

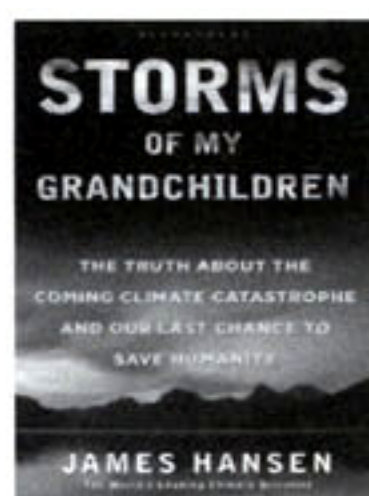
The Storms over Climate Change

DAVID MORRISON

Anthropogenic (human-caused) global warming has become an emotional issue rife with political overtones. There is no dispute among climate scientists about the reality of global warming and the fact that it is primarily caused by accelerated burning of fossil fuels. However, there are nontechnical aspects of global warming that should interest readers of the *Skeptical Inquirer*: Specifically, how scientific evidence should be assessed in such a complex situation—and the way this evidence has been distorted and denied by a handful of scientists who are savvy about the politics of Washington and the media. As skeptics, we need to recognize the techniques used to distort and politicize the science. And as citizens, we should learn to recognize the similarities between these attacks on climate science and those used by creationists to undercut the fundamentals of biological science.

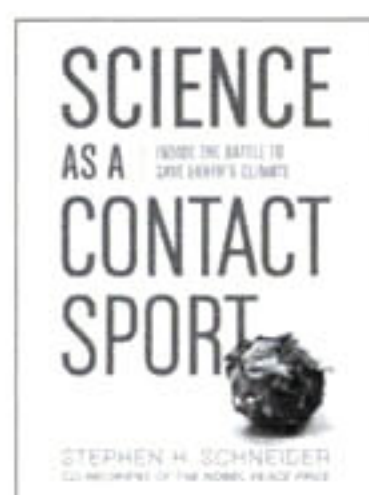
The three books I review here offer complementary frontline accounts of the Climate Wars. Both Jim Hansen and the late Steve Schneider have made important contributions to the development of climate science. Both started as modelers of the global atmosphere and ocean systems. Schneider led the climate team at the National Center for Atmospheric Research (NCAR) in Boulder, Colorado, and Hansen worked at (and now directs) the NASA Goddard Institute for Space Studies (GISS), located at Columbia University in New York City.

Schneider and Hansen, both members of the National Academy of Sciences (NAS), rose to prominence partly through their ability to explain complex climate issues to the press, to congress-



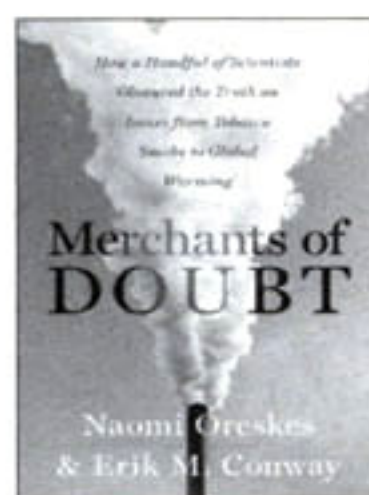
Storms of My Grandchildren: The Truth about the Coming Climate Catastrophe and Our Last Chance to Save Humanity

By James Hansen. Bloomsbury Press, New York, 2009. ISBN: 978-160819-200-7. 301 pp. Hardcover, \$25.



Science as a Contact Sport: Inside the Battle to Save Earth's Climate

By Stephen H. Schneider. National Geographic Society, Washington, DC, 2009. ISBN: 978-1-4262-0540-8. 295 pp. Hardcover, \$28.



Merchants of Doubt: How a Handful of Scientists Obscured the Truth on Issues from Tobacco Smoke to Global Warming

By Naomi Oreskes and Erik M. Conway. Bloomsbury Press, New York, 2010. ISBN: 978-1-59691-610-4. 355 pp. Hardcover, \$27.

sional committees, and ultimately to all of us. These two books of theirs are first-person accounts, geared toward the lay reader, that give about equal space to the scientific issues and to their own sometimes-controversial roles in them. The third book, *Merchants of Doubt* by Naomi Oreskes and Erik Conway, brings historical perspective to this issue. Oreskes and Conway compare the global-warming controversy to earlier campaigns to undercut the science that linked tobacco smoke to cancer, acid rain to smokestack emissions, and ozone depletion to the release of CFCs. This antiscience propaganda is a topic I will return to later in this review.

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Jim Hansen is perhaps the most famous (or notorious, depending on your politics) climate scientist. This is ironic given Hansen's midwestern roots, his careful approach to science, and his conservative, shy personality. Although he began his career as a planetary scientist studying the atmosphere of Venus, he has been working since the 1970s on understanding Earth's climate, primarily as leader of a small group of climate modelers who use NASA's powerful computers to simulate the processes that influence atmosphere and climate. As his conviction that the Earth is in

deadly peril due to the discharge of carbon dioxide into the atmosphere has grown, he has become an activist, first within the government as an advisor to the executive and legislative branches and more recently as an outspoken critic of “business as usual” practice and policies. *Storms of My Grandchildren* is his first book.

Hansen came to prominence in the hot summer of 1988, when he testified at a hearing before the Senate’s Energy and Natural Resources Committee. He said that “Global warming is now large enough that we can ascribe with a high degree of confidence a cause-and-effect relationship to the greenhouse effect.” The next day the *New York Times* declared: “global warming is here.” There had been a growing consensus among climate scientists that greenhouse warming would take place, but Hansen was the first to state bluntly that it was already happening. People listened. By the end of the year, thirty-two climate-related bills had been introduced in Congress (none passed).

Hansen’s book describes his adventures in the public spotlight, including interactions with Vice President Dick Cheney and President George W. Bush’s Climate Task Force. We also hear about Hansen’s experience in 1989 when he revealed, at a Senate hearing chaired by Al Gore, that the White House had altered his written testimony. In 2005 he again became the center of a controversy over censorship, as political appointees at NASA Headquarters tried to control even the basic temperature data that were being posted on the GISS website. When Andy Revkin of the *New York Times* exposed this heavy-handed attempt at political interference, the NASA Public Affairs officers backtracked and blamed the “misunderstanding” on a twenty-four-year-old intern who had faked his college degree and boasted that his job at NASA was “to make the President look good.”

Above all, Jim Hansen is a hard-

working scientist. Much of his book concerns his research on the science behind global warming as published in peer-reviewed academic journals. Hansen explains the fundamentals of climate change in a way that is accessible to the nonscientist. He does not overwhelm us with the mathematics of the greenhouse effect or the results of complex computer models of atmospheric circulation. Instead, he appeals to the more basic idea of conservation of energy, using data about climate changes over the past several million years to derive fundamental truths about our current dilemma.

The climate system reacts to changes imposed upon it, which is called *forcing*. These changes include variations in the amount of energy received from the Sun, slow changes in the orbit and tilt of the Earth, and of course changes in the composition of the atmosphere and its clouds. Greenhouse forcing is positive, as several watts per square meter of additional energy are radiated from the atmosphere back to the surface. Forcing due to clouds and other aerosols that reflect part of the solar energy back to space is negative. The degree of climate change depends primarily on the balance between the positive forcing by the greenhouse effect and the negative forcing by aerosols. During much of the Industrial Revolution, the two types of forcing were roughly balanced because the same industries that burned coal to release carbon dioxide also poured

smoke into the atmosphere. Since World War II, the output of greenhouse gases has greatly increased—not just carbon dioxide but also methane and industrial chemicals such as chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs). At the same time, environmentalists succeeded in reducing the emission of smoke and other aerosols. Thus we now have strong positive forcing, leading to rapid global warming.

Hansen goes further, however. He notes that the current system is not in equilibrium; we are receiving more heat than is being radiated back into space. It is this imbalance that causes rising temperature and is starting to melt the polar ice caps. Much of this excess heat is also going into the ocean reservoir. It is this heat sink that assures us that global warming will continue for several decades, even if greenhouse forcing is held steady or decreased.

We can see from studies of past climate that temperature and atmospheric carbon dioxide are highly correlated. Most previous climate changes were much more gradual than those we are experiencing today, but their magnitude has been quite large (5 degrees Celsius in both directions). Hansen calculated the forcing implied from paleoclimate data to estimate the equilibrium temperatures we can expect as a function of the CO₂ content of the atmosphere. He concludes that with the present CO₂ concentration, we will raise sea level by

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several meters at minimum due to melting ice. If the CO₂ should double or triple, which is likely if much of the Earth's coal deposits are mined and burned, we will slip into a new regime in which most of the ice caps will melt, raising the ocean level at least fifty meters, which was the level when Earth's atmosphere contained this much CO₂ in the past.

These considerations, based in interpretation of paleoclimate data, convinced Hansen of the existence of a *tipping point*, when the changes we are producing become irreversible (on human timescales). He believes that we are dangerously close to that tipping point, and he is a strong supporter of efforts to limit the CO₂ content of the atmosphere to 350 ppm (which requires a return to the level of the late 1980s). As he frequently asserts, meeting this goal precludes us from burning most coal deposits or trying to extract oil from tar shale and other difficult-to-use forms of hydrocarbons.

Hansen's proposed moratorium on coal-fired generating plants directly confronts our requirement for "base load," the steady electrical energy that cannot be supplied by solar or wind power. He describes a meeting with energy experts in Germany who said it was impossible to avoid building coal-fired generators because Germany is committed to a policy of phasing out nuclear energy. Hansen, reluctantly but firmly, is now an advocate for nuclear power, specifically for the new generation of clean-burning breeder reactors that can actually consume current radioactive waste. In reply to environmental organizations that oppose nuclear power, he notes that an estimated hundred thousand people per year die from exposure to coal, compared with at most a handful from our only serious nuclear accident at Chernobyl in 1986.

In his book we can see the gradual radicalization of Jim Hansen, self-described as a "placid, even comfortably stolid" atmospheric modeler and theorist. In 2006, *Time* magazine listed him among the 100 most influential people

in the world. Hansen concludes this book by stressing that we face the most urgent fight of our lives and noting that civil resistance to new coal plants may be our only recourse.

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Stephen H. Schneider, who died this summer (see "The Loss of Climate Scientist Stephen H. Schneider" in this issue), was a leading climate modeler much like Jim Hansen. But while Hansen is basically a reluctant public figure, Schneider epitomized the sophisticated scientist-politician; he was at home in the halls of Congress or on the front line of international climate negotiations. Winner of the MacArthur "genius" prize and co-recipient of the 2007 Nobel Peace Prize, he left NCAR for a senior professorship at Stanford University, providing him opportunities to mentor the next generation of atmospheric scientists. His wife, also a Stanford professor, is herself a world-class expert on the response of ecosystems to environmental change.

Schneider began to investigate the risk of climate change in the 1970s. As a graduate student he wrote a thesis on global *cooling*—when it appeared that negative climate forcing from smoke and other aerosols dominated over greenhouse heating, but the facts soon demonstrated otherwise. The danger of global warming was evident to many during the administration of Jimmy Carter, and a number of bipartisan government actions mandated increases in the efficiency of appliances and required substantial gains in automobile mileage performance. Schneider's first testimony before Congress was in 1979, a decade before Jim Hansen proclaimed the reality of global warming.

Two decades of bipartisan support for environmental science evaporated when Ronald Reagan became president. He and his appointees flatly denied the existence of either an energy problem or a threat of global warming. Famously, Reagan said that government is not the solution to our problems, it *is* the problem. The linked

issues of energy policy and climate change have been sharply polarizing topics in the United States ever since.

In this book, Schneider recounts his personal story of the Climate Wars. The highlight—and the source of the book's title, *Science as a Contact Sport*—is his description of the Intergovernmental Panel on Climate Change (IPCC) and associated international events in which he participated, such as the 1992 Earth Summit in Rio de Janeiro and the 1997 summit that approved the Kyoto Protocol. Along the way he also fought running battles with those who denied the reality of warming and used the media to distort and obfuscate climate science.

One of the common accusations of the climate contrarians is that the IPCC was a radical group in which alarmist scientists made unsupported statements about the dangers of global warming. It was thus with great interest that I read how this large international group, consisting of hundreds of scientists and thousands of reviewers and consultants, worked for three years on each of the three IPCC assessments. To hear the critics, one would think the radicals hijacked this process and then claimed consensus for their views. But as Schneider explains, the IPCC was forced to adopt the UN definition of "consensus," which is "unanimity." Every nation had to approve every word in the document, and even one veto could scuttle the entire process. Consequently, each statement of fact had to be documented, and every suggestion of policy approved by even the most conservative delegations.

Schneider's first-hand stories of these negotiations are fascinating. A handful of countries were the source of almost all of the objections: Saudi Arabia, the United States, China, and Russia—not coincidentally the biggest producers and consumers of hydrocarbons. One of the most frequent phrases in the IPCC notes is "Saudi Arabia, with the support of the United States, objected. . . ." Schneider also reports that many of the members of the official U.S. delegation admitted privately that they agreed with the majority of scien-

tists there but were under different orders from their bosses in Washington. He played a central role in finding compromises. At least once, he threatened to expose the obstructionist position of the U.S. delegation to the press and in congressional testimony scheduled for the next week. Schneider's description of the process explains why the IPCC assessments, far from being radical, have consistently underestimated future warming and its consequences.

Schneider's own contributions to the IPCC reports centered on providing meaningful estimates of uncertainties in both the anticipated climate changes and their likely effect on ecosystems and economies. Although the current state of the climate is measurable, all estimates of future trends are uncertain to varying degrees. Most of these predictions are based on computer models because, as Schneider often notes, you can't collect data about future conditions. To make such assessments useful to policymakers, the scientists must provide quantitative estimates of uncertainty, and Schneider insisted on a consistent vocabulary in the use of terms such as "likely," "very likely," and "high confidence level."

Schneider also describes his outrage in 1996 when the second IPCC assessment report was released. In a long letter published in the *Wall Street Journal*, solid state physicist Frederick Seitz personally attacked the lead author of the report, accusing him of a blatant attempt to "remove hints of the skepticism with which many scientists regard claims that human activities are having a major impact on climate" and claimed that this was a falsification intended to deceive the public and policymakers. The accusation was flatly untrue. But what amazed the scientists was that Seitz was a past president of the NAS. Why was Seitz, who was not a climate scientist, launching this personal attack—which was quickly echoed by Fred Singer, another senior scientist, in a *Wall Street Journal* article, "Coverup in the Greenhouse"?

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The third book in my trilogy deals with the role of contrarians like Fred Seitz and Fred Singer and their sophisticated campaign to undercut the science of global warming. They had previously also disputed the reality of ozone depletion and the links between cigarette smoking and cancer. These individuals and organizations are the "merchants of doubt" referred to in the title of the book by historians Naomi Oreskes and Erik Conway.

Merchants of Doubt places the attacks on climate science and the IPCC in a broader context. Seitz, Singer, and a handful of other scientists have waged a thirty-year campaign against a wide range of environmental issues. They followed what is often called the "Tobacco Strategy." In the 1950s and '60s, evidence rapidly grew that cigarette smoking causes lung cancer and a variety of other diseases. The tobacco industry could not prove this claim wrong, but they could and did try to undercut the science behind it. Internal tobacco memos state that "doubt is our product." Big Tobacco used science to fight science by funding a few pliable academic researchers and setting up nonprofit foundations and organizations that released "scientific reports" and engaged in other forms of "education." Although they lost this fight, their efforts delayed effective government action by more than two

decades and indirectly led to the premature deaths of millions of smokers, who were happy to believe that the link between smoking and cancer had not been proven.

When evidence began to accumulate in the 1990s that there was also a link between secondhand smoke and disease, the same techniques were used by the tobacco companies, this time with the support of a few famous scientists such as Fred Seitz (former president not only of the NAS but of Rockefeller University), Fred Singer (first director of the National Weather Satellites Service), Bill Nierenberg (former director of the Scripps Institution of Oceanography), and Robert Jastrow (founding director of the NASA GISS).

These four retired physicists had worked on Cold War defense projects and held senior advisory positions in the Reagan administration. They first gained national prominence for their outspoken support of the Strategic Defense Initiative (SDI, commonly called "Star Wars"). Jastrow, Seitz, and Nierenberg founded the George C. Marshall Institute, a tax-exempt educational organization promoting "science for public policy" with a goal to "raise the level of scientific literacy . . . with an impact on national security." They were strongly anti-communist, opposed to co-existence or detente with the Soviet Union, and in favor of much larger defense budgets. Many of their education efforts

were directed at journalists and congressional staff. The Marshall Institute joined other think tanks with similar political goals, such as the Heritage Foundation, the Hoover Institution, the Hudson Institute, the Competitive Enterprise Institute, and the Cato Institute.

Oreskes and Conway describe several of their campaigns in detail, beginning with their assertions that a “Star Wars” missile-defense system was both feasible and affordable. As physicists who had worked on defense programs, their opinions had considerable weight. At the same time, however, they went well beyond their areas of expertise to question the environmental harm of acid rain and oppose regulations to reduce smokestack emissions. This campaign, led by Fred Singer (affiliated with the Heritage Foundation and a White House insider), placed them in direct opposition to the NAS and the Environmental Protection Agency. They were aligned with the Reagan administration, however. “We don’t know what is causing it” became the official position of the U.S. government, and action was not taken to mitigate acid rain until 1990, under the first Bush administration.

Meanwhile, there was a growing scientific concern over depletion of ozone in the stratosphere. Ozone blocks short-wave ultraviolet sunlight that would otherwise be a risk for all life on land. The primary culprit was CFCs, which were used as refrigerants and spray-can propellants and to clean electronic compo-

nents. Billions of pounds of CFCs were being manufactured every year. In their defense, the chemical companies, through their trade organizations, began to follow the tobacco strategy. They dispensed millions of dollars in research grants and established several organizations for public relations purposes, such as the Aerosol Education Bureau. The industry promoted the idea that volcanic eruptions, not CFCs, were destroying stratospheric ozone.

In 1985, public interest and concern were stimulated by the discovery of the Antarctic ozone hole. Suddenly the invisible chemical changes in the stratosphere were made visible by satellite images of the Antarctic. A counternarrative was soon developed, led by Fred Singer. Writing in the *Wall Street Journal*, Singer criticized the “ozone scare” and asserted that there is no proof of ozone depletion or of a cause-and-effect relationship with CFCs. His thesis was that the science is uncertain, replacing CFCs will be difficult and expensive, and the scientific community is corrupt and motivated by self-interest and political ideology—the same arguments later used by global warming deniers.

As late as 1995, after the Montreal Protocol had banned most manufacture of CFCs, Singer testified before Congress that the scientific concern about ozone depletion was simply “wrong.” He attacked the Swedish Academy of Sciences when the Nobel Prize in Chemistry was given for analysis of stratospheric ozone chemistry. Singer

described his motivation in 1989 this way: “There are probably those with hidden agendas of their own—not just to save the environment but to change our economic system. Some are socialists, some are technology hating Lud-dites; most have a great desire to regulate on as large a scale as possible.” In 1991 he wrote that the real agenda of environmentalists was to destroy capitalism and replace it with some sort of worldwide utopian socialism—or perhaps communism. (All taken from *Merchants of Doubt*, which has extensive documentation.)

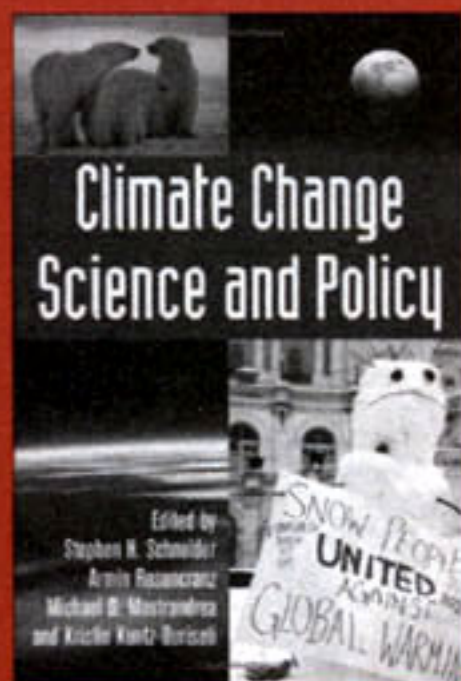
With this background, it is easier to understand Fred Seitz’s 1996 attack on the second IPCC assessment. Actually, the Marshall Institute had begun attacking climate science in 1989, the year the Berlin Wall fell. The Institute published a booklet titled “Global Warming: What Does the Science Tell Us?” by Jastrow, Seitz, and Nierenberg, blaming whatever global warming might be happening on the Sun. Nierenberg himself briefed the report to the White House. The contrarians founded a faux-scientific journal called the *World Climate Review*, partly funded by fossil-fuel interests. They used the right-wing *Washington Times* and the *Wall Street Journal*, knowing that these papers would not publish rebuttals from the climate scientists.

Even as the scientific case for anthropogenic global warming became more secure, Senator James Inhofe (then-chair of the Senate Committee

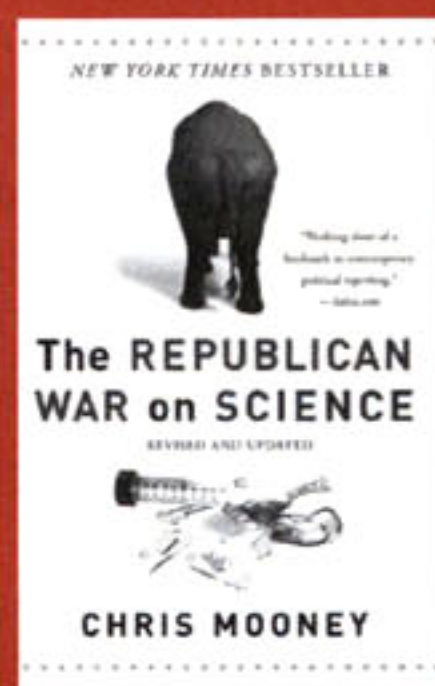
Additional Climate Wars Books

Several other recent books discuss climate change and its political context:

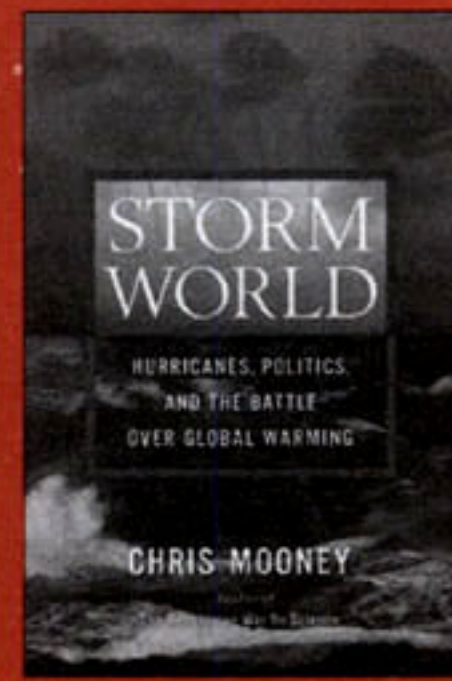
*Climate Change
Science and Policy*
Stephen H. Schneider,
et al. (eds.)



*The Republican War
on Science*
Chris Mooney



*Storm World:
Hurricanes,
Politics, and the
Battle over
Global Warming*
Chris Mooney



on Environment and Public Works) called global warming “the greatest hoax ever perpetuated on the American people.” In 1997, the U.S. Senate passed a resolution blocking adoption of the Kyoto Protocol by a vote of 97–0. In Washington, politics, money, and ideology were in ascendancy over science. The situation became even worse under George W. Bush, with the spectacle of science-fiction writer Michael Crichton appearing as an expert witness before Congress and lecturing at the White House on global warming.

The preceding paragraphs only hint at the detailed history of the science-contrarian movement described by Oreskes and Conway. It is frankly difficult for a scientist to believe that other scientists would consciously misrepresent the scientific facts, but the pattern is inescapable, as Seitz and Singer and a handful of others have taken the same denialist position on one issue after another: tobacco and cancer, acid rain, ozone depletion, DDT, secondhand smoke, and now global warming. As documented in this book, these contrarians are fighting science because of their political conviction that government regulations are in themselves evil. They believe that environmentalism leads to regulation, which will inevitably lead to the loss of our freedom. They call environmentalists watermelons: green on the outside but red on the inside. Having fought for freedom all their lives against the evils of communism, they are

now fighting just as hard to protect our liberty from the evils of government regulation. That mission apparently trumps their devotion to science.

* * *

These three books were written before the “climategate” accusations of late 2009, which were used effectively to smear the IPCC specifically and climate scientists generally. Most of the media went along with this sophisticated public-relations campaign, describing this as the greatest crisis faced by science in a generation. Some media later printed retractions and even apologized when impartial investigations showed that the accusations were false. But this episode demonstrated the ability of the contrarians to influence public opinion. I imagine that Oreskes and Conway could add this episode to their long list of public-relations battles, but it did nothing to undercut the reality of global warming or the serious implications it has for our future.

There are many parallels between this campaign against climate science and the widespread efforts to deny biological evolution and block its inclusion in science classes. Both climate denialism and evolution denialism are efforts to fight real science with pseudoscience—these contrarians publish fake science in non-refereed journals, found NGOs, and use sophisticated marketing in the halls of power from Washington to Austin. Apparently even good scientists can be seduced by a strong ideological commitment, just as the creationists are much

more interested in saving our souls than in addressing the science of biology. Like creationists, the climate contrarians are “merchants of doubt,” using pseudoscience to undercut real science and create a wedge for their nonscientific beliefs.

I recommend all three of these books. They are well written, timely, and provocative. Hansen emphasizes the science and introduces some novel ways to assess future warming without invoking complex computer models. Schneider paints a fascinating picture of the struggle to develop a consensus on global warming, especially through the UN IPCC assessments. Oreskes and Conway place the climate controversy in perspective as the most recent example of how ideology and politics have been used (with considerable success) to attack science. Their message is one that skeptics everywhere will want to read and ponder. ■

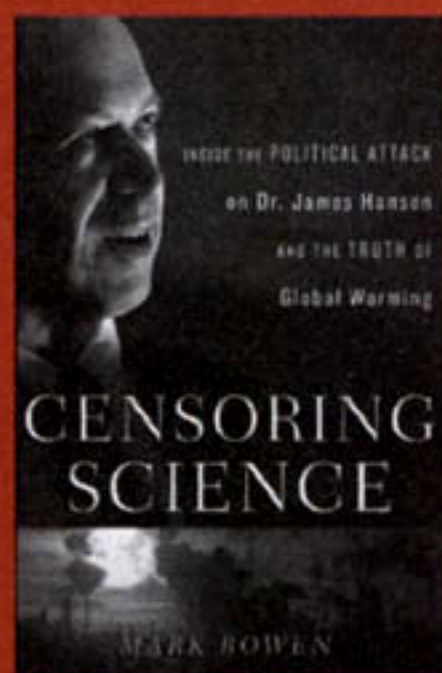
Note

Of the four leading climate denialists discussed here, only Fred Singer is still going strong. Bill Nierenberg died in 2000, and both Frederick Seitz and Robert Jastrow died in 2010.

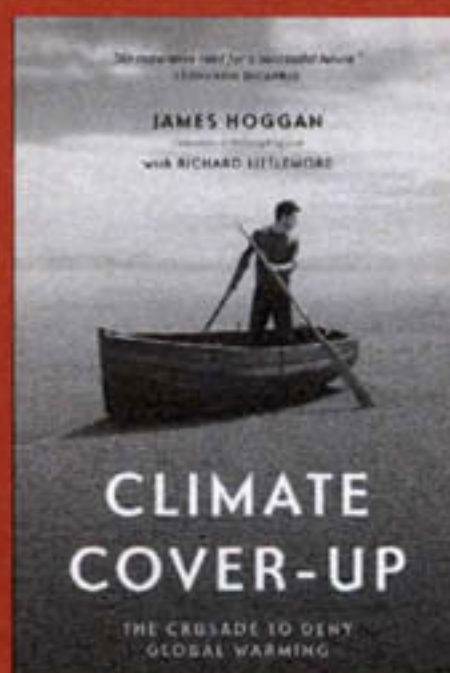
I thank several colleagues for helping to educate me on climate science or for offering constructive criticism of this manuscript: Mark Boslough, Clark Chapman, Bob Chatfield, Erik Conway, John Mashey, Naomi Oreskes, Phillip Russell, and Eugenie Scott.

David Morrison is a CSI fellow who divides his time between the SETI Institute, where he is director of the Carl Sagan Center for the Study of Life in the Universe, and the NASA Lunar Science Institute. Although he is a planetary scientist, not a climate scientist, he has followed the growing climate crisis with alarm over the past decade.

*Censoring Science:
Inside the Political
Attack on Dr. James
Hansen and the
Truth of Global
Warming*
Mark Bowen



*Climate Cover-Up:
The Crusade
to Deny Global
Warming*
James Hoggan with
Richard Littlemore



*A World
Without Ice*
Henry N.
Pollack

