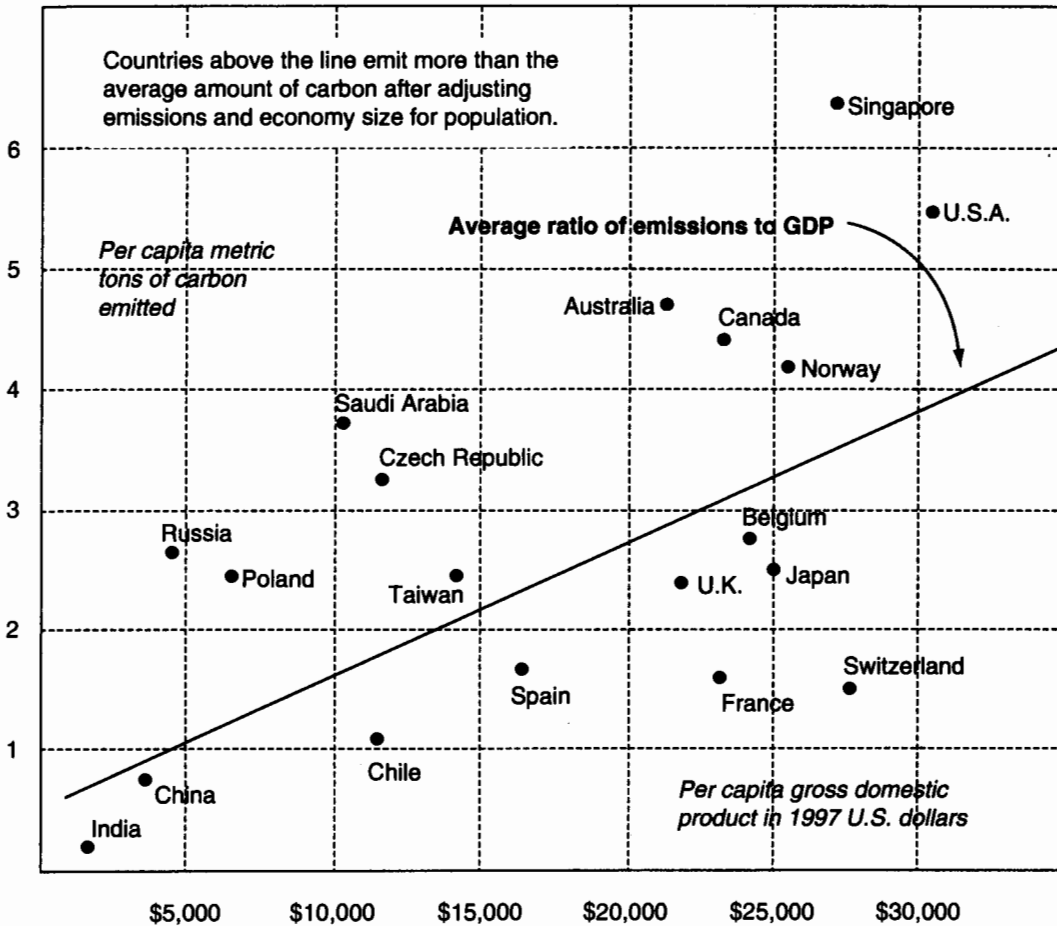


Figure 10.1. Emissions and gross domestic product.
Sources: CIA: Carbon Dioxide Information Analysis Center.

us to distribute resources so as to improve the level of the worst-off would still, given the huge resource gap between rich and poor nations, make the rich nations bear all of the costs of the required changes.

The Greatest Happiness Principle

Classical utilitarians would not support any of the principles of fairness discussed so far. They would ask what proposal would lead to the greatest net happiness for all affected—net happiness being what you have left when you deduct the suffering caused from the happiness brought about. An advocate of preference utilitarianism (a more contemporary version of utilitarianism) would instead ask what proposal would lead to the greatest net satisfaction of preferences for all concerned. But in this context, the difference between the two forms of

utilitarianism is not very significant. What is much more of a problem for either of these views is to indicate how one might do such a calculation. Evidently, there are good utilitarian reasons for capping the emissions of greenhouse gases, but what way of doing it will lead to the greatest net benefits?

Perhaps it is because of the difficulty of answering such broad questions about utility that we have other principles, like the ones we have been discussing. They give you easier answers and are more likely to lead to an outcome that approximates the best consequences (or is at least as likely to do so as any calculation we could make without using those principles). The principles discussed above can be justified in utilitarian terms, although each for somewhat different reasons. To go through them in turn:

1. The principles that “the polluter pays,” or more generally “you broke it, you fix it,”

provides a strong incentive to be careful about causing pollution, or breaking things. So if it is upheld as a general rule, there will be less pollution, and people will be more careful in situations where they might break something, all of which will be to the general benefit.

2. The egalitarian principle will not, in general, be what utilitarians with perfect knowledge of all the consequences of their actions would choose. Where there is no other clear criterion for allocating shares, however, it can be an ideal compromise that leads to a peaceful solution, rather than to continued fighting. Arguably, that is the best basis for defending "one person, one vote" as a rule of democracy against claims that those who have more education, or who pay more taxes, or who have served in the military, or who believe in the one true God, or who are worse off should have additional votes because of their particular attributes.³³

3. In practice, utilitarians can often support the principle of distributing resources to those who are worst off, because when you already have a lot, giving you more does not increase your utility as much as when you have only a little. One of the 1.2 billion people in the world living on \$1 per day will get much more utility out of an additional \$100 than will someone living on \$60,000 per year. Similarly, if we have to take \$100 from someone, we will cause much less suffering if we take it from the person earning \$60,000 than if we take it from the person earning \$365 a year. This is known as "diminishing marginal utility." When compared with giving resources to meet someone's core needs, giving further resources "at the margin" to someone else whose core needs have already been satisfied will lead to diminished utility. Hence a utilitarian will generally favor the worst-off when it comes to distributing resources. In contrast to Rawls, however, a utilitarian does not consider this principle to be absolute. The utilitarian always seeks the greatest overall benefit, and it is only a broad rule of thumb that this will generally be obtained by adding to the stock of resources of those who have the least.

The utilitarian would also have to take into account the greater hardship that might be imposed on people living in countries that have difficulty in complying with strict emission standards because their geography or climate

compels their citizens to use a greater amount of energy to achieve a given level of comfort than do people living elsewhere. Canadians, for example, could argue that it would simply not be possible to live in many parts of their country without using above average quantities of energy to keep warm. Residents of rich countries might even advance the bolder claim that, since their affluent residents have become used to traveling by car, and keeping their houses cool in warm, humid weather, they would suffer more if they have to give up their energy-intensive lifestyle than poorer people will suffer if they never get the chance to experience such comforts.

The utilitarian cannot refuse to consider such claims of hardship, even when they come from those who are already far better off than most of the world's people. As we shall see, however, these claims can be taken into account in a way that is compatible with the general conclusion to which the utilitarian view would otherwise lead: that the United States, Australia, and other rich nations should bear much more of the burden of reducing greenhouse-gas emissions than the poor nations—perhaps even the entire burden.

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Fairness: A Proposal

Each of the four principles of fairness I have considered could be defended as the best one to take, or we could take some in combination. I propose—both because of its simplicity, hence its suitability as a political compromise, and because it seems likely to increase global welfare—that we support the second principle, that of equal per capita future entitlements to a share of the capacity of the atmospheric sink, tied to the current United Nations projection of population growth per country in 2050.

Some will say that this is excessively harsh on industrialized nations like the United States, which will have to cut back the most on their output of greenhouse gases. But we have now seen that the equal per capita shares principle is much more indulgent to the United States, Australia, and other developed nations than

other principles for which there are strong arguments. If, for example, we combined the "polluter pays" principle with the equal-share principle, we would hold that until the excessive amounts of greenhouse gases in the atmosphere that the industrialized nations have put there have been soaked up, the emissions of industrialized nations ought to be held down to much *less* than a per capita equal share. As things stand now, even on an equal per capita share basis, for at least a century the developing nations are going to have to accept lower outputs of greenhouse gases than they would have had to if the industrialized nations had kept to an equal per capita share in the past. So by saying, "Forget about the past, let's start anew", the pure equal per capita share principle is a lot more favorable to the developed countries than a historically based principle would be.

The fact that 178 nations, including every major industrial nation in the world except the United States, have now indicated their intention to ratify the Kyoto Protocol makes the position of the United States particularly odious from an ethical perspective. Australia's position is certainly no better, for even though its total greenhouse-gas output is relatively minor, it is very high when calculated on a per capita basis—according to an Australian government report, among the highest in the world.³⁴ Thus Australia produces roughly the same quantity of greenhouse gases as Italy, although Italy's population is three times as large as Australia's. Moreover, Australia was offered a particularly generous deal, allowing it to increase its greenhouse-gas emissions by 8 percent over 1990 levels when other nations, on average, had to make a 5 percent cut. On top of that, further concessions granted at the Bonn meeting made it easier for Australia to meet its targets, by allowing countries to take into account carbon absorbed by increased forest plantations.

The claim that the Protocol does not require the developing nations to do their share does not stand up to scrutiny. Americans and Australians who think that even the Kyoto Protocol requires their nation to sacrifice more than it should are really demanding that the poor nations of the world commit themselves to a level that gives them, in perpetuity, lower levels of greenhouse-

gas production per head of population than the rich nations have. How could that principle be justified? Alternatively, if that is not what the U.S. and Australian governments are proposing, what exactly are they proposing?

It is true that there are some circumstances in which we are justified in refusing to contribute if others are not doing their share. If we eat communally and take turns cooking, then I can justifiably feel resentment if there are some who eat but never cook or carry out equivalent tasks for the good of the entire group. But that is not the situation with climate change, in which the behavior of the industrialized nations has been more like that of a person who has left the kitchen tap running but refuses either to turn it off or to mop up the resulting flood, until you—who spilt an insignificant half-glass of water onto the floor—promise not to spill any more. Now the other industrialized nations have agreed to turn off the tap (to be strictly accurate, to restrict the flow), leaving the United States (the biggest culprit) and Australia together in their refusal to commit to reducing emissions.

Although it is true that the Kyoto Protocol does not initially bind the developing nations, it is generally understood that the developing countries will be brought into the binding section of the agreement after the industrialized nations have begun to move toward their targets. That was the procedure with the successful Montreal Protocol concerning gases that damage the ozone layer, and there is no reason to believe that it will not also happen with the Kyoto Protocol. China, by far the largest greenhouse-gas emitter of the developing nations and the only one with the potential to rival the total—not, of course, per capita—emissions of the United States in the foreseeable future, has already, even in the absence of any binding targets, achieved a substantial decline in fossil-fuel carbon dioxide emissions, thanks to improved efficiency in coal use. Emissions fell from a high of 909 million metric tons of carbon in 1996 to 848 million metric tons in 1998. Meanwhile, U.S. emissions reached an all-time high of 1,906 million metric tons of carbon in 2000, an increase of 2.5 percent over the previous year.³⁵

The real objection to allocating the atmosphere's capacity to absorb greenhouse gases to nations on the basis of equal per capita shares

is that it would be tremendously dislocating for the industrialized nations to reduce their emissions so much that within five, ten or fifteen years they were not producing more than their share, on a per capita basis, of some acceptable level of greenhouse gases. But fortunately there is a mechanism that, while fully compatible with the equal per capita share principle, can make this transition much easier for the industrialized nations, while at the same time producing great benefits for the developing nations. That mechanism is emissions trading.

Emissions trading works on the same simple economic principle of trade in general: if you can buy something from someone else more cheaply than you can produce it yourself, you are better off buying it than making it. In this case, what you can buy will be a transferable quota to produce greenhouse gases, allocated on the basis of an equal per capita share. A country like the United States that is already producing more gases than its share will need its full quota and then some, but a country like Russia that is below its share will have excess quota that it can sell. If the quota were not transferable, the United States would immediately have to reduce its output to about 20 percent of what it now produces, a political impossibility. In contrast, Russia would have no incentive to maintain its levels of greenhouse-gas emissions well below its allowable share. With emissions trading, Russia has an incentive to maximize the amount of quota it can sell, and the United States has, at some cost, an opportunity to acquire the quotas it needs to avoid total disruption of the economy.³⁶

Although some may think that emissions trading allows the United States to avoid its burdens too easily, the point is not to punish nations with high emissions but to produce the best outcome for the atmosphere. Permitting emissions trading gives us a better hope of doing this than prohibiting emissions trading does. The Kyoto Protocol as agreed to in Bonn and Marrakesh allows emissions trading between states that have binding quotas. Thus Russia will have quota to sell, but countries such as India, Bangladesh, Mozambique, Ethiopia, and many others will not. Emissions trading would be much more effective, and have far better consequences, if all nations were given binding

quotas based on their per capita share of the designated total emissions. As we saw earlier, even the environmental skeptic Bjørn Lomborg accepts that with global emissions trading, the Kyoto Protocol produces a net economic benefit. Moreover, global emissions trading would give the world's poorest nations something that the rich nations very much want. They would have, at last, something that they can trade in exchange for the resources that will help them to meet their needs. This would be, on most principles of justice or utility, a very good thing indeed. It could also end the argument about making the developing nations part of a binding agreement on emissions, because the developing nations would see that they have a great deal to gain from binding quotas.

Since global emissions trading is both possible and desirable, it also answers two objections to allocating greenhouse-gas emissions quotas on the basis of equal per capita shares. First, it answers the objection raised when discussing a utilitarian approach to these problems—that countries like Canada might suffer undue hardship if forced to limit emissions to the same per capita amount as, say, Mexico, because Canadians need to use more energy to survive their winters. But global emissions trading means that Canada would be able to buy the quota it requires from other countries that do not need their full quota. Thus the market would provide a measure of the additional burden put on the world's atmosphere by keeping one's house at a pleasant temperature when it is too cold, or too hot, outside. Citizens of rich countries could choose to pay that price and keep themselves warm, or cool, as the case may be. They would not, however, be claiming a benefit for themselves that they were not prepared to allow poor countries to have, because the poor countries would benefit by having emissions quotas to sell. The claim of undue hardship therefore does not justify allowing rich countries to have a higher per capita emissions quota than poor countries.

Second, global emissions trading answers the objection that equal per capita shares would lead to inefficient production because countries with little industrialization would be able to continue to manufacture goods even

though they emit more greenhouse gases per unit of economic activity than highly industrialized nations, while the highly industrialized nations would have to cut back on their manufacturing capacity, even though they produce less emissions per unit of economic activity. But as we have seen, the present laissez-faire system allows emitters to reap economic benefits for themselves, while imposing costs on third parties that may or may not share in the benefits of the polluters' high productivity. That is neither a fair nor an efficient outcome. A well-regulated system of per capita entitlements combined with global emissions trading would, by internalizing the true costs of production, lead to a solution that is both fair and efficient.

There are two serious objections, one scientific and one ethical, to global emissions trading. The scientific objection is that we do not have the means to measure emissions accurately for all countries. Hence it would not be possible to know how much quota these countries have to sell or need to buy. This is something that needs more research, but it should not prove an insuperable obstacle in the long run. As long as estimates are fair, they do not need to be accurate to the last metric ton of carbon. The ethical objection is that while emissions trading would benefit poor countries if the governments of those countries used it for the benefit of their people, some countries are run by corrupt dictators more interested in increasing their military spending or adding to their Swiss bank accounts. Emissions trading would simply give them a new way of raising money for these purposes.

My proposed solution to the ethical objection is to refuse to recognize a corrupt dictatorial regime, interested only in self-preservation and self-enrichment, as the legitimate government of the country that has excess quota to sell. In the absence of any legitimate government that can receive payments for quota, the sale of quota could be managed by an international authority answerable to the United Nations. That authority could hold the money it receives in trust until the country has a government able to make a credible claim that the money will be used to benefit the people as a whole.

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Down from the Clouds?

To cynical observers of the Washington scene, all this must seem absurdly lacking in political realism. George W. Bush's administration spurned the Kyoto Protocol, which allows the United States to continue to produce at least four times its per capita share of carbon dioxide. Since 1990, U.S. emission levels have already risen by 14 percent. The halfhearted measures for energy conservation proposed by the Bush administration will, at best, slow that trend. They will not reverse it. So what is the point of discussing proposals that are far *less* likely to be accepted by the U.S. government than the Kyoto Protocol?

The aim of this chapter is to help us to see that there is no *ethical* basis for the present distribution of the atmosphere's capacity to absorb greenhouse gases without drastic climate change. If the industrialized countries choose to retain this distribution (as the United States does), or to use it as the starting point for a new allocation of the capacity of the global sink (as the countries that accept the Kyoto Protocol do), they are standing simply on their presumed rights as sovereign nations. That claim, and the raw military power these nations wield, makes it impossible for anyone else to impose on them a more ethically defensible solution. If we, as citizens of the industrialized nations, do not understand what would be a fair solution to global warming, then we cannot understand how flagrantly self-serving the position of those opposed to signing even the Kyoto Protocol is. If, on the other hand, we can convey to our fellow citizens a sense of what would be a fair solution to the problem, then it may be possible to change the policies that are now leading the United States to block international cooperation on something that will have an impact on every being on this planet.

Let us consider the implications of this situation a little further. Today the overwhelming majority of nations in the world are united in the view that greenhouse-gas emissions should be significantly reduced, and only the United States and Australia, of all the industrialized nations, have said that they are not prepared to

commit themselves to a binding treaty that will achieve this goal.

Such a situation gives impetus to the need to think about developing institutions or principles of international law that limit national sovereignty. It should be possible for people whose lands are flooded by sea-level rises due to global warming to win damages from nations that emit more than their fair share of greenhouse gases. Another possibility worth considering is sanctions. There have been several occasions on which the United Nations has used sanctions against countries that have been seen as doing something gravely wrong. Arguably, the case for sanctions against a nation that is causing harm, often fatal, to the citizens of other countries is even stronger than the case for sanctions against a country like South Africa under apartheid, since that government, iniquitous as its policies were, was not a threat to other countries. Is it inconceivable that one day a reformed and strengthened United Nations will invoke sanctions against countries that do not play their part in global measures for the protection of the environment?

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Notes

1. "This Year Was the 2nd Hottest, Confirming a Trend, UN Says," *New York Times*, December 19, 2001, p. A5.
2. J. T. Houghton et al., eds., *Climate Change 2001: The Scientific Basis: Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate*, United Nations Environment Program and Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, U.K., 2001, Summary for Policymakers. Available at www.ipcc.ch/pub/tar/wgi/index.htm. See also *Reconciling Observations of Global Temperature Change*, Panel on Reconciling Temperature Observations, National Research Council, National Academy of Sciences, Washington, D.C., 2000. Available at www.nap.edu/books/0309068916/html. For another example of recent research indicating that anthropogenic climate change is real, see Thomas J. Crowley, "Causes of Climate Change over the Past 1000 Years," *Science*, July 14, 2000, pp. 270–277.
3. Houghton et al., *Climate Change 2001*.
4. Munich Reinsurance, one of the world's largest insurance companies, has estimated that the number of major natural disasters has risen from 10 in the 1960s to 70 in the 1990s. Cited by Christian Aid, Global Advocacy Team Policy Position Paper, *Global Warming, Unnatural Disasters and the World's Poor*, November 2000. Available at www.christianaid.org.uk/indepth/ooiiglob/globwarm.htm.
5. James McCarthy et al., eds., *Climate Change 2001: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change*, United Nations Environment Program and Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, U.K., 2001, chap. 9.7. Available at www.ipcc.ch/pub/tar/wg2/index.htm.
6. Houghton et al., *Climate Change 2001*.
7. See Dale Jamieson, "Ethics, Public Policy and Global Warming," *Science, Technology, and Human Values* 17.2 (Spring 1992): 139–153, and "Global Responsibilities: Ethics, Public Health, and Global Environmental Change," *Indiana Journal of Global Legal Studies* 5.1 (Fall 1997): 99–119.
8. "Norway Wants Sanctions for Cross Border Polluters," Reuters News Service, February 1, 2002. Available at www.planetark.org/dailynewsstory.cfm?newsid/14316/story.htm.
9. *United Nations Framework Convention on Climate Change*, Article 4, section 2, subsections (a) and (b). Available at www.unfccc.int/resource/conv/conv.html. *Guide to the Climate Change Negotiation Process*. Available at www.unfccc.int/resource/process/components/response/responconv.html.
10. "U.S. Carbon Emissions Jump in 2000," *Los Angeles Times*, November 11, 2001, p. A36, citing figures released by the U.S. Department of Energy's Energy Information Administration on November 9, 2001.
11. Eileen Claussen and Lisa McNeilly, *The Complex Elements of Global Fairness*, Pew Center on Global Climate Change, Washington, D.C., October 29, 1998. Available at www.pewclimate.org/projects/pol_equity.cfm.
12. Bjørn Lomborg, "The Truth about the Environment," *Economist*, August 2, 2001. Available at www.economist.com/science/displayStory.cfm?Story_ID=718860&CFID=3046335&CFTOKEN=88404876.
13. For details of the very modest amounts of aid given by the rich nations to the world's poorest people, see Peter Singer, *The Life You Can Save* (Random House, New York, 2009), chaps. 3 and 7.

14. Bjorn Lomborg, *The Skeptical Environmentalist*, (Cambridge, U.K.: Cambridge University Press, 2001), p. 323.
15. See Richard Newell and William Pizer, *Discounting the Benefits of Future Climate Change Mitigation: How Much Do Uncertain Rates Increase Valuations?* Pew Center on Global Climate Change, Washington, D.C., December 2001. Available at www.pewclimate.org/projects/econ_discounting.cfm.
16. Robert Nozick, *Anarchy, State and Utopia* (New York: Basic Books, 1974), p. 153.
17. John Locke, *Second Treatise on Civil Government*, ed. C. B. Macpherson, (Indianapolis: Hackett, 1980), sec. 27, p. 19.
18. See Garrett Hardin, "The Tragedy of the Commons," *Science* 162 (1968): 1243–1248.
19. Locke, *Second Treatise*, sec. 41.
20. Adam Smith, *A Theory of the Moral Sentiments* (Amherst, N.Y.: Prometheus, 2000), IV, i. p. 10.
21. Peter Hayes and Kirk Smith, eds., *The Global Greenhouse Regime: Who Pays?* (London: Earthscan, 1993), chap. 2, table 2.4. Available at www.unu.edu/unupress/unupbooks/80836e/80836E08.htm.
22. See S. Fan, M. Gloor, J. Mahlman, S. Pacala, J. Sarmiento, T. Takahashi, and P. Tans, "A Large Terrestrial Carbon Sink in North America Implied by Atmospheric and Oceanic Carbon Dioxide Data and Models," *Science* 282 (October 16, 1998): 442–446.
23. William Schlesinger and John Lichter, "Limited Carbon Storage in Soil and Litter of Experimental Forest Plots under Increased Atmospheric CO₂," *Nature* 411 (May 24, 2001): pp. 466–469.
24. Duncan Austin, José Goldemberg, and Gwen Parker, "Contributions to Climate Change: Are Conventional Metrics Misleading the Debate?" World Resource Institute Climate Protection Initiative, Climate Notes. Available at www.igc.org/wri/cpi/notes/metrics.html.
25. The Intergovernmental Panel on Climate Change *First Assessment Report* was published in three volumes. See especially J. T. Houghton, G. J. Jenkins, and J. J. Ephraums, eds., *Scientific Assessment of Climate Change—Report of Working Group I* (Cambridge, U.K.: Cambridge University Press, 1990). For details of the other volumes, see www.ipcc.ch/pub/reports.htm.
26. See G. Marland, T. A. Boden, and R. J. Andres, *Global, Regional, and National Fossil Fuel CO₂ Emissions*, Carbon Dioxide Information Analysis Center, Oak Ridge, Tennessee. Available at cdiac.esd.ornl.gov/trends/emis/top96.cap. These are 1996 figures.
27. Paul Baer et al., "Equity and Greenhouse Gas Responsibility," *Science* 289 (September 29, 2000): p. 2287; Dale Jamieson, "Climate Change and Global Environmental Justice," in P. Edwards and C. Miller, eds., *Changing the Atmosphere: Expert Knowledge and Global Environmental Governance*, (Cambridge, Mass.: MIT Press, 2001), pp. 287–307.
28. See John Rawls, *A Theory of Justice*, especially pp. 65–83. For a different way of giving priority to the worst-off, see Derek Parfit, "Equality or Priority?" Lindley Lecture, University of Kansas, November 21, 1991, reprinted in Matthew Clayton and Andrew Williams, eds., *The Ideal of Equality*, (London: Macmillan, 2000).
29. This is Rawls's "difference principle," applied without the restriction to national boundaries that are difficult to defend in terms of his own argument.
30. "President Announces Clear Skies and Global Climate Change Initiative," Office of the Press Secretary, White House, February 14, 2002. Available at www.whitehouse.gov/news/releases/2002/02/20020214-5.html. For amplification of the basis of the administration's policy, see Executive Office of the President, Council of Economic Advisers, *2002 Economic Report of the President*, (Washington, D.C.: U.S. Government Printing Office, 2002), chap. 6, pp. 244–249, available at <http://w3.access.gpo.gov/eop/>.
31. National Council on Economic Education, "A Case Study: United States International Trade in Goods and Services—May 2001." Available at www.econedlink.org/lessons/index.cfm?lesson=EM196.
32. Andrew Revkin, "Sliced Another Way: Per Capita Emissions," *New York Times*, June 17, 2001, section 4, p. 5.
33. For discussion of equal votes as a compromise, see my *Democracy and Disobedience*, (Oxford, Clarendon Press, 1973), pp. 30–41.
34. Ross Garnaut, *The Garnaut Climate Change Review*, Commonwealth of Australia, Canberra, 2008, chap. 7, sec. 1. Available at <http://www.garnautreview.org.au/chp7.htm>.
35. Energy Information Administration, *Emissions of Greenhouse Gases in the United States 2000*, DOE/EIA-0573 (2000), U.S. Department of Energy, Washington, D.C., November 2001, page vii. Available at www.eia.doe.gov/pub/oiaf/1605/cdrom/pdf/ggrpt/057300.pdf.
36. See Jae Edmonds et al., *International Emissions Trading and Global Climate Change: Impacts on the Cost of Greenhouse Gas Mitigation*. Report prepared for the Pew Center on Global Climate Change, December 1999. Available at www.pewclimate.org/projects/econ_emissions.cfm.