
STOPPING CATASTROPHIC SEA LEVEL RISE

*The earth from 200 miles up, 3200 CE.
Carbon dioxide at 550 ppm and dropping.*

From space, the earth has taken on a new appearance over the past 1,000 years. The giant orbiting mirrors kept wide swaths of the planet's surface in shadow, giving the sunlit half of the globe a mottled appearance. All of the coastal areas of the oceans, and huge regions in the middle of the oceans, were now green. The immense quantities of iron filings, so laboriously dumped into the seawater, had done their job: great pastures of phytoplankton now filled ocean environments that had long been the home to little life. As those single-celled plants proliferated, they sucked up carbon dioxide from the sky. Viewed from space, the earth offered other, smaller bits of evidence indicating that major technological changes were under way. All of the countries of the mid-latitudes showed immense fields of black: cheap solar cells had finally been developed, and when the sun's rays were allowed to reach various areas of the earth's surface, the enormous panels created electricity. Giant pipes could be seen extending from many parts of the coastal oceans, with fine mist spewing into the atmosphere. Around every city a cordon of windmill-sized carbon dioxide scrubbers removed the industrial CO₂ wastes that urban areas so readily produced.

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FLOODED EARTH by Peter D. Ward.
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There was something even more different about the night side of the planet. It no longer looked like a light-infested Christmas tree on steroids. The swaths of light that had formerly extended down the entire eastern and western seaboard of North America, as well as through most of Asia and Europe, and driven astronomers so mad during the late twentieth and early twenty-first centuries, were now greatly dimmed. The giant cities still bejeweled the earth's dark side, but they were smaller, single diamonds of light, rather than the garish snarls of costume jewelry that had arisen as cities begat suburbs, and suburbs metastasized along the crisscrossing freeways. The cities had pulled themselves in; many of the overbuilt spiderwebs of roadage had fallen away. Nighttime was now an occasion to embrace darkness.

The planet's coastlines bristled with defense against the rising seas—dikes, but mainly offshore sandbars and gates in front of estuaries. But all of these barriers had now become superfluous. The sea had stopped rising. The ice had ceased to melt. The final tally of the encroachment was a 6-foot increase. That was enough to cause damage and death, but it fell far short of the catastrophe it could have been. The truce with the oceans had come at a cost, however. People no longer traveled so freely. Governments levied enormous fines for single drivers in cars. Distance driving was heavily taxed.

The restrictions and the new technology had worked—the combination of voluntary and government-enforced emission reduction, along with geoengineering—planetary-scale projects designed to deal with the many aspects of climate change and changing planetary habitability—on a vast scale, had combined to lessen the upsurge in carbon dioxide and the melting of polar ice. Neither effort could have effected the change alone. The enterprise had seemed foolhardy at first, the restrictions unnecessarily onerous; some considered the hundreds of billions of dollars spent on geoengineering solutions to be a gigantic boondoggle. But gradually the coastal cities were saved. The tipping point that would have capsized the planet into utter catastrophe was not reached.

At the planet's extreme north and south, the two most beautiful of all of Earth's jewels shone brightly. Greenland and the Arctic sea to the north and Antarctica and its ice sheets in the south reflected sunlight

back into space—light that began a reflected voyage into the farthest reaches of the galaxy, where other life might exist.

Far from Earth, a hundred light years away, in fact, another intelligent race looked at the imaging they had made of the distant planet. They saw an orb with artificial lights, but one whose ice caps neither grew nor shrank, and they knew they had found another truly intelligent form of life.

IS THERE HOPE?

The scenario above, the penultimate of this book's travels into the future, offers us the best we could hope for. I trust that it also conveys the enormity of the changes in human behavior and technology required for us to avoid disastrous climate change. Without such profound technological advances and alterations in behavior, we veer toward the other extreme, with the earth growing so warmed that not only do we lose the ice caps but we also ensure a mass extinction. That does not have to happen. Even though we have a long way to go, progress has been made—at least in our level of awareness of the problem. A decade ago, climate change was not news. Now it is part of our consciousness. It is the rare human on this planet who does not have a view one way or another about the changes in climate, and that is the best news. Unfortunately, the news about the climate itself is usually bad; we learn constantly of rising temperatures, rising carbon dioxide levels, and rising seas. Yet amid all the bad reports, short flashes of hope appear from time to time, in ways and places often subtle—but enough to indicate the opportunity of a world where global warming is arrested; where the seas do not rise from their basins; and where humans actively reduce their numbers as well as their greenhouse gases. It would be wonderful to live in a world in which the only thing going up was the global standard of living. We can get there only if we still have hope. Hope is not only a motive, but from where we stand now, perhaps itself a goal. Maybe we are at the stage where our best efforts will lead us to be hopeful, because we are actively doing things.

Is hope realistic? I will finish this not overly cheerful book with some specific strategies that, if successfully employed, could indeed give us hope that the ice sheets will not uncontrollably melt and that the seas will

not catastrophically rise. But unless we change our attitudes and engineer new climate-protecting technologies, the very possibility of such strategies is itself problematic. While I am sure that, barring major change, we are heading toward what indeed will be a flooded world, I am not sure that we have the will to do what is necessary. Over the course of writing this book, I found myself not a little shaken by all I had learned and synthesized. I grew increasingly pessimistic about the prospect of forestalling calamity. At the same time, I realized that offering a downer of an ending could indeed be counterproductive to my cause—which is to encourage the reader to try to change the world.

While I was completing this book, I met with the Australian environmentalist Tim Flannery, who wrote the best-selling *The Future Eaters: An Ecological History of the Australasian Lands and People*,¹ as well as many other eloquent and important works about climate change. Flannery is now part of the group trying to “save the world” through the Copenhagen treaty—an effort by environmentalists worldwide to create a blueprint for international action on emissions reductions.²

Called the “Copenhagen meeting” by all concerned, the meeting was really named “COP15,” itself an acronym for the 15th Conference of Parties, or countries, to the UN Framework Convention on Climate Change (UNFCCC). COP15 is also the fifth meeting of parties to the Kyoto Protocol, a legally binding emissions-reduction treaty created in 1997 in Kyoto, Japan. The Kyoto agreement aims to reduce global industrial greenhouse gas emissions by an average of 5 percent against 1990 levels over a five-year period, from 2008 to 2012. The Kyoto climate treaty, which went into force in 2005, was ratified by 185 nations—but not the United States. Because the Kyoto Protocol expires in 2012, an “ambitious new deal” needs to be worked out in 2010 to provide governments guidance beyond Kyoto, the UNFCCC says, and hence Copenhagen.

Tim Flannery was one of the thousands going there, with the best of intentions, to literally try to save the world—at least as we know it. Yet even when we met, prior to the late-2009 conference in the eponymous city, I could see that he had high hopes but far more realistic expectations for some sort of global agreement. Unfortunately, at its conclusion the ultimate result of Copenhagen seemed to have been a failure of even its most modest goals.

Going in, the goals of that conference seemed clear enough. They consisted of:

1. Make clear how much developed countries, such as the United States, Australia, and Japan, will limit their greenhouse gas emissions.
2. Determine how, and to what degree, developing countries, such as China, India, and Brazil, can limit their emissions without limiting economic growth.
3. Explore options for “stable and predictable financing” from developed countries that can help the developing world reduce greenhouse gas emissions and adapt to climate change.
4. Identify ways to ensure developing countries are treated as equal partners in decision-making, particularly when it comes to technology and finance.

The ultimate goal was and is to reduce emissions.

What of the results? Unfortunately, after more than a week of sniping, press leaks, and huffy entrances and exits, the results were minimal. The Copenhagen Accord set no goal for concluding a binding international treaty, leaving months, and perhaps years, of additional negotiations before it emerges in any internationally enforceable form. The only tangible result was that the conference appeared to have caused money in notable quantities to start flowing . . . from rich nations to poorer ones.

A REALITY CHECK

We too can focus on tasks that are immediate and doable, even as we examine some ambitious and far-reaching solutions. We are faced with three possibilities. The first posits that all or most of the interpretations and conclusions of so much recent climate science—that rising carbon dioxide will lead to catastrophic sea level change in the not-so-distant future—are wrong. Under this supposition, carbon dioxide really has *no* effect on global climate, or it does but the ice sheets will not melt no matter how much greenhouse gases rise. Or, in a variant on this possibility, perhaps the world really does warm significantly but the ice either does not melt

at all or does so in such limited amounts, or so slowly, that humans do not experience a significant environmental problem. We might discover that it takes a *lot* longer to melt ice sheets even at higher-than-normal temperatures than this book suggests. This prospect contends that we could do nothing to counter whatever climate changes occur—and get away with it. In this event, climatologists would be perceived as Chicken Littles, their dire warnings the object of mirth from every climate-change denier who will cry, “I told you so.”

The second possibility is that the ice melts significantly, seriously, quickly, and dangerously—and we do something about it, with such alacrity and efficacy that we stall the sea in its tracks and avert chaos in the world economy, uproar in global society, and massive human mortality. With this outcome, it turns out that we are indeed able to “fix” things through some combination of emissions reduction and geoengineering to stabilize sea level in a manner favorable to civilization. And maybe the planet will cooperate with our efforts, with climate change coming more slowly and modestly than predicted in this book, thus allowing us to manage its effects. If we are very optimistic about human ingenuity and adaptability, maybe even a 6-foot rise in sea level is something we can live with. (Personally, I would rejoice at the certainty of a mere 6-foot rise.)

Then there is the third possibility, the one that as a scientist I believe is the most likely: the ice sheets melt rapidly, the sea rises ferociously, and all the scenarios set forth in this book come to pass.

HUMAN ACTIONS TO FORESTALL CLIMATE CHANGE

Confronted with these three quite different prospects in mind, what do we do? As this book’s arguments and evidence make extremely clear, I reject the possibility that climate science is so far off the mark there will be no rapid global temperature rise—and thus no flooded world. Which leaves us with possibilities two and three, and number three just cannot be allowed to happen. In any event, if we significantly reduce pollution it will be only because we have produced a cleaner world, with more efficient industry, and diversified energy sources replacing most coal and oil—and because we have raised living standards everywhere.