

## Chapter 3

# Time's Up

Many observers, long used to the slow pace of political transformation, might agree with everything I've said so far but insist that we need not worry too much: given time, our economy will recover, the supermajority of Americans will prevail, our political system will work, and we will see real action on climate change. With enough persistence, over the next decade or so we will help forge a genuinely effective international agreement. The research into new technologies will begin to see fruitful results, we'll create the new energy economy, and we'll be on a secure footing at last.

But in the case of this particular transformation, unlike most others, we just don't have the time to let things play out. While we proceed at our usual deliberative pace, climate change speeds ahead. The mismatch is stark and growing. If we're going to get anything done, we should do it now, and preferably yesterday. As Rajendra Pachauri, the scientist who headed the IPCC in 2007, remarked in that year, "If there's no action before 2012, that's too late... . What we do in the next two or three years will determine our future. This is the defining moment."<sup>67</sup>

We're not used to thinking about acting so quickly in part because we tend to accept the pace of political change. The international negotiations for a climate change treaty, building on that premise, takes for granted that we have some time: the proposed agreement sets the target of an 80 percent reduction in the emission of carbon dioxide by 2050. *That* year is indeed some distance away. But if we take a good look at the most recent information, it's clear that we will have to make the cuts much deeper and sooner than we thought.

*But wait a minute, many voices say; why do you keep insisting that everything has to happen **now**? Why not let the country recover economically*

*before asking for change? Why not bring everybody on board before rushing into action?*

There are **eight** good reasons why time is up.

First of all, the target—cutting emissions 80 percent by 2050—was chosen for political reasons, not on the basis of the science. 2050 is far enough away to make deep cuts politically palatable. Whenever people suggest that we have to make these cuts earlier, others resist—not because of the science, but because they fear the political consequences. Unfortunately, the change in Earth's climate doesn't particularly care about what is palatable to us. The goals we once set are too far away; if we are honest, we must acknowledge that we must act much sooner.

Second, the science itself has changed since the international negotiations began. Over the past twenty years or so, scientists have been asking what would happen if we doubled the preindustrial level of atmospheric carbon dioxide—around 275 parts per million—to around 550 ppm. This number, chosen in part as a convenient signpost, has determined the shape of countless investigations of climate change as well as much of the discussion of potential future scenarios in the IPCC assessments. As a result, for many years we did not have a sure sense of how much change might take place at lower levels. In a rather different vein, those seeking international agreements initially chose 450 ppm as a target in part because it once seemed that with concerted effort the international community might be able to meet it.

But in the last four or five years, further research suggests that these numbers are too high. One paper (authored by James Hansen and many others) published in September 2009 argues that previous models failed to take into account the effect of positive feedback loops. Models once predicted that a doubling in carbon dioxide concentrations in the atmosphere would lead to a temperature increase of around 3° Centigrade (with a range of from 2 to 4.5°). But current models that include the effects of positive feedback loops estimate that the same carbon dioxide concentration will lead to an increase of around 6° Centigrade (with a range of from 4 to 8°). The implication of this argument is that the widely known and cited estimates of the IPCC are too optimistic—and that in fact we have *already* gone beyond what the planet can tolerate. If Rajendra Pachauri thought we have until 2012, these researchers imply

that we should have acted long before even *that* year. They estimate that the boundary for carbon dioxide concentration is 350 ppm; at the time of that article's publication, the concentration was 387 ppm and rising—and was forcing an exit from the Holocene, the stable environment we have enjoyed over the past 10,000 years.<sup>68</sup> Persuaded by this argument, Bill McKibben and many others have formed the group 350.org, which advocates for concerted action to meet that lower target.

Third, although the international community set 450 ppm as its target many years ago, the continuing rise in emissions from most developed nations in the intervening years, together with the huge increase from developing countries like China, has made that target totally unrealistic. In the Kyoto Protocol, most of the world's nations promised to reduce greenhouse emissions by about 5 percent below 1990 levels by 2012. But instead, global carbon dioxide emissions *increased* by 38 percent from 1990 to 2009.<sup>69</sup> Very few observers now believe that we will be able to stabilize carbon dioxide levels at that threshold. In August 2004, Stephen Pacala and Robert Socolow introduced the idea of “stabilization wedges.” In their definition, a wedge is the shape on a graph whose top (ascending) line depicts a gradual increase in carbon dioxide emissions and whose bottom (straight or descending) line depicts a potential decrease in those emissions if we adopt new practices. In short, a wedge is a chunk of unemitted carbon dioxide. Pacala and Socolow proposed fifteen possible wedges drawing on existing or nearly existing technologies and suggested that achieving seven of these wedges over the next fifty years would be enough to stabilize those concentrations at 500 ppm, a target they thought plausible.<sup>70</sup> But in September 2010, Martin Hoffert pointed out that because our emissions have been rising much more quickly than Pacala and Socolow envisioned, we would now need to achieve eighteen of these wedges just to reach stabilization and twenty-five to phase out fossil fuels altogether.<sup>71</sup>

Think about it: in six years, the world went from needing to achieve seven wedges to eighteen. We're going in the wrong direction, and going fast: we're *adding* to our challenge by nearly two wedges per year, making the task of reversing the effects of these emissions even more difficult.

It's true that during the recession, the usage of electricity and gas fell, slowing down the increase in our greenhouse gas emissions. But usage

fell because of hardship, not from any shift in our fundamental habits. In the midst of the downturn, it was easy to predict that once the recovery began, people would rush back to the behavior they know best. In fact, that is exactly what happened. Researchers found that global emissions of carbon dioxide increased by 5.9 percent in 2010, more than making up for a slight decrease in 2009, the year in which the recession had the most impact.<sup>72</sup> Clearly, the recession did not slow down the steady increase in greenhouse gas emissions.

Fourth, even *this* discussion does not face the full measure of the challenge, for the simple reason that carbon dioxide is not the only greenhouse gas. George Monbiot points out that according to the Potsdam Institute for Climate Impact Research, we should aim to stabilize “greenhouse gases in the atmosphere at or below the *equivalent* of 440 parts of carbon dioxide per million.” When the carbon dioxide concentration was around 380 ppm, “the other greenhouse gases raise[d] this to an equivalent of 440 or 450.”<sup>73</sup> But in late 2013, the global monthly mean of carbon dioxide approached 400 ppm, so that the overall concentration of greenhouse gases is now well above the equivalent of 450 ppm.<sup>74</sup> *We have already exceeded the upper limit* for our contribution to the greenhouse effect we set some years ago.

Fifth, we must take another factor into account as well. As time goes by and we emit more carbon dioxide, the less the biosphere can absorb; by one estimate, it will absorb fully one-third less as much by 2030.<sup>75</sup> As a result, emitting a certain quantity of carbon dioxide a decade from now will impose a greater burden on the biosphere than emitting it today—and what is more, reducing our output will only keep up with the Earth’s capacity to absorb less. In effect, we will have to cut back our footprint *an extra portion* just to take that fact into account.

Sixth, much as these estimates for how *deep* we must cut have to be revised, the guess as to how *soon* we should achieve our target must change as well. Monbiot’s already severe estimate—that the United Kingdom would have to cut its emissions 80 percent by 2030—was based on a guess as to when our emissions would be so great that they would trigger positive feedback loops and thus irreversible climate change. But Monbiot relies on an estimate in a paper published back in 2003.<sup>76</sup> It’s already clear that in the intervening years we’ve emitted far more than

scientists in 2003 would have guessed. If they thought that business as usual might trigger irreversible global warming around 2030, twenty-seven years later, the reckless emission of greenhouse gases over the last ten years has undoubtedly moved up the date much closer to the present.

These physical facts alone are dire. We have over twice the reductions to achieve as we did only a few years ago and far less time in which to achieve them. Very soon, the present in which we live and the future in which we would cross the tipping point will coincide—and we'll discover we've already passed the point at which those positive feedback loops kick in.

Doing some arithmetic based on these facts may help clarify our situation. In 2003 it once seemed we'd meet our goals by 2030, but we've managed to waste ten years or so. If we once needed to achieve seven wedges, we now need to achieve eighteen—*plus* a further increment to hit a target not of 500 ppm, but of 350. Since we are already above the equivalent of 450 ppm, if we wish not to go too far beyond that level we will have to try to eliminate fossil-fuel use entirely, and thus to achieve twenty-five wedges, as Hoffert suggests. But to do so now, after several years since his study have gone by, we'd most likely need to hit around thirty wedges. Yet we'd need to add a *further* increment to take into account the fact that the biosphere will absorb less of what we emit in the coming years. A back-of-the-envelope calculation suggests that *if we acted today* we would need to reduce our emissions by at least thirty-two wedges. Moreover, thanks to our profligacy in recent years, as well as our sense that we must hit a lower target, it's also likely we would need to achieve these cuts many years earlier.

Other ways of estimating the challenge confirm these figures. At the Copenhagen summit on climate change in 2010, a majority of nations endorsed a target of raising the Earth's temperatures no more than 1.5° Centigrade above preindustrial levels. But since we've already raised the average temperature by 0.8°, and the temperature will rise another 0.6° due to the inertia of the world's climate, 1.4 of those 1.5° are already inevitable, leaving us virtually without hope of reaching the target.<sup>77</sup> Even if we acted *today* to eliminate our greenhouse gas emissions *entirely*, we'd still barely meet our goal. And there is simply *no* chance we can eliminate all those emissions so quickly.

Let's take more than the purely physical facts into account here as well. It will take us a few years to pass the necessary legislation and sign the key international agreements, as I suggested above, and a few years after *that* to research and implement an array of new technologies, build the solar and wind plants, create a new energy infrastructure, convert our transportation system, and fund the protection of forests. If we're lucky, perhaps we will begin to see steep reductions in greenhouse gas emissions in about a decade. By then, however, we will have emitted so much more carbon dioxide that we'll have much further to go to meet our targets. How far is impossible to say—but clearly we'd need to achieve many more than the thirty-two wedges I mentioned a moment ago.

From these estimates it seems that if we acted *now*, our change in policy would finally *begin* to take effect roughly ten years from now, somewhere in the early 2020s. But the severity of our situation is clear if we take into account the seventh reason—the fact that, as I've said above, 2020 is the new 2100. As recent research indicates, we've already crossed one tipping point with the melting of the Arctic sea ice and may cross one or two more by the mid 2020s. Nearly all the above estimates take as their fundamental principle the overriding task of *not* crossing through those tipping points; once we reach them, we need not work our way through all those calculations but can sense our situation immediately from the state of those tipping points. We're now witnessing the very events we were trying to avoid, and all this talk of targets, all this arithmetic, however useful it may have once seemed, ultimately distracts us from what is right in front of us. And from the evidence of the melting sea ice, the exploding methane clathrates, the morphing permafrost, and the crackling Amazon rainforest, the essential story is becoming increasingly clear.

So it seems that even under the *best case scenario*, even if we acted today our efforts might take effect in the mid 2020s—just as we may be triggering severe and irreversible climate change. Fortune may smile upon us and allow us a few years of grace to hit our target, but if so, we really must achieve everything in a ridiculously tiny span of time. It is far more likely that we will be in the position of taking action after the feedback loops have already begun—making ourselves poster children for defiant foolishness. We are more than flirting with disaster; we're *inviting* it. It's

almost impossible not to think that all is lost, that even if we act, it will be too late.<sup>78</sup>

These realities undermine the premise of a major activist enterprise of our moment—Bill McKibben’s drive to encourage many public institutions to disinvest in fossil-fuel companies and thus help prevent the United States from pushing the biosphere beyond the limits of its tolerance. In the *Rolling Stone* article in which he lays out his case, McKibben first explains that the 2° threshold on which international negotiators rely is too high, but then invokes on a specific “carbon budget” derived from that threshold to argue we have time to make a difference through the strategy of divestment.<sup>79</sup> His effort, praiseworthy as it is, relies on a contradiction between his knowledge that we’ve already virtually met the limit of what the Earth can tolerate and his description of what a certain kind of activism can still accomplish.

Given all these factors, we can no longer assume that our efforts will bear fruit, that the civilizations of the Holocene will survive in anything like their present form. An honest look at the task ahead and the time remaining should disabuse us of our unspoken confidence that the world we know will endure in something of its current form for the rest of our lives.

*But hold on, someone might say, what if we lower our emissions after that target date? Wouldn't the Earth's temperatures eventually decline as well, getting back down to a level that would not cause extensive climate change? Even if we've been very slow and don't meet the target of 450 ppm, isn't there hope that we can **eventually** hit that or a lower target, and all will be well?*

In this question, I hear the voice of the last optimists speaking—the voice of those who hope that, however stupid and cowardly we all are, however slow to act, however likely to botch the entire task for a few more years, we might *still* have a chance. The activists at 350.org, acting on something of this premise, are organizing efforts to reduce our carbon dioxide emissions to that lower number in the long term, hinting that if we can do so, we will avert the onset of serious climate change.

But it simply isn't so. The eighth reason we have so little time is that *once we warm the planet up to a certain point, it will not cool down again* for a very long time. A recent paper showed that “the climate change that takes place due to increases in carbon dioxide concentration is largely

irreversible for 1,000 years after emissions stop.” If we did manage to stop emitting carbon dioxide, “radiative forcing”—or what we usually call the greenhouse effect—would indeed decline, but that decline would be “largely compensated by slower loss of heat to the ocean.”<sup>80</sup>

This finding means that even if we manage to cut our output of carbon dioxide, Earth’s temperatures will go up *and stay up*. But wait a minute: as I mentioned above, the rise in temperature lags behind the rise in carbon dioxide concentrations by many years, so that even after we stop emitting carbon dioxide, the temperature would rise another 0.6° Centigrade or so—a time lag that all the above estimates take into account. So the reality is that even after we cut our greenhouse gas output, the temperature level would *continue to rise*—and *then* eventually level off and *stay* at that higher level.

Unfortunately, then, the physics of the climate will not let us reverse the effects of our misbehavior now. If we push temperatures up, they are going to stay there. We have no second chance. And the first one is already slipping away.

It would be nice to pause here and suggest that it is not yet absolutely certain that those vicious circles are under way in full force and for good. That hesitation might have been plausible a year or two ago. But by now, the dire state of the Arctic feedback loop and our sense of its consequences for the entire global climate leave us little room for doubt.

Is there no basis for hope left to us? One last consideration remains, one final bedrock for hope: our general humility in the face of the vast complexity of Earth’s dynamic systems. Only the sense that our knowledge is limited, that something may be taking place and might still appear of which we have little inkling, stands between us and a frank acknowledgment that all is lost.

Many others seem to have come to a similar conclusion. Some of them show their awareness of our situation by introducing an entirely new angle on the problem, suggesting forms of geoengineering to address our plight; the Arctic Methane Emergency Group I mentioned in the introduction is a good case in point. But almost invariably such suggestions threaten to harm the planet in their own way. One idea is to inject aerosols into the atmosphere to dim the sun and lower the temperature. But doing so would ultimately cause serious ground-level pollution and



could help deplete the ozone layer. What about a shield placed in outer space to lower the amount of sunlight hitting the earth? It would need to be around 4.5 million square kilometers in size—and thus cost a huge amount of money to build and maintain (perhaps as much as 6 percent of the world's GNP, every year). Maybe putting white plastic sheeting over various deserts and reflecting the sunlight back into space would help. But doing so would prevent the circulation of dust, which has a vital role in providing iron and phosphorous to other regions and in supplying nutrients to plankton. What about placing that white reflective plastic over a vast area of the ocean? The objections to *that* idea are fairly obvious: vast quantities of plastic would cut off sunlight to organisms in the sea, would easily be transported by wind and storm, and could affect coastal ecosystems if the plastic were blown ashore.<sup>81</sup> These and other suggestions speak more about our current desperation than about any genuine attempt to address our dilemma.

Other suggestions seem quite sane. The leading climate scientist Wallace Broecker has concluded that there is no realistic chance we'll be able to replace fossil fuels with renewable sources in time. Accordingly, he proposes that we fix the climate by withdrawing carbon dioxide directly from the open air and injecting it deep into the earth. As I mentioned in chapter two, Carbon Engineering is putting similar ideas to work and is hoping to market its technology soon. But here again, there won't be enough of a commercial incentive to do so on a sufficient scale until there is a carbon tax (or untax)—until there is political action to make fossil fuels more expensive.<sup>82</sup> Sound familiar? We need political action before we get the new technology—and in this case, the technology is in a very preliminary stage.

Other observers, seeing our dilemma, do not imagine we can find a technological fix. They turn in a different direction, encouraging us to adapt to the massive transformations that are coming our way. Bill McKibben, for example, took a big step when he entitled his book *Eaarth*: in his view, we're no longer living on the planet Earth, for thanks to climate change, we find ourselves on another planet, one we're not used to at all. Earlier writers, like Al Gore or Monbiot, who discussed our dilemma in 2006 and 2007, still had reason to be optimistic. McKibben, writing in 2010, abandons the attempt to tell us how to avoid a dire fate.

Instead, he prepares us for that new planet and gives us advice about how we might live there. This shift in itself is a signal of how far we've come. Unfortunately, even his advice about adaptation cannot do justice to what we face. In the last half of his book, he suggests that we should create strong small communities, produce food locally, and rely on the resourcefulness and creativity of towns rather than the nation as a whole. These suggestions are remarkably sane. But doing so would hardly enable us to survive the events he describes so well in the first half of the book. How well will local communities raise their own food in many regions, when rain falls less regularly, the landscape retains water less well, and the plants may not have the chance to mature? How will towns flourish in the midst of dying forests and drying streams? Where exactly will these small communities succeed?

Not long ago, people who studied climate change could emphasize the possibility of transforming our fossil-fuel economy. A few years later, the tone has shifted: now they emphasize the prospect of engineering the Earth or offering up a localist ethic as a counterbalance. As I have suggested, I do not think these suggestions provide actual solutions. But they do have the merit of pointing out the problem. The challenge, then, is to face that problem without looking away, without escaping to increasingly less credible responses. A crucial shift has taken place in the last few years, and yet for the most part we avoid it; we hasten to move on, to find *some* pretext for optimism. There must *still* be comfort available to us, wherever it may be. But these responses fail to take into account the real implications of what is before us.

I do not discount the need for us to begin assessing the task of adapting to a changed Earth. Here again, the IPCC reports perform a valuable service. The 2007 assessment takes great care to describe the potential effects of various levels of warming on ecologies and societies around the world—and on how they might adapt. Because of our increasingly dire situation, many observers now treat these sections of the report more seriously than they did in the past. But as the focus shifts toward adaptation, we should pause and think about the implications of that change in emphasis.

For one thing, “adaptation” is a misleadingly gentle term for the task before us. “Adaptation” suggests that we can adjust some of our practices,

rethink how our ecosystems and economies will survive, and find a “new normal” in which to live. But this implication is simply too optimistic. Unless we make severe, thorough, and uncompromising changes soon, temperatures will climb to a high level. The longer they remain at that level, as they will, the more likely they are to trigger positive feedback loops—and thus create a *further* round of warming, with a further series of harsh consequences for the climate. These possibilities were not incorporated into the projections of climate change provided in the IPCC report in 2007, nor were they a factor in the scenarios of adaptation sketched there. The reality we face, then, is somewhat tougher than we thought a few years ago. The most likely scenario we face is that changes to Earth’s climate systems will accelerate and get steadily *worse*, step by lurching step, for decades—as various feedback loops kick in and impose devastating effects. The release of methane gas from the permafrost in the far North, for example, if it takes effect on a large scale, will lead to a rapid round of global warming, which in turn could trigger a wholesale collapse of the Amazonian ecosystem, with all its consequences for weather in the Americas, and a general increase in carbon concentrations in the atmosphere, which could in turn trigger feedback loops elsewhere. Once we pass the first tipping point, we cannot have confidence we will escape others and still others. What we face, in short, is *perpetual* adaptation—the task of making a wholesale adjustment to our reality, then doing it *again* ... then doing it *yet again*. It would be better if we admitted that if we make the necessary changes too late, we will have to *adjust radically, and at uneven and unpredictable intervals, for as long as we can imagine*.

That prospect is quite dire. But we should not therefore leap to the popular image of a planetary catastrophe. The future we face is *not* as simple as a full-out, planetary disaster that will simply defeat us. If that were the case, it would indeed make all our efforts vain, all our best strategies hopeless. But climate change is not a single, devastating event, like a nuclear holocaust. If irreversible, devastating climate change takes place, in the long term it will displace many societies, change the ethos of our cultures profoundly, cause untold suffering to millions of people, and reduce the Earth’s population by a major fraction. It will do so over generations, altering the world decade by decade, allowing us to accommodate certain changes and be defeated by others. As a result, it will not

allow us to relax into any particular mode of response. It may proceed at an incremental pace for many years but at other times strike quickly.<sup>83</sup> It will be an ongoing horror unlike any we have faced before. Planetary in scale, unfolding over a long span of time, it will at times give us room to change and at others interrupt our projects without mercy. It will allow us to have the illusion we are adapting successfully, then undercut our efforts with further ecological transformations. We cannot assume these events will necessarily finish us off soon, but neither should we pretend we can master them or survive them unscathed. Climate change, in short, will never quite allow us total hope or utter despair: we will be caught endlessly between conflicting possibilities.

In realizing that *this* is our most likely future, in turning from the hope we might ward it off to accepting the task of adapting to it, we are taking no small step. In doing so, we concede that our future will consist of living in a worsening world—a world that may get incrementally, steadily *less* habitable as time goes by.

This change will be much tougher on all of us than the most likely consequences of severe climate change, such as storms and floods, rising food prices and disappearing water supplies, economic distress and wars. Modern life has always been premised on the notion of progress—on democratization, economic growth, increasing cultural interchange, and improvements in the lives of ordinary people. America as a nation, borrowing on the promise of the Enlightenment it shares with many other traditions, has always looked ahead, building its identity on the promise of eventual liberation for its citizens and for the people of the world. For many generations, parents in modern societies have assumed that they were making better lives for their children, confident that their hard work and sacrifice would benefit their offspring. Even in dark times, at the depths of the Depression or in the midst of war, Americans have kept this hope alive. Participants in movements for social and economic justice have always cast their eyes far ahead, knowing that activism might pay off only decades into the future. All these hopes, in turn, have tacitly relied on the promise of economic growth, a promise that all advanced capitalist nations now rely on for their legitimacy—the hope that over time, all incomes would rise, and everyone would eventually flourish.

To give up the dream of progress and accept the prospect of a perpetually worsening world would be an immense loss for all of us. Without the promise of better lives for everyone, few of the attitudes of modern life survive intact. Facing the reality of our present moment, then, requires much more than an assessment of how we are doing in reducing our greenhouse gas emissions. It requires nothing less than a wholesale reexamination of the progressive attitude we inherit from the Enlightenment, a rethinking of the most basic attitudes we take for granted about our relation to the future.

Looking at our present moment in this way does not force us to give up our fight to ward it off in the first place. Nevertheless, as people begin to admit more and more that we have come to the final years in our effort to avoid irreversible climate change, as the emphasis falls ever more on adaptation, the question of how to be honest about our situation without giving up on the battle becomes more pressing. Al Gore once commented that “an astonishing number of people go straight from denial to despair, without pausing on the intermediate step of saying, ‘We can do something about this!’”<sup>84</sup> He’s absolutely right. I would only add that despair can be a form of denial: it, too, allows us to dismiss the problem, to assume we’re not responsible. Since nobody can do a thing, we’re off the hook.

But what if we have been dedicated to doing something about it—and nothing happens? What if we do what we can, join an activist community such as Repower America, the group Gore founded to agitate for political action, encourage the nation to shift to renewable sources by the end of the decade, and help individuals to take voluntary actions to reduce their carbon footprint—but ultimately realize the necessarily big shift will not take place in time? What then?

*That question* is what this book is about. Here we are now, fully aware of climate change and what it can bring, well aware of what we can do, but thwarted from real action. We’re stuck in a holding pattern, as if we must simply accept our fate. It would be the height of foolishness at this key moment simply to give up and abandon the effort. It’s devastatingly clear that our first task is to *intensify* the effort. After all, we are talking about the world’s greatest crime, ecocide, an assault on our entire planet’s ecology. It far outweighs genocide, the destruction of a people, for it

threatens to ruin the support system for all living things, and along the way displace, impoverish, or destroy a major portion of the human race. It undercuts our hopes for the future. It alters our understanding of the religious, cultural, and political traditions we inherit, for the future on which their validity relies threatens to disappear. We simply *must* fight on.

But as we do so, we should begin to confront the possibility that whatever the results of our efforts, the future we have always taken for granted is in danger of disappearing. We could once rely on the notion that the basic ecosystems of the Earth would still be present and flourishing for decades and centuries into the future. We can do so no longer.

As I mentioned in the introduction, the best thinking about our current situation almost always hesitates to acknowledge this fact. Inevitably, with only one or two exceptions, those who tell the truth about the dimensions of the challenge and the lateness of the hour lay great emphasis on the steps we can still take to alleviate the crisis or the best strategies we might use to survive the changes in the biosphere when they come. Providing a note of optimism is key; thanks to that gesture, we can handle an honest assessment of our situation much more productively. I too would emphasize that not all is lost, that we can still take action—if we do so immediately and on a vast scale. But anyone who stops there is not telling the whole story. In actual fact, given the slow pace of political change and the immense inertia of our economies, the probability we will do what is necessary in time is extremely low.

To face our situation without evasion, then, we must do the apparently impossible, break a very strong taboo, and begin to ponder what it would be like to live in a world undergoing severe climate change. None of us would ever seek out thoughts of this kind. Nevertheless, to block them out is ultimately another form of denial, another way to protect ourselves from the realities of climate change. Any such defense ultimately contributes to our complacency, our willingness on some level to accept things as they are. In contrast, the sanest, most humane, most transformative course of action is to face our situation as fully as we can.

Doing so will not undercut a commitment to changing our societies; on the contrary, it will help us understand the real stakes of the current fight. The goal is not only to safeguard the future of the biosphere; it is also to preserve our *idea* of the future, on which so much of our lives and

traditions are based. We are battling to preserve not only the ecosystems in which we live, but the *hope* for an expansive and joyous life for ourselves and others—the very hope on which we ultimately stake nearly everything we do. Let us face the abyss together, then, in the coming chapters, knowing that in doing so, we may be catching a glimpse of our actual future—or perhaps learning so much from that glimpse that we will fight even harder to keep it at bay.

### Notes

67. Elisabeth Rosenthal, “U. N. Chief Seeks More Climate Change Leadership,” *New York Times*, November 18, 2007, [http://www.nytimes.com/2007/11/18/science/earth/18climatenew.html?pagewanted=all&\\_r=0](http://www.nytimes.com/2007/11/18/science/earth/18climatenew.html?pagewanted=all&_r=0).
68. Johan Rockström and others, “A Safe Operating Space for Humanity,” *Nature* 461 (September 23, 2009), 472–475, doi:10.1038/461472a.
69. Robert B. Semple, Jr., “Remember Kyoto? Most Nations Don't,” *New York Times*, December 3, 2011, <http://www.nytimes.com/2011/12/04/opinion/sunday/remember-kyoto-most-nations-dont.html>.
70. S. Pacala and R. Socolow, “Stabilization Wedges: Solving the Climate Problem for the Next 50 Years with Current Technologies,” *Science*, volume 305, number 5686 (August 13, 2004), 968–972, doi:10.1126/science.1100103.
71. Martin I. Hoffert, “Farewell to Fossil Fuels?” *Science*, volume 329, number 5997 (September 10, 2010), 1292–1294, doi:10.1126/science.1195449.
72. Justin Gillis, “Carbon Emissions Show Biggest Jump Ever Recorded,” *New York Times*, December 4, 2011, <http://www.nytimes.com/2011/12/05/science/earth/record-jump-in-emissions-in-2010-study-finds.html>. This report was based on the report at the Global Carbon Project released on December 5, 2011; for its current report see <http://www.globalcarbonproject.org/carbonbudget/>.
73. Monbiot, *Heat*, 16.
74. See the data at CO2now, <http://co2now.org/>.
75. Monbiot, *Heat*, 16.
76. Monbiot, *Heat*, 15; see note 122 (page 227), which refers to a paper cited in note 86 (page 226).
77. See Mark Hertsgaard, *Hot: Living Through the Next Fifty Years on Earth* (Boston: Houghton Mifflin Harcourt, 2011), 70.

78. For a well-known discussion that comes to a similar conclusion, see James Lovelock, *The Revenge of Gaia: Earth's Climate Crisis & the Fate of Humanity* (New York: Basic Books, 2006). For a more recent, exemplary treatment that reaches conclusions similar to those outlined in the present chapter, see Clive Hamilton, *Requiem for a Species: Why We Resist the Truth about Climate Change* (Washington, DC: Earthscan, 2010), 1–31.
79. Bill McKibben, “Global Warming’s Terrifying New Math,” *Rolling Stone*, July 19, 2012, <http://www.rollingstone.com/politics/news/global-warmings-terrifying-new-math-20120719>. On the second page of this article, he writes, “Scientists estimate that humans can pour roughly 565 more gigatons of carbon dioxide into the atmosphere by midcentury and still have some reasonable hope of staying below two degrees.” But if the two-degree target is already too high, as McKibben suggests, this carbon budget is too generous as well.
80. Susan Solomon and others, “Irreversible Climate Change Due to Carbon Dioxide Emissions,” *Proceedings of the National Academy of Sciences of the United States of America*, volume 106, number 6 (February 10, 2009), 1704–1709, doi:10.1073/pnas.0812721106.
81. For a helpful discussion of these and other geoengineering schemes, see Parkinson, *Coming Climate Crisis?*, 165–191.
82. Wallace S. Broecker and Robert Kunzig, *Fixing Climate: What Past Climate Changes Reveal About the Current Threat—And How to Counter It* (New York: Hill and Wang, 2008), 186–233.
83. For a representative discussion of the possibility of abrupt climate change, see Richard Alley, *The Two-Mile Time Machine: Ice Cores, Abrupt Climate Change, and Our Future* (Princeton: Princeton University Press, 2000).
84. Gore, *An Inconvenient Truth: The Planetary Emergency of Global Warming and What We Can Do About It* (Emmaus, Pennsylvania: Rodale, 2006), 276.