

Americans' Problem with Global Warming¹

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Few environmental issues stir as much fuss as the prospect of a steamier, stormier planet. Almost everyone seems to have heard experts predict something like that, a variant on Hell freezing over or an Old Testament plague. Even calming voices concede that the temperature of the Earth's atmosphere (at least on average, near ground level) is on the rise. "Science" itself confirms it. Clincher factoids tumble from mountains of measurements around the world. They are assembled from patterns in tree rings, fossils, and satellite photos. They are transmitted from instrument-laden balloons high over Oklahoma and extracted from dust deep in Nordic glaciers. Together, they credit popular belief that something called "global warming" is a problem.

But folks are more reluctant to embrace any particular estimate of its dimensions and significance. When confronted with harsh forecasts, jokes about them, news of Kyoto maneuvers, an Arctic melt, or just an abrupt turn in the local weather, people dispute:

- How much hotter or more erratic is the climate really getting?
- How important are "greenhouse effects"—the atmospheric consequences of burning fossil fuels and of deforestation?

- Exactly where should consequences be expected?
- How bad are they apt to get? When?
- Where does responsibility lie?
- What can or should be done?

Decades of sophisticated research, monographs, press releases, and broadcast warnings do not seem to have instilled a precise lesson at-large. Diverse local conditions as well as practical and political considerations intervene. People seem to agree less about what *will* occur or *ought to be* done, than about what *could* be wrong in what *has been* done.²

From that perspective—one of tentative but widespread concern—recent increases in global, greenhouse-gas concentrations do not bode well. When viewed with extreme optimism, their effect may be negligible. But by every other estimate, it is bad, maybe colossally so. Likewise, the prospects for future increases in emissions would seem to range only from yet more of a sorry *status quo* to catastrophe. The distribution of reasonable responses, then, is skewed to the negative, ranging from denial or resignation to outrage or despair. Affirmation of existing human/atmosphere relations is barely imaginable, at least for anyone who cares about life as we know it.

Hence, countries that meet two conditions—that produce a large share of emissions and that can best afford to change—would seem ready targets for a reform campaign. Because the United States is at the top of most lists on both scores, environmentalists around the world figure that responsibility for initiating change lies there. After all, in hosting only a small proportion of humanity (less than 5 percent), this superpower is responsible for a giant share of greenhouse-gas production (about a third of the world's total, more than any other country).³ So Americans should be among the first to cut emissions and thereby their contribution to global warming and its attendant risks. Even if they doubt that the risks are all that bad, shouldn't they be ready to reduce the possibility of making matters worse? Apparently Americans are not, or at least are less so than citizens of other industrial nations.⁴

This essay aims to explain how that reluctance should be understood. The evidence comes from Americans' discussions of climate change—in everyday conversation, popular science and lore, history, journalism, opinion research, interviews, and ethnographic fieldwork (2000-2002). Recent publications on global warming are read in the light of older, touchstone disputes. Commonalities are then pursued in the more particular experiences and institutions of sundry "stakeholders"—people whose livelihood depends on the weather in obvious ways. They include Midwestern farmers and their suppliers, bankers, insurers, climate scientists, broadcast meteorologists, dealers in agricultural commodities, and their professional consultants.

The aim here is less to advance one solution (say, a particular carbon-credit scheme) over another than to clarify the social and cultural conditions that seem ever to stand in the way.⁵ On street corners and in shops overseas, strangers stop me to ask, "What's wrong with you Americans, anyway? Why the cowboys in-charge and gas-guzzling cars? Don't you understand ecology or value nature?"

Although I am also no fan of U.S. energy policy or Texas-style officialdom, I tend to be a bit defensive. After all, environmentalism has about as deep a history in the United States as anywhere, and nature has at times bordered on a fetish. When it comes to global warming (among other things), the charge that the United States is uniquely irresponsible or insensitive to environmental issues could use more precision and evidence. But in this case, Americans themselves seem only to choose sides. They rarely challenge the holier-than-thou quality of the debate itself. Instead they argue about who or what among them deserves the blame. Is it too little or too much science? Public prissiness or sloth? Tree-hugger hysteria or government/industry intrigue? The only obvious consensus is that something or someone *else* is to blame.

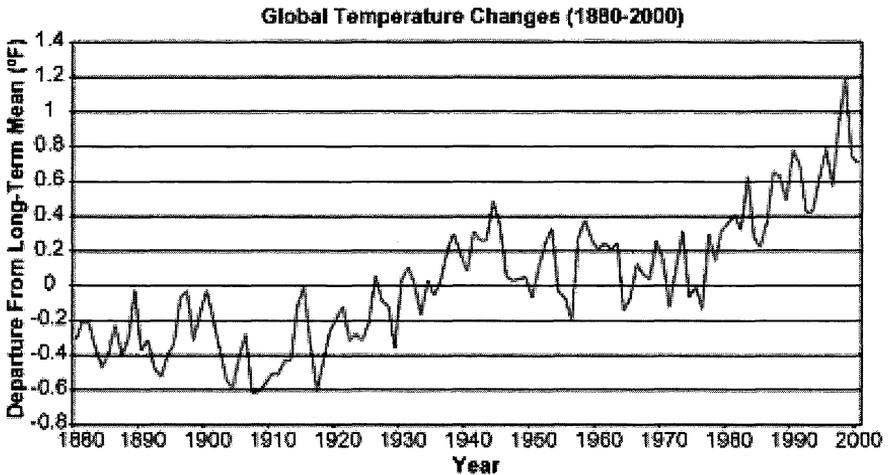
American studies has generally responded to such disputes by identifying a divide—usually portrayed as large and foundational—between the way things (such as gender, race, the pastoral or, here, climate change) *have been* understood and the way they *ought to be* understood, at least in the critic's own estimation. The following extends that tradition in several directions. First, rather than seeking only to locate the peaks of the divide (hegemony vs. resistance, *né* myth vs. reality), it also identifies practical, dynamic connections. In the course of everyday events, how do positions on climate change arise, interact, and persist? Second, it pushes the usual interdisciplinary program beyond history, language, literature, and popular arts to the natural sciences, business, ethnography, and public policy, particularly the practical as well as expressive links between commerce and politics. And third, rather than claiming a privileged viewpoint entirely of its own, it marshals the insights of Americans who draw upon diverse, intimate experiences with the subject. They help make sense of the meaning of global warming in America.⁶

The Problem

Much of the range of responses to the problem of climate change is prefigured in the variety of definitions of "the problem" itself. Basically, the broader the definition, the more disagreement it occasions.

First and probably least controversial is a definition that begins and ends with observation. At issue are merely a few brute indicators of change, stripped of implication or explanation. "Global warming," from this vantage, is more like a syndrome than a disease. It is just a long-term series of increases in temperature and other heat-sensitive conditions.

The current round of warming began during the industrial revolution and has been accelerating (with short-term exceptions) ever since. Over the course



Source: U.S. National Climatic Data Center, 2001

of millennia, prior comparable climbs—some more and some less extreme—have also been documented. But nearly all earth scientists now agree that recent indicators, even if contestable in their details, converge in their trajectory: It is getting warmer fast. Extrapolating from existing data, climate modelers figure that over the next century the average temperature will increase by two to twelve degrees Celsius. But even if the actual rise is only half that much, the change in related conditions could be radical: melting glaciers, rising seas, more frequent and severe droughts, storms, and attendant loss of life and habitat. Hence, warming, even in this narrow sense, is a “problem.”

Second, the definition of the problem can be expanded to include the syndrome’s most frequently credited “cause”—an increase in fossil-fueled emissions along with a decline in vegetation that digests them. “Global warming,” from this vantage, is like an environmental disease.

Under healthy conditions, greenhouse gases (chiefly CO₂ but also water vapor and methane) help sustain the planet’s climate. They allow heat from the sun’s rays to reach the surface of the Earth, but they also absorb and retain heat that accumulates at the surface, thereby moderating swings in the weather. In concentrations that have accompanied most of human evolution, these gases have helped make the climate hospitable, but higher concentrations could turn it hostile. Since the number of tailpipes and factory stacks is unlikely to decline, their contribution to overheating is a concern. Normally, too, through

photosynthesis (converting CO₂ to oxygen and growth) green plants help control greenhouse-gas accumulation. They “store” carbon; they cycle it from the atmosphere back to the earth, the site from which it was mined and combusted. Most scientists agree that there is more than a coincidence here—in particular, that increases in CO₂ emission and declines in vegetation are among the causes of the recent rise in the Earth’s average surface temperature.

But the importance of this effect is still debatable. Almost every factoid has its friends and foes. Positions become more polarized and passionate with greater distance between the persons doing the arguing and the social circle of state-of-the-art atmospheric science. Latter-day animists (e.g., in the loin-girding phase of “direct environmental action”) tend to presume a simple, doomsday connection, as if warming were God’s way of warning the world: “Don’t mess with mother nature.”⁷ Laissez-faire business boosters, though, see little more than nature’s “natural” variability. In climates as with markets, they trust, “the bull follows the bear.” Representatives of the Competitive Enterprise Institute and the Heritage Foundation, for example, insist that the greenhouse effect remains a Chicken-Little proposition.⁸ But even The Weather Channel (TWC), in its coolly “objective” posts to the World Wide Web, has clung to a more tentative estimate of the severity of the problem than academic or governmental organs of science. TWC does so, they say, not because there is much doubt about the current temperature trend, but because they are more reluctant to credit predictions that treat the trend’s alleged cause (the greenhouse effect) as if it were a well-understood part of the problem itself.⁹

Third, and yet more controversial, is the assertion that “the problem” includes not only a syndrome and a cause but also an unmet responsibility to “do something about it,” to find a cure. Presumably, humans have not only a capacity for understanding the environment but also a duty to apply it altruistically. For that reason, targeting potential sources of harm (say, doing something about those tailpipes and stacks) need not wait until all of the data are in. Well before the cost of inaction can be tallied, “stewards of the earth” err on the safe side: “If you are not part of the solution, then you a part of the problem.”

Predictably, even if less fervently than other self-styled stewards, climate scientists often appeal to this sensibility. It is featured, for example, in their laboratory press releases and in the “importance-of-research” section of their grant proposals. When they construe the problem as including both a known cause and an imperative to respond, their research “must be” part of the solution. Therein also lies an implied threat: An agency that fails to fund their research risks becoming part of the problem, in effect enlarging it, as well.¹⁰

But many scientists also admit—especially when grants are not at stake—that the time may have passed for further research so easily to matter. The momentum of climate change—the size and speed of the trend and the resilience of its causes—may be too great to imagine that remedies will work anytime soon. Although the rate of global warming might be slowed, no one alive today

can reasonably expect to see its direction reversed. Nevertheless, lay environmentalists (citing natural scientists who may or may not agree) often appeal to this ethically charged sense of the problem to promote rapid reduction in emissions and protection of vegetation, as if the climate will cool accordingly. Or, they despair that it is just too late. Then, “addressing the problem” entails scurrying to acquire habitats that will better endure heat and storms of the future. “Doing something” will come by way of jeremiads from cooler, higher ground.

American Public Opinion

Since the 1970s, focus groups, telephone interviews, and pencil-and-paper surveys have yielded a wealth of evidence of environmental opinion in the United States. In the late 1980s, pollsters turned their attention to global warming in particular. Research on its public perception intensified greatly in 1992, when 182 nations signed the Rio Climate Change Treaty, establishing a diplomatic framework for greenhouse gas reduction.¹¹ Pollsters shifted into even higher gear from 1995 to 1997, when the United Nations Intergovernmental Panel on Climate Change (IPCC) announced a scientific consensus (that global warming truly is a problem, in a broad sense of the word) and when President Bill Clinton heralded “the Kyoto process” (the follow-up to Rio).¹² The same trail has been well scouted ever since. Pollsters ask: How do Americans (that is, adults in the United States) perceive the prospect of climate change? How do they form and evaluate that impression, and how are they inclined to use it?

As one might expect, summary statistics vary not only over the years and across groups but also from study to study. Nevertheless, they converge on a few basic points:¹³

- When asked, nearly all Americans (more than 90 percent) consider themselves supporters of the natural environment. Their number and the intensity of their feelings have grown quite steadily since the first international “Earth Day,” in the Spring of 1970. But this huge, greenish majority still styles itself an embattled minority. They consistently underestimate how thoroughly U.S. compatriots share their sympathies. In fact, only a tiny portion of the population (fewer than 1 in 20) now claims to be hostile or even neutral toward “environmentalism.”
- Although dismayed by squabbles among scientists, the vast majority of Americans (now about 80 percent—over 50 percent even before the IPCC announcement) agree that global climate change is real, that it is likely to be more evident in the future, and that the consequences could be catastrophic. Among the effects that most people in the

United States (more than 7 in 10) affirm are threats to food and water supplies, wildlife, human health, and survival itself. Only a small minority (fewer than 2 in 10) believe that global warming is better understood as a natural than human-made phenomenon, and an even tinier proportion claim global warming is a delusion.

- The vast majority of Americans say that they would be willing to make some sacrifices (e.g., pay \$5-25 more per month for energy) and that they welcome international agreements to reduce greenhouse-gas emissions. Despite the huge role of U.S. negotiators in the failure of the 2000 Hague Conference of the Parties to the Kyoto Protocol, most U.S. citizens—then and now—endorse the principles and key particulars of that protocol, including regulatory relief for developing nations. Sixty to eighty percent assert that position even when reminded that U.S. negotiators and then President George W. Bush himself found the terms too costly or otherwise unacceptable. Only a small minority (fewer than 2 in 10) say that the United States should ratify the treaty only if other nations lead the way or if economic sacrifice would be unnecessary. In this respect, Americans resemble the rest of the industrial world. Their attitudes toward climate change are closer to the planet's mainstream than U.S. emissions or government policy might suggest.
- Nevertheless, global warming ranks near the bottom of Americans' environmental priorities (e.g., much lower than toxins in the air or waterways). They generally insist that the causes of climate change can be addressed without personal sacrifice. The intensity of their alarm and their eagerness to find solutions may actually have peaked back in 1989.
- When compared to Europeans, Americans appear eager neither to assume personal responsibility for climate change nor to mobilize to promote relevant policy reform. Americans generally assert that someone else—"government" or "big business"—should better exercise responsibility, but expectations are too low to counsel hope. Rather than targeting specific institutions or practices, patterns of energy accumulation or use, regulations or the lack of them, people most often blame global warming on

an alien force, on intangible behemoths (such as capitalism), or moral failings (greed, laziness) that seem inscrutable or unmovable.

- In trying to explain why the American people seem so unmoved, pollsters tend to stress “scientific illiteracy” at-large. Surveys reveal that citizens generally ignore or confuse oft-repeated details of the global-warming story, as scientists and journalists tell it. Since “uptake” of climate news is so poor, it only makes sense that Americans would also fail to act on implications that, environmentalists say, should be obvious.¹⁴

In general, then, opinion research suggests that Americans’ concern about global warming is widespread but shallow. U.S. politicians could well infer—and most obviously have—that support for reform is just too soft among the electorate to count on it, come election season. President George W. Bush can safely downplay (the Union of Concerned Scientists says, “distort or suppress”) alarming evidence of the greenhouse effect.¹⁵ Even avowed environmentalists such as Al Gore dare not be “out front” of a populace whose sympathies look more stylistic than substantive.

There are also, though, good reasons to question the findings that figure in this conclusion.

Perhaps engagement is not as broad as it seems. For example, some of the popular support for the Kyoto Protocol may be attributable to ignorance of its basic points. Among proponents who have been polled, strikingly few realize that the treaty would compel industrial nations like the United States by 2010 to reduce their emissions by 7 percent, not from present levels, but from what they were in 1990. Since they harbor bogus assumptions about the sacrifice required, it is hard to put much stock in the large number of people who say they would accept it.¹⁶ We can doubt that Americans will respond as graciously to actual cost increases as they have to hypothetical ones.

On the other hand, perhaps researchers underestimate the depth of popular engagement. How is it to be sounded, anyway? People who trade in subtle distinctions—like earth scientists and public-opinion analysts—might be a bit too impressed by their disregard at-large. For that matter, just about everyone looks for “deficiencies” of understanding when others disagree. Folks on one side are apt to credit their vantage by claiming moral or perceptual gifts that their opponents just so happen to lack. And when the point of contest can be construed as technically as climate, talk about technicalities can pass for wisdom. Your perspective is “deep” if you readily cite scientific details, and “shallow” if you don’t. Certainly, this way of calibrating depth is contestable. It entails both a rhetorical preference and a social prejudice.

But public knowledge does appear to be distinctly flawed in the case of the greenhouse effect, a crucial ingredient of all but the narrowest sense of the

problem. Non-scientists, for example, regularly confuse old stories about the ozone layer—e.g., about the danger of fluorocarbon spray-can propellants that the U.S. Congress actually banned back in 1978—with those about contemporary carbon-dioxide emissions.¹⁷ They also usually underestimate the cumulative atmospheric impact of all the engines in the cars and buses in which they ride, quite apart from anything that big business or government does. Whatever affinity Americans may claim they have for the environment, many of their stories about it, including their own role in it, do not pass elementary scientific muster.

Amidst the polls, too, there is reason to believe that schooling matters. For example, Americans with more years of formal education tend to be more in favor of the Kyoto Protocol and its approach. In this respect opinion research offers encouragement to environmentalist scientists. In effect, it says, “People who have a clue agree with you.” From this perspective, the main problem with global warming (in the broad sense) is a clueless or callous American public. To solve it, promote research and scientific literacy—“transfer knowledge.”

People in or around the education business, who publish or read articles like this one, might be expected to agree. No matter who is discussing climate change, wouldn't a dose of cutting-edge climatology be better than ignorance? On the other hand, the quality of recent discussion in the United States seems to have little to do with anything cutting-edge. Much of its shape and style can be found in well-worn, generically Western as well as recent, American precedent. “Knowledge” is both moving and staying put in persistent forms.

Story types

Far from pollsters, discussion moves to climate change under widely variable circumstances, with many modes and purposes. People often cite something relevant (say, from last-night's broadcast news) in taking a conversational turn, but their point—why they brought it up or how it matters—requires interpretation.

A single sentence (e.g., “Did you hear about that Polar melt?”) might signal that folks are eager to talk about global warming or just to change the subject, that they are up on the latest or tired of it, that they are revved for debate or segue to a joke. In any of these cases, they might be aiming to embrace or to estrange someone else's sensibility. That someone could be a friend within earshot, a figure in the news, or a figment of local imagination. Often, too, people struggle just to avoid an offensive position. They step toward that harmless, featureless ground that talk of weather seems to conjure.

So interpretation is required, but it is not necessarily difficult. If you know the circumstances and participants, you probably also instantly know what they mean. Shreds of global-warming lore can even telegraph messages among strangers. Bits and tones of conversation intimate familiar stories. *There*—in the tales that details presumably fit—meanings become clear.

Maybe, then, climate discussion is so polymorphous precisely because its allusions are not. The large variety of jokes, debates, and whatnot can be considered riffs on a small number of possibilities. When almost everyone knows

that few normal or credible tales about the climate “can” be told, it becomes easier—in just a phrase—not only to invoke one of them but also to declare one’s disposition, pro or con, or to concoct a variant. The novelty comes in refiguring “facts” that gained their meaning in stories so tried-and-true that they can be presumed. A mere fragment is ready for discussion precisely because “everyone knows” its corresponding whole.

So even humble, climatological detail can imply a full-grown tale—a rendering of some supposedly common sense. Each includes a chain of relevant events, hopes, regrets, and a lesson to be learned.¹⁸

Three types of stories seem particularly prevalent in the United States.¹⁹

- In “realist” versions global warming is rendered just another trend—a result of sundry, contestable, maybe inscrutable causes—like many that have occurred before. The lesson is that humans (at least “realistic” ones) should figure out how better to cope with yet another of Earth’s surprises. If some geek tells you that ice is melting where it shouldn’t, get over it. In fact, maybe people got themselves in the current tizzy by presuming (“unrealistically”) that scientists or bureaucrats should supervise the planet. Free of such meddling, nature, markets, and technology will adapt, as they have, in ways that belie all-too-common fears.²⁰
- “Liberal” environmentalist tales tend to begin with a more vulnerable, familiar, even intimate figure. In standard renderings, she is Mother Earth. Her changing climate is like a fever, a symptom of wounds that mass production and consumption inflict. So, what is required is more love and respect for Nature’s frailty. Look at the thermometer, take a deep breath, and you can tell that humans have much more to do. They should put Earth first, beginning with a sense of wonder, responsibility, and restraint. Go organic. If this ethic of “stewardship” advances social justice, so much the better.
- In “progressive” narratives warming is considered yet further proof that the dominant order of the world—capitalist, patriarchal, homophobic, racist, misogynist—is unsustainable. The key challenge is its leadership in outfits like Exxon and Enron, the World Trade Organization (WTO), the World Bank, the International Monetary Fund (IMF)—the environmental axis of evil. Rising temperatures indicate how dangerous they are and how urgently we must rally. First-world activists should ally with third-world

victims to target fat-cat perpetrators: dreadlocks versus suits. Advance “social justice,” and a more survivable planet will inevitably or at least much more likely follow.

In these ways, factoids seem to come with ready-made implications. They sort themselves—multiple-choice—even when no one actually says how or why. So simple conversation—say, about drought a hemisphere away—may start out pedestrian but seems ever on the verge of going high-horse. It saddles one of a few parables that trot well-worn trails.

Especially if you speak earnestly or flippantly, someone is apt to infer that you “must also” have a certain stake in that huge grab bag of things that, Americans say, “everyone” either loves or hates. For example, people who rally around the Kyoto process will be expected also to support an array of allegedly progressive causes and lifestyles, the organic section of the local grocery, public education, arms control, reproductive and gay rights, single moms, and foreign aid. People who oppose the Kyoto process will be expected to favor market forces, steak, SUVs, “family values,” and prayer in public school. Of course, individuals regularly defy these expectations, but they had better be prepared to deal with them. The story types define the terrain: “Now don’t get me wrong: even though I’m skeptical about that drought, I recycle plastic and vote Democratic.” In other words, positions on climate change slide on broad, slippery slopes. They strikingly resemble the flanks and fronts of “the culture war” that Pat Buchanan declared about a decade ago.²¹

In substance these three tale types—realist, liberal, and progressive—are well arrayed from contemporary “cultural right” to “left.” That is for the most part the way they are now told and heard in the United States. For example, although support for the Kyoto Protocol is related to many of the usual demographics—gender, income, age, ethnicity, religion, education, region, etc.—the single best predictor is the combination of these variables that also predicts a person’s position on a roughly bipolar political spectrum. Like voters for George W. Bush in 2000, Americans who are wary of Kyoto tend to be Republicans from Southern, Rocky Mountain, or Plains states, to reside in suburban or rural areas, and to be more evangelical Protestant, white, wealthy, and male than Kyoto boosters. Sociologically as well as substantively, then, Americans are wise to treat references to climate change as if they were codes of subcultural loyalty.²²

Surely, that is among the reasons that cutting-edge science is a bit beside the point. Americans might, say, “uptake” the latest data on the relationship between power-plant design and El Niño, yet feel no obligation to reassess their favorite pre-uptake tale. If new data “fit,” they can be used to lend yet more support to the same old story; if they don’t, they can be discounted, rendered “trivial” or “misleading.” Regardless, the configuration of tales and tellers remains. Such conservatism suggests that there are more than a few facts (or,

for that matter, platitudes about realism, liberality, and progress) at stake. At issue are people's common sense, their way of life, and the sort of person they become in living it.

We should expect, then, that their disposition toward global warming depends very little or indirectly on the "knowledge" that scientists, activists, and educators "transfer." Popular discussions are apt to cite bits of that knowledge, but their hold and meaning lie elsewhere. If changing American hearts and minds is the aim, it is hard to imagine a climatological clincher that would suffice. If doubt remains, just ask 20th Century Fox about the over-the-top look and cost of special effects in *The Day After Tomorrow*.

Roots and Branches

There is also good reason, however, to doubt that this process is unique to the United States or to the moment. "American" responses to climate change include strategies that theologians and scholars have long considered universal. For just about everyone, common sense is hitched to stories that lie in wait, ready for recall. Their sensibility is social as well as logical and empirical. Nearly everyone's first response to "cognitive dissonance" is conservative. Just about everywhere, some folks are more attuned to the voice of authority or change than others, and they distinguish themselves accordingly.

It is also worth emphasizing that key ingredients of Americans' climate-change lore have circulated in many societies for a long time.²³ The first scholarly papers on something like the greenhouse effect appeared in France in the 1820s.²⁴ Leading researchers subsequently came from elsewhere in northern Europe. The idea of using photos of glacial melts to sensationalize the subject can be traced to Sweden more than a half century ago.²⁵ For that matter, the notion that people can change the weather occurred to ancient Mediterraneans. Among the first to forecast global warming (albeit as a good thing) was a philosopher who knew Plato and Aristotle personally. About 2,300 years ago Theophrastus argued that, in clearing forest and draining wetlands, farmers magnified the long-term impact of the sun. Folks around the world still joke that it's cloud-free because they remembered an umbrella or rainy because they hung out the wash.²⁶

As James Rodger Fleming explains, in the West full-fledged "climate determinism"—faith that humans make their climatic fortune—is at least three or four centuries old.²⁷ DuBos, Montesquieu, and Hume were among the many "modern" Europeans who asserted that improving the land, moderating the atmosphere, and fostering genius were aspects of a single Enlightenment project. Since "better" people presumably take better care of the land (which in turn improves both nature and culture), agriculture links soil, produce, climate, and mind in a synergistic relation . . . that just so happened to place their own, mid-eighteenth century Europe (a.k.a. "Civilization") near the peak of possibility. Contemporary historians and philosophers trusted that they had achieved a superior atmospheric no less than spiritual condition.²⁸

Many of these same Europeans were alarmed then to hear of cold and stormy weather in the northern "New World." They considered the presence of "savage" people there both a sign and an explanation of natural challenges to the spread of Civilization. The climate (and the people who "failed" to alter it) figured heavily among them. So for colonists, clearing forests or marshes and planting crops had a compound purpose. They sought not only the actual produce of their husbandry but also its presumed byproducts: the subjection of Indians and of the climate. So charting the fruit of these labors became a republican pastime. Diarists compulsed thermometer readings and storm sightings. Budding scientists like Benjamin Franklin hyped temperature trends as proof that agriculture was making North America more temperate (like Europe), thereby making it also friendlier to the advance of European (vs. aboriginal) society. Thomas Jefferson reviewed journal entries to prophesy a similar nexus: more acres of cultivation and fewer of wilderness, more moderate weather, a decline of Indians, and an increase in colonial fortunes.²⁹

Meteorology and climatology in the United States grew from these republican roots. In the late nineteenth and early twentieth centuries, as instruments and records improved, scientists evaluated both climate determinism and its vain American application. They usually found both wanting. But both have also been reappearing ever since.³⁰ Today, for example, Ellsworth Huntington may be recalled as a crackpot, Harvard and Yale reject, but his ethnocentric and racist version of climate determinism—"the pulsatory hypothesis"—had a huge public following in the United States through the 1910s and 1920s. His most popular book, *Civilization and Climate*, argued that levels of human achievement rise and fall with "climatic energy." According to Huntington, they also just happened to peak in his own Anglo-Saxon environs.³¹

A temptation, then, is to treat the current brouhaha over climate change as a blast from the distant past. Once again, the worry is immoderate weather. Once again, both diagnosis and remedy entail climate determinism. Once again, records are reviewed in self-righteous and self-serving ways. Once again, thermometers, storms, and glaciers are consulted to flatter or condemn a people.

Gauging Human Consequences

Nevertheless, there are some respects in which the current brouhaha remains distinct. An important difference can be found in the way that human impacts are assessed. In prior publications, for example, European and American elites generally trusted that people (at least of their own sort, going about their daily business) had a neutral or beneficial effect on the climate. In the current round, though, stress is on the negative. At least since the mid-1980s, unlike their predecessors, Americans have been indicting business-as-usual for degrading the weather.

That change makes sense when we recall that for most of Western history the most worrisome prospect was actually global cooling. Long after the Age of

the Enlightenment and Exploration, warming was considered both a natural byproduct of Civilization (via farms or factories) and a force in its favor. In 1906, for example, Svante August Arrhenius, the Swedish chemist who is credited with first calculating the role of carbon compounds in global warming, observed:

By the influence of the increasing percentage of carbonic acid in the atmosphere, we may hope to enjoy ages with more equable and better climates, especially as regards the colder regions of the Earth, ages when the earth will bring forth much more abundant crops than at present for the benefit of rapidly propagating mankind.³²

Like most twentieth-century earth scientists, though, Arrhenius usually marked time in vastly longer increments than any stage of human experience. Most experts figured that the great bulk of atmospheric CO₂ came from volcanic activity when the Earth was new. They mainly wondered how Ice Ages came and went (2-800 million years ago) and how to anticipate the next one. So, insofar as “anthropogenic” influence mattered at all (say, from a century or two of industry), it seemed a benign flash in the pan.³³

In the late 1940s and early 1950s—at the end of an unbroken 40-year warming trend—news of the trend and fears of the effects of nuclear testing combined to spark worry that humanity might, indeed, be producing too much of a good thing.³⁴ But that particular alarm—the one most like today’s—lasted only a short time. Up-and-coming climatologists promoted cyclical theories of climate change just as, in fact, average global temperatures began to fall (ca. 1960-75). This change in circumstance and science buttressed new public concerns that particulates (e.g., ash in urban pollution or dust raised in a thermonuclear explosion) might block the sun’s rays. Hence, the ancestors of today’s progressives worried more about “nuclear winter” than endless summer. For example, in 1958 (one year after circulating the survey that inspired *The Feminine Mystique*) union journalist and feminist Betty Friedan titled her jeremiad on climate change, “The Coming Ice Age.”³⁵

Among the unique features of the current moment, then, is a shift in the object of concern (from too much cold to too much heat) and in the evaluation of its source (from industry as minor blessing to major curse).³⁶

Gauging Good Intentions

The confidence in science and technology that Kyoto requires (assuming people can “correct” the planet’s atmosphere) could also be considered distinct—an instance of the sort of megalomania that people around the world often take to be typically “Western” and acutely “American.” Who else would assume that it is possible to refashion God’s Earth as handlers and cosmetic surgeons might a Hollywood star?

During the Cold War, for example, the Pentagon strategized sci-fi scale climate-sabotage scenarios. Just in case the Soviet Union dammed the Bering Strait (in an evil plot to overheat the Pacific), the United States studied earth-cooling countermeasures: rounds of underground nuclear explosions, mass sterilizations, chemically manufactured weather fronts, and square miles of mirrors launched into orbit. Can anyone imagine India, France, or Brazil concocting such a scheme?³⁷

A classic, climatic precedent for this “distinctly American” and “scientific” hubris can be found amidst the heady nationalism of the early nineteenth century and in the figure of its premier meteorologist, James Pollard Espy. He is usually remembered for establishing a prototype of the U.S. Weather Bureau and the first decent thermodynamic theory of storms (considered moments in a cycle of convection, driven by temperature and pressure gradients overhead). By the mid 1830s, Espy (a.k.a. “the storm king”) reputedly knew more about weather than anyone else. He was a darling of the American public and its intellectual elite, transcendentalists like Thoreau and Hawthorne as well as scientists like Joseph Henry, the first secretary of the Smithsonian Institution. But in the late 1830s, Espy’s faith in convection cycles took a bizarre, applied turn. He proposed that the federal government maintain a massive timber reserve from the Great Lakes to the Pacific, purely for weather-control contingencies: If there should be a desire for rain or cooling in the East, set the West ablaze.

In this case—as in many others, when science and common sense openly compete—science lost. Espy’s stock plummeted. For the rest of his life he was the subject of scorn and ridicule. Some (especially Southern Senators) objected that, if the program were implemented, blazes would be set to the benefit of one region over another. Others figured that he had just lost his mind. In 1842, Philadelphia writer Eliza Leslie memorialized the whole episode in a farce that projected Espy’s plan into the twentieth century—a slapstick American version of Prometheus or Frankenstein.³⁸

International stereotypes and U.S. foreign policies to the contrary, for most of U.S. history most Americans have considered such megalomania outlandish, particularly when the environment was the target. (Consider the long list of schemes dubbed “So-and-so’s Folly.”) They became occasions to reaffirm the fallibility of humankind and the sublimity of nature—an entity that by definition (“by nature”) was beyond human capacity fully to comprehend, much less to improve. Americans often remember nature’s most powerful manipulators as its worst. They were men drunk with power. They were totalitarian scientists and industrialists who treated God’s creation as merely a “resource”—an object to be analyzed, processed, rearranged, or otherwise diminished for their own short-term gain.³⁹

The Puzzle

Perhaps, then, what is unique to the current climate-change debate in the United States is less its constituents than their priority and alignment. “Liberals” and “progressives” remain faithful toward nature and skeptical toward industry, but now they are more confident that nature is comprehensible, even manageable, and that science is on their side. Just about everyone who endorses Kyoto, for example, can cite a supporting factoid. They are confident that the IPCC got it right and that citizens can and should implement planetary improvements that scientists recommend. It is the “realist” opponents of Kyoto who must discount mainstream science as a fallible or biased “special interest.”⁴⁰ In this respect, even with its familiar, universal or Western ingredients, the current brouhaha is not just a blast from the past. Its configuration is in important ways distinctive of the United States and the moment.

Even as the ongoing “culture war” so mediates engagement, it is striking, then, that nature *and* science still matter to so many citizens, maybe now more than ever. Despite tired tales, political posturing, and cluelessness at-large, both climate and climatology obviously count. This pattern in U.S. responses to global warming poses a puzzle:

*Since Americans so style themselves environmentalists, and
since environmentalists now so ally with science, and
since scientists so counsel action to diminish greenhouse effects,
why do Americans remain so reluctant to deal with greenhouse
effects?*

In other words, when it comes to global warming, where is the disconnect between Americans’ environmentalist disposition and action? Where is the breakdown in conviction or communication?⁴¹

Stakeholders in the heartland of the United States—people whose livelihood is clearly hitched to the climate—suggest some places to look.

The Subject

Weather would seem to be among nature’s most accessible elements. A feel for it is a benchmark of human intelligence. (Either you do or you don’t know enough to get out of the rain.) It is especially important among people whose livelihood requires the “right” atmospheric conditions. The rhythm of sun and rain can make or break a crop and thereby fortunes up and down the chain of agricultural inputs and outputs, supplies, finance, marketing, and processing. Ignore it at great peril. Likewise, the date that a river freezes or thaws can determine the return on a year’s worth of shipping contracts. So people “in the business” talk about it a lot. But even in places like Palm Springs—where the climate is basically a lifestyle amenity, and one day’s forecast might as well be the next—weathercasts have a loyal following. They spew conversation starters.

“Hot ‘nough for you?” works just about as well in Boston as in Biloxi, in January as in June.

That may be part of the problem. Weather is too ubiquitous and amorphous a topic—talk about it, too “soft,” too much like “chatter”—to move “hard” investment or production decisions. Furthermore, “everyone” recalls the time broadcasters warned of a storm that arrived long after its estimated time of arrival or that never came at all. Farmers, commodity traders, shippers, and their consultants may be loyal forecast fans, but they also describe forecasters as just another party heard from: “Their guess is as good as mine.” In other words, the subject of their predictions is “by nature” too rambunctious to corral. Who would start reorienting a business because “some weather guy” forecasts Armageddon? (In this context the funds that were squandered over-preparing PCs for Y2K come to mind. And in that case, experts could at least agree when to expect the worst.)

Part of what is missing here is sensitivity to the difference—sacred in meteorology and climatology—between “weather” and “climate,” between short-term, small-scale, often volatile conditions and long-term, large-scale, quite orderly ones. In fact, when I told scientists of my aim to survey stakeholders, they insisted that I first teach everyone the difference, “to be sure they’re really talking about climate” rather than the weather. They assumed—as I did not—both that “stakeholders” meant *other* people and that they had a corner on correct lingo. I insisted on letting people use whatever terms seemed relevant in their workaday world, “wrong” or hybrid though they might be from someone else’s point of view. In fact, most of the people had to be led to the distinction.⁴²

When they were, they remained reluctant to credit the relevant science enough to use it on the job. They suspected that refocusing the target (from weather or from a mix of climate and weather to strictly climate) would, if anything, increase uncertainty: “If they can’t tell me when—in the next couple of weeks—the soil on our side of the county will get up to 50° [ready to plant], how could they possibly know that it’ll be 52° or whatever a hundred years from now?” (Such skepticism also figures in farmers’ resistance to “precision agriculture,” with its presumption that consultants can render nature sufficiently more predictable to justify their fees.)

No doubt, such skepticism betrays some misunderstanding of climate models. They speak to probable trends over large zones, not exact temperatures on somebody’s field. Forecasts can easily be excellent at one while poor at the other. But there are also ways that climate—itsself, as a subject—invites such confusion.

Scientists well know that people are unlikely to respond to models until predictions engage, not planetary averages, but the more particular time and place that inhabitants call their own.

As seas rise, will New York have to raise its airports?

Both LaGuardia and Kennedy or only one of them?

With warming, will U.S. grain production move north?
How far? When?
If power plants are cleaner in the Midwest, will summers moderate in the Northeast?
How much? Again, when?

But so far, “downscaling” of climate models to answer such questions has proven extremely difficult. Trimming the size of the target (say, from a country in the twentieth century to a county next year) comes at the expense of “levels of confidence” that predictions warrant; maybe unavoidably so. In general, the smaller the sector of the earth’s surface being modeled, the more likely predictions will fail because of developments far from it.⁴³

Of course, climate scientists well understand the tradeoff. Their everyday experience, monitoring and modeling the atmosphere, confirms the interdependence of its dimensions (across the surface of the earth, above and beneath it, over time) and the cost of slighting any one of them. A well-trained eye never loses sight of the big picture. But other folks must act in a tight, specific frame. If they bet on a change, it had better pay off—not just someplace, on average, over the long haul—but when and where they wagered. So, they regularly face a mismatch between climate predictions and day-to-day reality. Despite experts’ warnings, every cold snap challenges conviction to “do something” about global warming. The scale of the subject and its distance from ordinary experience (for all but scientists) makes it tough to rally around.⁴⁴

The Science

Stakeholders also detect problems in the way information has been gathered. With a bit of prompting, experts themselves confess that some of the data on climate change are weak. Standard records of temperature, pressure, wind, and precipitation, for example, tend to be low in geographic resolution. For the past century most systematic observations have been distributed on a grid system with considerably larger cells than any stakeholder would actually hold. This feature of the data deepens the challenge of downsizing models enough to touch the public.⁴⁵

Although the archive maintained by the U.S. National Weather Service (NWS) is likely the best in the world, it also has some gaps. For example, long-term data (the kind that modelers prefer) are relatively crude on snow and cloud cover, two key factors in atmospheric dynamics. And although modelers have made great strides in working around such gaps, some may be getting worse.

Many of the NWS data-recording sites are staffed by volunteers who enrolled early in the Cold War. More and more of them are ready to retire from service. An implication was brought home to me one memorable afternoon, spent with an NWS archivist as he massaged the numbers that old-timers posted to a central computer:

Oh yeah, I better adjust that barometer reading.
It doesn't look right.
I bet George or Mildred forgot to reset it yesterday.
They're like that.

It is more than a little daunting to discover that climate-change evidence has such an improvisational chain of custody. And George and Mildred's replacement may be worse. The common variety is an automated observation station. Although less forgetful, it cannot assess clouds overhead or snow on the ground.

And then there is the challenge of processing all of these data, making them "say something." Even supposedly definitive, headline-grabbing reports are laced with caveats that are difficult for a novice to decode. Imagine the sophistication required for an ordinary person to be moved by the drift in verb phrases from the UN IPCC and the U.S. National Academy of Science (NAS) over the past decade:

- "The unequivocal detection of the enhanced greenhouse effect from observation is not likely for a decade or more." (IPCC, 1990)
- "Increases in atmospheric greenhouse concentrations probably will be followed by increases in average atmospheric temperature." (NAS, 1992)
- "The balance of evidence suggests a discernible human influence on global climate." (IPCC, 1995)
- "There is new and stronger evidence that most of the warming over the last fifty years is attributable to human activities." (IPCC, 2001)
- "Greenhouse gases are accumulating in Earth's atmosphere as a result of human activities, causing surface air temperatures and subsurface ocean temperatures to rise. . . . The changes observed over the last several decades are likely mostly due to human activities, but we cannot rule out that some significant part of these changes is also a reflection of natural variability." (NAS, 2001)⁴⁶

All this hedging and hair splitting leaves not just confusion but also controversy in its wake. Indeed, it is hard to imagine any conclusion or data set, no matter how immaculate in origin, that would win everyone's confidence, once and for all.

Broadly speaking, scientists are as disputatious as trial lawyers. And the more conventional the wisdom, the greater the effort to overturn it. Convictions—especially popular ones—are *supposed* to be questioned. Scientists with integrity do their damndest to disprove them. As long as tests continue, common sense is “speculation,” and skeptics get the benefit of the doubt. Fame and funding come to those who advance novel interpretations, with extra credit for slain sacred cows. So, whatever their particular merits, new convictions (as for climate change and its cause or cure) are bound to be questioned.⁴⁷

Nevertheless American onlookers tend to treat scientific dispute as itself discrediting: “Why should I change the way I do business [e.g., engineer for lower CO₂ emissions] when even experts can’t agree on what’s happening?”

Such questions suggest important differences between Americans’ scientific and civic cultures. Science thrives on argument among experts, but citizens are reluctant to act in its presence. It doesn’t help that journalists feel obliged—in the name of “balance”—to feature controversy even when next to none exists. Even if there are only one or two scientists on one side and hundreds on the other, the lone rangers will be quoted in paragraph three or howl about “media bias” if they are not. Facing the threat of Kyoto-style regulation and being no fools, energy companies are sure to have a few dissident scientists on contract to feed journalists’ hunger. These are among the reasons that some climatologists, though devoutly environmentalist, regret that Kyoto proponents tethered their credibility to science. If the public awaits consensus, scientists are among the last folks likely to deliver it.⁴⁸

Lay stakeholders are also generally suspicious of experts’ dependence on lots of cash. Critics on the cultural left charge that anti-Kyoto scientists are hacks, losers underwritten by polluters who put an industry-friendly spin on their findings. Conversely, critics on the cultural right charge that pro-Kyoto scientists are chasing handouts from privileged primitivists, tree huggers, and hempsters.

Suspicious are also chalked up to the peculiar privilege that some scientific institutions enjoy over others. For example, in U.S. forecasting the NWS Storm Prediction Center (SPC) hones the cutting edge. Because Oklahoma and the Texas Panhandle desperately need tornado warnings, that is where the center is located and NWS artistry supreme. SPC staff are obviously good at an important job. But the models that they develop can be less reliable when applied, as they are, elsewhere in the United States and around the world. For example, their calculations have generally discounted “northwesterly flow events” that do not much matter in Oklahoma. But they sure do on the Northern Plains. Some major-league failures in climate forecasts have resulted, and the stakeholders who banked on them suffered huge losses. So, clearly experts are as vulnerable as other folks to quirks of nature, geography, and history, even if other folks are the ones who pay the price.⁴⁹

For many Americans, science appears to be an alien monopoly power, concentrated in anything but disinterested or down-home institutions. For

example, the basic ingredients for nearly every local broadcast of the weather in the United States come from one of three for-profit companies (Kavorus, Weather Central, and Weather Services Incorporated). A quick glance at the graphics in the paper or on television in any U.S. city, and you can tell which of the three is under contract. And nearly all of the actual numbers that go in those snazzy graphics come from a single source: the National Weather Service, a bureau of the behemoth National Oceanic and Atmospheric Administration (NOAA), a division of the U.S. Department of Commerce.

This public monopoly has its virtues. Despite popular cynicism, short-term forecasts like the ones that Americans tune in every day are quite accurate. Flaws and all, it is hard to imagine better data than those that a U.S. government agency provides everyone—ordinary citizens no less than corporate moguls—on time without charge. And its large measure of independence from the private sector has some obvious benefits. Imagine, for example, if one of the airlines or a port authority (vs. NWS) regulated airports. As hostile weather approaches, could they be as trusted to err on the safe side? To close their own hub before someone else's?

But this public monopoly also poses problems. Tort standards provide government agencies like NOAA with much more limited liability than private contractors. Furthermore, when information is published (for general consumption vs. for a particular client pursuant to a specific decision), courts have determined that the provider has absolutely no liability for its errors. Even cases of astounding negligence have been rebuffed (e.g., as in claims on behalf of mariners who died in a storm that the NWS marine forecasters failed to note, because of remote sensors that, NWS confessed, they knew were critical and defective but that they decided not to fix).⁵⁰

In this environment, it is actually quite remarkable that so much agreement among and around climate science has emerged. But from the point of view of many non-scientists, the heat and complexity of the global warming debate signal that the jury is still out. And under no circumstances—no matter how carefully you attend, how much you risk, or how bogus the expertise—will legal protection exceed “let the buyer beware.” Since the experts who counsel greenhouse gas reduction are so unaccountable for their advice, why would an investor flout everyday experience to follow it? In such ways, the style and structure of American science undercut conviction.

The Media

Among the most striking features of climate communication is the small number of channels on which Americans rely. They get the basics of barometric pressure, cloud types, cyclones, and whatnot in grade school. Temperature and precipitation trends attract coverage in stakeholders' trade publications (e.g., *Wallace's Farmer* or *Soy Bean News*). And NWS data are readily available at a large number of Internet sites. But none of these sources is frequently cited.

Instead, just about everyone credits their knowledge of the atmosphere to the latest weathercast on a local major-network television affiliate.⁵¹

Drawing viewers to weathercasts has long been among the strategies for building station profits. It is a fairly simple, well-known formula:

- A broadcasting company's income chiefly depends on the size of the fees that it can charge for commercials.
- Its rate depends on its "audience share," the number of viewers (particularly those with discretionary income) who watch its broadcast as opposed to others in the same area.
- Audience share chiefly depends on the number of viewers that the station attracts to its morning, evening, and late-night news.
- Most viewers (station managers estimate about 80 percent) tune in those broadcasts to catch the weather.

It is easy to understand, then, why most stations begin the news with a teaser about tomorrow's temperature and why the weather report itself spans the quarter hour. By beginning the report just before the quarter hour and continuing just after it, broadcasters increase their chance of being picked up, not just once but twice in Nielsen ratings. In major markets Nielsen samples audience share every fifteen minutes.

For those who bemoan scientific illiteracy at-large, this economic incentive could bode well. After all, there is probably more science in weather reports—measurements, maps, technical symbols, and deductions—than anywhere else in U.S. mass media. Furthermore, contrary to my expectation, broadcast meteorologists do not seem to be the bimbos that novels or films like *To Die For* invoke.⁵² At least the ones whom I met were confirmed "weather weenies," the sorts of people who were once earnest officers of their grade-school science club. They are pleased to celebrate their craft on the radio and in newspapers as well as TV. They are trained, certified, and committed to spreading appreciation of meteorology, including its value in understanding climate change.

But they also lament their inability to do much more than please an audience. Given their importance to station profitability, management keeps them on a short leash. They become, in effect, company mascots or clowns. By standard contract, the bulk of their workweek is reserved for public appearances that showcase a market-targeted "personality" and "community involvement" of the backslapping, booster sort. They can't leave their homes without clothes that sport station logos. They are supposed to smile and shake hands with every yahoo who recognizes them in the grocery store. (You can imagine how long it takes to shop.) As with Ronald McDonald or the village pastor, station contracts

normally include a “morals clause.” No matter what their expertise or ambition, they had better not offend the most narrow-minded viewer. Furthermore, since theirs is usually the least scripted portion of the news, they are the ones whose on-air time is grabbed for late-breaking stories. When I asked one star weather guy how he and his peers engaged the public, he answered, “We’re whores, man. We’re whores!”

TV weathercasts simply share the well-known constraints of broadcast (vs. face-to-face or print) communication. To fit standard time slots, there are fewer words and ideas per story. Presentations are littered with distractions. Their focus is ever on the verge of a shift or a break for commercial. Topics that lend themselves to sensational video displace everything slow or subtle. Isolated but photogenic flash floods will get more coverage than whole seas on the rise. As they say, “If it bleeds, it leads.” At the same time, the fluid, “friendly” style of presentation inhibits critical reception. Hence, for at least 30 years, media scholars (only occasionally over objections from producers themselves) have agreed that television news provides a poorer learning environment than just about any other medium. Tests of the knowledge that consumers gain through different media consistently confirm the point.⁵³

If a station meteorologist pushes for innovation—say, to better educate viewers—management must beware. They dare not estrange their audience. If the weathercaster persists, management is apt to bring in a consultant whose research is aimed to “let viewers decide.”⁵⁴ For example, one local weathercaster—a trusted source among Midwestern farmers—recalled his disappointment, trying to change a standard broadcast measure of humidity (for farmers, “drying conditions”). Rather than good ol’ relative humidity, he wanted to introduce dew point, which is more informative for many purposes, more independent of temperature or time of day. Even though few viewers know what either measurement means, consultants settled the matter: Polls “proved” audiences prefer relative humidity, and that’s what they will get, muddled, archaic, or meaningless as it may be. In such ways, as primed as weathercasts might seem, say, to deliver the “literacy” and “knowledge” that Kyoto boosters miss, the medium is bound to disappoint.

The Cultures

Of course, nearly all of the obstacles here blamed on the subject, the science, or the media can instead be blamed on the way that Americans use them. People in the United States *could* improve their understanding of the climate and of its complex relationship to the weather that they happen to experience. They *could* make science less alien and support its advance, even as they better understand its limits. They *could* develop and consult more media of communication that challenge as well as entertain. They *could* take more responsibility for their own role in global warming. They *could* better address the causes and prepare for the consequences.⁵⁵

But as I hope the foregoing has also made clear, there are formidable material and institutional impediments. If Americans seem clueless or callous toward global warming, the problem is not just their attitude. Until U.S. institutions as well as minds are changed, the public is apt to remain unmoved.⁵⁶

Furthermore, even if scientists succeed in “transferring knowledge” about global warming and its causes, the public may well disagree about how to use it. Stakeholders’ “stakes” are far from obvious or uniform. In fact, among the first lessons they provide is how diverse their attitudes are.

A hint can be found in the way relevant insurance tends to be financed. Normally, to prepare for perils, insurers research and amortize the risk. They set premiums to cover the damage claims that, they calculate, are most likely to occur over the life of a contract. They bet against a worst-case outcome, often advising or even pressuring clients to reduce their exposure. But climate-change insurance (e.g., to cover losses if global warming continues) is more often financed through the sale of “derivatives.” Rather than wagering on one outcome, the insurer builds a balanced pool of premium payers who will lose and gain from a temperature shift. No matter what actually happens—whether warmer, cooler, or the same—bets cover each other. No one’s definition of risk prevails; “attitudes” are irrelevant.⁵⁷

Such dodges are possible and desirable because global warming can be of such radically different import to different folks. On the ledger, for example, glacial melts and deeper seas might be great for shippers but awful for fishermen. A wave of winter heat might deflate profits on a ski slope but also inflate them around an otherwise chilly beach. Heavy late-summer rain might save a corn crop but spoil the hay. On the other hand, a large share of the American public considers weather an amenity. Change of any sort is a nuisance. The more that their outdoors resembles the indoors of a mall, the better. Alter the climate, and they expect thermostats to provide relief. So, convincing more and more people to expect global warming will not necessarily yield a convergent response.

There are also, though, conditions in the United States that encourage common attitudes toward the climate. Most stakeholders, for example, recall that earth science was relegated to relatively early grades, a “kid’s subject.” Biology, chemistry, and physics were the more prestigious, grown-up, college-bound sciences in high school. And most people recall that relations between their occupation and the environment were treated in training as charitable considerations, the sort of issue you address, only if and when you can afford to. No wonder, then, atmospheric science and public sentiment operate on different wavelengths.

There is also widespread resistance to believing that everyday comforts, like driving to work, can be so monstrous in their collective impact. Insofar as Americans consider private transit “a right” and emissions properly assessed one tailpipe at a time, responsibility will continue to be displaced onto the biggest one around, likely a factory stack. Compared to other industrial nations, the United States simply has fewer policy devices for making both individuals and

corporations absorb the ongoing environmental costs of their normal way of life. So as long as pollution stays within regulated extremes, environmental costs are “externalized,” that is, shifted to someone else and future generations.

Whatever their occupation or point of view, most stakeholders claim that their focus *must* remain on this month's bottom line. Many wish they could act with greater commitment to the long haul and the public good, but they cannot afford to be the only ones in their business who do so.

Furthermore, nearly everyone asserts that they are, as a practical matter, unable to decide, say, to reduce the contribution of their work to greenhouse gases. Someone else makes such decisions, even when, as in family farming, they would seem to be the boss. They speak of competitive pressures to cut short-term costs—say, by using more fossil fuels or defoliating fencerows—even when they see the social and environmental damage. As often as not, they say, their financial institution, supplier, or buyer will insist on such expediency. To qualify for spring loans, for example, many farmers have to agree to plant according to their lenders' instructions. And likewise, many lenders say they have little choice. Margins are small and default risks great. Agricultural finance is already too close to charity to imagine volunteering to absorb costs that can be avoided, at least for the moment.

Why should any of these people be eager to “uptake” climate information when they are so incapable of applying what they learn? Or when the experts who are selling uptake seem (even if unfairly) so irresponsible, ignorant, and disrespectful of other stakeholders' positions? To an awful lot of people, it barely makes sense to listen. The jeremiads just remind you how powerless you are to do what you might easily believe to be the right thing.⁵⁸

In short, American institutions seem insufficient for the sort of coordinated action that would make a difference, even if the will to act existed. Systems of finance, transportation, and regulation undercut the incentive of people to learn, to mobilize, or to make sacrifices, even when they are individually predisposed to do so.

Conclusion

Part of Americans' problem with global warming, in the large sense, can be attributed to the inhuman scale and staggering complexity of the subject. Public understanding is mired in conceptual confusion and a persistent culture war. Much of the data are partial, uneven, or simply weak, and their implications (e.g., for the priority of policies aimed at ameliorating long-term causes vs. consequences of warming) are highly contestable on ethical no less than empirical grounds. Scientific discourse thrives on discord, while “moving” the public awaits consensus that is unlikely to come.⁵⁹

As diverse Americans well know, many obstacles are purely institutional. For example, legally speaking, for most practical purposes, climate scientists (unlike other stakeholders) are generally protected from liability for the actions

that they counsel. Furthermore, climate science reaches the public most often by way of compromising media. Interviews with broadcast meteorologists and consultants confirm published concerns that entertainment (or “viewer preference”) can trump science when the two compete.

For-profit enterprises (including media industries) are driven by a bottom-line that limits the capacity for messengers to be “out front” of conventional consumer pleasures. For example, broadcast media (which are particularly important for information about the atmosphere) are not particularly good at inspiring informed, collective action. Public investments in basic science, data collection, and education are declining. The division of labor, liability, and responsibility separates the sensitivity of scientists and non-scientists, creating suspicion and mistrust. Individuals have a limited capacity to see and affect connections to large institutions

Perhaps most important in obstructing public “uptake” is a widespread sense of powerlessness. Interviews with people who have an obvious, direct stake in climate change—Midwesterners engaged in agriculture and its affiliated industries—confirm that many people feel as if there is simply no point in following the relevant science, that they are not in the position to apply whatever they might learn. They well recognize that their actions—e.g., how they plow or plant or with whom they contract—will have profound personal and (when considered collectively) environmental consequences. They insist that they want to do the right thing. But they also feel as if they simply “must” conform to the dictates of more powerful, distant institutions and economic “reality.”

So, yes, there are obstacles to communication between climate scientists and non-scientists despite common interest in a single subject. More precise science and more diverse, intense discussions of its implications could help. At least people might have more articulate warrants for their responses to global warming. But this research also suggests that there are broader cultural and institutional obstacles to collective action. In particular, members of the public seem to long for more evidence that talk about the climate—provisional as it may be—matters. The mere fact that people who have a lifetime of experience dealing with the climate can be construed as relatively passive “stakeholders”—as more or less skilled in receiving information that experts produce or as more or less entertained watchers of weathercasts—may be as much a cause as a consequence of miscommunication. Responses to global warming might well improve with more emphasis on the ways that specific, large economic, political, and scientific institutions can be more responsive to the public.

In the short run, scientists and other stakeholders might learn to work better together, to “downsize” models—connect to reality and to respect differing relations to it—in ways that are more faithful to both global ideals and workaday traditions. I hope environmentalists can help not only to clarify the problem that is global warming but also to increase the chances that American institutions and culture become a greater resource in doing something about it.

Notes

1. This research was funded by the Center for Global and Regional Environmental Research at the University of Iowa. Co-investigator David McGinnis put me in touch with the center and helped prepare the successful CGRER seed-grant proposal. I am also indebted to the many people who consented to tape-recorded interviews or helped more informally but whose privacy must be protected here. Credit for bibliographic advice is due David McGinnis and Barney Mergen and for research assistance, Heather K. Conley, Sheila K. McGinnis, and Sarah I. Walker.

2. For hypotheses on the roots of such popular discussion, see Marita Sturken, "Desiring the Weather: El Niño, the Media, and California Identity," *Popular Culture* 13:2 (2001), pp. 161-189 or <<http://www.uchicago.edu/research/jnl-pub-cult/backissues/pc34/sturken.html>>.

3. According to the United Nations Framework Convention on Climate Change (UNFCCC), in 1990 U.S. emissions of greenhouse gas (CO₂) were 36.1 percent of the world's total. The share of only one other "Annex 1" (industrialized) nation reached double digits: The Russian Federation, with 17.4 percent. <<http://unfccc.int/resource/kpoc2.pdf>>.

4. The appearance to which I refer is the refusal of the United States (along with a dozen other countries) to ratify the Kyoto Protocol to the UNFCCC. To date (February 2004), on the other hand, 120 nations have ratified, accepted, or acceded to the Protocol, well over the required minimum of 55. The U.S. refusal is crucial, though, since the Protocol cannot be in force until that minimum includes enough of the Annex 1 Parties to account for at least 55 percent of Annex 1 carbon dioxide emissions in 1990. That requirement in effect gives the United States a veto power that has frustrated the will of the vast majority of the planet's peoples. For updates on ratification, see <<http://unfccc.int/resource/kpthermo.html>>, <<http://www.greenyearbook.org/agree/atmosphe/m-kyoto.htm>> and <<http://unfccc.int/resource/kpstats.pdf>>. For an alternative interpretation, see for example: U.S. Department of State, "Policies and Measures," *U.S. Climate Action Report 2002* (May 2002), pp. 50-69, <<http://unfccc.int/resource/docs/natc/pam/sapamn3.pdf>>.

5. For an introductory review of policy alternatives (e.g., carbon credits), see Michael A. Tamon, ed., *Climate Change Economics and Policy: An RFF Anthology* (Washington, DC: Resources for the Future, 2001).

6. It should be clear from the outset, then, that stakeholders were not consulted to discover views "representative" of the group to which they belong. The number of individuals consulted was too small and the context of consultation too far from standardized to make any such claim. Instead, individuals were selected because they could readily connect their views of global warming to workaday reality, including a reality for a large number of people that would have to change if the United States were "to do something" about the greenhouse effect. For example, resistance could be anticipated if policies do not take their conditions into account. Hence, stakeholders and their comments are selected for attention in this essay, not because they are "typical" of anyone or anything, but because their views are uniquely relevant, grounded and enlightening.

7. See, for example: Greenpeace, "Greenpeace's International Campaign to Save the Climate" (2002), <<http://archive.greenpeace.org/~climate/>>; Rainforest Action Network, "Environmentalist, Students and Human Rights Advocates Confront Citigroup As Number One Funder of Global Warming," press release (November 7, 2001), <<http://www.ran.org/news/newsitem.php?id=453>>; Friends of the Earth, "Bianca Jagger, Annie Lennox, William Roache and Keith Allen Join National Campaign To Boycott Esso," press release (May 8, 2001), <<http://www.foe.co.uk/pubsinfo/infoeam/pressrel/2001/20010508114136.html>>.

8. Since 1989 (though currently "deactivated," apparently because the President so shares its view), the self-styled "industry voice" (preferring "new technology" and "economic growth" alternatives to Kyoto) has been the Global Climate Coalition, <<http://www.globalclimate.org>>. Angela Antonelli, Brett D. Schaefer, and Alex Annett, "The Road To Kyoto: How The Global Climate Treaty Fosters Economic Impoverishment and Endangers U.S. Security," *Roie Backgrounder* No. 1143 (October 6, 1997), from The Heritage Foundation (2002) <<http://www.heritage.org/library/categories/enviro/bg1143.html>>; Bruce Yandle, "Bootleggers, Baptists, and Global Warming," *Hoover Digest* 1 (2001) <<http://www.hooverdigest.org/011/yandle.html>>; "Global Warming Information Page," maintained for the Cooler Heads Coalition by Rich Zipperer (2001) <<http://www.globalwarming.org>>. Members of the coalition include the Competitive Enterprise Institute, Consumer Alert, the 60 Plus Association, and Frontiers of Freedom. It is a subgroup of the National Consumers Coalition that focuses on global warming issues. For an exemplary neo-conservative slam of Chicken-Little environmentalists, see the parody WWWeb site, "Friends of the Earth" (2002) <<http://www.earthfiends.org/globalwarming/globalwarming.html>>.

9. See, for example: The Weather Channel, "Hot Planet, A Special Report" and associated links <<http://www.weather.com/newscenter/specialreports/hotplanet/index.html>> (2002).

10. This impression was confirmed in reading many scientific abstracts and proposals, but it was dramatically evident—and explicitly acknowledged—in 2001, when I sat in on sessions in which inter-university teams of climatologists and meteorologists prepared three applications for research funding from NOAA and NSF. See also “Subjective Judgments by Climate Experts,” *Environmental Science and Technology* 29:10 (October 1, 1995), p. 468A.

11. *The United Nations Framework Convention on Climate Change* (May-June, 1992) <<http://unfccc.int/resource/docs/convkp/conveng.pdf>>.

12. See: IPCC, *IPCC Second Assessment: Climate Change 1995* (1995) <[http://www.ipcc.ch/pub/sa\(E\).pdf](http://www.ipcc.ch/pub/sa(E).pdf)>; IPCC, *IPCC Second Assessment Synthesis of Scientific-Technical Information Relevant to Interpreting Article 2 of the UN Framework Convention on Climate Change* (1995) <<http://www.ipcc.ch/pub/sarsyn.htm>>; Robert T. Watson, Marufu C. Zinyowera, Richard H. Moss, and David J. Dokken, eds., *The Regional Impacts of Climate Change: An Assessment of Vulnerability*, an IPCC Special Report (Cambridge, UK: Cambridge University Press, 1997) and “Summary for Policymakers” <[http://www.ipcc.ch/pub/regional\(E\).pdf](http://www.ipcc.ch/pub/regional(E).pdf)>; *Kyoto Protocol to the United Nations Framework Convention on Climate Change* (December, 1997) <<http://unfccc.int/resource/docs/convkp/kpeng.pdf>>.

13. The bulleted points are my own rendering of findings widely confirmed in recent survey research. Harris and Gallup Polls as well as most of the major print and broadcast news outlets and organizations of concerned citizens have published much of their raw data as well as summary reports. See, for example, Gallup’s reports on “global warming” at <<http://www.gallup.com/poll/>>. Many polls have also received coverage in the mainstream press. For bibliography and reviews of trends among these sources, see: Steven Kull, Clay Ramsay, and Monica Wolford, “Americans on the Global Warming Treaty,” a PIPA (Program on International Policy Attitudes) Report (November 27, 2000) <http://www.pipa.org/OnlineReports/GlobalWarming/Buenos_aires.html>; Jon A. Krosnick and Penny S. Visser, “American Public Opinion on Global Warming,” Ohio State University Survey of Public Opinion on Global Warming (1997) <<http://www.weathervane.rff.org/refdocs/osu2.pdf>>; John Immerwahr, “Waiting for a Signal: Public Attitudes Toward Global Warming, Environment and Geophysical Research,” A Report to the American Geophysical Union for *Public Agenda* (April 15, 1999), <http://www.agu.org/sci_soc/attitude_study.html>; Willett Kempton, “How the Public Views Climate Change,” *Environment* 39:9 (1997), pp. 12-21; Program on International Policy Attitudes (PIPA), Steven Kull Principal Investigator, *Seeking a New Balance: A Study of American and European Attitudes on Transatlantic Issues* (June 1998), pp. 56-61; and Pew Research Center for the People and the Press, “Bush’s Base Backs Him to the Hilt: Tepid Opposition From Democrats, Little Fallout on Environment,” *Pew Research Center News Interest Index* (April 26, 2001), pp. 2, 7-10.

14. Ann Bostrom, M. Granger Morgan, Barch Fischhoff, and Daniel Read, “What Do People Know About Global Climate Change? 1. Mental Models” and “2. Survey Studies of Educated Laypeople,” *Risk Analysis* 14:6 (1994), pp. 959-970 and 971-982; Mike Michael, “Ignoring Science: Discourses of Ignorance in the Public Understanding of Science,” in *Misunderstanding Science? The Public Reconstruction of Science and Technology*, Alan Irwin and Bryan Wynne, eds. (Cambridge: Cambridge University Press, 1996), pp. 105-125.

15. On February 18, 2004, with specific reference to global warming, UCS published a report finding: “The current Bush administration has suppressed or distorted the scientific analyses of federal agencies to bring these results in line with administration policy. . . . The scope and scale of the manipulation, suppression and misrepresentation of science by the Bush administration is unprecedented.” Signatories included 20 Nobel Prize winners and 19 recipients of the National Medal of Science. Union of Concerned Scientists, “Integrity in Policymaking: An Investigation Into the Bush Administration’s Misuse of Science,” (February, 2004), <http://www.ucsusa.org/global_environment/rsi/RSI_final_fullreport.pdf>, p. 2; Associated Press, “‘Concerned Scientists’ Accuse Administration of Manipulation” (February 18, 2004); James Glanz, “Scientists Say Administration Distorts Facts,” *New York Times* (February 19, 2004), p. S1.

16. 1990 is also a more convenient date for some nations than others. In effect, chiefly because of this reference point, the Kyoto protocol encourages the transfer of wealth (via carbon credits) from nations that at that time happened to be more efficient with fossil fuels (like the United States) to those (like the former USSR) that were less so—say, loaded with old, unprofitable, smoke-belching industries. So, for example, Russia and its former satellites would get credits (that might be sold elsewhere) for reducing emissions from facilities that have been producing none for more than a decade, since the USSR collapsed. That may be a good idea, at least for redistributing wealth, but its net effect on greenhouse-gas emissions is certainly questionable.

17. Exercising authority derived from the Federal Food, Drug and Cosmetic Act (1938), enhanced with the Toxic Substance Control Act (1976) and amendments to the Clean Air Act (1977), the U.S. Environmental Protection Agency (EPA) and the Food and Drug Administration (FDA) banned all non-essential uses of CFC (including refrigerants and aerosol propellants), effective December, 1978.

18. This line of reasoning owes much to humanistic theories of culture and discourse that have become influential in science studies over the past twenty years. See for example: Bernard

D. Davis, *Storm Over Biology: Essays On Science, Sentiment, and Public Policy* (Buffalo, NY: Prometheus Books, 1986); Monica Leggett and Marie Finlay, "Science, Story, and Image: A New Approach To Crossing the Communication Barrier Posed By Scientific Jargon," *Public Understanding of Science* 10:2 (April 2001), pp. 157-171; Alan Irwin and Brian Wynne, *Misunderstanding Science? The Public Reconstruction of Science and Technology* (New York: Cambridge University Press, 1996); Ullica Segerstråle, ed, *Beyond the Science Wars: The Missing Discourse About Science and Society* (Albany: State University of New York Press, 2000); Steve Fuller, *Philosophy, Rhetoric, and The End Of Knowledge: The Coming of Science and Technology Studies* (Madison: University of Wisconsin Press, 1993).

19. This typology comes from my own fieldwork—primarily informal exchanges with as diverse folks as I could muster, 2000-2002. Although I do not have an actual count of their number, it surely totals in the hundreds. Whenever conversation turned to global warming (most likely through a telegraphic reference—"You know, I heard about X yesterday on the news), I would ask them to make allusions explicit: "Sorry, but I don't understand why X is remarkable. Would you please explain? Are there folks (besides me) who might not get it? Like who? And why? What would they make of X instead? How are the people who do get it different? Why?" So, the types of tales represent a condensed, generic rendering of the replies that I received.

20. For print versions of this sort of story, see the Heritage Foundation or Enterprise Institute publications above or (for somewhat more scientific variants) the "Climate Change" WWWeb pages of the George C. Marshall Institute (2002) <<http://www.marshall.org/subcategory.php?id=9>>.

21. Patrick J. Buchanan, "The Culture War," a speech before the 1992 Republican National Convention in Houston, Texas, (August 17, 1992), <<http://www.buchanan.org/pa-92-0817-rnc.html>>. Note that Buchanan claimed that his foes started the war in the 1960s; so his was a strictly defensive campaign.

22. See for example: "Large Majority of Public Now Believes in Global Warming and Supports International Agreements to Limit Greenhouse Gases; Harris Interactive Data Show, However, Reactions to U.S. Opposition to International Agreements Polarized by Party," *Financial News* (September 12, 2001); Pew Research Center for the People and the Press, "Bush's Base Backs Him to the Hilt: Tepid Opposition From Democrats, Little Fallout on Environment," *Pew Research Center News Interest Index* (April 26, 2001).

23. Probably the single most influential, current anti-alarmist voice on global warming comes from a Dane, Bjørn Lomborg, *The Skeptical Environmentalist: Measuring the Real State of the World* (New York: Cambridge University Press, 2001). For a sharp critique, see Adair Turner, "Bjorn Again," *Prospect* 74 (May 2002), pp. 28-33. Although people speak of the greenhouse effect as if it were a novel fear, it was ancient in earth science and prominent in U.S. popular culture well before environmentalism was a mass movement. See, for example, Howard R. Lewis, "Every Breath You Take," *Reader's Digest* (September 1965), p. 68.

24. Jean Baptiste Joseph Fourier, "Remarques générales sur la température du globe terrestre et des espaces planétaires [General Remarks on the Temperature of the Terrestrial Globe and Planetary Spaces]" *Annales de chimie et de physique* 27 (1824), pp. 136-167. See also *Théorie Analytique de la Chaleur [The Analytical Theory of Heat]* (Paris, 1822), translated by Alexander Freeman (Cambridge: Cambridge University Press, 1878).

25. Swedish climatologist Hans Wilhelmsson Ahlmann (namesake of the Ahlmann glacier in Antarctica) published such photos in 1948.

26. Douglas V. Hoyt and Kenneth H. Schatten, *The Role of the Sun in Climate Change* (New York: Oxford University Press, 1997).

27. The following discussion owes much to James Rodger Fleming, *Historical Perspectives on Climate Change* (New York: Oxford University Press, 1998). See also: Clarence J. Glacken, *Traces on the Rhodian Shore: Nature and Culture in Western Thought from Ancient Times to the End of the Eighteenth Century* (Berkeley: University of California Press, 1967); Spencer R. Weart, *The Discovery of Global Warming* (Cambridge: Harvard University Press, 2003); and the Center for the History of Physics of the American Institute of Physics, "The Discovery of Global Warming" <<http://www.aip.org/history/climate/>>.

28. For that matter, Hippocrates linked climate and national character about 2500 years ago. See "On Airs, Waters, and Places" (ca. 400 BCE), trans. Francis Adams <<http://www.grtbooks.com/exitfram.asp?id=0&yr=-5000&a=AA&a=AA&t=AA&ref=hippocrates&URL=http://classics.mit.edu/Hippocrates/airwatpl.html>>; or *Hippocrates: Ancient Medicine, Airs, Waters, Places, Epidemics 1-2, Oath, Precepts, Nutriment*, Vol. 1, trans. William Henry Jones (Cambridge, MA: Harvard University Press, 1923, 1992).

29. Benjamin Franklin, Letter to Ezra Stiles, May 29, 1763, in *The Papers of Benjamin Franklin*, ed. Leonard W. Labaree (New Haven, CT: Yale University Press, 1959-95), Vol. 10, pp. 264-267. Thomas Jefferson, Letter to Lewis E. Beck, July 16, 1824, in *The Writings of Thomas Jefferson*, ed. Andrew A. Lipscomb and Albert E. Bergh (Washington, DC: Thomas Jefferson Memorial Association of the United States, 1907), pp. 71-72; *Notes on the State of Virginia [1785]* (Gloucester, MA: Peter Smith, 1976), p. 79; and "Weather Memorandum Book," quoted

in David M. Ludlum, *Early American Writers, 1604-1820* (Boston: American Meteorological Society, 1966), Vol. 1, p. 214.

30. See, for example "Influence of Climate Upon National Character," *Harper's New Monthly Magazine* 31:183 (August 1865), pp. 390-392; "The Climate of the United States and Its Effects on Habits of Life and Moral Qualities," *Manufacturer and Builder* 3:5 (May 1871), p. 110.

31. Ellsworth Huntington's *Civilization and Climate* (New Haven: Yale University Press, 1915) was revised in 1922 and 1924, reprinted in 1939, then reissued by Archon Books in 1971. Madrid's *Revista de Occidente* published a Spanish edition in 1942. See also Huntington's *World-Power and Evolution* (New Haven: Yale University Press, 1919); *Climatic Changes; Their Nature and Causes* (New Haven: Yale University Press, 1922); *The Character of Races As Influenced by Physical Environment, Natural Selection and Historical Development* (New York: C. Scribner's Sons, 1924).

32. Svante August Arrhenius, *Världarnas utveckling [World in the Making]* (Stockholm: H. Gebers, 1906). See also his "On the Influence of Carbonic Acid in the Air Upon the Temperature of the Ground," *Philosophical Magazine* 41 (December 1896), pp. 237-276. For a recent replay of the argument, see "It's Official: Global Warming Makes Things Grow Better," *Insurance Day* (September 6, 2001), p. 3.

33. Gale E. Christianson, *Greenhouse: The 200-Year Story of Global Warming* (New York: Penguin, 1999).

34. See, for example, "Is the World Getting Warmer?" *Saturday Evening Post* (July 1, 1950). During this period many scientists advanced understanding of the subject, but Roger Revelle ("father of the greenhouse effect") received much of the glory. See Roger Revelle and Hans E. Suess, "Carbon Dioxide Exchange Between Atmosphere and Ocean and the Question of an Increase in Atmospheric CO₂ During the Past Decades," *Tellus* 9 (1957), pp. 18-27.

35. Betty Friedan, *The Feminine Mystique* (New York: Norton, 1963); "The Coming Ice Age," *Harper's Magazine* (September 1958), pp. 39-45.

36. Carl Sagan and Paul Ehrlich were among the scientists who fostered models of "nuclear winter" that suited anti-nuke sentiment in the early 1980s and that contributed to their own celebrity on the emerging cultural left. Now folks on the cultural right remind everyone that doomsday forecasts have flipped from cold to warm, a change they cite as evidence, not of progress, but of the vulnerability of science to leftist manipulation. Brian Martin, "Nuclear Winter: Science and Politics," *Science and Public Policy*, 15:5 (October 1988), pp. 321-334. Among the most influential 1980s publications were: Richard P. Turco, Owen B. Toon, Thomas P. Ackerman, James B. Pollack, and Carl Sagan [a.k.a. TTAPS], "Long Term Biological Consequences of Nuclear War," *Science* 222 (December 1983), pp. 1293-1300; "The Climatic Effects of Nuclear Winter," *Scientific American* (August 1984), pp. 33-43; and Carl Sagan, "The Nuclear Winter." *Parade Magazine* (October 30, 1983), pp. 4-5, 7.

37. Fleming, *Historical Perspectives on Climate Change*, pp. 133-135. See also Lowell Ponte, *The Cooling* (Englewood Cliffs, NJ: Prentice Hall, 1976). For an earlier precedent, see: Nathaniel Southgate Shaler, "How to Change the North America Climate," *The Atlantic Monthly* 40:206 (December 1877), pp. 724-731.

38. William B. Meyer, *Americans and Their Weather* (New York: Oxford University Press, 2000), pp. 85-90; Bernard Mergen, *Snow in America* (Washington, DC: Smithsonian Institution Press, 1997), pp. 1-12; James P. Espy, Report on Meteorology to the American Philosophical Society (October 17, 1836), and *The Philosophy of Storms* (Boston: Charles C. Little and James Brown, 1841); Eliza Leslie, "The Rain King; or, A Glance at the Next Century," *Godey's Lady's Book and Ladies' American Magazine* 25 (1842), pp. 7-11.

39. For a classic survey of the history of these forces in the United States, see Roderick Nash, *Wilderness and the American Mind*, 4th Ed. (New Haven: Yale University Press, 2001). For an exemplary response from the World Meteorological Organization in the 1960s, see "Large Scale Effort to Control Weather Called 'Foolhardy,'" *New York Times* (October 22, 1966), p. 20. To see such disputes projected on a global stage, see Raymond Bonner, *At the Hand of Man: Peril and Hope for Africa's Wildlife* (New York: Knopf, 1993).

40. Llewellyn H. Rockwell, Jr. posted a particularly vivid example of the dismissal of mainstream science as "special interest" in "The Power Behind Kyoto" (August 17, 2001), <<http://www.lewrockwell.com/rockwell/kyoto.html>>. See also: Richard Foot, "Global Warming a Natural Process, Scientists Argue; Mankind 'Not To Blame'" [Toronto] *National Post* (August 23, 2001), <<http://www.nationalpost.com/news/national/story.html?f=/stories/20010823/661943.html>>.

41. For helpful background, see "Global Climate Change and the Public," a special issue of *Public Understanding of Science* 9:3 (July 2000); and Timothy McDaniels, Lawrence J. Axelrod, and Paul Slovic, "Perceived Ecological Risks of Global Change: A Psychometric Comparison of Causes and Consequences," *Global Environmental Change* 6:2 (1996), pp. 159-171.

42. Lewis E. Holloway, "Understanding Climate Change and Farming: Scientific and Farmers' Constructions of 'Global Warming' in Relation to Agriculture," *Environment and Planning* 31 (1999), pp. 2017-2032; Nico Stehr and Hans von Storch, "The Social Construct of

Climate and Climate Change," *Climate Research* 5 (June 1995), pp. 99-105. See also: Martine Rebetez, "Public Expectation as an Element of Human Perception of Climate Change," *Climate Change* 32 (1996), pp. 495-509.

43. See: Matt Ridley and Bobbi S. Low, "Can Selfishness Save the Environment?" *The Atlantic Magazine* (September 1993), pp. 76-86; and Kirk Johnson, "Putting the Debate Over Global Warming Into Action: Planning for a Changing Climate," *New York Times* (November 19, 2000), p. Y35.

For a recent exemplar of projections, downsized from hemispheres to regions of the United States, see: National Assessment Synthesis Team, U.S. Global Change Research Program, *Climate Change Impacts on the United States: The Potential Consequences of Climate Variability and Change* (New York: Cambridge University Press, 2001).

44. James Shanahan and Jennifer Good, "Heat and Hot Air: Local Temperature and Global Climate Change," *Public Understanding of Science* 9:3 (July, 2000), pp. 285-295.

45. Observations for GCM (NOAA's meso-scale General Circulation Model, born in the mid-1970s, now in its "third generation") are recorded in 2.5°-by-3.5° of latitude/longitude. Each grid cell, then, is about 150-210 square miles. Finer NCEP (National Center for Environmental Prediction) data are recorded in 0.5°-by-0.5° of latitude/longitude. So each grid cell is about 30 square miles. David A. Randall, ed., *General Circulation Model Development: Past, Present, and Future* (San Diego, CA: Academic Press, 2000).

For an extremely skeptical review of the data, see for example: Roy W. Spencer "How Do We Know the Temperature of the Earth?: Global Warming and Global Temperatures," in *Earth Report 2000: Revisiting the True State of the Planet*, ed. Robert Bailey (New York: McGraw Hill for the Competitive Enterprise Institute, 1999). "Highlights" are linked to a WWW website of the conservative Competitive Enterprise Institute: <<http://www.cei.org/books/earthreport2.html>>.

46. Andrew C. Revkin, "All That Hot Air Must Be Having an Effect," *New York Times* (January 12, 2003), p. WK 5. Revkin cites *First Assessment of the IPCC* (IPCC, 1990), *Policy Implications of Greenhouse Warming: Mitigation, Adaptation and the Science Base* (NAS, 1992), *Second Assessment Report of the IPCC* (IPCC, 1995), *Third Assessment Report of the IPCC* (IPCC, 2001), and *Climate Change Science: An Analysis of Some Key Questions* (NAS, 2001).

47. See: Myanna H. Lahsen, "Climate Rhetoric: Construction of Climate Science in the Age of Environmentalism," Ph.D. Dissertation, Anthropology Department, Rice University (May, 1998).

48. For an example of a star contrarian, see: Richard S. Lindzen, "Testimony Before the Senate Environment and Public Works Committee on 2 May 2001" (2001) <<http://www.globalwarming.org/lindzetest.htm>>. Among the scientists concerned about environmentalists' dependence on science are: Daniel Sarewitz and Roger Pielke, Jr., "Breaking the Global-Warming Deadlock," *The Atlantic Magazine* (July 2000), pp. 54-64; and Peter G. Brown, "Climate Change and the Planetary Trust," *Energy Policy* (March 1992), pp. 208-222. See also: Katherine McComas and James Shanahan, "Telling Stories About Global Climate Change: Measuring the Impact of Narratives on Issue Cycles," *Communications Research* 26:1 (1999), pp. 30-57. See also Ross Gelbspan, *The Heat Is On: The Climate Crisis, the Cover-Up, the Prescription* (NY: Basic Books, 1998) and *Boiling Point: How Politicians, Big Oil and Coal, Journalists, and Activists Are Fueling the Climate-Crisis—And What We Can Do to Avert Disaster* (NY: Basic Books, 2004). For a whimsical version of this argument, see Michael Crichton, "Aliens Cause Global Warming," Caltech Michelin Lecture (January 17, 2003), <http://www.crichton-official.com/speeches/speeches_quote04.html> and the controversy it attracted, as on Metafilter <<http://www.metafilter.com/mefi/30532>>.

49. From 1966 to 1995, the SPC, based in Norman, Oklahoma, was known as the National Severe Storms Forecast Center. "Northwesterly flow events" are meso-scale systems that develop a stationary front boundary on a northwest-to-southeast orientation. They are not associated with precipitation in Oklahoma and the Texas Panhandle, but they are very much so to the north and east. For example, the famous "Alberta Clipper" that brings frigid air to the Plains is a classic winter example of a northwesterly flow, as are torrential rains in the summer.

The SPC's Oklahoma bent is likely among the causes of a major blunder in drought predictions for the U.S. Heartland in the Spring of 2000. (Somehow, too, the inherent limits of "probabilistic" prediction escaped notice.) It was the very first drought ever forecast specifically by NOAA. They put the agency's credibility on the line. Relying heavily on "runs" of SPC's GCM model ("spinning it up"), NOAA issued its warning in a high-profile news conference in March. Since most of the Midwest was very dry at the time (and low soil moisture tends to "draw a ridge," in effect suppressing rainfall), people took the news as if dry conditions would surely persist, and the drought worsen. Maps featured "a red blob of death" (a.k.a. "a precipitation anomaly") in the Midwestern grain belt. In anticipation of crop failures, grain prices soared, and farmers decided to delay sales ("hold grain off the market") to wait for yet higher prices, as the drought, they were told, soon deepened. But then in April and May, as a northwesterly flow brought rain to most areas, people identified a defect in the statistical models (in particular an overemphasis on the southern portion of ridges), and the drought warning was—this time more

quietly—repealed. In fact, outside of western Nebraska (close to Oklahoma, where the drought remained severe), talk turned to flooding and grain surpluses on the Plains. Grain prices tumbled, and farmers who had heeded NOAA's warning suffered horribly. To them, "the wettest drought on record" was worse than embarrassing. They were furious with NOAA. Likewise, Ohio suffered a severe tornado (an "F4") late that same Summer, 2000, that no one predicted: "It wasn't Oklahoma model." SPC is learning from such mistakes, but others find small compensation in that fact. See, for example, contemporary coverage in *Iowa Farmer Today Online* <<http://www.iowafarmer.com>>.

50. For a concise summary of the relevant jurisprudence, see: Robert B. Loper, "Red Sky in the Morning, Forecasters Take Warning": The Liability of Meteorologists for Negligent Weather Forecasts," *Texas Law Review* 66 (February 1983), pp. 683-713. The marine forecast precedent is *Brown v. United States*, 599 F. Supp. 887, 888 (D. Mass. 1984), rev'd, 790 F.2d 199 (1st Cir. 1986), cert. denied, 107 S. Ct. 938 (1987). The limits on liability here discussed are purely within the United States. Foreign or international courts may develop quite different approaches to the responsibility of states for environmental issues. See for example, Edith Brown Weiss, "Management of Weather and Climate Disputes," *UCLA Journal of Environmental Law and Policy* (1983), pp. 275-309.

51. Of course, too, popular newspapers and magazines have followed Kyoto, its ancestors and progeny. E.g., beneath the picture of a fry pan on the cover of a special issue (April 9, 2001), *Time* magazine posed the challenge: "Global Warming: Climbing Temperatures. Melting Glaciers. Rising Seas. All over the Earth we're feeling the heat. Why isn't Washington?" The September/October 2001 issue of *Nature Conservancy* bore the theme, "Nature Feels the Heat: Confronting the Challenge of Climate Change." But such sources did not come up in interviews or conversations. See also: Michael R. Harrison, "The Media and Public Perceptions of Climatic Change," *Bulletin of the American Meteorological Society* 63:7 (July, 1982), pp. 730-738. Timothy C. Weiskel, compiler, "Some Sources on the Global Warming Debate and the Kyoto Treaty," *Occasional Bibliography* 2:1 (1998), <<http://www.ecoethics.net/bib/1998/otca-001.htm>>.

52. The "bimbo" I refer to is the bubble-headed but ruthless sexual predator neé weathercaster, "Suzanne Stone," played by Nicole Kidman in the 1995 Columbia Pictures film produced by Laura Ziskin and directed by Gus Vat Sant. Buck Henry adapted the screenplay from Joyce Maynard's novel, *To Die For* (New York: E.P. Dutton, 1992).

53. John P. Robinson and Mark R. Levy, *The Main Source: Learning from Television News* (Beverly Hills: Sage, 1986), p17; Andrew Ross, *Strange Weather: Culture, Science and Technology in the Age of Limits* (London, Verso, 1991).

54. For this research, it was convenient that Frank N. Magid Associates Incorporated, the largest and most influential media consulting firm in the United States (and likely in the world) happens to be headquartered in the Heartland (Marion, Iowa). Magid consultants are the ones most often credited/blamed for propagating "happy news" among local major-network affiliates. Magid executives insist that what they are encouraging is "comprehension." The wisdom of a broadcast will hardly matter if viewers cannot understand it. So they are proud to provide empirical assessments of broadcast engagement and retention.

55. See: James Shanahan and Craig W. Trumbo, "Social Research on Climate Change: Where We Have Been, Where We Are, and Where We Might Go," *Public Understanding of Science* 9:3 (July, 2000), pp. 199-204.

56. For a fisheries-based critique of the "deficit of information" theory of stockholder's resistance to scientific advice, see: Priscilla Weeks and Jane M. Packard, "Acceptance of Scientific Management By Natural Resource Dependent Communities," *Conservation Biology* 11:1 (February, 1997), pp. 236-245. See also: Éric Darier, Simon Shackley, and Brian Wynne, "Towards a 'Folk Integrated Assessment' of Climate Change?" *International Journal of Environment and Pollution* 11:3 (1999), pp. 351-372; Luis E. González and Pablo da Silveira, "The People's Attitudes Towards Global Environmental Phenomena: A Case Study," *Climate Research* 9 (1997), pp. 95-100.

57. On derivatives, see: Lixin Zeng, "Weather Derivatives and Weather Insurance: Concept, Application, and Analysis," *Bulletin of the American Meteorological Society* 81:9 (September 2000), p. 2075-2083; Pamela Sebastian Ridge, "Business Bulletin: A Special Background Report on Trends in Industry and Finance," *The Wall Street Journal* (June 1, 2000), p. 1A; Dell Jones, "Playing the Weather Game: Firms Cash In By Staying One Step Ahead of Mother Nature," *USA Today* (December 11, 2001), p. 1-2B; James Surowiecki, "The Financial Page: What Weather Costs," *The New Yorker* (July 23, 2001), p. 29; Koch Industries, Inc. "Innovative New Product To Manage Weather Exposure," Press Release (November 1, 1999) <http://www.kochind.com/newsroom/news_detail_printable.asp?ID=228>; Weather Risk Advisory Limited, "Weather Risk," <<http://www.weatherriskadvisory.com/weather.htm>> and "Glossary of Weather Derivatives Terminology," (2000) <<http://www.weatherriskadvisory.com/glossary.htm>>. Contrast with more traditional insurers' approach, such as: Carolyn Aldred, "Reinsurers Urge Passage of Greenhouse Gas Limits," *Business Insurance* (September 3, 2001), p. 10; Chip Cummins, "The New Forecast for Meteorologists: It's Raining Job Offers," *The Wall Street Journal* (March 8, 2001), p. 1A; or

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58. See: Roger Pielke, Jr. and Richard E. Carbone, "Weather Impacts, Forecasts, and Policy," *Bulletin of the American Meteorological Society* (March, 2002), pp. 393-403 or <http://sciencepolicy.colorado.edu/homepages/roger_pielke/hp_roger/pdf/2001.05.pdf>.

59. For a broader discussion of the role of reason, information, and consensus in public conflict, see: Carlo C. Jaeger, Ortwin Renn, Eugene A. Rosa, and Thomas Webler, *Risk, Uncertainty and Rational Action* (London: Earthscan, 2001).