GABRIELLE WALKER

AND SIR DAVID KING

"In a world full of misinformation, *The Hot Topic* is a beacon of clarity."
—AL GORE

THE HOT TOPIC

WHAT WE CAN DO ABOUT GLOBAL WARMING

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Gabrielle Walker and
Sir David King

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For Rosa Malloy and Jane Lichtenstein

PREFACE

The North Pole of planet Earth is an extraordinary place. It's a smudgy circle of frozen ocean, hemmed in by the surrounding landmasses of Siberia, North America, and Europe. Cracks occasionally appear in its surface where the ice has been torn apart by winds above and currents below. But for the most part, its gray-white facade is as unyielding as rock. You can walk on it, stamp on it, even land planes on it. When you're there, the Arctic sea ice doesn't seem remotely fragile, just motionless, silent, and strong, as if water had been turned irreparably to stone.

And yet photographs taken from satellites have now shown conclusively what scientists have been fearing for decades: The North Pole is melting. Each summer, the spread of the sea ice shrinks a little farther. It is vanishing from beneath the feet of the Arctic's polar bears. If we do nothing to stop it, by the end of the century the ice, polar bears and all, could be gone.

The story of global warming has progressed in the past few years from conjecture to suspicion to cold, hard fact. We now know for certain that on every inhabited continent on Earth, year by year and decade by decade, the world's temperature is rising. Something, or someone, is turning up the heat.

Should we care? After all, over the billions of years our planet has been around its climate has changed many times. In the geological past there have been ice ages, global floods, and heat waves. There have also been winners and losers throughout Earth's history—some species have become extinct while others have gone forth and multiplied.

But this time is different. If the current wave of change has its way with us, the polar bears will not be the only ones to suffer.

Human civilization has never before been faced with a climate that is changing this fast or this furiously. The threat has become urgent. In 2004 one of us (David King) caused a furor by describing climate change as "the most severe problem we are facing today, more serious even than the threat of terrorism."[1] Since then, the scale of the problem has become even clearer.

Also, the amount of material focusing on the problem has multiplied. Books, newspapers, TV, radio—another day, another headline. It has become almost impossible to sort out what really matters.

Amid this cacophony there is a handful of voices that persists in arguing that warming isn't happening, or that it's not caused by humans, while others see disaster around every corner and indulge in gory scenarios that have been labeled "climate porn." We don't agree with either of these approaches. Climate change is happening, and humans are largely to blame. However, we do not believe that disaster is inevitable. A few shiny new Priuses won't get humans out of this mess, nor will sticking our collective heads in the sand. But we still have time to tackle the worst aspects of climate change if we act fast and work hard.

In the course of this book we will pick our way through the blizzard of information and misinformation about global warming, explaining each point in the most straightforward way possible. We are both trained scientists, and our approach will be a scientific one—to examine the evidence, giving most weight to rigorous research that has been tested by peer review.

If you're looking for a debate about the science of global warming, you won't find it here, though we do cover some of the most common misconceptions about the problem in a handy list of climate myths at the back. What you will find is the latest scientific explanations of how much the world is warming, how we know that humans are to blame, what the worst-case scenarios might be, an overview of the most promising new tech-

nologies, and a political overview of where the world stands in its fight to solve the problem.

Though between us we have considerable experience in the worlds of media and politics, we are neither lobbyists nor politicians, and we have no personal axes to grind. We will lay out the entire essential story of global warming—what we humans have done, how we have done it, how we will need to prepare for the changes we can't stop, and how we can prevent the even worse effects that will otherwise follow. We aim to tell you everything you wanted to know about global warming but were too depressed to ask.

However, this is not a book about generic "green" issues. Most measures that increase efficiency and reduce waste will also help—at least a little—to reduce global warming. But this book is not a general environmental call to arms. It proposes a very specific set of solutions to a very specific, though wide-ranging, problem.

In particular, it seeks to show that the story need not have an unhappy ending. Global warming is a serious problem, probably the most serious that the human race has, collectively, ever faced. But we can still do something about it. This is a time for neither pessimism nor denial. It is a time for constructive, determined action.

CONTENTS

PART I

THE PROBLEM

Before we can start discussing how to get ourselves out of the climate mess, we first need to set out the problem. There has been an extraordinary amount of confusion and misinformation about the science of climate change—which is surprising, since it is one of the few areas of complex science for which researchers are in almost unanimous agreement. In the next few chapters we will explain the science of global warming—what is happening, how we know the cause, the future changes that are now inevitable, and the ones that we still have a chance of avoiding.

1

WARMING WORLD

Climate change isn't new. Our planet is restless and its environment rarely stays still for long. There have been times in the distant past when carbon dioxide levels were much higher than they are today and Antarctica was a tropical paradise. There have been others when carbon dioxide levels were much lower and even the equator was encrusted with ice.

But over the past ten thousand years, the time during which human civilization has existed, Earth's climate has been unusually steady. We humans have become used to a world where the way things are is more or less the way they will be, at least when it comes to temperature. In other words, we have been lucky.

Now our steady reliable climate is changing, and this time nature isn't to blame. But how do we know for certain that the world is warming, and how can we identify the culprit?

The Heat Is On

When you're trying to determine whether the world's temperature is rising, the biggest problem is picking out a signal from the background "noise." Even in our relatively stable times, temperatures lurch up and down from one day to another, from season to season, from year to year and from place to place. To be sure that the underlying trend is changing, you need to take

precise measurements from many different places around the world, and do so for an extremely long time.

We do have a few long temperature records, thanks to certain individuals who decided to make the measurements just in case they ever proved useful. The world's longest is the Central England Temperature Record, which is a tribute to the obsessive data-collecting habits of seventeenth-century British natural scientists. It covers a triangular region of England from London to Bristol to Lancashire and stretches back to 1659. This impressive record shows clear signs of warming, especially toward the end of the twentieth century.

However, the record covers only a tiny part of the globe. Changes in England don't necessarily reflect changes in the United States, say, or Brazil. It also doesn't go back far enough to reveal just how unusual our recent warm temperatures really are. How do they compare, for instance, to the apparent warm period in medieval times when the Vikings settled a verdant, pleasant "Greenland" and there were vineyards in northern England? Or to the so-called Little Ice Age in the midcenturies of the last millennium, when the River Thames in London froze over completely so that frost fairs were held on its solid surface?

To answer these questions, scientists have come up with ingenious ways to expand the records geographically and extend them backward in time. Some people have tried to interpret written archives that didn't quote actual temperatures,[1] but the best way is to look at records written not by humans, but by nature.

Every year, the average tree grows a ring of new wood around its trunk. In a good year the ring will be thicker, in a bad year, thinner.[2] Researchers drill a small core into the side of the tree, about the diameter of a wine cork, extract the wood, and then count and measure. By examining trees that are different ages, and even some trees that are long dead but have been preserved in peaty bogs, they have come up with a temperature

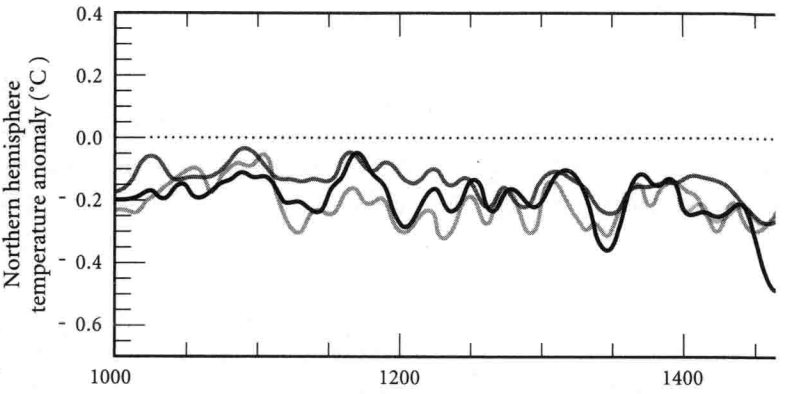
record spanning more than a thousand years and from regions across northern Europe, Russia, and North America.

For more tropical regions, corals can play a similar role since they, like trees, grow a new ring every year. And in the frozen north and south (and the snowcapped peaks of tropical mountains), ice also contains a record book of past climate. Each year's snowfall buries the previous one. If temperatures are cold enough, the snow stays around long enough to be squeezed into ice, clearly marking out the annual layers because summer's snow crystals are larger than winter's, or because more dust blows in each year with the winter winds. The amount of snow that fell in a given year, and especially the changing nature of the oxygen atoms bound up in the ice,[3] gives clues as to how warm it was then.

Another clue comes from changing plant life, as written into the record of mud at the bottom of lakes. As temperature rises and falls, different plants flourish and each one sheds its pollen into passing currents of air. Some of this lands on the surface of a nearby lake, before slowly sinking into the mud beneath. Drill a hole in this mud, collect and analyze the pollen grains each layer contains, and you have yet another record of temperature changes over time.

Researchers have now used a host of different ways like these to analyze and splice together these different measures, and all come to strikingly similar conclusions for temperatures over the last thousand years.[4] The eleventh century was indeed relatively warm, corresponding to the Medieval Warm Period. ("Verdant" Greenland turned out to be more of a marketing exercise than the truth. Ice cores drilled into the heart of Greenland's ice cap show that a substantial quantity of ice has been present on the island for hundreds of thousands of years. Any Vikings who fell for the hype must have had an unpleasant shock when they arrived.)

Temperatures were also cooler in the seventeenth century, corresponding to the Little Ice Age, and again in the early nineteenth century. These warm and cool periods apparently were



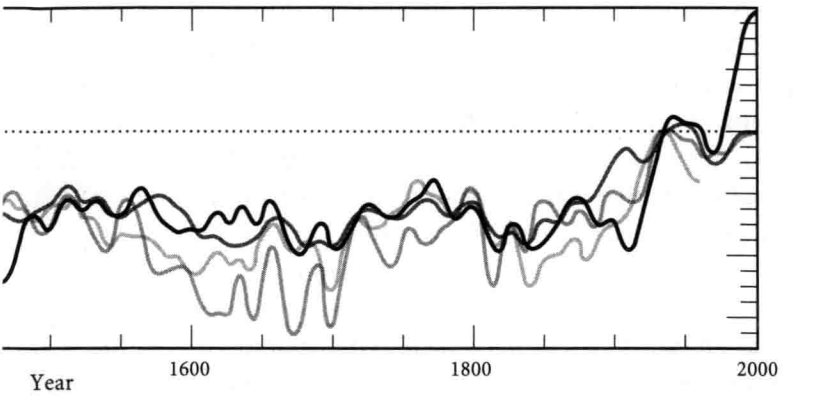
Changes in northern hemisphere temperature relative to the average value from 1961–90 in °C (1°C is approximately 1.8°F) for the past 1,000 years. The different lines reflect data that come from different sources and methods, but all show the same dramatic increase in temperature

also fairly widespread, though they may have been less prevalent in the southern hemisphere.[5]

However, it was only in the twentieth century that temperatures really began to take off. The warming didn't happen regularly, but in two bursts—which turns out to be important. The first one occurred during the early years of the century and was marked enough that it made itself clearly felt. In 1939 *Time* magazine wrote: "Gaffers who claim that winters were harder when they were boys are quite right . . . Weather men have no doubt that the world at least for the time being is growing warmer."[6] But the following few decades brought slightly cooler temperatures, at least in the northern hemisphere, and public interest waned.

The second burst of warming began in the 1970s and has been gathering pace ever since. And, crucially, the temperatures we are experiencing now are hotter than they have been for the entire last millennium. Even the Medieval Warm Period was cooler than it is today.[7]

Let's look at some numbers. Globally averaged, from the 1910s to the 1940s temperatures rose by about 0.6°F. After that



in the last few decades. (Source: P. D. Jones, T. J. Osborn, and K. R. Briffa, "The Evolution of Climate over the Last Millennium," *Science*, vol. 292 (5517), pp. 662–7, April 27, 2001)

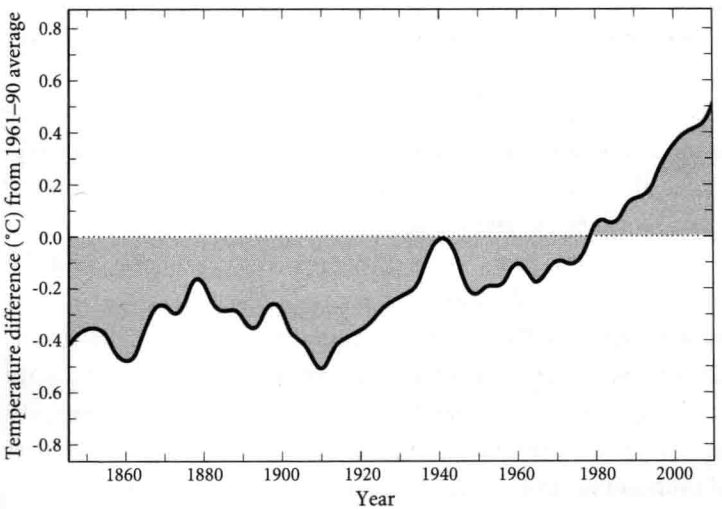
there was a cooling of about 0.2°F, and since 1970 the world has warmed by a further 1°F.[8] These numbers might not sound like much, but they are very significant. Although the temperature where you live can change by much more than this within the space of a few hours or days, it is much more worrying when global annual averages show an inexorable upward trend. Averaging in this way smooths out short-term flurries and shows what's really happening. That's why a small change in global average temperature can reflect a very big shift in climate. Speaking in global averages, only a few degrees separate us from the frigid world of the last ice age.[9]

Though the proxy records of tree rings, ice cores, and the like give a good indication of average temperatures over a timescale of decades, they're not as accurate on temperatures for individual years. Thus, although we can say that the temperature is now greater than it has been in the past thousand years, it's harder to say how 2005 compared with, say, 1105. For that sort of pinpoint accuracy only a human record will do.

Good widespread records started to become available by about 1850, so we can put the past few individual years into the

perspective of the past 160 or so. Once again, the message is stark. The hottest years in the entire instrumental record were in 1998 and 2005. They were very close in temperature, and opinion is divided as to which one takes the warming crown. The years 2002, 2003, and 2004 were, respectively, the third, fourth, and fifth warmest on record. In fact, eleven of the past twelve years have been in the top twelve on record.[10]

(Much fuss was made of the recent news that an adjustment to NASA's records meant that one of the years of the Oklahoma Dust Bowl, 1934, was marginally warmer in the United States than 1998. While skeptics claimed that this threw the global warming research into disarray, in fact it did no such thing. These two years were long known to be within a few hundredths of a degree of each other in the record of local American temperatures. But averaged over the whole world, 1998 and 2005 remain the joint record holders. Regional records can be interesting, but they don't tell the global story.)



Temperature change over the past 150 years in °C compared to the 1961–90 average. (Source: IPCC)