

GLOBAL WARMING

A Personal Guide to Causes and Solutions

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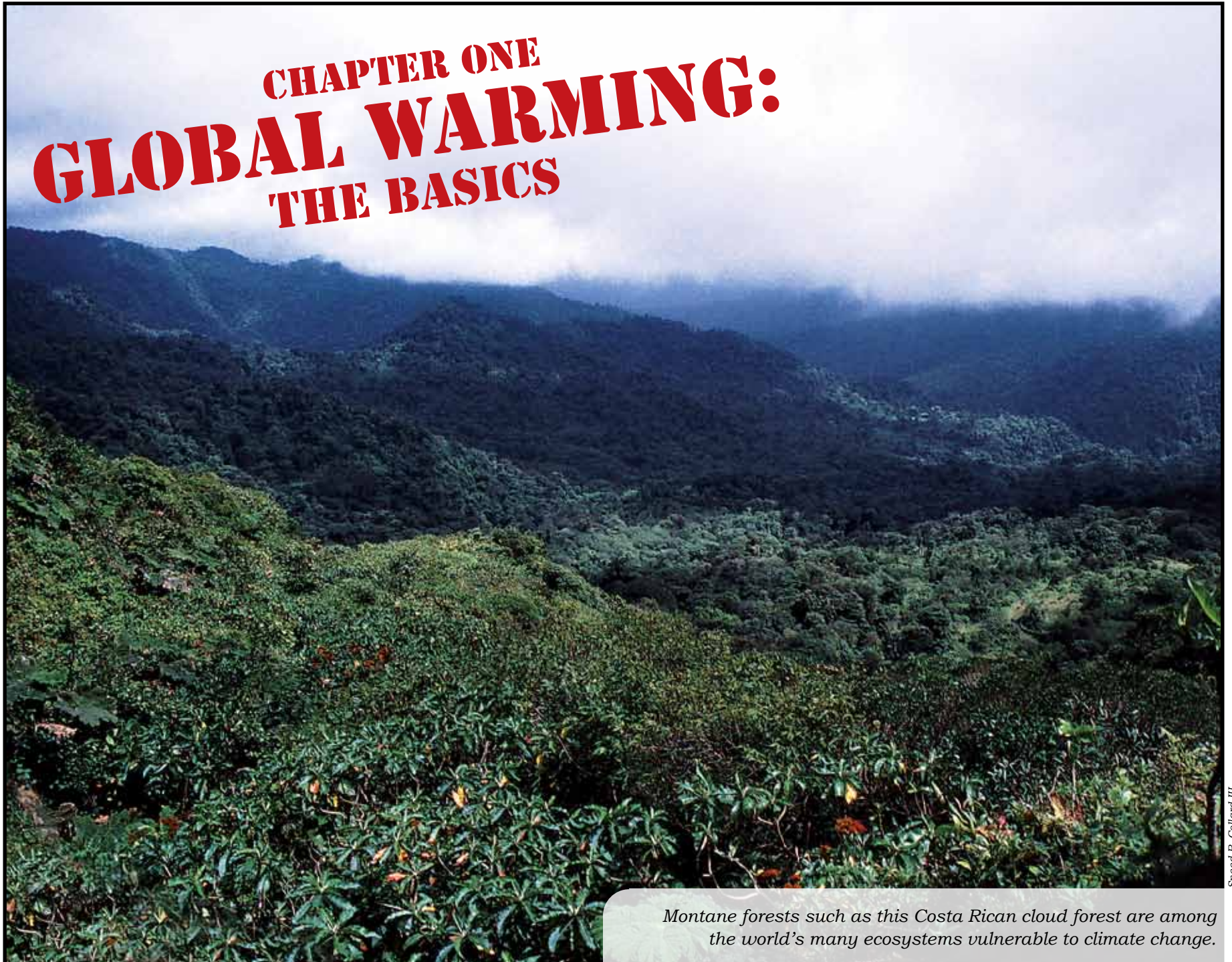


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CHAPTER ONE GLOBAL WARMING: THE BASICS



Montane forests such as this Costa Rican cloud forest are among the world's many ecosystems vulnerable to climate change.

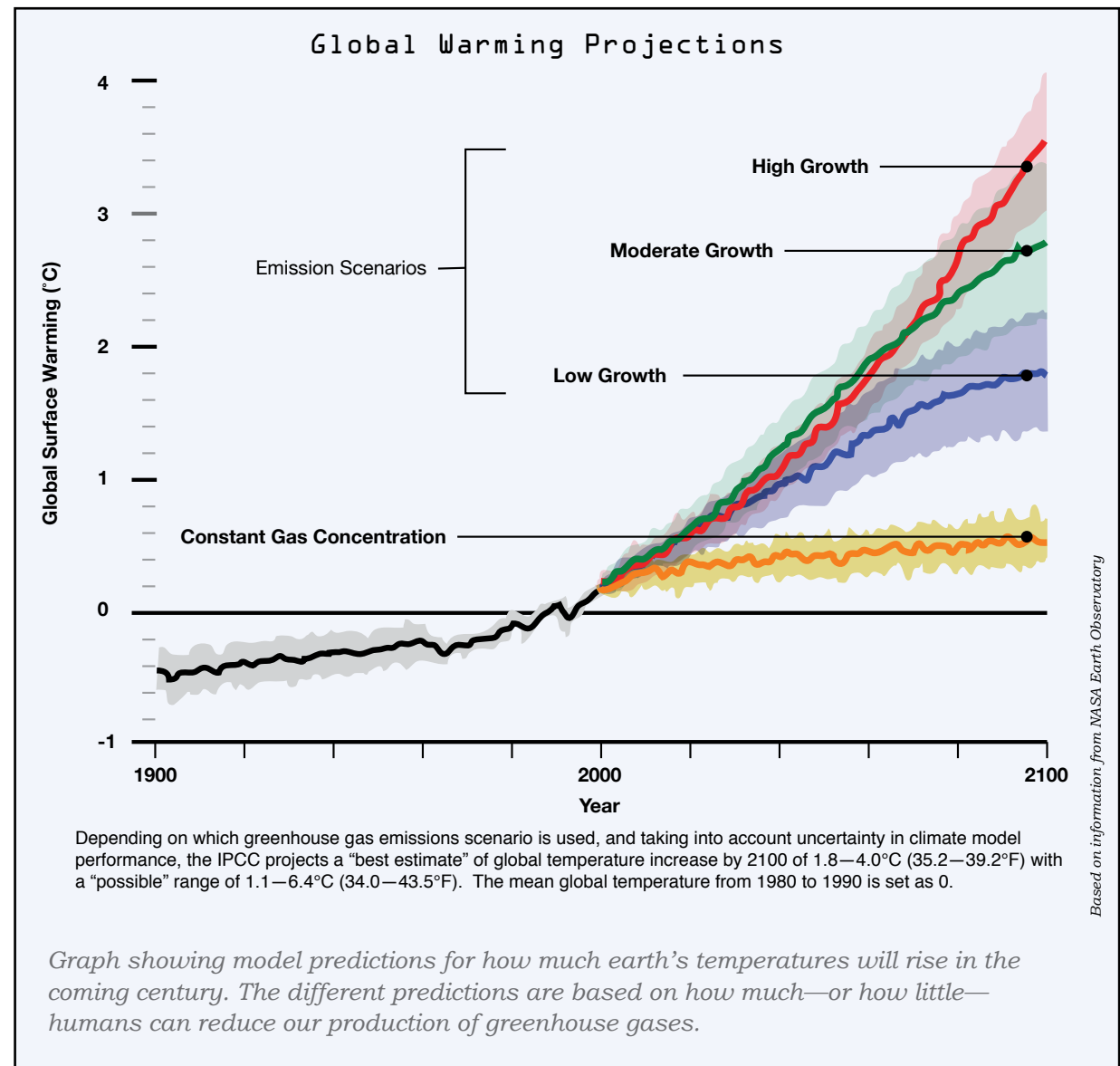
IN LATE SUMMER OF 2007, something astonishing happened in the Arctic Ocean. For the first time in recorded human history, an ice-free passageway opened up in the waters above North America, providing a new shipping shortcut between the northern Atlantic and Pacific oceans. Canada and other interested nations immediately began bickering over who should control this valuable route. But scientists and many others saw something ominous in the new waterway—evidence that global warming may be changing our planet much more quickly than anyone expected.

THE ISSUE:

Our planet is heating up at an increasing rate. The Intergovernmental Panel on Climate Change, or IPCC, is an international body of hundreds of climate experts from around the globe. It was set up by the World Meteorological Organization and the United Nations Environment Programme. In 2007, the scientists of the IPCC released a report stating that earth's average surface temperature rose 1.33 degrees Fahrenheit (.74 degrees Celsius) between the years 1906 and 2005. That may not sound like much, but this figure is an average for the entire planet. Many regions, including huge areas of the northern hemisphere, have experienced much larger temperature increases. Temperatures in many Arctic regions, for example, have risen between 3.6 and 6.3 degrees F (2.0-3.5 degrees

Celsius). Worldwide, the years 1995 through 2008, ranked as 13 of the 14 warmest years on record. What's more, the IPCC predicted that global warming in the coming century will be even more dramatic. In a few parts of the world, these warmer temperatures may actually lead to changes that make life

better for people. For billions of others, global warming will not only make survival more difficult, it will damage ecosystems necessary to support life. An overwhelming number of scientists agree that humans are to blame for this unfolding crisis.



BACKGROUND FILE:

Earth's average temperatures have risen and fallen repeatedly throughout history. Studies of ice cores in Antarctica reveal that in the past 740,000 years, our planet has experienced eight major ice ages and eight warming periods. Many factors affect climate and temperatures. These include the orbit and tilt of the earth, energy output from the sun, ocean currents, and even volcanic eruptions. A critical influence on temperatures is the presence of greenhouse gases in the atmosphere.

Greenhouse gases include water vapor, carbon dioxide (CO₂), and

methane. These gases trap heat in the atmosphere and make our planet a hospitable place to live. Without them, earth's average temperature would be almost sixty degrees (Fahrenheit) colder than it is today. But Earth can get too much of a good thing—which is what's happening now.

Since the start of the Industrial Revolution in the 1700s, humans have been releasing enormous amounts of CO₂ and other greenhouse gases into the atmosphere. How? Primarily by burning carbon-based fossil fuels, such as coal, oil, and natural gas. These fuels generate electricity, provide heat, and power billions of cars, trucks,

ships, and other vehicles. Farming, livestock, and destruction of forests also produce greenhouse gases.

Between the early 1700s and the year 2005, carbon dioxide levels increased about 36 percent—280 parts per million (ppm) to 380 ppm—the highest by far in the last 650,000 years. As our appetite for fuel and energy grows, we are dumping more and more greenhouse gases into our atmosphere every year. The higher temperatures these gases create are already unleashing a series of calamities across the planet.



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According to the Center for Global Development, the world's 50,000 power plants dump about 10 billion tons of carbon dioxide into the atmosphere every year.

A BRIEF, HOT HISTORY OF GLOBAL WARMING

Jean Baptiste Joseph Fourier not only has a very long name, he can be considered the father of global warming. Back in 1824, this French mathematician discovered that Earth's temperature was slowly increasing. He blamed this increase on heat trapped in our atmosphere. It wasn't until the 1950s, however, that scientists began seriously measuring levels of greenhouse gases and exploring whether or not humans were responsible for increasing temperatures.

Throughout the 1980s, scientific evidence for global warming was building, along with serious concern that we needed to do something about it. By 1988, the countries of the United Nations had become worried enough to assemble a group of scientists to evaluate the problem. That group was the Intergovernmental Panel on Climate Change (IPCC). In 1992, 150 nations—

including the United States—signed a United Nations declaration committing themselves to reducing greenhouse gases. In 1997, leaders from around the world drafted the Kyoto Protocol treaty—a legally-binding agreement to lower greenhouse gas production. By 2005, more than 100 nations approved, or ratified, the document. The United States—until recently, the world's largest emitter of greenhouse gases—was not one of them. Why not?

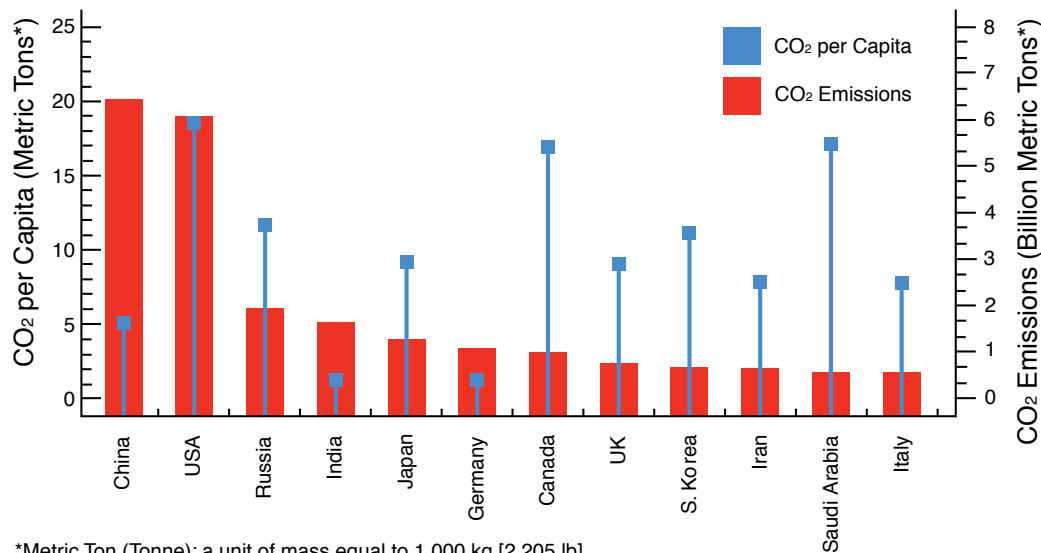
The Kyoto Protocol allowed China, India, and other developing nations to release unlimited amounts of greenhouse gases. The United States stated this provision was unfair and used this as a reason for not signing the treaty. Developing nations, on the other hand, correctly stated that it was primarily the United States and other industrialized nations that had created global warming. Why, they argued, should poor nations be punished for wanting to catch up and improve their economies?

On the face of it, both sides had reasonable arguments. What wasn't reasonable is that the United States used Kyoto as an excuse for taking almost no action on the problem. While European nations aggressively worked to cut their greenhouse emissions, the United States carried on business as usual. In fact, between 1990 and 2005, greenhouse emissions in the United States actually increased by 16.3 percent.

Fortunately, America's leaders are beginning to take action. In 2009, President Obama signed the American Recovery and Reinvestment Act, a bill loaded with money and tax incentives to promote clean energy and conservation investment. Unfortunately, as this book goes to press, Congress has still failed to pass long-term, comprehensive legislation to set clean energy standards and reduce global warming emissions. Chances for such legislation remain highly uncertain.



Top 12 CO₂ Emitting Countries and their Per Person Emissions (2008)



*Metric Ton (Tonne): a unit of mass equal to 1,000 kg [2,205 lb]

Based on information from Climate Analysis Indicators Tool, <http://cait.wri.org/>

DATA FILES: Global Warming's Impacts

Global warming's negative impacts promise to overshadow almost every aspect of our lives. These impacts include:

- Rising sea levels.
- Increased number of extreme weather events (drought, flooding, storm damage).
- Lower food production.
- Extinction of species.
- Destruction of forests.
- Increased spread of harmful, or invasive, species.
- More human health issues.

A look at a few of these begins to paint the picture.



NASA Johnson Space Center

(Above) The Greenland ice sheet alone holds enough water to flood huge portions of our planet.

(Lower Right) Global warming data suggest an increase in extreme weather events such as Hurricane Katrina, shown in this image created from satellite data.

Rising Sea Levels

On December 24th, 2006, *The Independent* news service reported, “Rising seas, caused by global warming, have for the first time washed an inhabited island off the face of the earth.” Lohachara Island was located in the vast Ganges river delta between Bangladesh and India, and was home to 10,000 people. In 2006, it vanished under rising sea levels. Yet, Lohachara was only the first of hundreds of

islands worldwide that face obliteration. Since 1993, the global sea level has risen about 3.1 millimeters per year—or about one and a quarter inches per decade. The rate is increasing.

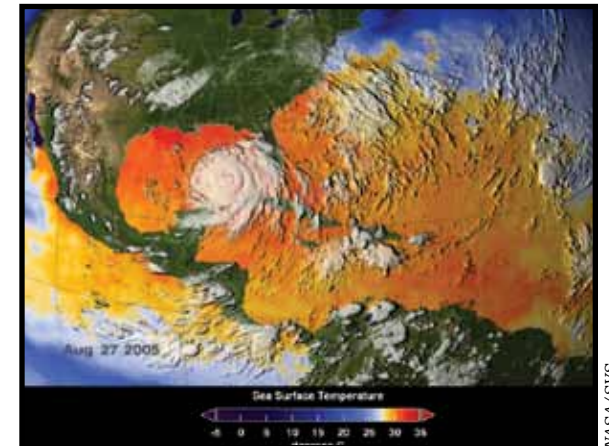
Two processes cause sea levels to rise. As water gets warmer, it expands, taking up more space. Melting glaciers and other “permanent” ice dump even more water into the oceans, pushing up sea levels further. The Greenland ice sheet alone holds enough water to raise

global sea levels by 23 feet (7 meters). Scientists do not expect the entire ice sheet to melt anytime soon, but already, Greenland is losing 100 billion tons of ice each year.

According to one scientist studying the problem, by the year 2100, Greenland’s melting ice could push up sea levels by as much as three feet (about one meter)—inundating low-lying coastal areas around the world, from much of Florida and California to heavily populated river deltas in Asia, Africa, and the Americas. On Pacific Island nations, such as Vanuatu and Kiribati, entire villages have already been forced to move to higher ground. If sea levels rise as predicted, millions of people worldwide will have to relocate as their homes disappear beneath the waves.

Extreme Weather Events

According to the Intergovernmental Panel on Climate Change, it is “virtually certain” that earth’s land areas will experience fewer cold days and nights and more frequent hot days and nights



NASA/SVS

in the future. Scientists predict heat waves and torrential rains are “very likely” to increase and that it is “likely” the number of droughts and extremely intense hurricanes will increase. These processes have already begun. In many mountainous areas, winter snow is melting earlier and more quickly than it used to, leading to flooding rivers and reduced water supplies during summer’s hottest months. Food production in many parts of the world is falling because of drought, storm damage, and soil erosion. Even human health is suffering. In China, authorities believe hotter temperatures may be causing as many as one million additional deaths per year through strokes and heart disease. Mosquitoes are also thriving under warmer temperatures, adding to the range and incidence of malaria, dengue fever, and West Nile virus in Africa, Europe, Asia, and elsewhere.

Extinction of Species

On May 14th, 2008, the U.S. government officially listed the polar bear as an endangered species. The reason? Polar bears need summer sea ice to hunt and rest on, but sea ice cover has shrunk dramatically over the last three decades. Without the ice, polar bears are already starving and drowning in record numbers. Yet the polar bear is only one of millions of species facing extinction on our warming planet. As the planet heats up, many tropical rainforests and other forests will become grasslands, while grasslands turn into deserts.

Just how many species we will lose remains uncertain. Some scientists believe we may lose a relatively small number. IPCC scientists, on the other hand estimate that up to 30 percent of all species risk extinction—a loss that would forever change the face of our planet.



Warmer arctic temperatures have already impacted the polar bear, which needs summer ice to hunt seals.

NOAA

CONCLUSION:

The solution to global warming is simple: we must dramatically reduce the amount of greenhouse gases we release into the atmosphere. There’s only one way to do that: quit burning coal, oil, and natural gas for energy production. Unfortunately, that is not as easy as it sounds. The rest of this book will be devoted to examining the details of what’s involved.

Coral Reefs Taking a Bath

Coral reefs have shown some of the earliest—and most harmful—effects of global warming. Extremely warm temperatures lead to episodes of coral bleaching in which corals dump the tiny algae called zooxanthellae living inside of them. These zooxanthellae produce much of the food that a coral needs to survive. If coral bleaching is mild, some corals can recover from bleaching, but often they die. As the ocean heats up, however, coral bleaching events around the world have been more severe and more frequent. Six major coral bleaching events have occurred in the past twenty years. In the 1997-98 event, 46 percent of the corals were killed on some Indian Ocean reefs. In 2001-02, large areas of Australia’s Great Barrier Reef were also affected. Scientists believe that, unless global warming is rapidly reversed, rising ocean temperatures will destroy most of the world’s coral reefs before the year 2050. As the reefs disappear, they will take thousands of other species with them—and deprive millions of fishermen and other coastal people of their livelihoods.



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