

American Behavioral Scientist

<http://abs.sagepub.com/>

Reexamining Climate Change Debates: Scientific Disagreement or Scientific Certainty Argumentation Methods (SCAMs)?

William R. Freudenburg and Violetta Muselli

American Behavioral Scientist 2013 57: 777 originally published online 13 September 2012

DOI: 10.1177/0002764212458274

The online version of this article can be found at:
<http://abs.sagepub.com/content/57/6/777>

Published by:



<http://www.sagepublications.com>

Additional services and information for *American Behavioral Scientist* can be found at:

Email Alerts: <http://abs.sagepub.com/cgi/alerts>

Subscriptions: <http://abs.sagepub.com/subscriptions>

Reprints: <http://www.sagepub.com/journalsReprints.nav>

Permissions: <http://www.sagepub.com/journalsPermissions.nav>

Citations: <http://abs.sagepub.com/content/57/6/777.refs.html>

>> [Version of Record](#) - May 14, 2013

[OnlineFirst Version of Record](#) - Sep 13, 2012

[What is This?](#)

Reexamining Climate Change Debates: Scientific Disagreement or Scientific Certainty Argumentation Methods (SCAMs)?

American Behavioral Scientist
57(6) 777–795

© 2013 SAGE Publications

Reprints and permissions:

sagepub.com/journalsPermissions.nav

DOI: 10.1177/0002764212458274

abs.sagepub.com



William R. Freudenburg¹ and Violetta Muselli¹

Abstract

Despite strong scientific consensus that global climate disruption is real and due in significant part to human activities, stories in the U.S. mass media often still present the opposite view, characterizing the issue as being “in dispute.” Even today, the U.S. media devote significant attention to small numbers of denialists, who claim that scientific consensus assessments, such as those by the Intergovernmental Panel on Climate Change (IPCC), are “exaggerated” and “political.” Such claims, however, are testable hypotheses—and just the opposite expectation is hypothesized in the small but growing literature on Scientific Certainty Argumentation Methods, or SCAMs. The work on SCAMs suggests that, rather than being a reflection of legitimate scientific disagreement, the intense criticisms of climate science may reflect a predictable pattern that grows out of “the politics of doubt”: If enough doubt can be raised about the relevant scientific findings, regulation can be avoided or delayed for years or even decades. Ironically, though, while such a pattern can lead to a bias in scientific work, the likely bias is expected to be just the opposite of the one usually feared. The underlying reason has to do with the Asymmetry of Scientific Challenge, or ASC—so named because certain theories or findings, such as those indicating the significance of climate disruption, are subjected to systematically greater challenges than are those supporting opposing conclusions. As this article shows, available evidence provides significantly more support for SCAM and ASC perspectives than for the concerns that are commonly expressed in the U.S. mass media. These findings suggest that, if current scientific consensus is in error, it is likely because global climate disruption may be even worse than commonly expected to date.

¹University of California, Santa Barbara, Santa Barbara, CA, USA

Corresponding Author:

Violetta Muselli, UC Santa Barbara, 4312 Bren Hall, Santa Barbara, CA 93106, USA.

Email: violetta.muselli@gmail.com

Keywords

climate change debates, Asymmetry of Scientific Challenge, SCAMs, IPCC

In March 2009, more than 2,500 scientists from over 70 countries met in a scientific congress in Copenhagen, Denmark. The congress was organized to provide input to the major UN negotiating session regarding climate disruption—the Conference of the Parties—that was planned for the same city in December of the same year. Although journalists often complain that academic meetings produce little more than boring academic jargon, this congress was an exception, and its consensus statements made front-page headline news all across Europe. The story that ran in Britain's *Daily Telegraph* ("Britain's best-selling quality daily") described the congress as "a watershed moment," in which the scientists issued a "desperate" and "strongly worded message" to political leaders, saying there was "no excuse for inaction," and that the world's governments needed to act without delay. "Worst-case" scenarios were already becoming reality, the scientists concluded, noting that "unless drastic action was taken soon, 'dangerous climate change' was imminent" (Alleyne, 2009, p. 1; see also AFP, 2009; CNN.com/Europe, 2009; *International Herald Tribune*, 2009). These media stories accurately reflected the main thrust of the synthesis report that was a major focus of attention at the Congress (see Richardson et al., 2009).

In the mainstream press of the United States, however, the scientists' warnings received almost no attention whatever. Aside from a few specialized outlets such as *Scientific American* (Neff, 2009), U.S. mainstream media treated even these unambiguous scientific warnings as being almost completely unnewsworthy. The online "Dot Earth" blog from the *New York Times* did carry a report on the conference by one of the nation's leading climate change journalists, Andrew Revkin (see Revkin, 2009a). However, in the print editions of the *New York Times* itself, the only story from the conference conveyed a starkly different message, and one that had only vague resemblance to the official consensus reports from the Congress: "Scientists Are Grim, Economists More Optimistic About Climate Change's Effects" (Macabrey, 2009). Revkin himself did not attend the Copenhagen meeting; instead, he covered a very different kind of meeting, strategically scheduled just a few days earlier (Revkin, 2009b), and organized by The Heartland Institute—a "free-market" think tank that plays an active role in what Jacques, Dunlap, and Freeman (2008) have called "The Organisation of Denial."

Of course, one possible explanation for the lack of attention to scientists' views in the United States is that climate scientists' views truly might be as divided as coverage in the mainstream media seems to indicate. Another possibility, however—and one that appears more credible—is that U.S. media coverage patterns have more to do with efforts by that same Heartland Institute, and a small group of other ideological think tanks, to challenge the science. Drawing in part on extensive funding from tobacco companies and the oil industry, these organizations have worked tirelessly to challenge the scientific evidence on global climate disruption, as well as mounting challenges to

scientific research on smoking and a range of other risks (see, e.g., Dunlap & McCright, 2010; Oreskes & Conway, 2010). Based on a small but growing body of social science findings, moreover, there are good reasons for the taken-for-granted assumptions about “scientific debates” to be subjected to closer scrutiny. In this article, accordingly, we review the accumulated evidence, treating the typical mass media accounts of “scientific debates”—along with competing expectations from the literature on Scientific Certainty Argumentation Methods, or SCAMs—as being testable and competing hypotheses. We begin with a brief review of U.S. media coverage, followed by a quick summary of newer literature that points to precisely the opposite expectations. We move next to an assessment of the evidence that is available for choosing between the competing expectations, closing with an assessment of implications for future work.

A Closer Look at U.S. Coverage of Climate Disruption Issues

Most residents of the United States spend so little time in monitoring mass media reports from other countries that many are surprised to learn that climate issues are covered in different ways in other industrialized countries. Colleagues from those other countries, however, have noted a tendency for the mass media in their own nations to report on the work of climate scientists in a way that reinforces rather than challenges the scientists’ assessments, and that, if anything, sometimes adds further drama to the scientists’ main points (see, e.g., Sampei & Aoyagi-Usui [2009] or Weingart, Engels, & Pansegrau [2000] for assessments of Japan and Germany, respectively). In the United States, however, the larger pattern has long involved the same kinds of stark differences between scientists’ actual recommendations and the coverage of those recommendations that was seen in the case of the Copenhagen meeting.

For roughly two decades, there has been a remarkable disjuncture between scientific assessments and mass media reports on global climate disruption in the United States (see, e.g., the examinations by Boykoff & Boykoff, 2004; Trumbo, 1996; Trumbo & Shanahan, 2000). In the world of climate science, on the one hand, research has clearly produced a consensus: Global warming is occurring, it is due in significant part to humans, and it is producing deleterious impacts. Oreskes (2004) found that this consensus position was actively supported by three fourths of relevant scientific articles published in top technical journals between 1993 and 2003, with *not a single paper* disagreeing. The broad outlines of that consensus have been ratified and reinforced, repeatedly—not just by the Intergovernmental Panel on Climate Change, or IPCC (see, e.g., IPCC, 2007), but also by the British Royal Society (2007) and by most of the world’s leading Academies of Science, including that of the U.S. (see, e.g., National Research Council, 2001, 2006; see also Adam, 2006).

Over roughly the same period, on the other hand, over half of the stories on the topic in U.S. “prestige” newspapers were found to convey nearly the opposite message, depicting the science as being “in dispute” (see Boykoff & Boykoff, 2004). In

network television newscasts, the contrast was even more extreme: 70% of the media reports portrayed climate scientists as being in strong disagreement on the topic (Boykoff, 2008). Although the pattern may have moderated somewhat in the immediate aftermath of the Nobel Peace Prizes that were awarded to the IPCC and to Al Gore in 2007, U.S. mass media reports were found by Cox (2009) to have returned to previous patterns by late 2008 and early 2009, once again tending to characterize the IPCC and other scientific consensus reports as “exaggerating” the degree of scientific consensus about the reality of global climate disruption.

In fact, media patterns in the U.S. appear to differ considerably from those in the rest of the world, and so do scientists’ views toward the policy process, as well as the broader public’s views toward the science. In the 1990s, an international survey of scientists found that the majority of the climate scientists in the U.S. believed that climate scientists had little control over the information getting to policymakers, whereas in Germany, less than a quarter of the climate scientists agreed (von Storch & Bray, 1999, p. 48). A decade later, a 15-nation survey found that U.S. views toward global climate disruption were substantially different from those in other parts of the world. Approximately two thirds of survey respondents in Japan (66%) and India (65%) said they personally worried a great deal about global warming, and around half shared similar worries in Spain (51%) and France (46%). The comparable figure for the United States was just 19%—the lowest in any of the 15 countries surveyed (Kohut, Doherty, & Wike, 2006).

When analysts have attempted to explain the sharp differences between the U.S. and other industrialized countries, a number of the explanations have focused on the amount of media attention devoted to a relatively small number of critics of mainstream scientific work (see Gelbspan, 1997; Shanahan & Trumbo, 1998; Trumbo, 1996). Other studies have focused on the tradition of “even-handed” reporting in the U.S., with journalists commonly reporting that “some researchers see a problem as serious, while others disagree,” noting that their stories confer roughly equal weight and credibility to “both sides” regardless of the actual distribution of views within the scientific community (see Mazur, 1979, 1981; see also especially Boykoff & Boykoff, 2004).

Another approach, which will receive more emphasis in this article, is to build on broader analyses of the relationships between science and society. As pointed out by a number of observers, arguments over global climate disruption are not just “scientific” disputes (see, e.g., Charlesworth & Okereke, 2010; Cox, 2009; Gautier, 2008; Hulme, 2009; Trumbo & Shanahan, 2000; Weingart et al., 2000); instead, they are examples of what Mazur long ago (1981) called technological controversies, meaning they will inherently involve a mixture of facts, values, and blind spots (see, e.g., Freudenburg, 1996; Jasanoff, 1993; Kleinman, 2003; Latour & Woolgar, 1979).

When seen from this perspective, the scientific work regarding global climate disruption—like many other forms of science—inherently involves a two-way relationship with the broader society. To date, however, only a limited number of peer-reviewed articles have begun to analyze one of those two “directions,” the ways in

which the worlds of policy and the mass media might be shaping what is taken to be mainstream science (see Charlesworth & Okereke, 2010; Hulme, 2009; Pulver, 2007). We believe that this possibility deserves more attention, particularly in a form that goes beyond the tradition of “epistemological critiques” of the science (Charlesworth & Okereke, 2010; Hulme, 2009). In particular, what continues to be largely missing is attention to the ways in which economically powerful and politically organized groups can shape what is taken to be the “mainstream” of scientific findings.

As indicated by the small but growing body of research on this topic, such efforts to shape mainstream science can have unexpected consequences for scientists as well as for society (see especially Freudenburg, Wilson, & O’Leary, 1998; Jaques et al., 2008; McCright & Dunlap, 2000, 2003; Michaels, 2008). Although the broader public often expects science to provide clear, black and white findings, that very expectation provides an opportunity for politically organized groups. In fact, science is generally characterized not by certainty, but by uncertainty, meaning that the outcomes of scientific/technological controversies may depend less on which side has “the best science” than on which side enjoys the benefit of the doubts in the face of unavoidable scientific ambiguity. Although government decisions are widely expected to be based on “science,” in other words, the notion of a clear and unchanging science has been known at least since the time of Kuhn (1962) to be misguided. Actual policy outcomes, instead, often need to be worked out in a realm of knowledge that Weinberg (1972) long ago called “trans-scientific”—one where questions can be *asked* in scientific language, but where the questions simply cannot be *answered* with anything like certainty, at least not in advance.

Instead, the scientific evidence available for policy decisions—like scientific evidence in general—is often inherently ambiguous and/or incomplete (see, e.g., Freudenburg, Gramling, & Davidson, 2008; Harrison, 1991; Hattis & Anderson, 1999; Hirt, 1994; McMullan & Eyles, 1999; Tesh, 2000). Under such conditions, actual outcomes may have less to do with what is “known” than with how the agency decides to handle what is *not* known. This point applies with special force to cases where an organized group has something to gain from depicting a given body of scientific findings as “unproven” (cf. Michaels, 2008; Oreskes & Conway, 2010).

Part of the effectiveness of the technique is its very simplicity. To put the matter as straightforwardly as possible, a scientific effort to test a given hypothesis can only come up with three answers—yes, no, and maybe. A “yes” involves clear support for a given hypothesis; a “no” involves a clear rejection; and a “maybe” involves an indeterminate answer, or a finding that available data do not permit clear-cut acceptance or rejection of the hypothesis. Contrary to popular expectations for science to be neat, orderly, and definitive, actual findings are rarely so clear-cut. Even in cases of scientific and technological controversies that contain high levels of scientific content, the debates nearly always rage around questions where the available findings fall into the category of “maybe.” Once the data become sufficiently strong to justify a clear yes-or-no answer to a given question, the argument can simply move to the “next” question—typically meaning one where no such clear-cut yes/no answer is yet possible. Freudenburg

et al. (2008) refer to this approach as involving Scientific Certainty Argumentation Methods—SCAMs—arguing that “the SCAM has the potential to exert as much leverage on actual policy decisions as high levels of scientific quality, scientific consensus, and formal scientific legitimation, *even in combination*” (p. 5, italics in original).

The problem is that, as noted by Freudenburg et al. (2008, p. 2), “the benefits of doubts may be distributed in ways that are not merely random.” Although there is clearly a need for more extensive research, that initial article identified a series of risk-related controversies, over a period of nearly a century, where industrial interests “managed to delay or prevent legislative and/or regulatory actions even in ‘tough’ cases—those where the preponderance of scientific evidence had indicated significant reasons for concern” (p. 2). It traced a series of risk-related “cases,” from the introduction of lead into gasoline in the 1920s, up through debates over tobacco, asbestos, and pesticides in the 1950s to 1990s, that displayed similar characteristics. Although few scientists now see the data on these cases as being ambiguous, organized industrial interests were able to forestall effective regulations in all of those cases—generally for decades—by claiming, accurately, that the available evidence on the hazards fell short of “full certainty.”

“Doubtful” Science?

To date, perhaps the best-known case of industry-supported efforts to create biases within a field of science grew out of tobacco industry efforts to create scientific and hence policy doubts about the health damages associated with smoking. Working largely through the industry-funded “Center for Tobacco Research”—and through still more secret funding of researchers whose work proved useful to them—the tobacco industry enjoyed considerable success, for years, in calling into question the mounting evidence of health harms that was by then becoming available from independent scientists (see, e.g., Glantz, Slade, Bero, Hanauer, & Barnes, 1996; Warner, 1986).

Still, despite the substantial problems associated with the work done over the years by the Center for Tobacco Research—ethical as well as scientific—that Center did support at least some original research. What is still necessary, for two reasons, is to build more systematically on the less well-known body of work that highlights selective *challenges* to research, notably in the problematic form of organized efforts to keep unfavorable evidence from coming to public attention and/or to undermine its legitimacy (see, e.g., Dietz, Stern, & Rycroft, 1989; Krimsky, 2000; Martin, 1999; Rosner & Markowitz, 1985). The first reason is that—as will be evident to anyone who has ever found that it is easier to point out holes in someone else’s work than to fill all the holes in one’s own—selective challenges may offer opportunities to exert greater influence over what will be taken to be mainstream scientific consensus, per dollar of “investment,” than will spending on original research. As noted by Michaels (2008, p. xi), “debating the *science* is much easier and more effective than debating the *policy*” (italics in original). The second reason is the very fact that scientific challenges

are such an integral aspect of ordinary scientific research, so much so that selective applications of scientific challenge may go largely unrecognized even by active researchers in a field. This point appears to have special relevance to ongoing climate debates, which appear to illustrate the Asymmetry of Scientific Challenge (ASC).

The ASC concept derives from research on forest science by Paul Hirt (1994), although the ASC terminology was first used by Freudenburg and Youn (1999) in discussing Hirt's later work (1999). Hirt focused in part on quantitative assessments of tree growth rates on U.S. public lands, and on a pattern that his book on the subject called a *Conspiracy of Optimism* (Hirt, 1994). Hirt emphasized, however, that this was not a "conspiracy" in the usual sense: The forest scientists may not even have realized they were pursuing anything other than the best possible scientific estimates. Instead, Hirt found that organized industrial interests—often in alliance with relevant governmental agencies of that era, particularly the U.S. Forest Service—shaped research findings in two ways. Not only did they support research that showed higher levels of logging to be "sustainable," but they also hired the most skillful experts available to challenge any research that might have suggested the need to reduce logging rates. In part because industry-friendly or "optimistic" estimates did not face comparably vigorous challenges, Hirt found that prevailing scientific estimates of "sustainable" logging levels came to be far too high—ultimately proving to be more than double the levels that have been seen in subsequent work as being scientifically credible (Hirt, 1994, 1999; see also Bosworth & Brown, 2007).

Hirt's research is part of the limited but important body of work that highlights selective *challenges* to research. Much of that work focuses on organized efforts to keep unfavorable evidence from coming to public attention and/or to undermine its legitimacy (see, e.g., Dietz et al., 1989; Krinsky, 2000; Martin, 1999; Rosner & Markowitz, 1985). In extreme cases, the challenges can lead to what Martin (1999) has called the "suppression of dissent," through efforts to sustain the impression of expert unanimity. As Martin notes, such "suppression" appears most likely where the vast majority of funding for scientific research on a given technology comes from agencies or commercial interests that support further expansion of the technology, as was the case in the U.S. logging industry at the time of Hirt's work, as well as in the cases of industries that Martin examined, such as nuclear power. In Martin's terminology, "suppression" differs from concepts such as censorship, discrimination, or whistleblowing, and it could be expected to be "more common and visible" in cases where "a powerful interest group . . . has a near-monopoly on scientific credibility" (Martin, 1999, p. 126).

The SCAM, the ASC, and Climate Disruption

In the case of global climate disruption, of course, a common claim is that climate science has been characterized by "suppression" and/or a "conspiracy," but these claims differ strongly from Martin's. The usual charge is that research on global climate disruption has been biased *against* industrial interests, and the charges are often

leveled at agencies that are well respected for scientific work, such as the National Science Foundation or National Aeronautics and Space Administration, to say nothing of the IPCC itself (Powell, 2011). Given the extensive news coverage devoted to denialists in the U.S. media, it would be difficult to argue that contrary views have been “suppressed,” or for that matter to claim that the press and the public have been presented with any impression of “scientific unanimity” (Boykoff & Boykoff, 2004). Instead, more careful assessments of climate debates have noted that the organized industrial interests most similar to those identified by Hirt or Martin—fossil fuel industries and the ideologically conservative think tanks that are supported in part by such industries—have been actively challenging peer-reviewed publications, while celebrating the work of contrarians and ideologically oriented think tanks that rely in part on industry funding (see, e.g., Gelbspan, 1997; Harkinson, 2009; McCright & Dunlap, 2000, 2003; Trumbo, 1996). In sum, as noted by Freudenburg and Muselli (2010), committed climate contrarians have been hard at work, for over two decades, promoting an ASC.

To date, work on the ASC has identified three key patterns in global warming research. First, organized industrial interests have consistently challenged scientific findings on anthropogenic climate disruptions. Second, “optimistic” or no-worries findings have not been subjected to similar levels of criticism; indeed, findings that suggest reasons for optimism have often been praised and widely publicized by the same industrial interests. Third, mainstream scientists are strongly motivated by norms of “being fair” to the points of view that have been publicly expressed. This third point, however, leads to an ironic implication. If scientists’ *individual* commitment to “fairness” is exercised within a broader context where views on one side of an issue have been subjected to substantially greater challenges than those on the opposing side, the net result may well be a pattern of *collective* bias (Freudenburg & Muselli, 2010). The kinds of “biases” that are expected, in other words, have to do *not* with one of the typical dictionary definitions of the term—individual prejudice—but instead with another common meaning, namely, systematic error.

Overall, the expectation is for a “steering” of the science—an initially imperceptible but cumulatively significant bias in what comes to be taken as scientific “consensus”—even if the vast majority of the actual research is dedicated to moving the science straight ahead. The key expectation derived from work on SCAMs and the ASC, however, is that the actual pattern of systematic error is likely to be *precisely the opposite* of the one that has received the proverbial lion’s share of attention in mass media reports to date. While discussions of climate disruption in the mass media have been dominated by assertions that the IPCC and other scientists are biased toward overstating the available evidence, the key theoretical expectation from work on SCAMs and the ASC involves just the opposite expectation. Still, although the differing views offer a classic case of competing, and testable, hypotheses, the central challenge involves the need to offer a fair test.

Toward a Test of Competing Perspectives

The best available approach is not to presume that it is possible to identify Ultimate Truth at any given time, but instead to rely on the tendency for science to be self-correcting over time. In the words of the Danish mathematician Piet Hein (1969, p. 34), “The Way to Truth is simple / and easy to express / to err, and err, and err again / but less, and less, and less.” That, however, may not be enough guidance, particularly given that scientists are rightfully famous for being able to see the potential plausibility of alternative interpretations. As noted in one old joke, if there are 10 scientists in the room, there will be at least 20 theories vying for primacy. An additional complication is that, in at least one key respect, the world of science actually tends to resemble the world of the mass media: Scientific journals prefer to report “findings,” rather than “nonfindings.” New evidence on global climate disruption may be more likely to be published if it indicates that the problem is “worse than previously thought,” or “not as bad as previously thought,” rather than simply concluding that “past estimates were roughly correct.”

The net effect is that, as committed partisans have shown, it is not at all difficult to find individual studies concluding that past estimates have been either too high or too low. One recent MIT study, for example, concluded that levels of global warming are now likely to be twice as high as projected just 6 years earlier (Sokolov et al., 2009). Climate denialists, on the other hand, continue to focus on studies suggesting that the dangers may have been “overblown”—for example, because one portion of the ice of Antarctica is getting thicker, not thinner (see Maugh, 2009)—and on repeated examinations of stolen emails that have been found to show “no evidence of impropriety” (Powell, 2011). According to climate scientists, meanwhile, if even a few new findings point to conclusions that differ from prevailing consensus views, those few studies can create possibilities for selective sampling: Even if most new studies underscore the significance of climate disruption, selective “samples” of new findings can still suggest that prevailing consensus estimates of climate disruption are “exaggerated” or “in dispute.”

To move forward from our current state of understanding, accordingly, will require us to move beyond the identification of individual or potentially idiosyncratic studies. Two main approaches are available for doing so. The first and most scientifically credible approach is the one that has been used repeatedly by the IPCC itself, namely, the careful consideration of emerging, peer-reviewed research. To the extent to which such reassessments have supported either of the competing hypotheses, the four major “Assessment Reports” from the IPCC—along with the latest systematic assessment at the time of this writing, the United Nations Environment Programme (UNEP) *Compendium* (2009)—have provided a modest degree of support for the ASC hypothesis. The *Compendium*, which analyzed more than 400 major studies published after the IPCC’s most recent *Assessment Report* (IPCC, 2007), indicated that climate

disruption appears more severe than would have been expected on the basis of earlier appraisals from the IPCC. The *Compendium* concluded that human activities to date have already created “dangerous anthropogenic interference” with climate tipping points, “committing” the planet to a future of serious changes, including ocean acidification, sea-level rise, damage or destruction of coral ecosystems and many forms of marine life, and the kinds of mountain glacier loss that will disrupt irrigation systems and hydroelectric installations, affecting the lives of perhaps 20% to 25% of the human population (UNEP, 2009, p. 15).

Still, as suggested by Table 1, although the quantitative changes across the various reports have been in the same direction as those that were called out in the text of the *Compendium*, they have been less clear-cut—offering, as noted above, only modest support for the ASC perspective. The emissions growth rate since 2000, for example, was found to be greater than had been expected even in the “highest” or most fossil-fuel intensive of the IPCC emissions scenarios from the late 1990s, and findings for sea-level rise were near the upper end of the ranges that had been described as plausible by the IPCC; but the major differences between the later reports and the earlier ones have had to do with the degree of confidence being expressed in the findings.

Like the IPCC itself, moreover, the *Compendium* was bitterly attacked by contrarians as lacking in credibility. A relatively typical example was provided by the so-called “American Thinker” blog, which saw the reassessment as “blatant lies,” accompanied by “frantic hype” and a “call-to-pointless-action” (Sheppard, 2009). In a recent article, accordingly, Freudenburg and Muselli (2010) took an entirely different approach to “sampling” the emerging scientific research—one that, if anything, is biased against the painstakingly scientific process employed by the IPCC, being biased instead in favor of the expectations that are common in the U.S. mass media. The approach in that article was to build on the earlier findings of Boykoff and Boykoff (2004), who found a pattern of “biased coverage” in the U.S. prestige press (the *New York Times*, *Washington Post*, *Los Angeles Times*, and *Wall Street Journal*) between 1988 and 2002.

As noted above, the Boykoff and Boykoff (2004) study found that, in contrast to the increasingly clear consensus in the scientific community over this time period—namely, that global temperatures were rising and that human or anthropogenic factors were contributing significantly to that trend—the *majority* of the stories in these four newspapers during the years in question depicted the scientific findings as being uncertain or in debate, continuing to do so in a way that showed little significant variation over time. The Freudenburg-Muselli (2010) study, however, followed the advice of Zehr (2000, p. 87) to “consider popular press representations of science as another arena for *doing* science,” taking note in particular of the difference between what journalists sometimes informally call “policy stories” versus “science stories.”

As shown by past studies, around the time of the IPCC First Assessment Report in 1990, as the U.S. public was just beginning to learn about climate disruption, the U.S. mass media began to pay increasing attention to (mis)information from ideologically oriented think tanks (Boykoff & Boykoff, 2004; Trumbo, 1996). That pattern has been particularly pronounced in news stories about scientific input to the policy process.

Table 1. Predictions and Measured Changes from IPCC Scientific Assessments.

	1st assessment: 1990	2nd assessment: 1995	3rd assessment: 2001	4th assessment: 2007	Science compendium: 2009
Long-term predictions					
Change in global average surface temperature, 1990–2100	0.3 C (per decade)	1.0–3.5 C	1.4–5.8 C	1.1–6.4 C	“Most likely committed to” 1.4–4.3 C
Average sea level rise, 1990–2100	30–110 cm	15–95 cm	9–88 cm	18–59 cm	80–200 cm
Change in Greenland ice sheet mass	Small change		Loss of mass ^a	Loss of mass ^b	Loss of mass ^c
Measured changes					
Change in global average surface temperature, 100-year linear trend	0.45 C	0.3–0.6 C	0.6 C	0.74 C	0.6 C “already realized”
Global sea level rise over 100-year trend	10–20 cm	10–25 cm	10–20 cm	17 cm	17 cm (20th century); 29 cm since 1993 ^d
Newly identified problems					
Effects to Earth’s ecosystems				20%–30% of biota if temperature >1.5–2.5 C	90% species change, some areas ^e
Committed to warming					0.6 C by 2005; 2.2 C by 2050
Glaciers and ice caps					Complete elimination by 2200

^a7-meter sea rise if global average warming of > 3 C were sustained for 1,000 years.

^b7-meter sea rise if global average warming of > 1.9–4.6 C were sustained for 1,000 years

^cOver centuries to millennia, the Greenland and West Antarctic Ice Sheets could potentially raise sea level by 6 meters and 3.3 meters, respectively.

^d1.7 mm/year for 20th century; 3.1 mm/year 1993–2003, 2.5 mm/year 2004–2009.

^eChanges predicted for the tundra, Central America, and the Andes Mountains.

During the same years, however, scientists have continued to publish new research articles in peer-reviewed journals—some of which have been identified by reporters and editors as being sufficiently newsworthy to deserve attention in their own right. The stories on emerging research, however, are commonly written by different journalists, many of whom have relatively high levels of science literacy and who regularly cover what they call the “science beat.”

The result is that the same newspapers can carry two different types of news stories—those that focus on the policy and those that focus on the science. The “policy stories” generally include quotations for “balance” or “context” from political rather than scientific observers. By January 2000, for example, when the *Los Angeles Times* ran a news article on a National Research Council report, which concluded that the warming of the Earth’s surface was “undoubtedly real” (Hotz, 2000, p. A3), the article did not include any quotes from independent climate scientists at universities or government agencies. Instead, it included a supportive comment from an environmental organization, plus a much more negative comment from the president of a contrarian organization, who claimed that the “National Academy board has pretty much been taken over by enviros” (see also Pan, 2001). Similar charges have characterized the majority of U.S. news articles on the IPCC’s painstaking Assessment Reports.

An example of a “science story,” by contrast, would be the one in the *New York Times* that summarized the results of a new scientific study around the time of the IPCC’s Third Assessment Report. Given the study’s findings that droughts could activate dormant enzymes in moist, peaty northern soils—potentially triggering decomposition of billions of tons of carbon—the new research had important potential implications for global climate disruption. Few of the employees of ideologically oriented think tanks have any visible expertise on dormant enzymes or soil ecology, however, and the article focused on the science, not the policy. This story’s quotations for balance and context came not from political actors but from scientific ones, including a professor of biological sciences at one university and an ecologist at another, both of whom offered scientific perspectives, rather than political input (Glanz, 2001, p. A24).

Still, given that news media outlets select what they consider “newsworthy” stories (see Molotch, 1979), it might well be expected that the four newspapers studied by Boykoff and Boykoff (2004) would focus on scientific findings that would challenge the scientific consensus position, particularly during the years covered by the Boykoff and Boykoff study, namely, 1998 to 2002. The Freudenburg and Muselli (2010) study, accordingly, analyzed news articles about emerging climate science in the same four newspapers, but during two time periods—one overlapping with the dates analyzed by Boykoff and Boykoff, and the other focused instead on the year of 2008, after the release of *An Inconvenient Truth* (which became one of the highest-grossing documentary films ever released, winning the 2007 Academy Award for Documentaries) and after the film’s “star,” Al Gore, won the 2007 Nobel Peace Prize, along with the IPCC itself.

Table 2 summarizes three sets of results—the previously noted findings of Oreskes (2004), who focused on the peer-reviewed science, and of Boykoff and Boykoff

Table 2. Representations of Scientific Findings on Global Climate Disruption.

Conclusion: Source, and findings being summarized	Evidence is “in debate” and/or not as bad as consensus	Prevailing consensus is roughly correct	Evidence indicates conditions to be worse than consensus	Ratios of “worse than consensus” to “not as bad as consensus”
Oreskes (2004): Scientific literature	0%	75%	NA	NA
Boykoff and Boykoff (2004): mass media “policy stories” on climate	58.8% ^a	35.3%	5.9% ^b	0.1
Freudenburg and Muselli (2010): Mass media “science stories” on climate	3.6%	10.9%	85.4%	23.7

^aThis figure combines two numbers from Boykoff and Boykoff (2004): Stories that only reported doubts about anthropogenic contributions to climate change (6.2%) and stories that reported the science to be “in debate” (52.7%).

^bThe percentage of articles that focused strictly on problems associated with anthropogenic contributions to climate change.

(2004), who focused on newspaper coverage of the global climate disruption issue, plus the Freudenburg and Muselli (2010) findings on the same newspapers’ coverage of new or emerging scientific findings. The table’s top row summarizes the findings of Oreskes, who focused on articles *in peer-reviewed scientific literature*; as noted above, she found that not a single article characterized the fundamental scientific consensus on global climate disruption as being “exaggerated” or “in debate.” (Oreskes did not separately identify studies concluding that conditions might be worse than indicated in scientific consensus assessments of the time.) The second row summarizes the findings of Boykoff and Boykoff, who focused on “*policy stories*” on climate disruption in the four “prestige newspapers” noted above. They found that news articles characterizing scientists as debating or questioning the severity of climate disruption outnumbered those that saw the prevailing scientific consensus as having been insufficiently pessimistic by a ratio of roughly 10 to 1 (58.8% vs. 5.9%). The third row of the table, finally, summarizes the findings of Freudenburg and Muselli, who focused on “*emerging science*” stories in the same four newspapers. The contrast could scarcely be more pronounced: This study found that the vast majority of the “emerging science” articles in the same newspapers (85.4%) indicated climate disruption to be worse than suggested by the prevailing scientific consensus (such as IPCC reports). In contrast, only 3.6% of the articles in the same newspapers supported the usual claim of the denialists and the U.S. mass media, namely, that things might not be so bad, after all. The numbers supporting the usual framing of climate stories in the U.S. mass media were thus outnumbered by articles supporting the ASC/SCAM hypothesis by a

ratio of well over 20 to 1. The emerging science stories overwhelmingly reported results indicating that climate change and its impacts are more severe than suggested in consensus reports such as those issued by the IPCC. Thus, in direct contrast to the claims of denialist critics, it appears that the IPCC reports tend to err on the side of caution rather than exaggerate the severity of climate disruption and its impacts.

Implications for the Future

The possibility suggested by the little-known ASC perspective is precisely the opposite of the one that has been argued by most of the conservative think tanks—and reported by most mass media outlets in the United States—over the past several decades. The mass media, reflecting in part the dogged arguments from a committed set of conservative think tanks, and the handful of contrarian scientists they support, have tended for many years to suggest that “real” problems of global climate disruption might be less significant than indicated by consensus assessments such as those from the IPCC. By contrast, the literature on SCAMs and on the ASC would lead to just the opposite prediction—namely that, *precisely because conservative interests have been so successful in getting the scientific as well as the policy world to worry about whether the concerns might be “exaggerated,”* the more likely outcome is that the scientific consensus assessments such as those from the IPCC *may not be pessimistic enough.*

Very few studies have compared the two perspectives against one another, and as such, the present findings—while striking in their apparent strength—should be interpreted with caution. In particular, there is a need for further research, assessing the preponderance of emergent scientific findings through other approaches. It would be premature, in short, to consider the evidence to date to be definitive. It is not too soon, however, to conclude that *the usual pattern of reporting in the U.S. mass media* is what can no longer be accepted without challenge. Based on the best evidence available to date, there is no credible basis for continuing to repeat the common assertions that scientific consensus statements, such as those from the IPCC, are “exaggerated.”

At least in factual terms, if not in policy terms, such claims need to be recognized as being what they are—testable hypotheses. The evidence available to date—from decades of research by the leading scientific bodies of the world, from systematic reassessments by the IPCC, and *even from the very newspapers that have routinely reported the conservative think tanks’ claims*—indicate that, if anything, scientific consensus reports are likely to be *insufficiently* pessimistic. Rather than supporting the widespread claims that scientific consensus assessments represent “exaggerated fears,” there is significantly stronger support for the testable prediction from the ASC—namely, that scientific consensus statements such as that provided by the IPCC are more likely to be *understating* the actual degree of climate change and disruption taking place.

All in all, the accumulated peer-reviewed findings have particularly clear implications for anyone who wishes to represent “both *scientifically legitimate* sides of the

climate debate.” Whether the intention is to represent the scientifically credible findings in the mass media or elsewhere, the *scientifically credible* “other side” is that, if the consensus estimates are wrong, it is because the physical reality is significantly *more* ominous than has been widely recognized to date. The usual framing of the issue in the U.S. mass media, by contrast, appears to be little more than a SCAM.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interests with respect to the research, authorship, and/or publication of this article.

Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

References

- Adam, D. (2006, September 20). Royal Society tells Exxon: Stop funding climate change denial. *Guardian Unlimited*. Retrieved October 6, 2006, from <http://www.guardian.co.uk/environment/2006/sep/20/oilandpetrol.business>
- AFP. (2009, March 16). *Climate change blues: How scientists cope*. Retrieved May 15, 2009, from <http://www.google.com/hostednews/afp/article/ALeqM5hInfHpbHvjGUBnXtMxL0n4Yhn1xA>
- Alleyne, R. (2009, March 13). Scientists: Act now or face climate catastrophe. *The Daily Telegraph*, 1.
- Bosworth, D., & Brown, H. (2007). Discussion: After the timber wars: Collaborative community-based stewardship. *Journal of Forestry*, 105(5), 271–273.
- Boykoff, M. T. (2008). Lost in translation? United States television news coverage of anthropogenic climate change, 1995–2004. *Climatic Change*, 86, 1–11.
- Boykoff, M. T., & Boykoff, J. M. (2004). Balance as bias: Global warming and the U.S. prestige press. *Global Environmental Change*, 14, 125–136.
- British Royal Society. (2007). *Climate change controversies: A simple guide*. London: The Royal Society.
- Charlesworth, M., & Okereke, C. (2010). Policy responses to rapid climate change: An epistemological critique of dominant approaches. *Global Environmental Change*, 20.
- CNN.com/Europe. (2009, March 12). World faces “irreversible” climate change, researchers warn. Retrieved on May 6, 2009, from <http://www.cnn.com/2009/WORLD/europe/03/12/irreversible.climate/index.html>
- Cox, R. (2009, April). *Complexity, new media, and contested knowledge claims: Climate change in 2009*. Keynote address to Conference on Media and the Environment, Lisbon, Portugal.
- Dietz, T., Stern, P. C., & Rycroft, R. W. (1989). Definitions of conflict and the legitimation of resources: The case of environmental risk. *Sociological Forum*, 4(1), 47–70.
- Dunlap, R. E., & McCright, A. M. (2010). Climate change denial: Sources, actors and strategies. In C. Lever-Tracy (Ed.), *Routledge handbook of climate change and society* (pp. 240–250). London: Routledge.

- Freudenburg, W. R. (1996). Risky thinking: Irrational fears about risk and society. *Annals of the American Academy of Political and Social Sciences*, 545, 44–53.
- Freudenburg, W. R., Gramling, R., & Davidson, D. (2008). Scientific certainty argumentation methods (SCAMs): Science and the politics of doubt. *Sociological Inquiry*, 78(1), 2–38.
- Freudenburg, W. R., & Muselli, V. (2010). Global warming estimates, media expectations, and the asymmetry of scientific challenge. *Global Environmental Change*.
- Freudenburg, W. R., Wilson, L. J., & O’Leary, D. (1998). Forty years of spotted owls? A longitudinal analysis of logging-industry job losses. *Sociological Perspectives*, 41, 1–26.
- Freudenburg, W. R., & Youn, T. (1999). Institutional failure in environmental management: Toward a fuller understanding of social problems and public policy. *Research in Social Problems and Public Policy*, 7, 3–18.
- Gautier, C. (2008). *Oil, water, and climate: An introduction*. Cambridge, UK: Cambridge University Press.
- Gelbspan, R. (1997). *The heat is on*. Reading, MA: Addison-Wesley.
- Glantz, S. A., Slade, J., Bero, L. A., Hanauer, P., & Barnes, D. E. (Eds.). (1996). *The cigarette papers*. Berkeley: University of California Press.
- Glanz, J. (2001, January 11). Droughts linked to warming might speed climate change. *New York Times*, A1.
- Harkinson, J. (2009, December 22). Climate change deniers without borders: How American oil money is pumping up climate change skeptics abroad—and how they could derail any progress made in Copenhagen. *Mother Jones*. Retrieved January 29, 2010, from <http://motherjones.com/environment/2009/12/climate-deniers-atlas-foundation>
- Harrison, K. (1991). Between science and politics: Assessing the risks of dioxins in Canada and the United States. *Policy Sciences*, 24, 367–388.
- Hattis, D., & Anderson, E. L. (1999). What should be the implications of uncertainty, variability, and inherent “biases”/“conservatism” for risk management decision-making? *Risk Analysis*, 19(1), 95–107.
- Hein, P. (1969). *Grooks* (Vol. I). Garden City, NY: Doubleday.
- Hilts, P. J. (1996). *Smokescreen: The truth behind the tobacco industry cover-up*. Reading, MA: Addison-Wesley.
- Hirt, P. W. (1994). *A conspiracy of optimism: Management of the national forests since World War Two*. Lincoln: University of Nebraska Press.
- Hirt, P. W. (1999). Institutional failure in the U.S. Forest Service: A historical perspective. *Research in Social Problems and Public Policy*, 7, 217–239.
- Hotz, R. L. (2000, January 13). Global warming real, panel says: Experts find that surface temperatures on earth have risen in the last 20 years at a rate greater than the average for the last 100. *Los Angeles Times*, A3.
- Hulme, M. (2009). *Why we disagree about climate change*. Cambridge, UK: Cambridge University Press.
- Intergovernmental Panel on Climate Change. (2007). *Climate change 2007: Synthesis report*. Geneva, Switzerland: Author.
- International Herald Tribune* (European edition). (2009, March 9). Scientists present latest news on climate change. Retrieved May 6, 2009, from <http://www.climatetalks.net/2008-ENVRE130/Audio/20090309-IHT-Scientific-Data-Copenhagen.htm>

- Jaques, P. J., Dunlap, R. E., & Freeman, M. (2008). The organisation of denial: Conservative think tanks and environmental skepticism. *Environmental Politics*, 17(3), 349–385.
- Jasanoff, S. (1993). Bridging the two cultures of risk analysis. *Risk Analysis*, 13(2), 123–129.
- Kleinman, D. L. (2003). *Impure cultures: University biology and the world of commerce*. Madison: University of Wisconsin Press.
- Kohut, A., Doherty, C., & Wike, R. (2006). *No global warming alarm in the U.S., China; America's image slips, but allies share U.S. concerns over Iran, Hamas: 15-nation Pew global attitudes survey*. Washington, DC: Pew Research Center. Retrieved May 6, 2009, from <http://pewglobal.org/reports/pdf/252.pdf>
- Krimsky, S. (2000). *Hormonal chaos: The scientific and social origins of the environmental endocrine hypothesis*. Baltimore, MD: Johns Hopkins University Press.
- Kuhn, T. S. (1962). *The structure of scientific revolutions*. Chicago, IL: University of Chicago Press.
- Latour, B., & Woolgar, S. (1979). *Laboratory life: The social construction of scientific facts*. Beverly Hills, CA: Sage.
- Macabrey, J. M. (2009, March 13). Scientists are grim, economists more optimistic about climate change's effects. *New York Times*. Retrieved May 9, 2009, from <http://www.nytimes.com/cwire/2009/03/13/13climatewire-scientists-see-more-grimeffects-of-climate--10121.html>
- Martin, B. (1999). Suppression of dissent in science. *Research in Social Problems and Public Policy*, 7, 105–135.
- Maugh, T., II. (2009, January 24). Antarctica is not cooling after all. *Los Angeles Times*, A14.
- Mazur, A. (1979). The mass media in environmental controversies. In A. Brannin & S. Goldberg (Eds.), *Social responses to technological change* (pp. 119–133). Westport, CT: Greenwood.
- Mazur, A. (1981). *The dynamics of technical controversy*. Washington, DC: Communications Press.
- McCright, A. M., & Dunlap, R. E. (2000). Challenging global warming as a social problem: An analysis of the conservative movement's counter-claims. *Social Problems*, 47(4), 499–522.
- McCright, A. M., & Dunlap, R. E. (2003). Defeating Kyoto: The conservative movement's impact on U.S. climate-change policy. *Social Problems*, 50(3), 348–373.
- McMullan, C., & Eyles, J. (1999). Risky business: An analysis of claimsmaking in the development of an Ontario drinking water objective for tritium. *Social Problems*, 46(2), 294–311.
- Michaels, D. (2008). *Doubt is their product: How industry's assault on science threatens your health*. New York, NY: Oxford Univ. Press.
- Molotch, H. (1979). "Media and movements." In M. N. Zald & J. D. McCarthy (Eds.), *The dynamics of social movements* (pp. 71–93). Cambridge, MA: Winthrop.
- National Research Council. (2001). *Climate change science*. Washington, DC: National Academy Press.
- National Research Council. (2006). *Surface temperature reconstructions for the last 2,000 years*. Washington, DC: National Academy Press.
- Neff, T. (2009, March 17). Connecting science and policy to combat climate change. *Scientific American*. Retrieved May 6, 2009, from <http://www.scientificamerican.com/article.cfm?id=connectin-g-scienceand-po>
- Oreskes, N. (2004). The scientific consensus on climate change. *Science*, 306(3), 1686.

- Oreskes, N., & Conway, E. (2010). *Merchants of doubt: How a handful of scientists obscured the truth on issues from tobacco smoke to global warming*. New York, NY: Bloomsbury.
- Pan, P. P. (2001, January 23). Scientists issue dire prediction on warming; faster climate shift portends global calamity this century. *Washington Post*, A1.
- Powell, J. L. (2011). *The inquisition of climate science*. New York, NY: Columbia University Press.
- Pulver, S. (2007). Making sense of corporate environmentalism: An environmental contestation approach to analyzing the causes and consequences of the climate change policy split in the oil industry. *Organization and Environment*, 20(1), 44–83.
- Revkin, A. C. (2009a, March 12). *Copenhagen summit seeks climate action*. Dot Earth. Retrieved May 6, 2009, from <http://dotearth.blogs.nytimes.com/2009/03/12/copenhagen-summit-seeks-climate-action/>
- Revkin, A. C. (2009b, March 8). Skeptics dispute climate worries and each other. *New York Times*, A2. Retrieved May 6, 2009, from <http://www.nytimes.com/2009/03/09/science/earth/09climate.html>
- Richardson, K., Steffen, W., Schellnhuber, H. J., Alcamo, J., Barker, T., Kammen, D. M., . . . Wæver, O. (2009). *Climate change: Global risks, challenges & decisions*. Copenhagen, Denmark: International Alliance of Research Universities.
- Rosner, D., & Markowitz, G. (1985). A “gift of God”? The public health controversy over leaded gasoline during the 1920s. *American Journal of Public Health*, 75(4), 344–352.
- Sampei, Y., & Aoyagi-Utsui, M. (2009). Mass-media coverage, its influence on public awareness of climate-change issues, and implications for Japan’s national campaign to reduce greenhouse gas emissions. *Global Environmental Change*, 19, 203–212.
- Shanahan, J., & Trumbo, C. (1998, May). *Voices and messages in global climate change coverage*. Paper presented at 4th International Symposium on Society and Resource Management, Columbia, MO.
- Sheppard, M. (2009). *UN climate reports: They lie*. Retrieved October 26, 2009, from http://www.americanthinker.com/2009/10/un_climate_reports_they_lie.html
- Sokolov, A. P., Stone, P. H., Forest, C. E., Prinn, R., Sarofim, M. C., Webster, M., . . . Jacoby, H. D. (2009). Probabilistic forecast for 21st century climate based on uncertainties in emissions (without policy) and climate parameters. *Journal of Climate*, 22(19), 5175–5204. doi:10.1175/2009JCLI2863.1
- Tesh, S. N. (2000). *Uncertain hazards: Environmental activists and scientific proof*. Ithaca, NY: Cornell University Press.
- Trumbo, C. (1996). Constructing climate change: Claims and frames in US news coverage of an environmental issue. *Public Understanding of Science*, 5(3), 269–283. Retrieved April 9, 1998, from <http://www.iop.org/EJ/S/3/301>
- Trumbo, C., & Shanahan, J. (2000). Social research on climate change: Where we are, and where we might go. *Public Understanding of Science*, 9, 199–204. doi:10.1088/0963-6625/9/3/002
- United Nations Environment Programme. (2009) *Climate change science compendium 2009*. New York, NY: United Nations Environment Programme. Retrieved January 20, 2010, from http://www.unep.org/pdf/ccScienceCompendium2009/cc_ScienceCompendium2009_full_highres_en.pdf

- von Storch, H., & Bray, D. (1999). Perspectives of climate scientists on global climate change. In R. Coppock, E. McGarraugh, S. Rushton, & R. D. Tuch (Eds.), *Climate change policy in Germany and the United States* (pp. 33–48). Bonn, Germany: German-American Academic Council Foundation.
- Warner, K. E. (1986). *Selling smoke: Cigarette advertising and public health*. Washington, DC: APHA Health Policy Monograph Series.
- Weinberg, A. M. (1972). Science and trans-science. *Minerva*, 10(2), 209–222.
- Weingart, P., Engels, A., & Pansegrau, P. (2000). Risks of communication discourses on climate change in science, politics, and the mass media. *Public Understanding of Science*, 9(3), 261–283.
- Zehr, S. (2000). Public representations of scientific uncertainty about global climate change. *Public Understanding of Science*, 9, 85–103.

Author Biographies

William R. Freudenburg was Dehlsen Professor of Environment and Society in the Environmental Studies Program at the University of California, Santa Barbara when he passed away on December 28, 2011.

Violetta Muselli graduated from the Environmental Studies Program at the University of California, Santa Barbara and is currently employed in the private sector.