CHAPTER 1

Environmental Problems and Society

Without self-understanding we cannot hope for enduring solutions to environmental problems, which are fundamentally human problems.

—Yi-Fu Tuan, 1974

"Pass the hominy, please."

It was a lovely brunch, with fruit salad, homemade coffee cake, a great pan of scrambled eggs, bread, butter, jam, coffee, tea—and hominy grits. Our friends Dan and Sarah had invited my wife and me and our son over that morning to meet some friends of theirs. The grown-ups sat around the dining room table, and the kids (four in all) careened from their own table in the kitchen to the pile of toys in the living room, and often into each other. Each family had contributed something to the feast before us. It was all good food, but for some reason the hominy grits (which I had never had before) was the most popular.

There was a pleasant mix of personalities, and the adults soon got into one of those excited chats that leads in an irreproducible way from one topic to another, as unfamiliar people seek to get to know each other a bit better. Eventually, the inevitable question came my way: "So, what do you do?"

"I'm an environmental sociologist."

"Environmental sociology. That's interesting. I've never heard of it. What does sociology have to do with the environment?"

I used to think, during earlier editions, that the point of this book was to answer that question—a question I often used to get, as in this breakfast conversation from many years ago. (My children, like this book, are much older now.) Today, I sense a change in general attitudes. Now I don't get so many blank looks when I say I'm an environmental sociologist. Most people I meet have still never heard of the field, but more and more of them immediately get the basic idea behind it: that society and environment are interrelated.

And more and more, the people I meet recognize that this interrelation has to confront some significant problems, perhaps the most fundamental problems facing the future of life, human and otherwise. They readily understand that environmental problems are not only problems of technology and industry, of ecology and biology, of pollution control and pollution prevention. Environmental problems are also social problems. Environmental problems are problems *for* society—problems that threaten our existing patterns of social organization and social thought. Environmental problems are as well problems *of* society—problems that challenge us to change those patterns of organization and thought. Increasingly, we appreciate that it is people who create environmental problems and it is people who must resolve them.

That recognition is good news. But we've sure got a lot to do, and in this work we'll need the insights of all the disciplines—the biophysical sciences, the social sciences, and the humanities. There is an environmental dimension to all knowledge. The way I now understand the point of this book is to bring the sociological imagination to this necessarily pan-disciplinary conversation.

A good place to begin, I think, is to offer a definition of *environmental sociology.* Here goes: *Environmental sociology is the study of community in the largest possible sense.* People, other animals, land, water, air—all of these are closely interconnected. Together they form a kind of solidarity, what we have come to call ecology. As in any community, there are also conflicts in the midst of the interconnections. Environmental sociology studies this largest of communities with an eye to understanding the origins of, and proposing solutions to, these all-too-real social and biophysical conflicts.

But who are environmental sociologists? My view of who is a large community in itself—a large community of scholars from many social science disciplines that share this passion for studying community in the largest possible sense. Some might call themselves "environmental geographers" or "environmental anthropologists" or "environmental economists" or "environmental psychologists." Or they might prefer to think of themselves as "political ecologists" or "social ecologists" or "human ecologists" or "ecological economists." What is important is the passion, not the disciplinary label. Increasingly, academic conferences focus on an issue like global warming or sustainable consumption or sustainable agriculture or environmental justice, not on a specific discipline's take on it. The research papers that come out of these conferences similarly cite scholars from across this wide spectrum. We all have our starting points, of course, our distinctive angles of vision to bring to the conversation, which is great. That is how, and why, one learns from others. But it is the goals that matter, not the starting points. In this book, I discuss contributions from scholars with all these many different departments on their business cards. It is all environmental sociology.

One of environmental sociology's most basic contributions to studying the conflicts behind environmental problems is to point out the pivotal role of social inequality. Not only are the effects of environmental problems distributed unequally across the human community, but social inequality is deeply involved in causing those problems. Social inequality is both a product and a producer of global warming, pollution, overconsumption, resource depletion, habitat loss, risky technology, and rapid population growth. As well, social inequality influences how we envision what our environmental problems are. And most fundamentally, it can influence how we envision nature itself, for inequality shapes our social experiences, and our social experiences shape all our knowledge.

Which returns us to the question of community. Social inequality cannot be understood apart from the communities in which it takes place. We need, then, to make the study of community the central task of environmental sociology. Ecology is often described as the study of natural communities. Sociology is often described as the study of human communities. Environmental sociology is the study of both together, the single commons of the Earth we humans share, sometimes grudgingly, with others—other people, other forms of life, and the rocks and water and soil and air that support all life. Environmental sociology is the study of this, the biggest community of all.

Joining the Dialogue

The biggest community of all: Then clearly, the topic of environmental sociology is vast. Not even a book the length of this one can cover all of it, at least not in any detail. In the pages to come, I will take up the main conversations about the state of relations within this vast community. I won't take up all the side conversations, but I will invite the reader into a good many of them, in order to trace how the larger debates play out in particular neighborhoods of discussion and investigation. Continually, though, the book will return to the front pages of debate, the better to bring the local and the global, the particular and the general, into better communication.

For the most part, this first chapter considers the front pages—of environmental sociology; of the environmental predicament; and, in this section, quite literally of the book itself. (These are the front pages of the book, after all.) After this introduction, the book falls into three parts:

The Material: How consumption, the economy, technology, development, population, and the health of our bodies shape our environmental conditions

The Ideal: How culture, ideology, moral values, risk, and social experience influence the way we think about and act toward the environment

The Practical: How we can bring about a more ecological society, taking the relations of the material and the ideal into account

Of course, it is not possible to fully separate these three topics. The deep union of the material, the ideal, and the practical is one of the most important truths that environmental sociology has to offer. The parts of the book represent only a sequence of emphases, not rigid conceptual boundaries. A number of themes running throughout the book help unite the parts:

- The dialogic, or interactive and unfinished, character of causality in environmental sociology
- The interplay of material and ideal factors with each other, constituting the practical conditions of lived experience
- The central role of social inequality in environmental conflict
- The connections between the local and the global
- The power of the metaphor of community for understanding these social and ecological dynamics
- The important influence of political institutions and commitments on our environmental practices

The Ecology of Dialogue

By approaching environmental sociology in this way, I hope to bridge a long-standing dispute among scholars about the relationship between environment and society. *Realists* argue that environmental problems cannot be understood apart from the threats posed by the way we have organized our societies, including the organization of ecologic relations. They believe that we can ill afford to ignore the material truth of organizational problems and their ecologic consequences. *Constructionists* do not necessarily disagree, but they emphasize the influence of social life on how we conceptualize those problems, or the lack of those problems. Constructionists focus on the ideological origins of environmental problems—including their very definition *as* problems (or as nonproblems). A realist might say, for example, that global warming is a dangerous consequence of how we currently organize the economic side of social life. A constructionist might say that in order to recognize the danger—or even the existence—of global warming, we must wear the appropriate conceptual and ideological eyeglasses. Although the debate sometimes gets quite abstract, it has important consequences. Realists argue that the practical thing to do is to solve the social organizational issues behind environmental problems, like the way land use laws and current technologies encourage the overuse of cars. Constructionists argue that the first step must be to understand our environmental ideologies, with all their insights and oversights, lest our solutions lead to still other conflicts.[1]

Fundamentally, the realist–constructionist debate is over materialist versus idealist explanations of social life. I mean "materialist" here in the philosophical sense of emphasizing the material conditions of life, not in the sense of material acquisitiveness. And I similarly mean "idealist" in the philosophical sense of emphasizing the role of ideas, not in the sense of what is the best or highest. The tension between materialist and idealist explanations is itself a centuries-old philosophical dispute, one that perhaps all cultural traditions have grappled with in one way or another. An ancient fable from India expresses the tension well. A group of blind people encounters an elephant for the first time. One grabs the elephant's tail and says, "An elephant is like a snake!" Another grabs a leg and says, "An elephant is like a tree!" A third grabs an ear and says, "An elephant is like a big leaf!" To the materialist, the fable shows how misinformed all three blind people are, for a sighted person can plainly see how the "snake," "tree," and "big leaf" connect together into what an elephant really is. To the idealist, the fable says that we all have our ideological blindnesses and there is no fully sighted person who can see the whole elephant—that we are all blind people wildly grasping at the elusive truth of the world.

The approach I take to this ancient debate is that the material and the ideal dimensions of the environment depend upon and interact with each other and together constitute the practical conditions of our lives. What we believe depends on what we see and feel, and what we see and feel depends on what we believe. It is not a matter of either/or; rather, it is a matter of both together. Each side helps constitute and reconstitute the other, in a process that will never, we must hope, finish. I term this mutual and unfinalizable interrelationship *ecological dialogue.*[2] Throughout the book, I consider the constant conversation between the material and ideal dimensions of this never-ending dialogue of life and how our environmental practices emerge from it.

Ecological dialogue is also a way to conceptualize power—to conceptualize the environmental relations that shape our scope for action: our ability to do, to think, to be. These relations of power include both the organizational factors of materiality and the knowledge factors of our ideas—which, in turn, shape each other. By using the word *dialogue,* I don't mean that everything in this interrelationship is happy and respectful, smooth and trouble-free, or even that it always should be. Dialogue is not a state we reach when we have overcome power; it only happens *because of* power. There is often conflict involved, which is one of the main ways that the material and the ideal continually reshape each other and express themselves in our practices of living. And conflict is not necessarily a bad thing. Sometimes it is exactly what is needed to get us to pay attention. But neither is power all kicking and yelling. There is much cooperative and complementary action in the dialogue of ecology, much conviviality that we relish and that constantly changes us. We experience power in cooperative and complementary action, too. Nor is power necessarily a bad thing. (Imagine for a moment having no power at all in your life and what an awful circumstance that would be.) It's a matter of what power does and how and why, and the legitimacy of its balances and imbalances. These are moral questions that we need to continually ask and re-ask.

Maybe a diagram will help. Have a look at Figure 1.1, a kind of environmental sociological updating of the *Taijitu,* the ancient Chinese yin–yang icon. The *Taijitu* suggests that the world is constituted through the interaction of yin and yang, which together create a unity of earth and heaven—or in more Western terms, of the material and the ideal. Often the *Taijitu* is interpreted to mean that yin and yang are opposites, but the black dot in the white side and the white dot in the black side are supposed to indicate that each is the seed of the other. Also, the *Taijitu* indicates the

Figure 1.1 Ecological dialogue.

Source: Matthew Robinson and the author.

interactiveness of yin and yang through curved inter-nesting of the two sides, instead of a straight line dividing yin and yang into oppositional hemispheres. It's one of history's great images.

But from the perspective of ecological dialogue, the *Taijitu* represents the world as overly unified, static, and finished. Figure 1.1 suggests the changing, unfinished, and sometimes conflictual character of the world through showing the material and the ideal as two partial moon faces in practical dialogue with each other. Together, the moons of the "material" and the "ideal," which tuck together in a basket weave at their edges, make a circle and a kind of ecological holism. That holism is always unfinished, though, and thus never fully whole, which the diagram represents through the open space between the partial moons. But the open space is not empty. Rather, it is an active space of interchange, interaction, and interrelation through the "practical"—the ideas and materialisms we put into joint practice. Some of that practice may be conflictual, and some may be cooperative and complementary. Through it, the ideal and material shape each other and change each other, shaping and changing the practical at the same time. To further represent this mutual constitution of the material and the ideal, through the relations of the practical, Figure 1.1 takes the seed imagery of the *Taijitu* and converts it to eyes, one of the central organs of communication, with a black eye on the white side and a white eye on the black side. Plus, the imagery of the moon faces is meant to suggest the motion of light and shadow across the ever-unfinished holism, like phases of a moon, as white becomes black and black becomes white over time.

I'm not completely satisfied with the diagram. But at least, I hope Figure 1.1 is thought-provoking. There are also many resonances between Figure 1.1 and the cover illustration of the book, Marc Chagall's great painting *I and the Village.* I'll leave it to each reader to puzzle those connections out in his or her own way.

But the most important connection to puzzle out is simply that we are connected, although by no means completely so. Like power and conflict, this incompleteness of connection can also be okay, for it provides the crucial open space for change. It also provides for difference, and that is okay, too. If everything were connected up into one great sameness, there would be no connections to make—no need, and no possibility, for dialogue and its endless creativity. I mean this, too, by the phrase "ecological dialogue": that we should see ourselves as part of a creative community of the Earth and all its inhabitants, ever working out our ever-changing samenesses and differences, connections and disconnections, in the practical art of living.[3] The biggest community of all is thus the biggest dialogue of all.

The Dialogue of Scholarship

Let me also make it clear that this book takes an activist position with regard to environmental problems and the way we think about them. We often look to scholars to provide an unbiased perspective on issues that concern us, and we sometimes regard an active commitment to a political position as cause for suspicion about just how scientific that perspective is. Yet, as many have argued, it is not possible to escape political implications.[4] Everyone has concerns for and interests in the condition of our world and our society. Such concerns and interests are what guide us all every day, and scholars are no different from anyone else in this regard. Nor should they be any different. Such concerns and interests are not necessarily a problem for scholarship. On the contrary, they are the whole reason for scholarship.

This does not mean that anything goes—that any perspective is just as academically valid as any other because all knowledge is only opinion and we are all entitled to our own opinions. Scholarship is opinion, of course, but it is a special kind of opinion. What scholarship means is being critical, careful, honest, open, straightforward, and responsible in one's opinions—in what one claims is valid knowledge. One needs to reason critically and carefully, to be honest about the reasons one suggests to others, to be open to the reasons others suggest, to be straightforward about one's political reasons, and to be responsible in the kinds of reasons one promotes. Being honest, open, and straightforward with each other about our careful, critical reasons is the only academically responsible thing to do.[5]

Therefore, it is best for me to be straightforward about why I think environmental sociology is an important topic of study: I believe there are serious environmental problems that need concerted attention—now, not later. And I believe environmental issues are closely intertwined with a host of social issues, most of them at least in part manifestations of social inequality and the challenges inequality poses for community. Addressing these intertwinings, manifestations, and challenges is in everyone's interests. We will all benefit, I believe, by reconsidering the present state of ecological dialogue.

My perspective, particularly the focus on social inequality, coincides more closely with the current politics of the Left than the Right. Yet issues of the environment and inequality cut across traditional political boundaries, as later chapters discuss. The evidence and arguments that I offer in this book should be of interest to anyone committed to careful, critical reasoning. In any event, we should not let political differences stop us from engaging in dialogue about ecological dialogue.

Nevertheless, you, the reader, should be aware that I indeed have a moral and political perspective and that it unavoidably informs what I have written here. Keep that in mind as you carefully and critically evaluate what is in this book. But it is also your scholarly responsibility to be open to the reasoning I present and to have honest reasons for disagreeing.

Sustainability

Let us now turn to some of the reasons that lead many people to believe there is cause for considerable concern about the current condition of ecological dialogue: the challenges to *sustainability, justice,* and the *beauty of ecology.* These, the three central environmental issues, will already be well-known to some readers. Still, as these considerations underlie the rest of the book, it is appropriate to pause and review them here, beginning first with sustainability.

How long can we keep doing what we're doing? This is the essential question of sustainability. The length of the list of threats to environmental sustainability is, at the very least, unnerving. True, much is unknown, and some have exaggerated the dangers we face. Consequently, there is considerable controversy about the long-term consequences of humanity's continuing transformation of the Earth, as the headlines and blogs and podcasts every week demonstrate. But much relevant evidence has been gathered, and some have underestimated the dangers involved. It is therefore prudent that we all pay close attention to the potential challenges to sustainability.

Energy

How much longer can we keep doing what we're doing with regard to energy? Not any longer at all. In almost everyone's view these days, we want more energy than we have—or at least more than we can easily get. The issues of this mismatch confront the world already. Rising costs. Pollution of land, air, and water. Declining stocks of some sources. Competition for space to produce energy. Tense international politics and even, say some, war.

What to do? When you don't have enough of something, there are two basic ways to go: Get more or use less. Or maybe do both. There is a caveat, too, especially with regard to energy: Make sure that any way you go is clean, safe, and just. Given our record with energy recently, we'll have to inspect our options with care. Let's begin with the "get more" approach.

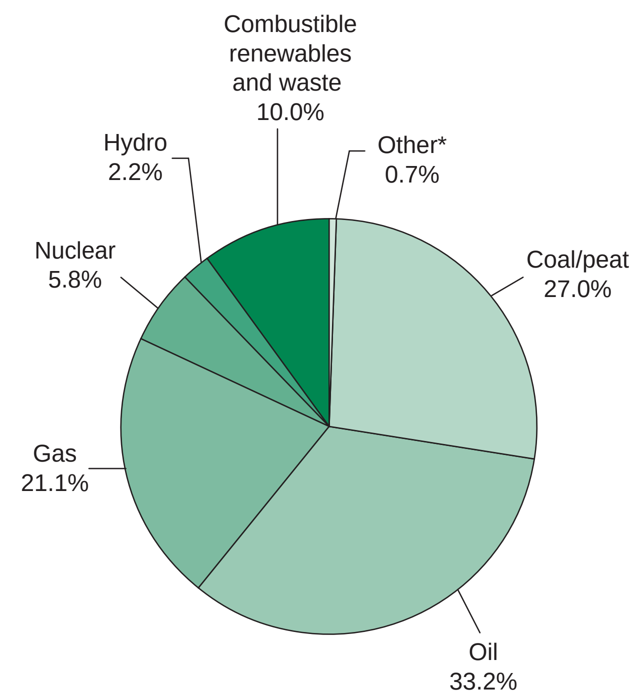
First, let's review where we get energy from now, as of 2008 (see Figure 1.2). About 37 percent of the world's energy supply comes from oil, the most of any source. Coal and peat are next at a combined 27 percent, followed by gas at 21 percent. Given that oil and gas generally come together or from closely related geologies, it is worth pointing out that together they amount to 54 percent of the world's energy supply. Then add in coal and peat, and we're up to 81 percent of our energy coming from fossil carbon. That's a lot of fossil carbon. And then add in what the International Energy Agency (the keeper of these statistics) calls "combustible renewables and waste"—firewood, ethanol, and other biofuels, plus whatever else people can get to burn, like municipal solid waste and animal dung—at 10 percent. That's a lot of total carbon. Combined, we're up to a 91 percent carbon energy economy.

The other 9 percent? Six percent is nuclear energy and 2 percent is hydropower. The rest is so quantitatively insignificant that the International Energy Agency lumps it all into a single "other" category of less than 1 percent: mostly wind, solar, and geothermal.

Can we get more? There are a lot of unknowns of geology and technology here. Plus, a lot of money and jobs hang on this question, so clear and straight answers are hard to come by.

Much attention has been given of late to the contention that we have now reached a "peak oil" state, fulfilling M. King Hubbert's prediction in the 1950s that we would soon see terminal decline in oil and gas production, albeit a few decades later than Hubbert thought. There are still

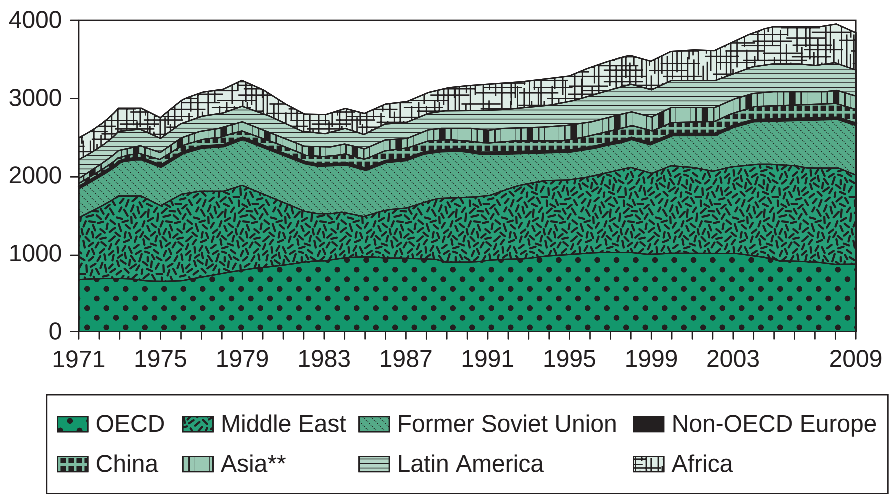
Figure 1.2 Share of total world primary energy supply by type of fuel in 2008.



Source: International Energy Agency. 2010. *2010 Key World Energy Statistics*. Paris: International Energy Agency.

substantial reserves of oil and gas in the world, and still some regions that have not been fully prospected. But the big and easy petroleum fields appear to have been pretty much all found. Although oil and gas interests often argue that there is no need for alarm, it seems likely that the finds of the future will be mostly smaller and harder to access, raising costs and lowering yields. The evidence? Crude oil production has been basically flat since 2004, and has even begun to decline. In the 30 years from 1979 to 2009, it grew considerably more slowly than the world economy, rising roughly 20 percent while the world economy grew two and a half times larger (see Figure 1.3). Consequently, the proportion of the world's energy supplied by oil and gas has declined from about 70 percent in 1979 to 54 percent in 2008.

Figure 1.3 World crude oil production.



Source: International Energy Agency, 2010.

Moreover, it is becoming increasingly acknowledged that oil and gas, especially oil, is dirty and dangerous. The huge Gulf of Mexico spill in the spring and summer of 2010 from the explosion of the Deepwater Horizon drilling platform focused worldwide attention on the costs of oil and gas that we don't see directly in our bills. Many of the environmental troubles that the rest of this chapter describes can be traced back to fossil fuels. Global warming. Smog. Particulates. Acid rain. Social inequalities in who bears the brunt of pollution.

Plus, it seems that much of the supply of oil and gas that we will need to rely on in the future is from the dirtiest and most dangerous sources. Canada and Venezuela boast huge reserves of what used to be known as "tar sands," but recently has come to have the more polite names "oil sands" or "bituminous sands." Tar sands is more accurate to describe the form of these deposits in the ground: thick, rigid, and sticky, in need of vast investments in digging equipment for surface mining and heating equipment for pumping it out through steam injection, which makes the tar flow. The resulting landscape is not pretty. Conventional oil sources are also increasingly not so conventional, as they present new technological and environmental challenges. The Deepwater Horizon well was part of a push into deeper waters, further offshore, where water pressure is higher and infrastructure is chancier. Many potential reserves on land underlie areas where it is colder, hotter, or more remote—which is why they haven't been tapped already.

In a world that often seems to agree on little, politicians from across the political spectrum now speak of the need to transition to other energy sources. Presidents George W. Bush and Barack Obama in the United States, Prime Ministers David Cameron and Gordon Brown in Britain, and Chancellors Angela Merkel and Gerhard Schröder in Germany all have promoted reducing dependence on oil and finding alternative sources, despite their wide political differences on other issues.

How about coal, the next biggest of our current sources? There is still a lot of it in the ground, to be sure. But coal is infamously dirty. It is a carbon-based fuel, after all, which means it leads to global warming, smog, acid rain, particulates, and most of the rest of our carbon woes. Plus, coal has some special zingers of its own. Take the continued despoliation of land from coal mining. Take the billions of gallons of hot water discharged from coal-fired power plants into surrounding lakes and rivers. Take the hundreds of thousands of tons of highly toxic ash and sludge from smokestack scrubbers that a typical coal-fired power plant produces each year. Take the airborne mercury deposition from coal-fired power plants that has led to health guidelines on how many wild-caught fish from lakes in the U.S. Midwest one can safely eat. Or take the continued loss of miners' lives, like the 104 miners that died in a coal mine explosion on November 21, 2009, in China's Heilongjiang Province—and these were only a small proportion of the 2,600 mine fatalities in China in 2009 alone.[6] Some argue that new technologies will allow us to speak of "clean coal," which doesn't contribute to global warming and other carbon troubles. Perhaps so. And if so, this is very welcome news. But most of the special zingers of coal would still remain.

Maybe nuclear energy, then? Many say that, after the 2011 Fukushima Daiichi reactor leak in Japan, nuclear energy should clearly be off the table. It's just way too risky. But others say the new plant designs are much safer, and the operation of the older ones has improved considerably. Sure, the Fukushima meltdowns led to horrible and long-lasting problems, and the Chernobyl and Three Mile Island accidents were terrible too—especially Chernobyl, which killed several thousand as a direct result of the explosion, and is expected in time to cause at least another 4,000 deaths (some say tens of thousands more) due to radiation exposure.[7] Even so, say advocates, most of the 441 nuclear power plants around the world have good safety records.[8] The French get about three-quarters of their electricity from nuclear power, for example, and they haven't had serious problems. In the face of global warming and the other problems with a carbon economy, nuclear energy is worth the risks, the argument goes: the risks of radiation, of terrorism, of nuclear proliferation and warfare, of plant malfunctions, of earthquakes, of tsunamis, of tornados, of hurricanes, of storing the waste for 100,000 years, and of problems no one has thought of yet. In addition, right in the present, nuclear power also despoils land and depresses property values through mining, reclaiming, and plant siting. Still, maybe all that is better than floods, droughts, heat waves, strip-mining, air pollution, oil spills, coal mine accidents, and the rest of the carbon economy mess. Personally, I don't think so. But whether or not the risks are worth it, of this we can all be sure: The situation can't be good if the choices are so bad.

Or are they so bad? Are renewables a realistic option? Maybe we can power a twenty-first–century and even a twenty-second– and twenty-third–century economy with the sun, the wind, the water, the tide, the heat of the Earth, and the living power of biofuels. Environmentalists have been saying this for years, and not without reason. Most countries certainly do not make a lot of effort in these regards now, except with hydropower and increasingly with wind and biofuels. But some countries have made huge progress, especially Germany, which as of 2009 was getting 10 percent of its energy from renewables, and 16 percent of its electricity, thanks to policies like "feed-in tariffs" that require utilities to buy from renewable sources.[9] In Germany now, it is utterly routine to see a house with photovoltaic solar panels on the roof.

The most growth is in wind power. For some time now, wind energy capacity around the world has been doubling every 3 years or so.[10] The world leader in wind is Spain, in percentage terms; in 2009, Spain generated 14.3 percent of its electricity with wind power.[11] In absolute terms, China has the most, and is working hard to have a whole lot more big white blades churning above its countryside (as well as to have a whole lot more nuclear plants around and about, it must be said). Worldwide, 38 gigawatts of new wind turbines went up in 2009 alone. That's the equivalent of about 38 new nuclear power plants. In less than 10 years, at current growth rates, there will be as much wind power capacity around the world as nuclear capacity.

Imagine. Heat and cool your house with a heat pump run through the soil all around it. Light it with wind and photovoltaic roofing tiles. Run your car that way, too. Concentrate sunlight with some well-placed mirrors or split hydrogen from water with the sun or set up an axial turbine to catch the tide, and power your schools, offices, hospitals, and factories. It can all be done, and it is being done, although not at the scale of production or with the depth of research that would bring costs down to where everyone would install these technologies.

But renewable energy sources have their costs and consequences, too—arguably considerably lower and fewer than with oil and gas, coal, and nuclear energy, but costs and consequences nonetheless. The sight and sound of wind power raises the hackles of many of those who live close by. Hydropower dams up the flow of ecology with the flow of water and displaces people from their lands and homes; moreover, most of the really good sites have been exploited already. Biofuels need land, which competes with land for food and habitat; biofuels need production technologies like fertilizer, tractors, and distilleries, which decrease energy efficiency and increase erosion, water pollution, and other agricultural problems; and biofuels need to be combusted to yield energy, contributing to the ills of the carbon economy we look to them to help resolve. Photovoltaics, heat pumps, and tidal turbines aren't without their environmental impacts, too, from the mining needed for batteries and copper tubing to the wider array of power lines required to feed more spread-out energy sources into a nation's electrical grid.

So maybe "get more" isn't the best approach to solving our energy needs. Maybe "use less" is the better emphasis. How about not just a little conservation and efficiency but a whole lot of it? That hasn't really been tried much either, after all. And using less almost certainly means abusing less. This seems right to me, and to essentially all environmental thinkers. There really is huge agreement here.

Of course, you shouldn't necessarily rush out and ditch the gas-guzzling SUV you bought in a fit of testosterone glory 3 years ago, and spring for a Prius or a Volt instead. Tossing out the not-very-old for something that is more efficient can introduce significant inefficiencies of waste, like the embedded energy and environmental damage in the manufacture of any car, even a Prius. You'd probably do more good by driving the gas guzzler less, and slower, and by buying a bike. Which points to one of the great challenges of conservation: The slow transition time caused by the investments we have already made.

The good news is that when you invest in something more efficient, its advantages continue on through the years. Which is hard to give up: Something efficient should last longer and we'll want to keep it longer, if it is truly efficient—a point that I will come back to at the end of this chapter.

There are two other huge challenges for energy conservation: Some interests make money through waste, and our appetite for energy goes up with many of the ways we put population and aspiration into practice. But these are not as inevitable as we might fear in our darker moments. There is a lot of money to be made and jobs to be had in selling conservation, as businesses around the world are starting to recognize. And there is plenty of money and there are lots of jobs in replacing our current energy sources with more benign sources like renewables. (Even with a vast increase in energy conservation, we will still need some energy generation.) In

Germany, the renewable energy sector now employs some 340,000 people, as of 2009.[12] And the form and consequences of our population and aspiration, and even of our aspiration for population, depend upon how we constitute our lives as social and ecological beings.

So while the above review of the sustainability challenges of energy is assuredly gloomy, hold on, gentle reader. There is the rest of a chapter and the rest of a book to come. But first, we must consider quite a bit more gloom.

Global Warming

The deepest shadow in that gloom could well be the threat posed by global warming. Some say don't worry, and some even say it's a hoax. But in the minds of the overwhelming majority of scientists—the same people who gave us the modern comforts we routinely enjoy—the debate is pretty much over. Global warming is happening. The main scientific controversy is over what we should do about it.

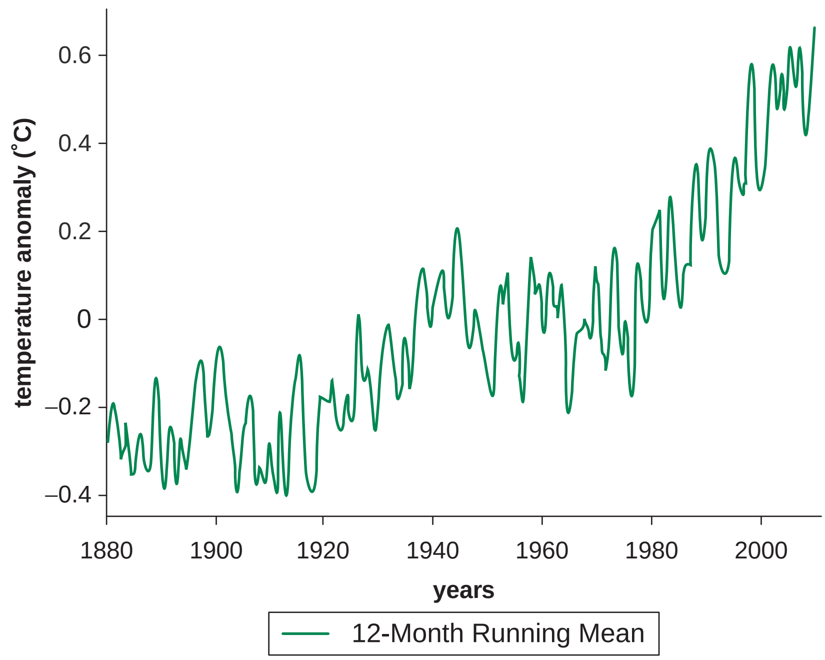
Scientists are not alone in this judgment. A majority of people in most countries agree that global warming is happening. Even in the United States, where global warming skepticism is unusually high, a majority of people agree that the effects of global warming are here now or will begin within a few years, according to 10 straight years of Gallup polls, from 2001 to 2010.[13] After all, there is plenty of evidence you don't need statistical software to appreciate. Broiling hot summers. Drought alerts. Floods. Rising sea levels. Record hurricanes. Melting glaciers. Decreased snow cover. Open-water fishing at the North Pole. Palm trees and peaches where they never grew before. Diseases and insects our grandparents' generation never had to contend with in our own regions. People notice such things in their own lives, and that makes a difference.

And here it is in numbers: When averages are calculated for the entire globe, the 10 warmest years on record (through 2010) have all occurred since 1997.[14] The last 10 years are all among the eleven hottest.[15] Plus, the trend is upward: The 1970s were hotter than the 1960s, the 1980s were hotter than the 1970s, the 1990s were still hotter, and the 2000s were hotter yet (see Figure 1.4). In every year since 1977, the annual average world temperature has been at least 14 degrees Celsius (57 degrees Fahrenheit), a level hardly ever reached in the past 200 years.[16] At this writing, the 5 hottest years on record are, in descending order, 2005, 2007, 2009, 1998, and 2002.[17] But January to December is an arbitrary unit of time. Twelve-month long running averages show that the hottest 12-month period on record was July 2009 through June 2010.[18]

Long-term weather records also show that there was a grain of truth to an earlier generation's fireside stories about having to walk to school through 3 feet of chilling snow, barefoot and uphill both ways. The eighteenth- and nineteenth-century images of the whole town out for a skating party or of Hans Brinker and his silver skates on the frozen canals of the Netherlands are more than merely romantic. It really was colder back then. Winters were longer, blizzards were stronger, and glaciers used to come down farther out of the mountains. The year 1963 was the last year Dutch canals froze enough that the "Tour of Eleven Towns," once an annual event with thousands of participants, could be skated—until it was moved to the northern coast of Finland in 1977.[19] There are reports that Long Island Sound, the body of salt water between Long Island and the Connecticut coast, used to freeze over some winters and people would drive 15 miles across the ice with a team and wagon. That kind of freeze hasn't happened in 150 years.[20]

It's not warming up everywhere, however. Different places are experiencing different changes, which is why the issue is often called "global climate change" rather than "global warming." But overall, the heat is on, globally. We are already feeling the effects. And if this warming trend continues over the next 100 years, say almost all climatologists and oceanographers, we will see major environmental changes. Climatic zones will shift, rainfall patterns will change, weather conditions will become more variable, sea level will rise, and more, too much more.

Figure 1.4 A warming world: Global surface temperature anomalies relative to 1950–1980, based on a 12-month running mean (using data through June 2010).



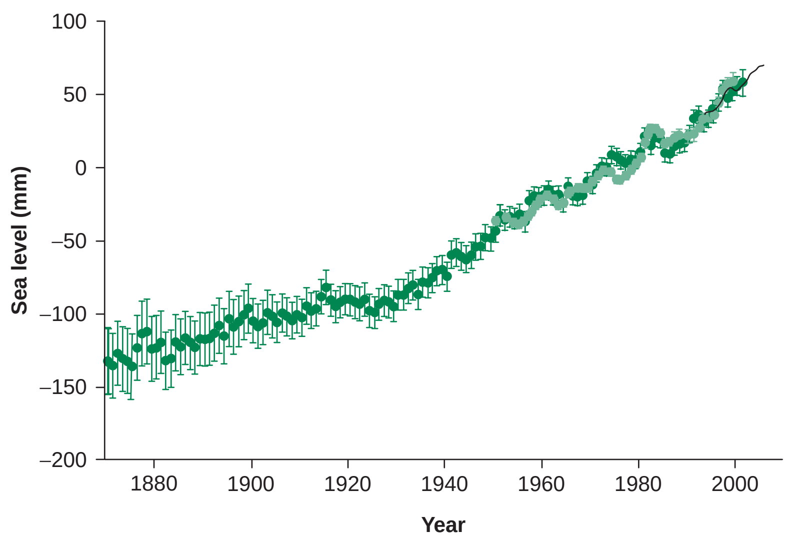
Source: Hansen, J. R., Ruedy, Mki. Sato, and K. Lo (In press.).

Why is it happening? You'd have to be living in a cave not to have heard by now that scientists place the blame most squarely on carbon dioxide emissions from fossil fuel use. The excess carbon dioxide in turn leads to an increased "greenhouse effect" through the ability of carbon dioxide to trap heat that would otherwise radiate out into space. The greenhouse effect is not a new discovery. Scientists figured out 150 years ago that the Earth would be a cold and barren place without it. But too much of a good thing is, well, too much of a good thing.

However, extra carbon dioxide accounts for only about half of human-induced climate "forcing," as climatologists say. Other greenhouse gasses like methane, nitrous oxide, chlorofluorocarbons (CFCs), and ozone, as well as the soot or "black carbon" released by the myriad combustion processes of human activity, together account for roughly as much forcing as carbon dioxide does.[21] However, most of these forcings also come about through the burning of carbon-based fuels, directly or indirectly. Here's where a lot of the controversy comes, of course. The great engine of modern life is currently utterly dependent on carbon-based fuels, as the previous section discusses.

That is pretty scary, considering the effects that global warming is likely to bring about. Take what sea-level rise will mean for the settlement patterns of humanity. Sea level has already risen significantly as the climate has warmed. The Intergovernmental Panel on Climate Change (IPCC) projects that the average sea level will rise another 0.18 to 0.59 meters—half a foot to 2 feet—by the beginning of the twenty-second century, as glaciers and the ice caps melt and as ocean water heats up and expands.[22] That may not seem like all that much, unless you happen to live in a place like New Orleans, Amsterdam, or the low-lying Pacific Island nations of Tuvalu and Kiribati. Extensive regions of low-lying coastal land (where much of the world's human population lives) would be in grave danger of flooding during storm surges—or even being submerged underwater. It is not inconceivable that Tuvalu and Kiribati could be washed away. In view of the threat, the New Zealand government has already made plans for accepting immigrants displaced from Tuvalu.[23]

Figure 1.5 Oceans on the rise: Global mean sea level, 1870–2005, based on field evidence, tide gauges, and satellite data.



Source: IPCC (2007b).

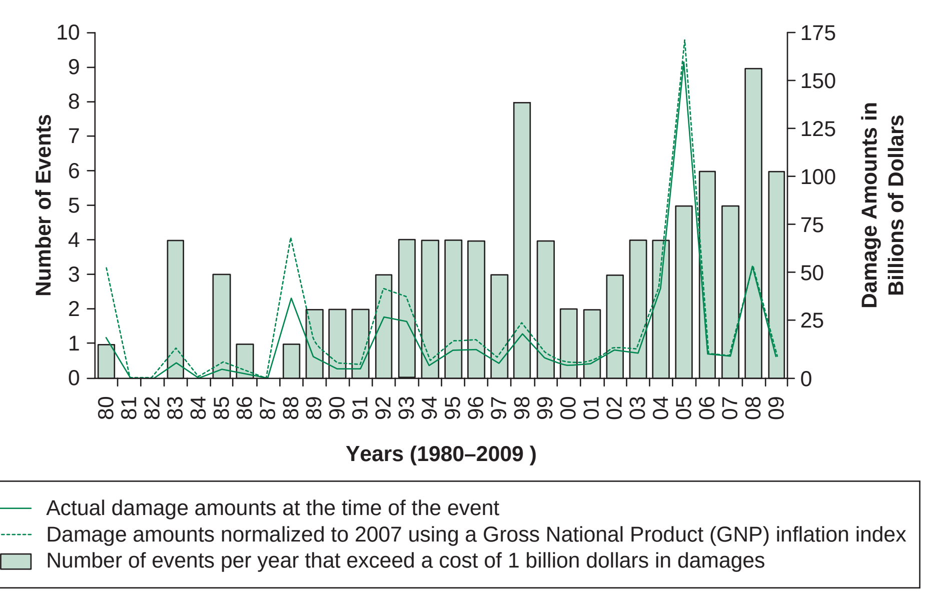
Or consider the ecological disruptions global warming will bring. Coral reef dieback.[24] Increased wildfires.[25] Oceans so acidic that shellfish cannot make shells. Increased risk of extinction for up to 30 percent of species.[26] Gradual replacement of tropical forests with savanna in eastern Amazonia.[27] Increased drinking-water shortages and heat waves. Increased drought stress.[28] Increased incidence of disease, as the new conditions would likely be more hospitable to mosquitoes, ticks, rodents, bacteria, and viruses.[29] Increased incidence of damaging storms, with consequences for shoreline ecologies, including human ones like New Orleans.[30]

The consequences for agriculture would be complex. Some farming areas will likely be stricken with drier conditions. For example, the IPCC projects that rain-fed agriculture in Africa could be down as much as 50 percent in yields by 2020.[31] Farmers in Iowa, the leading corn-producing region in the United States, might have to switch over to wheat and drought-tolerant corn varieties, which would mean overall declines in food production per acre.[32] On the other hand, some regions will likely receive more rain. Yet many of these regions do not have the same quality of soil as, say, Iowa. To add to the complexity, carbon dioxide can stimulate growth in some crop plants; one study has found a 17-percent yield boost in soybeans.[33] However, this stimulation may not result in actual increased crop yields because of other limiting factors, such as low rainfall, poor soil conditions, and the existence of other pollutants in the air.[34]

Indeed, the predictions are coming true already. We are seeing an increase in heat waves, and resulting fatalities and property loss are on the rise. The spell of four days that peaked at around 100 degrees Fahrenheit between July 12 and 15, 1995, blamed for 739 deaths in Chicago.[35] The 2002 heat wave from April to May in India, which killed 1,000 people.[36] The even more horrific 2003 heat wave in Europe, estimated to have killed an astounding 35,000 to 50,000 people in France, Germany, and other European countries.[37] The July 2007 Western North American heat wave and drought that eventually led to the devastating wildfires of Southern California in October of 2007, which burned 1,500 houses and 400 million acres and forced 1 million people to evacuate their homes.[38] The summer of 2010 heat wave in Russia, the hottest on record there, which touched off devastating forest fires and is estimated to have caused $15 billion in damage and to have killed at least 15,000 people, and possibly as many as the European heat wave of 2003.[39]

The occurrence of devastating storms and floods is also way up. The Great Storm of 1987 in Britain. Hurricane Mitch in 1998. Katrina in 2005. The Mumbai floods of 2005. The British floods of 2007. The Tennessee, Iowa, Pakistan, China, India, Brazil, Nigeria, Central Europe and Northeast Australia floods of 2010. From the too wet to the too windy to the too hot to the too dry, the global rate of severe weather events now is twice what it was in the early 1980s, with 600 to 700 weather-related disasters per year.[40] The number of named Atlantic storms per year is now double what it was 100 years ago and 50 percent higher than it was 50 years ago.[41] The insurance industry is quite worried about the upsurge in claims that has resulted.[42] In most years now, worldwide economic losses from catastrophic weather events top $50 billion, which is 10 times the 1970s rate and 16 times the 1960s rate, measured in 2006 constant dollars.[43] In 2005, the worst year yet, worldwide losses were $220 billion.[44] In the United States alone, every year from 2004 to 2009 saw at least five weather-related disasters that topped $1 billion in damage (in 2007 dollars). In the 1980s, most years saw from none to two, with only one year (1983) as high as four (see Figure 1.6).

Figure 1.6 Billion dollar U.S. weather disasters 1980–2009.



Source: NRDC (2010).

There's more. Meteorologists are becoming increasingly alarmed about the successive break-offs of ever-larger chunks of high-latitude ice shelves, such as the Rhode Island–sized patch of the Larsen B Ice Shelf that disintegrated during February 2002 and the 41-square-mile Ayles Ice Shelf that broke free of Canada's Ellesmere Island in the summer of 2005.[45] At the North Pole, there isn't as much ice to begin with, but it is showing worrisome signs of losing what there is. The years 2007, 2008, and 2009 recorded the three lowest extents of the Arctic ice cap on record.[46] This is especially worrying because less white surface cover on the Earth means less solar energy is reflected back out to space, heating the planet even more. By 2008, the mean thickness of Arctic sea ice had dropped 48 percent since 1958, from 11.9 feet to 6.2 feet.[47] There are now frequent sizable stretches of open water at the Arctic ice cap during the summer, including a 10-mile by 3-mile-wide stretch quite close to the North Pole itself in 2001, although scientists say this open water may have been there for some time.[48] But the northern ice cap is clearly retreating and thinning. Researchers from the National Aeronautics and Space Administration (NASA) predict that by 2040, we will have no Arctic ice cap at all at the height of the Northern Hemisphere summer; the British Antarctic Survey thinks it will happen even earlier than that.[49]

Then there are the implications for disease. Warmer world weather has been implicated in the resurgence of cholera in Latin America in 1991 and pneumonic plague in India in 1994, and in the outbreak of a hantavirus epidemic in the U.S. Southwest in 1994. Scientists are wondering if global warming is a factor in about 10 other diseases that resurged or reemerged in the 1990s.[50] Increased allergy complaints may be due to global warming, one study suggests.[51] A 2009 report by the World Health Organization concludes, based on a review of many studies, that climate change increases malaria, dengue, diarrhea, Lyme disease, tick-borne encephalitis, and food-borne pathogens such as salmonella.[52] In areas where a population's disease resistance is already weakened by the AIDS virus, these increases will be particularly problematic.[53]

Meanwhile, greenhouse gas emissions continue to rise. Annual mean carbon dioxide, as measured at Hawaii's Mauna Loa Observatory as of 2010, is up to 390 parts per million in the atmosphere.[54] In the mid–eighteenth century, the number was about 277 parts per million, according to data from ice cores drilled in Antarctica.[55] But growth still hasn't leveled out, despite the initial efforts of many nations around the world. Recently, the concentration has been going up about 2 parts per million per year, as we continue to force the climate, and push our luck.[56]

You could think of human-induced climate forcings as acting like extra blankets on a warm night, gradually stifling the planet. I say "on a warm night" because solar radiation is also on the rise, adding a climate forcing about a tenth as strong as human-induced forcings.[57] This is, at the very least, bad timing. Consequently, taking together all the forcings that are warming as well as cooling the planet—and there are indeed a few working in the direction of cooling, such as increased reflectivity back into outer space from increased cloudiness—the IPCC estimates that average temperatures will rise 1.1 to 6.4 degrees Celsius in the twenty-first century, depending on the scenario and model.[58] These are enormous increases when you consider that an average drop of 6 degrees Celsius caused the ice ages, covering much of the northern latitudes with a mile-thick sheet of ice.[59] Climate is a touchy thing. A few degrees average change one way or the other can make quite a difference. In this case, we could be on the verge of many centuries of generally lousy sleeping weather—and circumstances much more ominous than that.

Think about it the next hot summer evening as you ponder whether you should crank the air conditioner up another notch, causing your local utility to burn just that much more carbon-based fuel, and to release that much more smog and soot to generate the necessary electricity.[60] More cooling for you will mean more heating for all of us.

The Two Ozone Problems

There are several other threats to our atmosphere. While perhaps not quite as drastic in their potential consequences as global warming, they are plenty drastic enough for considerable concern. Two of these threats involve ozone, although in quite different ways.

Ozone forms when groups of three oxygen atoms bond together into single molecules, which chemists signify as O_3. Most atmospheric oxygen is in the form of two bonded oxygen atoms, or O_2, but a vital layer of O_3 in the upper atmosphere helps protect life on the Earth's surface from the effects of the sun's ultraviolet radiation. Ultraviolet light can cause skin cancer, promote cataracts, damage immune systems, and disrupt ecosystems. Were there no ozone layer in the upper atmosphere, life on Earth would have evolved in quite different ways—if indeed it had begun at all. In any event, current life forms are not equipped to tolerate much more ultraviolet radiation than the surface of the Earth currently receives. We badly need the upper-atmosphere ozone layer.

In 1974, two chemists, Mario Molina and Sherwood Rowland, proposed that CFCs—which, as we have seen, are also a potent global-warming forcing—could be reacting with the ozone layer and breaking it down. Molina and Rowland predicted that CFCs could ultimately make their way into the upper atmosphere and attack the integrity of the ozone layer. In 1985, scientists poring over satellite imagery of the atmosphere over Antarctica discovered (almost accidentally) that the ozone layer over the South Pole had, in fact, grown dangerously depleted.

Many studies later, we now know that this "ozone hole," as it has come to be called, is dramatically large. We also know that it changes in size with the seasons, has a much smaller mate over the North Pole, and stretches to some degree everywhere on the planet except the tropics. In fact, it's really not a hole. It is more accurate to say that, outside the tropics, the ozone layer is *depleted,* particularly over the South Pole. (See Chapter 8 for an extensive discussion about the metaphor of an ozone "hole.") At times, the layer depletes to as low as 25 percent of the levels observed in the 1970s.[61] Most worrisome is that the area of high depletion might spread to heavily populated areas. In 2000, the high-depletion area passed over the tip of South America for 9 days, including the Chilean city of Punta Arenas. The perimeter of the hole skirts Punta Arenas most years now.[62] Australians and New Zealanders have yet to experience this, but they're plenty worried. Levels of depletion there are already worse than in other populated regions, skin cancer rates are the highest in the world, and classes in "sun health" have become an essential feature of the school curriculum.[63] And in Punta Arenas, the world's most southerly city, skin cancer rates shot up 66 percent between 1994 and 2001.[64]

This is scary stuff. Skin cancer is no fun. But it has galvanized a truculent world into unusually cooperative action.[65] In 1987, the major industrial countries signed the first of a series of agreements, known as the Montreal Protocol, to reduce the production of CFCs. As a result of these agreements, CFC production for use in these countries ended on December 31, 1995, and ended throughout the world on December 31, 2010.

There is more good news to report: The ozone hole is no longer increasing. Since 2000, the amount of ozone at the poles has been essentially stable.[66] It will be many decades until the depletion is repaired, however. The ozone-damaging chlorine that CFCs contain remains resident in the atmosphere for some time, and the HCFCs (hydrochlorofluorocarbons) that industrial countries first turned to as a substitute also damage the ozone layer to some extent. Plus, like CFCs, HCFCs are a potent greenhouse gas. Chlorine-free "Greenfreeze" refrigerants do not damage the upper-atmosphere ozone layer and do not contribute to global warming. Greenfreeze technology now dominates the refrigerator market in Europe and is taking hold in South America, Japan, China, and elsewhere. But Greenfreeze is just now reaching the North American market and, at this writing, is still not approved for use in its refrigerators—for reasons of protectionism, argue some.[67] Meanwhile, an extensive black market in CFCs has arisen in North America.[68] Thus, the current expert view is that ozone depletion will be with us until the middle of the century at least, and likely longer than that.[69]

The banning of CFC production and resulting stabilization of the ozone hole is nevertheless one of the great success stories of the environmental movement, and perhaps the greatest. Despite our differences, sometimes we can achieve the international cooperation necessary to make major progress on big problems. We know we can because, in the case of CFCs, we have done it.

Much less progress, however, has been made on the other ozone problem: ozone at ground level. Hardly a city in the world is free of a frequent brown haze above which only the tallest buildings rise (see Figure 1.7). Ozone is the principal component of this brown smog that has become an unpleasantly familiar feature of modern urban life.

Figure 1.7 Mexico City disappears in the smog, trapped by the mountains that surround the city, December 23, 2009. Unacceptable levels of ground-level ozone, as defined by the World Health Organization, occur about 180 days a year. But 20 years ago, before a huge clean-up campaign, the figure used to be over 300 days a year.

Source: Author.

Ground-level ozone forms when sunlight glares down on a city's dirty air. As a result of fossil fuel combustion, cars and factories discharge large volumes of a whole array of nitrogen oxide compounds. NO_X (pronounced "knocks") is the usual term for this varied nitrous mixture. In sunlight, NO_X reacts with volatile organic compounds (or VOCs) to produce ozone. (The VOCs themselves are also produced during fossil fuel combustion, as well as by off-gassing from drying paint and by various industrial processes.) If the day is warm and still, this ozone will hug the ground. Because it needs sunlight to form, scientists often call the resulting haze "photochemical smog."

Although we need ozone up high to protect us from the sun, down low, in the inhabited part of the atmosphere, ozone burns the lung tissue of animals and the leaf tissue of plants. This can kill. A 2006 study estimated that over 100,000 Americans suffer premature death each year because of photochemical smog.[70] Stop for a moment: That's a huge number of premature deaths. A 2004 study found that even small differences in ozone concentration have measurable effects on mortality.[71] Smog alerts have become an everyday feature of big-city life in all industrial countries. Walking and bicycling are increasingly unhealthful and unpleasant—driving people even more into their cars and causing even more smog. In Mexico City, long a victim of some of the world's worst ozone pollution, a 2006 study showed that smog even compromised residents' sense of smell.[72] When it drifts out of the city and into the countryside, smog also reduces crop production and damages forests. For example, soybeans suffer a 20 percent loss in yield due to ozone—not an insignificant amount in a hungry world.[73]

To put the matter simply, there's too much ozone down low, not enough up high, and no way to pump ozone from down here to up there.

Particulates and Acid Rain

Big cities and their surrounding suburbs also face the hazard of fine particulates in the air. These particles are microscopic—the definition of "fine particulates" is particles 2.5 microns or smaller in size, much smaller than the diameter of a human hair—and they penetrate deeply into lung tissue. In contrast to the brownish color of photochemical smog, fine particulates envelop cities with a whitish smog. About half of these particulates are basically dust, mainly released because of poor fuel combustion in cars, trucks, power plants, wood stoves, and outdoor burning, or kicked up by traffic, construction, and wind erosion from farms. Most of the rest are tiny pieces and droplets of sulfates, nitrates, and VOCs formed in the atmosphere following the burning of fossil fuels, such as the coal used for electric generation; together, these are called "secondary" particulates.[74] Ammonium and ammonium compounds also contribute significantly to secondary fine-particulate pollution, mainly due to emissions from livestock and fertilizers.

According to a 2006 study, over 160,000 Americans die prematurely each year due to fine particulates.[75] Stop again: That's 160,000 premature deaths. Another study found that in American cities with the most fine particulates, residents are 15 to 17 percent more likely to die prematurely.[76] A study in Sydney, Australia, found premature death rates to be double even those of American studies.[77] Children in Los Angeles who live closer to roads have decreased lung capacity, largely because of fine particulates.[78] Fine particulates also increase heart attack rates, according to another 2006 study, which, along with studies of lung capacity and asthma effects, helps explain the higher death rates associated with areas that have higher levels of fine particulates.[79] This is serious stuff, even worse than the much better-known problem of photochemical smog.

And then there's acid rain. This is an issue that has largely dropped from sight, after a flurry of concern in the 1970s and early 1980s over sharp declines in the populations of some fish and frogs and extensive signs of plant stress and dieback in many forests. But acid rain is still falling from the sky, despite substantial efforts to reduce acidifying emissions of sulfur dioxide and NOx (which also have other dangerous impacts, as we have seen). These pollutants combine with water in the atmosphere to acidify rain, resulting in direct damage to plant tissues, as well the leaching of nutrients from soil and the acidification of lake waters, which, in turn, affect most wildlife—particularly in areas with normally acidic conditions, where ecosystems have less capacity to buffer the effects of acid fallout. When things get bad enough, lakes die and trees refuse to grow, like the miles of blasted heath in the acid deposition zone surrounding the old nickel smelters in Sudbury, Ontario. The situation is especially severe in northern Europe, where more than 90 percent of natural ecosystems have been damaged by acid rain; a year 2000 survey by the European Union found that 22 percent of all trees in Europe have lost 25 percent or more of their leaves.[80] Conditions are also quite worrisome in much of Canada and in China. One 2007 study found defoliation rates as high as 40 percent in some Chinese forests.[81]

Efforts to reduce acidifying emissions of sulfur dioxide and NOx have made a difference in some regions. There does seem to be some slight improvement in the condition of Canadian lakes and forests—but only slight.[82] Deposition rates for sulfate from rain are down considerably in much of the United States. But there are areas of the country, mostly in Ohio, Indiana, and Illinois, that as of 2008 were still receiving more than 25 kilograms per hectare of sulphate from the sky each year—10 times more than falls in the western United States.[83] A 2000 review of the scientific literature by the federal government's General Accounting Office found that the condition of lakes in New England and the Adirondack Mountains of New York was either stable or getting worse, but none seemed to be improving.[84] Some 43 percent of Adirondack lakes are expected to be acidic by 2040—up from the 19 percent observed to be acidic in 1984.[85] Between 1992 and 1999, the condition of trees in Europe did improve in 15 percent of the test sites, but deteriorated in a further 30 percent of sites.[86] In Taiwan, the Central Weather Bureau has registered increasingly severe acid rain events in recent years.[87]

In other words, the situation is at best a mixed bag. Why, after so many years of effort, does acid rain still threaten? Technological improvements, international treaties, and domestic legislation have all contributed to a sharp decline in sulfur emissions in most countries. But we have made little overall progress in reducing nitrogen emissions. Industry's nitrogen emissions have been reduced, but these advances have been overwhelmed by increased emissions from automobiles and trucks as the world comes to rely ever more on these highly polluting forms of transportation.[88] Plus, there is evidence that the ability of sensitive ecosystems to handle acid rain has been damaged such that slight improvement in the acidity of rain often does not result in any improvement in the condition of lakes and forests.[89]

Acid rain is still a big problem.

Threats to Land and Water

There's a well-known saying about land: They aren't making any more of it. The same is true of water. And in a way, there is less of both each year as the expansion of industry, agriculture, and development erodes and pollutes what we have, reducing the world's capacity to sustain life.

Consider soil erosion in the United States. Soil erodes from farmland at least 10 times faster than it can be replaced by ecological processes, according to a 2006 study.[90] Despite decades of work in reducing soil erosion, largely in response to the lessons of the Dust Bowl, it still takes a bushel of soil erosion to grow a bushel of corn.[91] The Conservation Reserve Program, implemented by the U.S. Congress in 1985, has resulted in significant improvements by offering farmers 10- to 15-year contracts to take the most erodible land out of production. Many farmers have also switched to much less erosive cropping practices. Consequently, soil erosion dropped 43 percent from 1982 to 2007, water erosion dropped from 4.0 to 2.7 tons per acre, and wind erosion dropped from 3.3 to 2.1 tons per acre.[92] But those numbers are still way too high, most observers inside and outside of agriculture agree.

Elsewhere, the situation is equally grim. Soil erosion exceeds replacement rates on a third of the world's agricultural land.[93] Worldwide, almost a quarter—23 percent—of cropland, pasture lands, forests, and woodlands have become degraded.[94] True, fertilizers can make up for some of the production losses that come from eroded soils, at least in the short term, but only at increased cost to farmers and with increased energy use from the production of fertilizer and the application of it to fields—and increased water pollution as the fertilizer washes off into streams, rivers, and groundwater.

Soil erosion is only one of many serious threats to farmland. Much of the twentieth century's gain in crop production was due to irrigation. But irrigation can also salinize soils. Because most irrigation occurs in parched regions, the abundant sunlight of dry climates evaporates much of the water away, leaving salts behind. In China, nearly half of the cropland is irrigated, and 15 percent of the irrigated land is affected by salinization. In the United States, only about 10 percent of cropland is irrigated, but almost a quarter of that 10 percent has experienced salinization. In Egypt, virtually 100 percent of cropland is irrigated, and almost a third of it is affected by salinization.[95]

Irrigation can also waterlog poorly drained soils. Clearing of land is doing the same thing in Australia. Once the land is cleared of its native woodland and bush, rates of transpiration—the pumping of water through the leaves of plants, enabling plants to "breathe"—slow down. Water tables in the dry wheat belt of Western Australia are rising by up to one meter a year, waterlogging these poorly drained soils. This, in turn, can lead to salinization as waterlogged soils bake in the sun. A 2006 estimate found that 16 percent of Australia's agricultural land has been degraded by salinization.[96] Thus, over-irrigation can turn soils both swampy and salty at the same time.

Irrigation of cropland, combined with the growing thirst of cities, is leading to an even more fundamental problem: a lack of water. The World Bank reports that 700 million people in 43 countries face "water stress"—that is, demand for water in their regions exceeds availability, at least temporarily.[97] Another depressingly vogue term is "peak water" to describe the moment when overall demand for water in a country or region exceeds the rate of replenishment, and not just temporarily. Some 15 nations, mainly in the Middle East, now use more water than their climates can replenish.[98] How do people in these regions survive? Mainly by importing food, a strategy that leaves them dependent on world markets for what policy analysts have begun calling "virtual water": the water it took to produce a crop or a product. Even in countries not classified as water-stressed, the situation is increasingly dire. Take the United States and Mexico. By the time it reaches the ocean in the Gulf of California, the Colorado is probably the world's most famous "non-river," for not a running drop remains after the farms and cities of the United States and Mexico have drunk their fill. Further development in the regions dependent on the Colorado River will require water from other sources—and it is not obvious where those generally dry territories can easily find them—or greatly improved efficiency in current water use.

In the Murray-Darling Basin of Australia, the country's richest agricultural region, the story is much the same. Today, only one fifth of the water that enters the basin's rivers is still there by the time the Murray reaches the sea, and the comparative trickle of water that remains is salty and prone to bacterial blooms and fish kills.[99] Perhaps the most dramatic example of overuse of water sources is the Aral Sea in central Asia—once the world's fourth-largest lake. Diversion for irrigation has reduced the Aral's surface area by 90 percent. Salinity has quadrupled; former fishing ports lie miles inland; thousands of square miles of lake bottom have turned to desert; the 24 species of native fish are all gone because of the salinity, as are half the bird and mammal species; and the region's economy has collapsed.[100] By 2000, the Aral had divided into two separate bodies of water: what are now called the North Aral Sea (also known as the Small Aral Sea) and the South Aral Sea.[101] But those names are already dated, for the Aral later divided into four even smaller bodies of water, and, as of 2010, one of those—the Eastern Lobe of the South Aral Sea—had almost completely dried up. The European Space Agency predicts the entire South Aral Sea will be gone by 2020.[102] Some good news is that a dike funded by the World Bank has begun restoring some of the lake area in the North Aral Sea.[103] But the overall situation remains very grim.

Not only surface water, but groundwater too is being rapidly depleted. Over-irrigation can lead to rising water tables and the waterlogging of soils in some regions, but the more general problem is falling water tables from the depletion of groundwater stocks. Around the world, extraction of groundwater for cities and farms is exceeding replenishment rates. Recent production gains in agriculture in India have relied heavily on irrigation from groundwater, but now, because of what one observer has called a "race to the bottom of the aquifer," water levels have dropped in some 90 percent of wells in the Indian state of Gujarat, and every year more wells run dry.[104] There are reports of villagers having to pump from as deep as 800 feet to get water.[105] In the dry Great Plains of the United States, farmers pump the famous Ogallala Aquifer 8 times faster than it recharges from precipitation, endangering 15 percent of U.S. corn and wheat production and 25 percent of U.S. cotton production. Nearly one-fifth of the Ogallala's water reserves have already been pumped out, and the taps have had to be turned off in many places.[106] In the North China Plain, a major grain-producing area, water tables have been dropping at the rate of 3 to 5 feet each year, due to overdraw for irrigation.[107] In some regions, the lowering of water tables is causing major land subsidence. Downtown Mexico City has dropped nearly 25 feet.[108] Some parts of the Central Valley of California and the Hebei Province surrounding Beijing have dropped similar amounts.[109] Venice has dropped 10 centimeters because of pumping the freshwater aquifer beneath it—which may not sound like a lot, but for a city at the water line, that is an alarming figure.[110]

Overextraction can degrade the quality of the groundwater that remains. The main threat here again is salinization, either through the overapplication of irrigated water to the land's surface or through the invasion of seawater into shrinking groundwater aquifers. Ten percent of wells in Israel have already been abandoned because of seawater invasion, and many more will soon have to be given up.[111] In the Indian state of Gujarat, half the hand-pumped wells are now salty.[112] When farmers overapply irrigated water, the salinization of the soil can be carried down into the aquifer, as the water percolates down past crop roots. In many areas, only some 30 to 40 percent of irrigated water actually reaches crops, with the rest being lost through evaporation and percolation, promoting salinization of groundwater. In the lower Indus River Valley of India and Pakistan, the situation is so bad that engineers have installed an expensive system of pumps and surface drains to carry some of the salinized groundwater away to the sea.[113]

Much of the freshwater that remains is badly polluted. Some years ago, in 1992, Donella Meadows, Denis Meadows, and Jorgen Randers calculated that "the amount of water made unusable by pollution is almost as great as the amount actually used by the human economy."[114] They also noted then that we are very close to using, or making unusable, all the easily accessible freshwater—freshwater that is close to where people live (as opposed to rivers in the Arctic, say) and that can be stored in rivers, lakes, and aquifers (as opposed to the huge amounts of freshwater lost to the sea during seasonal floods, which cannot be easily stored).[115] The situation around the world today remains dire. The remaining margin for growth in freshwater use is disturbingly narrow.

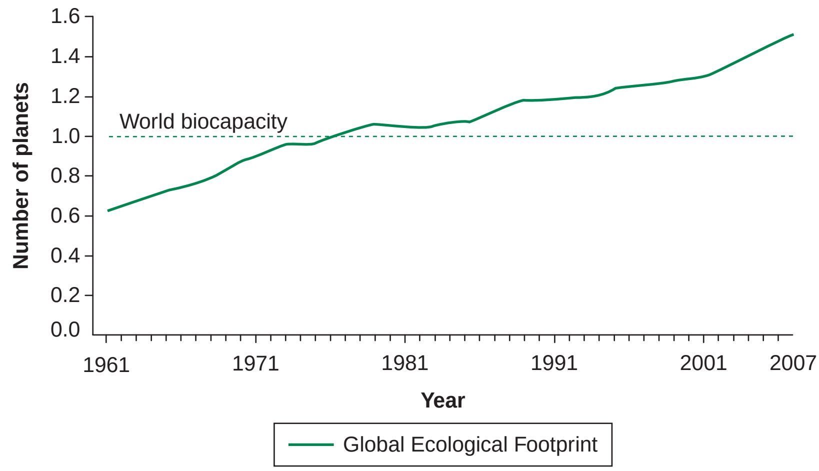
Cleaning up water pollution is one way to increase that vital margin, and industrial water pollution has diminished in many areas, particularly in the wealthier countries. We have also made progress in controlling agricultural water pollution. But we still have a long way to go. From 1950 to 2001, farmers across the world upped their use of commercial fertilizers 8-fold and their use of pesticides 32-fold.[116] In the United States, the development of stronger pesticides for a number of years led to substantial drops in the number of pounds of pesticides farmers applied. After the 1980s, pesticide use in the United States began to rise again, with about a 10 percent increase through 2001.[117] No agency has tabulated national or worldwide statistics since then, but local reports suggest that pesticide use is now rising rapidly. Many developing countries are continuing a "green revolution" approach to food production, using all available agricultural chemistry. And in wealthy nations, use has increased with the widespread planting of herbicide-tolerant GMO crops like "Round Up–ready" corn and soybeans—that is, crops with a gene spliced in that lets farmers increase their use of Round Up, a popular herbicide, without hurting the crop. The resulting runoff continues to threaten the safety of many drinking water supplies. As Chapter 5 discusses in detail, many pesticides are quite hazardous for human health. Excess nitrogen fertilizer in the water is, too. We all need something to eat and something to drink, but some of our efforts at maintaining food production put us in the untenable position of trading food to eat for water to drink.

Or are we trading them both away? In addition to the threats to agricultural production caused by soil erosion, salinization, waterlogging, and water shortages, we are losing considerable amounts of productive farmland to the expansion of roads and suburbs, particularly in the wealthiest nations. Cities need food; thus, the sensible place to build a city is in the midst of productive agricultural land. And that is just what people have done for centuries. But the advent of the automobile made possible (although not inevitable) the sprawling forms of low-density development so characteristic of the modern city. The result is that cities now gobble up not only food but also the best land for growing it. The problem is worst in the United States, which has both a large proportion of the world's best agricultural land and some of the world's most land-consuming patterns of development. Some 86 percent of fruit and vegetable production and 63 percent of dairy production come from urban counties or from those adjacent to urban counties. A 2002 study found that the United States loses about 2 acres of farmland every minute, or about 1.2 million acres per year, an area the size of Delaware.[118] Given that the United States has almost a billion acres of agricultural land, this may not seem worth worrying about. But in most cases, the nation is losing its best land, and in the places where it is most needed: close to where people live.

Then factor into the calculation the effects of global warming, photochemical smog, and acid rain on crop production. Now add some major issues I have not even mentioned: increased resistance of pests to pesticides, declining response of crops to fertilizer increases, the tremendous energy inputs of modern agriculture, loss of genetic diversity, desertification due to overgrazing, and pesticide residues in food. It is no wonder that increases in agricultural production have been falling behind increases in human population. The result is that after decades of steady increases, world grain production per person per year declined from the historical high of 343 kilograms in 1985 to 297 kilograms in 2002, the first year below 300 kilograms since 1970.[119] Production per person has picked up a bit since 2002, due to a number of world-record harvests in subsequent years, but the 1985 figure of 343 kilograms per person has not been exceeded. The needle has basically been stuck for 25 years. Plus, the growth of biofuels threatens to divert a sizable proportion of grain away from food, as many have tried to point out.[120]

Let's face it. We're eating up the world. An increasingly popular way to represent our overconsumption on an ecological scale is ecological footprint analysis, which converts all the various demands we make on the Earth's ecosystems to a measure of area (see Figure 1.8). Since about 1975, our collective footprint has been larger than the Earth itself. We are now demanding about 1.5 Earths. We are provided with only one. You can't eat your Earth and have it, too.

Figure 1.8 Living beyond our means: Global ecological footprint, 1961 to 2007.



Source: Global Footprint Network. 2010.

Environmental Justice

On the morning of January 4, 1993, an estimated 300,000 Ogoni rallied together. The protesters waved green twigs as they listened to speeches by Ken Saro-Wiwa, a famous Ogoni writer, and others. With such a huge turnout, the Ogoni—a small African ethnic group, numbering only a half million in all—hoped that finally someone would pay attention to the mess that Shell Oil Company had made of their section of Nigeria. Leaking pipelines. Oil blowouts that showered on nearby villages. Disrupted field drainage systems. (Much of Ogoniland has to be drained to be farmed.) Fish kills. Gas flares that fouled the air. Water so polluted that just wearing clothes washed in it caused rashes. Acid rain from the gas flares so bad that the zinc roofs people in the area favor for their houses corroded away after a year. Meanwhile, the profits flowed overseas to Shell and to the notoriously corrupt Nigerian government. The Ogoni got only the pollution.[121]

Such open protest by the relatively powerless is a courageous act. And for the Ogoni, the consequences were swift and severe. During the next 2 years, Nigerian soldiers oversaw the ransacking of Ogoni villages, the killing of about 2,000 Ogoni people, and the torture and displacement of thousands more.[122] Much of the terror was carried out by people from neighboring regions whom the soldiers forced or otherwise enticed into violence so that the government could portray the repression as ethnic rivalry.[123] The army also sealed the borders of Ogoniland, and no one was let in or out without government permission. Ken Saro-Wiwa and other Ogoni leaders were repeatedly arrested and interrogated. Finally, the government trumped up a murder charge against Saro-Wiwa and eight others and, despite a storm of objection from the rest of the world, executed them on November 10, 1995.[124] The torture and killing of protestors continued for some years. For example, on June 15, 2001, police shot Friday Nwiido, a few weeks after Nwiido had led a peaceful protest against the April 29, 2001, oil blowout that rained Shell's crude onto the surrounding countryside for 9 days.[125] Recently, there have been efforts to broker a peace process for the region among Shell, the Nigerian government, the United

Nations Environment Programme (UNEP), and the Ogoni people. But as of this writing, the situation remains chaotic with the recent killing of a 20-year-old Ogoni man by Shell's private security forces, a major oil fire on Ogoni farmland, and the displacement of about 1,700 Ogoni fishing families after a series of oil spills in adjacent creeks.[126]

The Ogoni experience is a vivid example of a common worldwide pattern: Those with the least power get the most pollution.

The Ogoni experience is also an outrage, as virtually the entire world agrees.[127] This outrage is a reminder of another of the three central issues of environmentalism: the frequent and tragic challenges to *environmental justice*. There is a striking unevenness in the distribution of environmental costs and environmental benefits—in the distribution of what might be termed *environmental bads* and *environmental goods*.[128] Global warming, sea level rises, ozone depletion, photochemical smog, fine-particulate smog, acid rain, soil erosion, salinization, waterlogging, desertification, loss of genetic diversity, loss of farmland to development, water shortages, and water pollution: These have a potential impact on everyone's lives. But the well-to-do and well-connected are generally in a better position to avoid the worst consequences of environmental problems, and often to avoid the consequences entirely.

Who Gets the Bads?

One prominent basis of being well-connected is a person's social heritage, as a large number of sociological studies have depressingly documented, and as everyday social experience routinely proves. Within issues of environmental justice, there are special challenges of *environmental racism*—that is, social heritage differences in the distribution of environmental bads, due to either intentional or institutional reasons.

For example, much research in environmental racism has shown that people of color are more likely than not to live in communities with hazardous waste problems. In 1987, the United Church of Christ's Commission for Racial Justice released the first of two controversial reports. Based on studies of zip codes, the reports concluded that African Americans and other people of color were 2 to 3 times as likely as other Americans to live in communities with commercial hazardous waste landfills.[129] A 1992 study found that 3 percent of all Whites and 11 percent of all minorities in the Detroit region live within a mile of hazardous waste facilities—a difference of a factor of nearly 4.[130]

Findings like these were central to the emergence in the early 1990s of the *environmental justice movement*. Originally a largely grassroots movement of local activists concerned about pollution in their neighborhoods, environmental justice now has a prominent place on the agenda of most national and international environmental organizations. Environmental justice has become one of the central civil rights issues in the United States and elsewhere, helping create a political climate for change.[131] The U.S. government, on occasion, has taken these issues seriously and has undertaken several self-studies. As a result, in 1992, the U.S. Environmental Protection Agency admitted that it may sometimes have been discriminatory in its siting and regulatory decisions, and in 1994, President Clinton signed Executive Order 12898, which requires all federal agencies to work toward environmental justice.[132]

Some studies of hazardous waste siting, however, have found that social class predicts who gets the bads better than race does. For example, a 2000 study by researchers from the University of Massachusetts found a strong association of hazardous waste facilities with blue-collar working-class communities, and only a slight association with African Americans (and only for African Americans living in rural areas).[133] Researchers are coming around to the view that a "is-it-race-or-income" debate is a bit beside the point, however.[134] For one thing, within the United States at least, race and income closely correspond and intertwine. To talk about one is largely to talk about the other. And when one is dealing with statistical categories that necessarily do a bit of jamming and cramming of the variety of the world to get it into the precise boxes needed for numerical calculation, some dimensions of things get compromised. Nevertheless, of 27 empirical studies of environmental justice in the United States published between 1998 and 2007, a total of 9 found race was significant,[135] 7 found social class was significant,[136] and 11 showed that both race and social class were significant factors.[137] Moreover, every single one found evidence of environmental inequality. More and more studies find the same pattern. In 2010 alone, 10 new studies of environmental justice in the United States all confirmed these results.[138]

They found that Los Angeles schools with high proportions of minority students tend to be located in areas with high levels of airborne toxics.[139] They found that in Florida, people of color face much higher odds that their homes are located near a toxic chemical plant—up to 5 times higher, in some cases.[140] They found that in Michigan, poor people and people of color are more likely to live in areas subjected to the toxic releases registered in the U.S. Environmental Protection Agency's Toxic Release Inventory.[141] They found that industrial-scale hog farms in Missouri are more likely to be located in counties with lower average income.[142] They found that in Massachusetts, low-income communities experience 8.5 times as many chemical releases from industry than high-income communities and that communities with a high proportion of minorities receive 10 times as many releases as communities with a low minority proportion.[143] They found that poor people across the United States experience higher levels of ambient and indoor air pollution, worse drinking water quality, and more ambient noise (from streets and highways, for example) where they live.[144] They found that people of color disproportionately hold the dirtiest and most dangerous jobs in the United States, and typically are poorly paid for their sacrifices.[145] And can we ever forget who was living in the Lower Ninth Ward of New Orleans on August 29, 2005, as Katrina's winds began to gust and the levees began to breach?

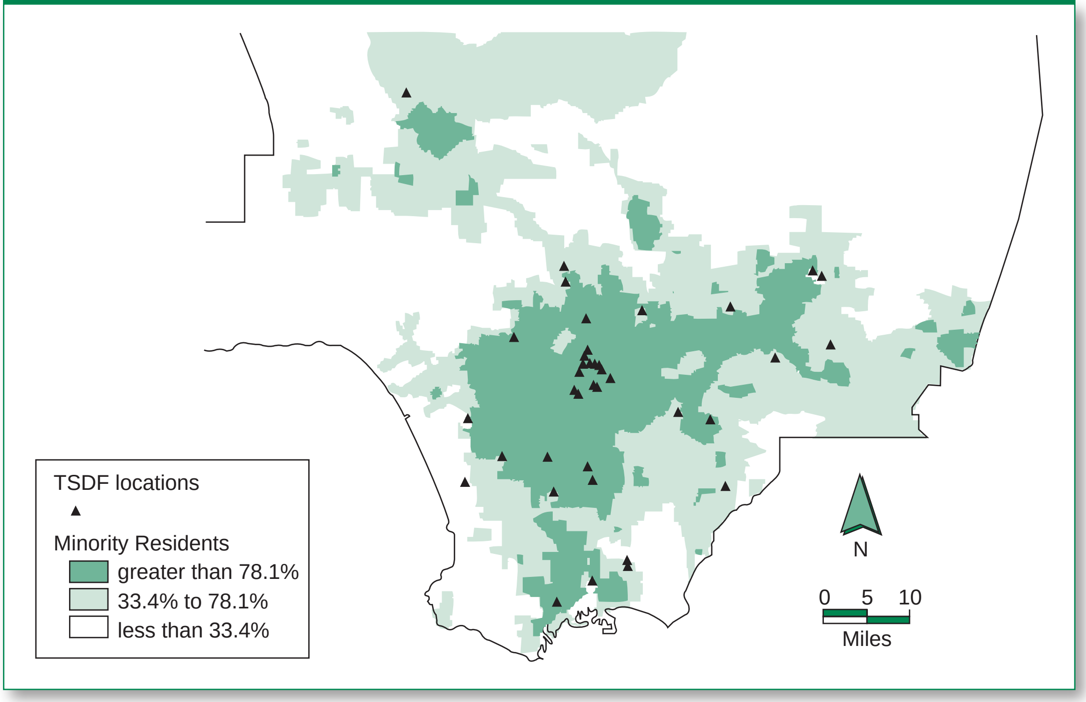
But whether along race or class lines or any other dimension of social difference, such biases are a challenge to the environmental and justice we all have a right to enjoy.

One of those other dimensions of social difference is whether one lives in a rich country or a poor one. Take the hazardous waste crisis, for instance. Wealthy countries are now finding that there is more to disposing of garbage than simply putting it in a can on the curb. One response has been to pay others to take it. We now have a lively international trade, much of it illegal, in waste too hazardous for rich countries to dispose of at home.

There has been considerable protest about this practice. In 1988, Nigeria even went so far as to commandeer an Italian freighter with the intent of loading it up with thousands of barrels of toxics that had arrived from Italy under suspicious circumstances and shipping it back to Europe. After a heated diplomatic dispute, the waste—which turned out to originate in 10 European countries and the United States—was loaded on board the *Karin B.,* a West German ship, and sent back to Italy. But harbor officials in Ravenna, Italy, where the waste was supposed to go, refused the load because of vigorous local opposition to it. The *Karin B.* was later refused entry in Cadiz, Spain, and banned from French and British ports, where it also tried to land. Months later it was finally accepted into Italy.[146]

In 1989, in response to diplomatic crises like these, 105 countries signed the Basel Convention, which is supposed to control international toxic shipments. Yet loopholes are large enough and enforcement lax enough that these shipments still go on. INTERPOL, with its 188 member countries, holds regular conferences to try to control this and other forms of international environmental crime, as does the 150-nation International Network for Environmental Compliance and Enforcement. They've had some success, but there is much that they don't catch, unfortunately.

Figure 1.9 Evidence of environmental racism: Sites of toxic releases to the air and percentage minority in Los Angeles County, based on the Federal Toxic Release Inventory.



Source: Adapted from Pastor, Manuel, Jr., Sadd, Jim, & Hipp, John. 2001. "Which Came First? Toxic Facilities, Minority Move-In, and Environmental Justice." *Journal of Urban Affairs* 23(1):1–21.

Plus, much that most people would regard as environmental crime is perfectly legal. Perhaps most glaringly, no international conventions currently stop companies from merely relocating their most hazardous production practices to poorer countries, or from purchasing from companies that use the laxer environmental and labor regulations and enforcement in most poorer countries to save on production costs. Like Union Carbide, which operated the infamous pesticide plant at Bhopal, India, that killed over 5,000 people in a single night, due to a chemical leak on December 2, 1984. (See Chapter 5 for the details on what happened.) Like the many companies that buy from the textile, toy, and electronics factories of China, which have so badly polluted the land, water, and people of the "factory to the world." Or like the companies that buy from the sweatshops of Southeast Asia, India, Africa, and Latin America. Many of our industrial practices expose workers—generally those on the production line, as opposed to those in the head office—to environmental hazards. Exporting hazardous jobs does not lessen the degree of environmental inequality involved, however.

All this seems to take place far away—until a toxic disaster happens in your own community. The growing placelessness of the marketplace makes it easy to overlook the devastating impact untempered industrialism can have on the daily lives of the farmworker applying alachlor in the field and the factory worker running a noisy machine on a dirty and dangerous assembly line. When we shop, we meet a product's retailers, usually not the people who made it, and the product itself tells no tales.

Who Gets the Goods?

Environmental justice also concerns patterns of inequality in the distribution of environmental goods. These patterns are usually closely associated with inequality in the distribution of wealth. Thus, those who are concerned about environmental justice often point to the huge inequalities in average income between countries. Here are the numbers, based on gross national income (GNI) per capita in 2009 in U.S. dollars.[147]

The average annual income in the world is $8,728. In contrast, the average annual income in the world's 20 wealthiest countries is $48,874. In the United States, it is $46,360. The richest country in the world is Norway, at $84,640 per capita. But once we take into account the cost of living, Luxembourg noses out Norway in per capita buying power at $59,550 to $54,880.[148] (The United States ranks as the fifth-richest country in the world in per capita buying power at $45,640 annual income.)

With all that income flowing to the top, hardly any is left for those on the bottom. The 2.4 billion people of the 50 poorest nations average just $794 per capita per year—hardly more than $2 a day. The 8 million people of Burundi have the lowest average: just $150 per capita per year. That's less than 50 cents a day for the average Burundian. The situation is hardly better for the people of the Democratic Republic of the Congo: just $160. In Liberia, it's also $160. True, the cost of living is unusually low in those countries. That $150 annual income in Burundi buys about what $390 buys in the United States. But $390 is still not very much. Imagine living on so little.

Moreover, despite the many advances in technology and the change to a more market-oriented world economy—and some say because of these advances and this change, as Chapter 3 discusses—income inequality has dramatically increased in recent decades. In 1960, the fifth of the world's people living in its richest countries commanded 30 times as much of the world's income as the fifth of people living in the poorest countries—a figure that, in most people's view, was bad enough.[149] Roughly 100 years earlier, in 1879, it was 7 to 1.[150] But today, that richest fifth commands at least 66 times as much of the world's income as the poorest fifth, and probably more.[151]

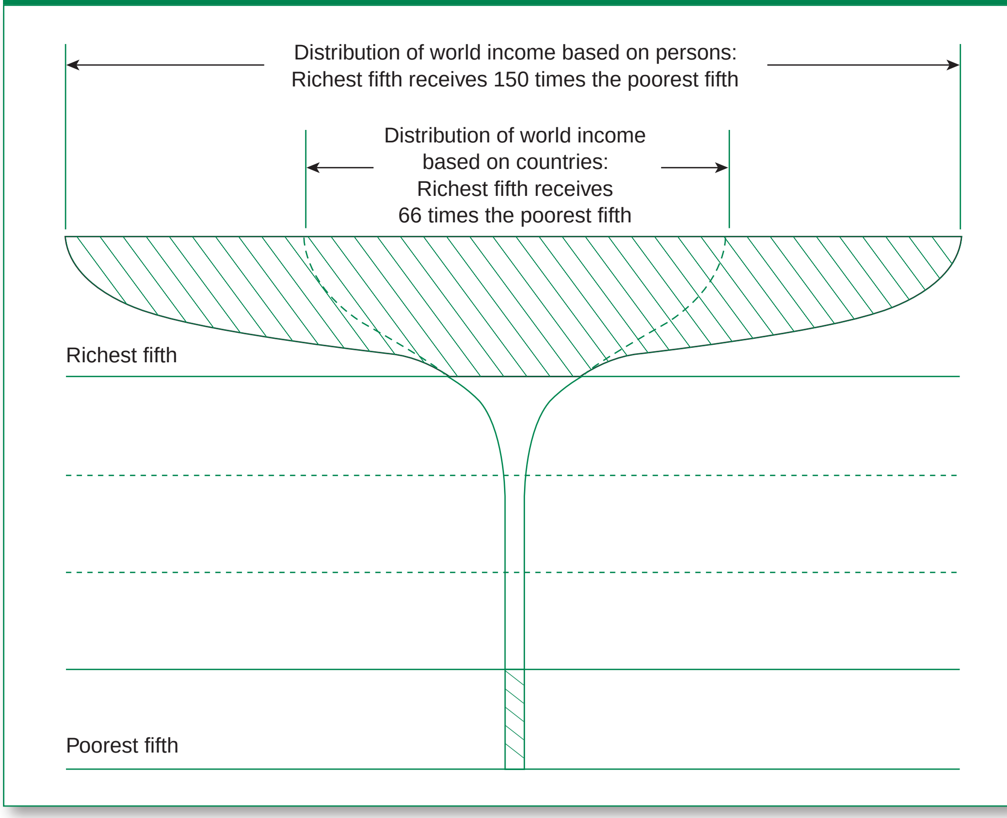
These figures are all based on averages for the populations of whole countries. But there are also substantial levels of inequality *within* countries. Typically, the income differential between the richest 20 percent and poorest 20 percent within a country is 7 to 1 or less.[152] In many poor and middle-income countries, however, the numbers are far higher. The situation is most extreme in Sierra Leone, where the richest fifth command 57.6 times the income of the poorest fifth. In another half-dozen countries, such as Brazil and South Africa, the ratio is 30 to 1 or higher. In 13 other countries, it is 15 to 1 or higher.[153]

Although there is usually less inequality in wealthy countries, some do exceed the world norm of 7 to 1. In Germany, the ratio of richest to poorest 20 percent is 8 to 1. In the United States, it is 9 to 1. In fact, the United States has the most unequal income distribution of all 26 OECD (Organisation for Economic Co-operation and Development) nations, once tax policies are taken into account.[154] Interestingly, the situation in the United States represents a historical reversal. In the 1920s (the first decade for which these figures are available), the United States was one of the most economically egalitarian countries, giving America the image of the land of opportunity. In comparison, most European countries, such as Britain, were more wealth stratified at the time.[155] Today, European countries are all less stratified, in most cases much less so—such as the 4-to-1 figures for the Scandinavian countries and the 5-to-1 and 6-to-1 figures for France, Belgium, Switzerland, Spain, and the Netherlands. The lowest figure in the world is for Japan, 3.4 to 1.[156] Most countries with a Muslim majority also have quite egalitarian income ratios.[157]

Inequality within countries means that the 66-to-1 ratio of income between the fifth of people living in the richest countries and the fifth living in the poorest understates the level of global inequality. If the richest fifth of the world population from all countries, rich and poor, were put together, their income would likely total 150 times that of the poorest fifth of the world's population (see Figure 1.10).[158]

Consequently, taking the world's population as a whole, the number of very poor people is staggering. The World Bank defines "extreme poverty" as living on $1.25 a day or less in terms of local purchasing power. As of 2005, some 1.4 billion people live in this deplorable condition, and the number has almost certainly increased since then as a result of the Great Recession.[159] The good news is that there have been substantial improvements. In 1990, a total of 1.8 billion were living on less than $1.25 a day.[160] Moreover, world population has risen

Figure 1.10 The champagne glass of world wealth distribution. The fifth of world population from the world's richest countries receives about 66 times the income of the fifth of world population from the poorest countries. When calculated on the basis of the richest fifth of persons from all countries versus the poorest fifth from all countries, the ratio of income disparity likely rises to 150 to 1.



Source: Based on Korten (1995) and World Bank (2007a).

quite a bit since then, so the proportion of the poor has actually fallen even further. Thus, there have been some encouraging changes. But there are also significant regional differences. Due to rapid population growth, the numbers of the very poor have been on the rise in India and Africa over this time period even as the proportion of the very poor has declined. Almost all of the numerical gains in poverty alleviation have been in just one country, albeit a very large one: China.[161] And most of those who used to be on the very bottom haven't moved up very far. In fact, the overall number of those living on $2 a day or less has actually gone up a bit since 1981—by about 100 million.[162]

Income isn't the same as wealth, though. One's command of riches can come in many forms: savings accounts, land, buildings, possessions, investments, and more. The discrepancy in distribution of environmental goods gets even more extreme when we calculate it by wealth instead of income because the wealth of the poor is usually pretty much only in the form of income, as their assets are so minimal. For example, in the United States, the firebrand filmmaker Michael Moore made headlines by declaring that "just 400 Americans—400—have more wealth than half of all Americans combined." (He made this statement in a speech in my city, Madison, Wisconsin, on March 5, 2011.) Closer inspection using figures for 2010 shows this is actually an understatement. The 400 richest have a combined wealth of $1.37 trillion. The combined wealth of the poorest 60 percent of American households—more than half, and totaling roughly 100 million households in all—is $1.26 trillion, or 2.3 percent of the United States' total net worth.[163]

Global figures show much the same pattern. A 2008 study by United Nations University, based on 2000 data, found that the top 1 percent of the world's population commands 40 percent of the world's wealth. The top 5 percent commands 71 percent of the world's wealth, and the top 10 percent commands 85 percent. This study didn't provide a ratio of the wealth of the top and bottom 20 percent, as I calculated above for income. However, the ratios the study's authors did provide show how much more extreme the difference in wealth is versus the difference in income. The figures show that the top 10 percent is 400 times wealthier than the entire bottom 50 percent (not just the bottom 10 percent or 20 percent), and the top 1 percent is almost 2,000 times richer than the entire bottom 50 percent. The entire bottom 50 percent owns just 1.1 percent of the world's wealth.[164]

The wealth of the world's richest people is staggering. As of 2010, the world had 1,011 billionaires worth a combined $3.6 trillion dollars, or an average of about $3.5 billion each.[165] Now consider the wealth of the 2.4 billion people living in the world's 50 poorest countries. As their assets are so minimal, we can, roughly speaking, consider their annual income to be the same as their wealth. Pretty much all they've got is what they make. Their annual income together amounts to $1.9 trillion, barely half the wealth of the 1,011 richest people.[166] Now let's assume that the poor do usually have a few assets—some clothes, tools, housing of some sort, perhaps a radio and some other saleable possessions—and estimate the value of those as equal to their income. That brings their wealth up to $3.8 trillion, almost the same as the wealth of the 1,011 richest individuals. Think of it: 1,011 people as wealthy as 2.4 billion people put together.

That's a rough calculation, of course. So let's narrow it down to one person, Carlos Slim Helú, the richest person in the world as of 2010 with $53.5 billion, having slightly passed Bill Gates's $53.0 billion. And let's make the comparison straight on annual income this time. Slim's assets increased by $18.5 billion during 2009.[167] The individual national incomes of the 72 smallest economies were less than that in 2009.[168] In other words, Carlos Slim Helú is a mid-sized national economy all on his own. Taken together, his income that year was roughly the same as that of the 27 smallest national economies put together. Let me put it more plainly: He made more money in 2009 than 27 entire countries did.

The wealth of the average person in the rich countries leads to a substantial global consumption gap. The average person in the rich countries consumes 3 times as much grain, fish, and fresh water; 6 times as much meat; 10 times as much energy and timber; 13 times as much iron and steel; and 14 times as much paper as the average resident of a poor country. And that average person from a rich country uses 18 times as much in chemicals along the way.[169] These consumption figures are lower than the 66-to-1 income differential because the comparison here is between the roughly 20 percent of the world's people who live in industrial countries and the roughly 80 percent who don't—not the richest fifth and poorest fifth of countries. If the 60 percent in the middle were removed from the calculations, the consumption gap for many of these items would probably reach or exceed the 66-to-1 ratio of income. (For some items, however, it would not—even a very wealthy person can eat only so much grain, fish, and meat.)[170]

Along with the consumption gap comes an equally significant pollution gap. The wealthy of the world create far more pollution per capita than do the poor. For example, in the rich countries, per capita emissions of carbon dioxide are 12 times higher than in poor countries.[171] Moreover, the rich countries are also more able to arrange their circumstances such that effects of the pollution they cause are not as significantly felt locally, as with the export of toxic wastes and dirty forms of manufacturing noted earlier.

The consequences of these differentials are serious indeed. The Global Information and Early Warning System of the Food and Agriculture Organization regularly reports that 30 or more countries at any one time are in need of external food assistance.[172] As of 2010, some 925 million people in the world are undernourished, a figure that has generally remained flat in percentage terms since the mid-1990s at around 13 to 14 percent, but took a sharp spike upwards as a result of the Great Recession.[173] Twenty-five percent of the world's children under age 5 are malnourished.[174] In the 39 poorest countries, the figure is 28 percent. India has the highest figure: 44 percent.[175] Hunger and malnutrition annually cause the death of almost 6 million children before they reach the age of 5.[176] Because of rampant malnourishment, adults face a reduced capacity to work and children grow up smaller, have trouble learning, and experience lifelong damage to their mental capacities.[177]

Many of the world's poor find it difficult to protect themselves from environmental "bads." As of 2006, an estimated 825 million people live in slums, generally in shelter that does not adequately protect them from such environmental hazards as rain, snow, heat, cold, filth, and rats and other disease-carrying pests.[178] And the number is rising fast; by 2030, it could be 2 billion, the United Nations Human Settlements Agency projects.[179] Moreover, the world's poor are more likely to live on steep slopes prone to landslides and in low-lying areas prone to floods. Over 700 million lack access to safe drinking water.[180] Some 18 percent of the world's population, about 1.5 billion people, do not have any form of sanitation—no toilets or even latrines.[181] The poor also typically find themselves relegated to the least productive farmland, undermining their capacity to provide themselves with sufficient food (as well as income). Compounding the situation are the common associations between poor communities and increased levels of pollution and between poverty and environmentally hazardous working conditions.

It is also possible to have too much of the good things in life. In the United Kingdom, 66 percent of men and 57 percent of women are now either overweight or obese.[182] From 1993 to 2008, the prevalence of obesity in the United Kingdom shot up from 16 to 24 percent of women and 13 to 25 percent of men.[183] The situation in the United States is even worse, with some 73.7 percent of all adults being overweight, obese, or extremely obese in 2008.[184] Adult obesity in the United States has more than tripled since 1962, to 34.3 percent, and for children aged 6 to 11 it has gone up by almost a factor of 5.[185] Other wealthy countries have also experienced rapid rises as lifestyles have become more sedentary and calorie intake has increased. The diseases associated with too much food are increasing as well: diabetes (especially type II), hypertension, heart disease, stroke, and many forms of cancer.

But the problem of being overweight is not limited to the wealthy nations. Weight problems are rising dramatically in poorer nations, as people increasingly take up more sedentary lives there, too, and as food consumption shifts more into the marketplace and away from home production, making healthier foods less readily available for the poor. The World Health Organization (WHO) estimates that, worldwide, 1.6 billion adults were overweight and 400 million were obese, as of 2005.[186] More than 30 percent of adults in Egypt and Kuwait are obese.[187] The problem is particularly pronounced in urban areas. In China, the obesity rate as of 2002 was 7 percent, double what it was in 1992. But the rate was double in the cities in comparison with the countryside.[188] In some cities in China, 20 percent or more are obese.[189] In urban Samoa, as many as 75 percent of adults are obese—not just overweight, but obese.[190] With excess weight comes its many deleterious effects on health. Yet the world's wealthy are generally better able to protect themselves from the consequences of high weight. Medical treatments for diabetes, circulation problems, and cancer are far less accessible for the poor.

Considering these stark facts, it comes as no surprise that people in the wealthy countries live an average of over two decades longer than those in the poor countries—80.3 years versus 57.7—despite great advances in the availability of medical care.[191] In 14 very poor countries, the average person has no better than a 50 percent chance of reaching age 50.[192] In half a dozen countries, 20 percent or more won't even make it to age 5.[193] The good news is that, in recent years, the life expectancy gap between rich and poor has closed a good bit. But it remains wide and stark.

Within-country differences in income have a substantial impact on the quality of life for the poor, even in rich countries. In the United States, some 3.5 million Americans experience a period of homelessness during the year, about one-third of them children, according to a 2009 estimate based on several studies.[194] A 2007 study estimated that 7.7 percent of the British, 4 percent of Italians, and 3.4 of Belgians experience homelessness at some point in their lives.[195] Typically, some 5,000 in France, 20,000 in Germany, and 8,000 in Spain are "sleeping rough," with no roof at all.[196]

Hunger can also exist in conditions of prosperity. Take the United States, for example. Some 14.7 percent of American households experienced *food insecurity* in 2009, the highest figure the U.S. Department of Agriculture (USDA) had recorded since it began tracking this statistic in 1995. As a result, people are forced to reduce the "quality, variety, or desirability" of their diet, without necessarily experiencing hunger, according to the USDA definition of food insecurity. But some 5.7 percent of American households experienced "very low food insecurity" during the year, meaning they experienced hunger—what the USDA defines as "multiple indications of disrupted eating patterns and reduced food intake." Three-fourths of those 5.7 percent faced hunger in 3 or more months of the year. As of September 2010, a total of 43 million people were receiving food stamps, or 14 percent of the U.S. population. During the 2009–2010 school year, the USDA provided 2.9 billion free lunches to U.S. schoolchildren from poor families, and another half billion reduced-price lunches.[197]

Food, shelter, longevity—these are the most basic of benefits we can expect from our environment. Yet people's capabilities to attain them are highly unequal. As Tom Anthanasiou has observed, ours is a "divided planet."[198]

Environmental Justice for All

But you don't have to be poor to experience environmental injustice. (Some argue that you don't have to be human either—that all living things can experience it.) Many environmental hazards cross social boundaries as they cross bodily ones.

Take the nine people, including journalist Bill Moyers, who in 2003 volunteered to let Mount Sinai Hospital researchers search their bodies for traces of industrial chemicals and pollutants—chemicals that their own bodies did not make. None of the nine had jobs that exposed them to hazardous chemicals in their workplace, and none of them lived near industrial facilities; these were middle-class and upper-class folks. Yet when researchers took blood and urine samples, they found in the volunteers' bodies an average of 91 different chemical pollutants. Among these chemicals, the volunteers averaged 53 that cause cancer, 62 neurotoxins, 53 immune system disrupters, 55 that cause birth defects or disrupt the body's normal development, and 34 that damage hearing. (Many of these chemicals have more than one effect.) Of course, these chemicals were present in only trace amounts, and the researchers used sophisticated equipment to detect them. But they were there. And although this was a comprehensive assessment of individual *body burden,* as toxicologists call it, there were many kinds of common chemical pollutants that the researchers were not able to study. Indeed, some 80,000 chemicals circulate in products on the market in the United States today, and only a few hundred of them have been screened for their safety.[199] So it is likely that 91 was a low estimate of the number of trace pollutants.[200]

Can trace amounts sometimes amount to something? Many observers now think unfortunately yes. Increasingly, the leading medical journals are filling up with studies that link environmental chemicals with a host of diseases. Not all the studies show this link. But more and more do. For decades, cancer researchers had estimated that environmental factors account for 2 to 4 percent of all cancers, and have attributed most cancer to inheritance and pathogens, matters which are largely unavoidable and therefore apolitical.[201] Then in 2010, the President's Cancer Panel—appointed earlier by President George W. Bush—declared that those low estimates are "woefully out of date" and that "the true burden of environmentally induced cancer has been grossly underestimated."[202] These were controversial statements, and many voices rushed to rebut them, including the American Cancer Society. However, many voices, such as the Science and Environmental Health Network, also rushed to support them.[203]

No matter how wealthy you are, you can't run far enough, or build a gated community secure enough, to escape the body burden of industrialism. True, the wealthy are better able to avoid these effects through buying organic food and working cleaner jobs. And they are better able to deal with the consequences through better health care. There is definitely considerable inequality in the impact of industrialism's dirty side. But it wouldn't make it just if there were some way to divide the impact equally. Even if everyone suffers from something that is preventable, it is still preventable suffering. Environmental justice is an issue for us all.

The Beauty of Ecology

"A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise."[204] These are probably the most famous lines ever written by Aldo Leopold, one of the most important figures in the history of the environmental movement. Leopold's words direct our attention to a sense of community—to a sense of *ecos,* of home, of the habitat we share with so many others. Understood in this way, sustainability and environmental justice concern not only the conditions of human life but also the conditions of the lives of nonhumans. I think that's what Leopold was getting at with the words "integrity" and "stability." Integrity sounds to me like justice, and stability sounds like sustainability. And to talk about community is to talk about the interdependence of justice and sustainability for all.

Leopold also directs our attention to a word that is certainly one of the hardest of all to define but is no less significant for that difficulty: beauty. (Indeed, the difficulty of describing this area of environmental concern has led me to change the term I use for it from earlier editions of this book.[205]) For many, and myself included, an essential part of beauty is the sustainability and justice of what we behold. To speak about the *beauty of ecology*, then, is to speak about every living thing's right to a home, a habitat, that is sustainably beautiful and beautifully sustainable.

Threats to the integrity, stability, and beauty of ecology are manifold. Take the loss of species. For example, of the 10,027 known species of birds, some 12 percent were threatened with extinction as of 2010.[206] Many have already gone; the passenger pigeon, the dodo, the ivory-billed woodpecker, and the 11 species of moa are only some of the best known. Since 1800, a total of 103 have gone extinct.[207] New Zealand has perhaps been the hardest hit. Before people arrived around 1300 CE, New Zealand's birds had no mammalian predators, and thus no evolutionary pressure to adapt to them. Since then, half the bird species of the North and South Islands have disappeared, including all 11 species of moa—among them the wondrous *Dinornis robustus* and *Dinornis novaezelandiae* which grew to 500 pounds and 12 feet tall.[208]

Estimates of extinction rates for all species vary widely because we still do not have a good count of how many there are, or ever were. Many species are still unknown or survive in such low numbers that they are hard to study. But even the low estimates are staggering. Perhaps the most widely regarded account, based entirely on individual assessments for each species, is the "Red List" of the World Conservation Union, known by the acronym IUCN, a 140-nation organization (see Figure 1.11). As of 2010, the Red List registered 18,351 species as threatened with extinction. In addition to the 12 percent of bird species, extinction is now a real and present possibility for 20 percent of mammal species, 4 percent of fish, 5 percent of reptiles, and 29 percent of amphibians, according to the 2010 Red List.[209] But while the IUCN has reviewed the status of all bird species and about 53 percent of all vertebrate species, very little is yet known about the status of invertebrates and plants. All told, as of 2010, the IUCN had evaluated the status of only about 3 percent of known species.[210] Most have been barely studied.

The overall extinction rate is thus in the realm of educated guesswork, given the spotty data we have. Richard Leakey, the famous paleontologist, is one who has made a try. He suggests that we could lose as many as 50 percent of all species on Earth in the next 100 years, largely because of very high rates of extinction among invertebrates, the group we know the least about. (For example, nearly half of the insect species that the IUCN has assessed are threatened. However, evaluations often focus on species at risk.) If Leakey is anywhere near right, that would put the current period of extinction on the same scale as the one that did in most dinosaurs and much of everything else 65 million years ago, and four earlier periods that had a similar effect on the Earth's living things. That's why Leakey and Roger Lewin call the current period the "sixth extinction."[211] When we add in the extinction of subspecies and sub-varieties, the decreasing diversity of planetary life is even more dramatic.

Of course, species have always come and gone, as Charles Darwin famously observed in his theory of natural selection. But the rate of these losses has greatly increased since the beginning of the Industrial Revolution. Some have disappeared because of habitat loss, as forestlands have been cleared, grasslands plowed, and wetlands drained and filled. Some have suffered from pollution of their habitat. Some have found themselves with no defenses against animals, plants, and diseases that humans have brought, often unintentionally, from other regions of the world into their habitat. The Earth is a single, gigantic preserve for life, and we have not been honoring its boundaries and protecting its inhabitants.

The loss of species is an instrumental issue of sustainability. The leaking global gene pool means a declining genetic resource base for the development of new crops, drugs, and chemicals.

Figure 1.11 A leaking gene pool: The IUCN "Red List" of threatened species, an annually updated inventory.

	Number of described species	*Number of species evaluated by 2010*	*Number of threatened species in 2010*	*Number threatened in 2010, as % of species described*	*Number threatened in 2010, as % of species evaluated*
Vertebrates					
Mammals	5,491	4,863	1,094	20%	22%
Birds	10,027	9,956	1,217	12%	12%
Reptiles	9,205	1,385	422	5%	30%
Amphibians	6,638	5,915	1,808	29%	31%
Fishes	31,800	3,119	1,201	4%	39%
Subtotal	63,161	25,238	5,742	10%	23%
Invertebrates					
Insects	1,000,000	1,255	623	0.07%	50%
Molluscs	85,000	2,212	978	1.21%	44%
Crustaceans	47,000	553	460	1.15%	83%
Corals	2,175	13	5	0.23%	38%
Arachnids	102,248	33	19	0.02%	58%
Velvet Worms	165	11	9	5%	82%
Horseshoe Crabs	4	4	0	0.0%	0%
Others	130,200	52	24	0.03%	46%
Subtotal	1,305,250	9,526	2,904	0.0%	30%
Plants					
Mosses	16,236	101	80	0.0%	79%
Ferns and Allies	12,000	243	148	1%	61%
Gymnosperms	1,052	926	371	35%	40%
Flowering Plants	268,000	11,584	8,116	3%	70%
Green Algae	4,242	2	0	0.0%	0%
Red Algae	6,144	58	9	0.1%	16%
Subtotal	307,674	12,914	8,724	3%	68%
Fungi & Protists					
Lichens	17,000	2	2	0.01%	100%
Mushrooms	31,496	1	1	0.003%	100%
Brown Algae	3,127	15	6	0.2%	40%
Subtotal	51,623	18	9	0.0%	50%
TOTAL	1,727,708	55,926	18,351	1%	33%

Source: IUCN (2010).

In addition, most ecologists suspect that decreased diversity destabilizes ecosystems—ecosystems that we, too, need to survive. But the ethical and aesthetic impact of the loss of so many forms of life may be as great, if not greater.

The loss is not only one of forms of life but also of forms of landscape. Take deforestation. The world has lost about half of its original area of forestland.[212] Between 2000 and 2010, the loss continued as some 13 million hectares of forested landscapes were converted to other uses every year—an area about the size of Costa Rica.[213] Some areas have reforested, though, mainly through replanting, such that the net loss of forested land was about 5 million hectares a year during 2000 to 2010. These numbers represent considerable improvement over the previous decade, when forestland was being converted to other types of land use at a rate of 18 million hectares a year and reforestation was running at about 10 million hectares a year, for a net loss of 8 million hectares a year. So we've seen almost a 40 percent improvement, which is certainly encouraging. Nonetheless, Africa lost 4.9 percent of its forestland from 2000 to 2010, as did South America, including Brazil and the Amazon. Only about one third of the world's remaining forestlands are what ecologists call primary forests, little disturbed by human use. Alarmingly, 80 percent the continuing net loss—some 4 million hectares annually—is of these primary forests, with their richness of species and habitat.[214] Replanted forests are poor substitutes for the woods they replace, at least in terms of biodiversity—the ecological equivalent of exchanging the paintings in the Louvre for a permanent display of engineering blueprints.

There's another loss, too—the disappearance of a kind of quiet intimacy with the Earth, the sense of being connected to the land and to each other through land. It is a common complaint that modern technology removes us from contact with a greater, wilder, and somehow realer reality. This removal, it should be said, has been the whole point of modern technology, but some have come to wonder whether our lives are emptier because of it. A romantic concern, perhaps. But do we want a world without romance?

Moreover, the loss of quiet intimacy is not merely a philosophical matter. It is physical, too. We in the industrialized world are seldom away from the sound of machines, and we generally interact with the world by means of machines. Got something to do? Get a machine. Try to escape from the constant sound of machines? Good luck. Saturday morning in the suburbs, and the lawn mowers and leaf blowers are at it. Late into the summer night, the air-conditioners hum and the highways growl. Out in the countryside, the situation is often no better: tractors, snowmobiles, Jet Skis, motorcycles, passing airplanes, chain saws, all manner of power tools, and the nearly inescapable sound of the highway except in the remotest locations. Back at the office, the lights buzz, the computer whines, the air-handling equipment rushes with a constant Darth Vader exhale, and the traffic—always the traffic—invades the sanctum of the ear with an ever-present tinnitus of technology. And we hardly seem to notice. We have lost our hearing, our hearing for habitat.

Finally, there's the question of our right to make such great transformations in the world. Nothing lasts forever, of course. Over millions of years, even a mountain is worn away by erosion. Wind, rain, ice, and changes in temperature constantly sculpt the land, and the shape of Earth's surface constantly changes as a result. But geologists now recognize humans to be the most significant erosive force on the planet.[215] Agriculture, forest cutting, road building, mining, construction, landscaping, and the weathering effects of acid rain—all these have resulted in enormous increases in the amount of sediment that rivers carry into the oceans. We wield the biggest sculptor's chisel now. Perhaps it is our right. If so, then it is also our responsibility.

Although I have not covered the question of the beauty of ecology in much detail, let me conclude here. After all these pages on our environmental problems, I'm exhausted. Maybe that's the most difficult environmental problem of all: There are so many of them.

Figure 1.12 The beauty of ecology: Sunrise over Grenadier Island, St. Lawrence River, 2007.

Source: Author.

The Social Constitution of Environmental Problems

These matters seemed quite remote at that lovely brunch as we loaded up our plates with fruit salad, coffee cake, scrambled eggs, bread, butter, and those great hominy grits—remote but ironic. Here I was amid a group of three families whose incomes, although not unusually high by Western standards, were sufficient to command a brunch that two centuries ago would have been seen as lavish even by royalty. And what was I doing? Once I had finished explaining environmental sociology, I was reaching for seconds.

My point is not that there is something wrong with pigging out every once in a while. Nor is it that consumption is necessarily a bad thing. (To consume is to live.) Rather, I tell this story to highlight how social circumstances can lead to the sidelining of concern and action about environmental consequences.

Everything we do has environmental implications, as responsible citizens recognize today. Although at the time sociology's relevance for the environment was less widely recognized, the adults at that brunch a decade ago were genuinely interested in my explanation of environmental sociology. They listened avidly for the 2 minutes the dynamics of politeness grant in such a setting. But the currents of social life quickly washed over the momentary island of recognition and concern that my explanation had created. Soon we were all reaching for more of the eggs from chicken-factory hens, the fruit salad with its bananas raised on deforested land and picked by laborers poorly protected from pesticides, the coffee cake made with butter and milk from a dairy herd likely hundreds of energy-consuming miles away, and the grits made from corn grown at the price of one bushel of soil erosion for one bushel of grain. Meanwhile, the conversation moved on to other matters. And shortly, we guests got into our cars and drove home, spewing greenhouse gases, smog, and fine particulates all along the way.

A completely ordinary brunch. But do you refuse to invite friends over because you cannot easily get environmentally friendly ingredients for the dishes you know how to prepare? Do you refuse a host's food because it was produced in a damaging and unjust manner? And do you refuse an invitation to brunch because the buses don't run very regularly on a Sunday morning, because a 20-minute ride in the bike trailer in below-freezing weather seems too harsh and long for your 5-year-old, and because no one nearby enough to carpool with is coming to the party? Do you refuse, especially when you have your own car sitting in the driveway, as is almost certainly the case in the United States?

Likely not.

What leads to this sidelining of environmental concern and action is the same thing that manufactures environmental problems to begin with: the *social constitution of daily life*—how we as a human community institute the many structures and motivations that pattern our days, making some actions convenient and immediately sensible and other actions not.[216] Caught in the flow of society, we carry on and carry on and carry on, perhaps pausing when we can to get a view of where we're eventually headed, but in the main just trying to keep afloat, to be sociable, and to get to where we want to go on time. Our lives are guided by the possibilities our social situation presents to us and by our vision of what those possibilities are—that vision itself being guided in particular directions by our social situation. That is to say, it is a matter of the social organization of our material conditions, the ideas we bring to bear upon them, and the practices we therefore enact. Yet the environmental implications of those conditions, ideas, and practices are seldom a prominent part of how we socially constitute our situation. Instead, that constitution typically depends most on a more immediate presence in our lives: other people.

We need, I believe, to consider the environment as an equally immediate (and more social) presence in our lives. That does not mean we need to be always thinking about the environmental consequences of what we do. As an environmental sociologist, I cannot expect this—especially when I don't always think about environmental consequences myself. People have lots and lots of other concerns. Nor should it be necessary to think constantly about environmental consequences. Rather, what is necessary is to think carefully about how we as a community constitute the circumstances in which people make environmentally significant decisions. What is necessary is to create social situations in which people take the environmentally appropriate action, even when, as will often be the case, they are not at that moment consciously considering the environmental consequences of those actions. What is necessary is to reconstitute our situations so what we daily find ourselves doing compromises neither our social nor our environmental lives.

The challenge of environmental sociology is to illuminate the issues such a reconstitution must consider.