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Introduction: Making Climate Change Understandable

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Over the centuries, humans have tried to change the weather. People have prayed, danced, seeded clouds, and used other strategies to get more rain, to stop the rain, to decrease the heat, and to warm things up a bit. Seldom have we deliberately tried to change *climate*—the average weather conditions over an extended period of time—but we have unintentionally changed climate historically and we are changing it today.

This book draws on the vast knowledge of earth-system science to explore changes in climate, including important changes linked to the level of what are known as *greenhouse gases*—the 3 percent of the gases in the earth's atmosphere that help to warm the planet. It addresses how such changes may affect us, our children, and our grandchildren—globally and locally.

Global climate change is a major societal issue that many citizens do not understand, do not take seriously, and do not consider to be a major public-policy concern. At most, as Bill McKibben notes in *Granta*, they think of climate change as they do of the trade deficit, violence, and television—"as a marginal concern for them . . . if a concern at all" (McKibben 2003). Californians are a bit of an exception, although their understanding probably is not much different than that of

other Americans.[1] Yet the scientific community, with the exception of a few contrarians, sees climate as one of the major challenges facing society in the next decades. This book aims to make climate change understandable to the educated public.

We have a number of friends who respond to assertions that climate change is a problem by saying that concerns are part of "a disaster strategy." They feel that scientists and policymakers articulate dire environmental futures because it is in their professional interests to do so. One developer friend put it this way:

> I remember years ago during a short downturn in the fish catch in Upper Newport Bay, California, we were told that the situation was hopeless and that the future was one of us being fished out. This year, like others back and forth, we have had great catches. I just don't believe some of these scare scenarios.[2]

The scientific community's assessment of the importance of climate change has not persuaded some governments to take actions to address the problem. While many environmental risks (such as nuclear contamination) arouse greater anxiety among policymakers and the public than among members of the scientific community, climate change seems to produce the reverse result, at least in the United States.

Not everyone downplays the threat of global climate change, however. Internationally and nationally, industry and some governments are responding to the science of climate change in ways that will affect us and our grandchildren.

This book assumes three things: that the public would like to understand climate change better, that understanding climate change is not easy, and that it doesn't have to be that way.

Obstacles to Understanding Climate Change

Climate change can be difficult to understand for four key reasons.

Some people believe that scientists lack consensus on the human contribution to climate change.

In part, a public perception of lack of consensus has been powered by the strong statements made by politicians who have selectively parsed the words of mainstream scientists and used the conclusions of those who are outliers on the subject. One outspoken United States senator regularly refers to global climate change as the largest hoax ever perpetrated on the American people. In part, the perception of a weak scientific base comes from fictional works like Michael Crichton's novel. To write a compelling piece of fiction, he uses footnotes and other gimmicks to give the impression that science is being abused by climate-change investigators.

Governments also use ambiguous language to promote particular policy positions. A White House staff member, for instance, recently edited governmental climate reports in ways that could have major implications for the public's understanding of the seriousness of the climate issue (figure 1.1). Adding a phrase like "significant and fundamental" before "uncertainties" can "tend to produce an air of doubt about findings that most climate experts say are robust" (Revkin 2005).

Amplifying uncertainties about climate change is consistent with the national politics of the United States and mirrors the minimizing of uncertainties that some environmental groups have done. Outcomes that are "likely" can easily convert to statements of either fact or uncertainty.

The public's conclusion that scientific consensus on climate change has not been reached also derives from the way climate change has been treated in the communication media. Ethical journalists are committed to presenting controversial subjects fairly and to searching out contrarian view points. But readers of newspaper and magazine articles and viewers of television news programs are left with an impression that

An Editor in the White House

Handwritten revisions and comments by Philip A. Cooney, chief of staff for the White House Council on Environmental Quality, appear on two draft reports by the Climate Change Science Program and the Subcommittee on Global Change Research. Mr. Cooney's changes were incorporated into later versions of each document, shown below with revisions in bold.

"STRATEGIC PLAN FOR THE U.S. CLIMATE CHANGE SCIENCE PROGRAM," DRAFT TEXT, OCT. 2002

wetlands will expand in areas where meltwater resulting from deeper and longer thaw
periods does not have a natural drainage path to the ocean.

~~Warming will also cause reductions in mountain glaciers and advance the timing of the melt of mountain snow packs in polar regions. In turn, runoff rates will change and flood potential will be altered in ways that are currently not well understood. There will be significant shifts in the seasonality of runoff that will have serious impacts on native populations that rely on fishing and hunting for their livelihood. These changes will be further complicated by shifts in precipitation regimes and a possible intensification and increased frequency of extreme hydrologic events.~~ Reducing the uncertainties in current understanding of the relationships between climate change and Arctic hydrology is critical

PUBLIC REVIEW DRAFT, NOV. 2002

Warming **could** also **lead to changes in the water cycle in polar regions**. Reducing the uncertainties ...

FINAL REPORT, JULY 2003

The paragraph does not appear in the final report.

"OUR CHANGING PLANET," DRAFT TEXT, OCT. 2002

the next, and perhaps even beyond.

The challenge for the USGCRP is to provide the best possible scientific basis for documenting, ~~diagnosing~~, and projecting changes in the Earth's life-support systems, and the role for CCRI is to facilitate full use of ~~this~~ scientific information in policy and decisionmaking on ~~response strategies for adaptation and mitigation at the international, national, and regional scales~~ **possible**

From "Discovery" to "Comparative Analysis"

Because of the scientific accomplishments of USGCRP and other research programs during the last decade, a period that could be termed a productive *"period of discovery and characterization,"* the CCRI, in coordination with the USGCRP, will move into a new *"period of comparative analysis of response strategies."* In this new phase of the climate science programs, information that compares the potential consequences of different responses to global changes, including climate change, will be ~~developed in a form useful to national debate and decisionmaking~~. ~~This~~

FINAL REPORT, 2003

The challenge for the USGCRP is to provide the best possible scientific basis for documenting, **understanding**, and projecting changes in the Earth's life-support systems, and the role for CCRI is to **reduce the significant remaining uncertainties associated with human-induced climate change and** facilitate full use of scientific information in policy and decisionmaking on **possible** response strategies for adaptation and mitigation.

Figure 1.1
An edited climate report

climate change is both a major worry and nothing to be concerned about.

The media also tend not to provide in-depth coverage of environmental issues—especially one that does not have immediate dramatic effects. Responsible ongoing coverage will seldom impress a public bombarded with more easily graspable stories. Occasionally, climate change is a front-page news item, as with the case of hurricane damage, but later coverage might question whether the original story was merited or even accurate. When accurate science stories reach the popular media's front pages or major segments, they often are packaged in a way that seems exaggerated.

In part, a perception of nonconsensus on climate change results from the nature of the science, which is based both on computer models and also on actual tests, measurements, and completed studies in the field. Computer models are powerful tools that make assumptions that are not always considered credible by critics, and even mainline scientists agree that the models need refinement. For example, one of our authors has written that the models need to reflect "improving understanding of the aerosols spewed by smokestacks, unfiltered tailpipes and volcanoes. They were once presumed only to have a cooling influence. Now, however, aerosols are known to cause both cooling and warming, depending on their color and composition and how they affect clouds, whose properties are slowly being incorporated in the simulations" (Revkin 2004).

Based on a growing body of observations, field research, ice-core drilling, and increasingly detailed computer models, a majority of scientists share the opinion that climate change is real, serious, and to an important extent, human induced. Clearly measuring and communicating how much, within convincing and influential ranges, is human caused and how much results

from "natural variability" would be an important step in educating the public and perhaps influencing policymakers.

Scientists work with probabilities, risks, ranges, uncertainties, and "scenarios"—approaches that are foreign to many citizens. People often learn of scientific findings from experts who are not trained in communication or are trained to communicate only with their peers. Furthermore, models that earth-system scientists, atmospheric chemists, and others consider simple are not easy to follow for the nonscientifically educated person.

The vocabulary, science, and policies of climate change are complex.
The climate field is peppered with terms such as *sinks*, *forcing*, *secondary effects*, *adaptive capacity*, *albedo*, *carbon cycle*, *integrated assessment*, *no-regrets policy*, *net primary production*, *joint development*, and *clean-development mechanism* and many acronyms. In fact, there are 288 terms in the glossary of terms of one assessment report of one working group of the Intergovernmental Panel on Climate Change (IPCC). The IPCC, created in 1988, is the main international body established by the World Meteorological Organization and the United Nations Environment Program to assess climate-change science and provide advice to the international community. In this book, we use everyday language terms or define a term that is not common when it is first used. We use the terms *anthropogenic* and *human* interchangeably.

The environmental and social effects of climate change are not discreet.
The effects of climate change do not cluster in ways that can be clearly linked by the nonscientist (and in some cases, even by

scientists) to climate-change dynamics. The environmental and social impacts are and will be unevenly distributed, even within countries. So it is not uncommon that people living in different regions of a country differ in their views of what if anything is going on and what if anything needs to be done.

Preview of the Book

This book responds to these challenges. The authors bring the how, what, and why of climate change from the laboratory to the living room. *Climate Change* summarizes in understandable terms what science knows about climate change and addresses how that knowledge has been used and can be turned to action by government and business. The book also recommends ways to further the public's understanding of this complex international environmental challenge and to affect public opinion in ways that may drive policy and actions.

The book first offers a primer on global climate change. Chapter 2 explains the nuts and bolts of climate, the greenhouse effect, and historical discoveries of their interaction. Next, in chapter 3, we summarize the effects of climate change on the world, on regions, and on states. Here we describe how people, plants, animals, crops, and the natural environment are all affected by climate change. Adding a science historian's perspective, Naomi Oreskes explains in chapter 4 the nature and nurture of consensus in the climate-change debate and asks how we know that we're not wrong and whether the contrarians might yet carry the day.

Following these science-based chapters, in chapter 5 we explore world responses from the public and private sectors. How have international scientific and legal organizations reacted? What has been the U.S. position, and how has it

changed? How have states and businesses large and small responded? Can New Jersey, California, and other states and BP, GE, and other major companies mitigate climate-change effects? The book then turns squarely to the question of how climate science is communicated to us, our children, and our grandchildren. In chapter 6, *New York Times* writer Andrew C. Revkin shares his experiences and ideas for improvement. An important factor in societal decisions about action and nonaction is the manner in which scientific information is understood. Richard Matthew addresses in chapter 7 the effect of climate change on "other people's children," especially in developing countries but also touching on areas at risk in the United States. Our concluding chapter takes readers to next steps in thinking about climate change and in acting on the science, the costs and benefits of actions of various sorts, the policy responses, and the roles that are appropriate to be taken by governments, businesses, and citizens.

Notes

1. According to the Public Policy Institute of California's *Special Survey on Californians and the Environment* (Baldassare 2003): "Two in three Californians (68 percent) believe that increased carbon dioxide and other gases released in the atmosphere will, if unchecked, lead to global warming. Forty-five percent of state residents—and 54 percent of those ages 18–34—believe that global warming will pose a serious threat to them in their lifetime. Nearly three of four (73 percent) believe that immediate steps should be taken to counter the effects of global climate change. What are they willing to do? Majorities say they are willing to make major lifestyle changes to address the problem (69 percent), believe that the federal government should set new legally binding industrial standards to limit emissions thought to cause global warming (66 percent), and that the federal government should work with other nations to set standards for the reduction of greenhouse gases (52 percent). Democrats (77 percent) are more likely

than Republicans (59 percent) to believe that global warming exists." National data on public opinion are summarized in chapter 5.

2. This friend attended the 2003 program sponsored by the Newkirk Center for Science and Society, which is the basis for several of the chapters in this book, and was impressed with what he learned.

References

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