

Climate of scepticism: US newspaper coverage of the science of climate change

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Abstract

This two-part study integrates a quantitative review of one year of US newspaper coverage of climate science with a qualitative, comparative analysis of media-created themes and frames using a social constructivist approach. In addition to an examination of newspaper articles, this paper includes a reflexive comparison with attendant wire stories and scientific texts. Special attention is given to articles constructed with and framed by rhetoric emphasising uncertainty, controversy, and climate scepticism.

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1. Introduction

One problematic trend of the US media has been the suggestion that substantive disagreement exists within the international scientific community as to the reality of anthropogenic climate change; however, this concept is false (Oreskes, 2004). The Intergovernmental Panel on Climate Change (IPCC) concluded (2001) that there is strong evidence that most of the observed warming of the Earth over the last 50 years is attributable to human activities, and other scientific bodies agree.¹ Notwithstanding the tendency by some in the media and elsewhere to portray the science of climate change as uncertain or controversial, a recent poll by the Program on International Policy Attitudes (PIPA) (2005) found that 73% of the US public believe that their country should participate in the Kyoto Protocol and 86% think that President Bush should act to limit greenhouse gas emissions if such action

is taken by the leaders of other G8 countries. The US is the world's largest emitter of greenhouse gases,² but despite all of these facts, the US federal government is repudiating the challenge of anthropogenic climate change.

Quite relative to this state of affairs is the fact that powerful forces within society combine to distract both the US public and policy-makers from this reality. There is no question that certain business sectors benefit from this political impasse, the contours of which are most discernible when influential individuals publicly dispute the scientific consensus on climate change—such as when Republican Senator James Inhofe of Oklahoma (2004, S11292), on the floor of the Senate, proclaimed (as he also had in 2003) that ‘Global warming is the greatest hoax ever perpetrated on the American people’.³ A number of large

²The [US] continues to be the largest single national source of fossil fuel-related CO₂ emissions reaching an all-time high of 1529 million metric tons of carbon in 2000. In fact, US emissions are approximately twice those of the world's second largest emitter, the People's Republic of China'. Marland, G., Boden, T., Andres, R., 2003. Global, Regional, and National CO₂ Emissions. In Trends: A Compendium of Data on Global Change. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, US Department of Energy. Available at: http://cdiac.esd.ornl.gov/trends/emis/tre_usa.htm [accessed 6 March 2005].

³Reference Inhofe, see also: Gelbspan (2004); Mooney (2005a,b); Austin, A., 2005. War hawks and the ugly American: the origins of Bush's Central Asia and Middle East policy. In: Hamm, B. (Ed.),

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¹See also: US National Research Council, 2002. Abrupt Climate Change: Inevitable Surprises. National Academy Press, Washington, DC. Available at: <http://www.nap.edu/books/0309074347/html> [accessed 10 July 2005]; Joint Science Academies' Statement: Global Response to Climate Change, 2005. 7 June. Available at: <http://nationalacademies.org/onpi/06072005.pdf> [accessed 11 July 2005]; Oreskes (2004).

corporations that profit substantially from fossil fuel consumption, such as ExxonMobil,⁴ provide financial support to their political allies in an effort to undermine public trust in climate science.

At the centre of this climate backlash is a group of dissident scientists. The number of these climate sceptics⁵ is greater in the US than in any other country (Demeritt, 2001; Lahsen, 2005). Although the peer-reviewed scientific literature agrees with the IPCC (Oreskes, 2004), within the media—wherefrom the majority of adults in the US are informed about science (Nelkin, 1995)—claims that are dismissive of anthropogenic climate change are prominently featured. Many global ecological crises are so abstract as to escape immediate public notice. Therefore, it is primarily through the media that climate change is publicly represented (Wilson, 1995, 2000a, b) and in this sense it is the media that *construct* climate change as a social problem. The term *social construction* is polymorphous and one associated with a variety of analytical approaches (e.g. Hacking, 1999; Demeritt, 2002); but as I use it here, social construction is simply ‘the idea that the social context of inquiry, rather than the world which is investigated, determines—constructs—knowledge’ (Barnes, 2003, pp. 747–748).

The Newspaper Association of America (NAA) reported that in 2003, 54.1% of the total adult population read weekday newspapers; Sunday readership was at 62.5%.⁶ Although the NAA statistics reflect a decline in newspaper readership,⁷ this forum is still an important source of public knowledge. In light of this, the dual goals of this paper are to examine the breadth and sourcing of US

(footnote continued)

Devastating Society: The Neo-Conservative Assault on Democracy and Justice. Pluto Press, London, pp. 47–66.

⁴See: US Public Interest Research Groups (PIRG) Education Fund, 2004. Paying to Pollute: campaign contributions and lobbying expenditures by polluters working to weaken environmental laws. April. Available at: www.uspirg.org/uspig.asp?id2=12811&id3=USPIRG [accessed 28 December 2004]; Rowlands, I., 2000. Beauty and the beast? BP’s and Exxon’s positions on global climate change. *Environment and Planning C: Government and Policy* 18, 339–354; Gueterbock, R., 2004. Greenpeace campaign case study—StopEsso. *Journal of Consumer Behaviour* 3(3), 265–271.

⁵For the purposes of this paper I adopt the following passage: ‘All scientists are [sceptics] because the scientific process demands continuing questioning [T]he scientists [referred to here] as “[sceptics]” are those who have taken a highly visible public role in criticizing the scientific consensus on ... climate change through publications and statements addressed more to the media and the public than to the scientific community’. Brown Jr., G., 1996. *Environmental Science Under Siege: Fringe Science and the 104th Congress*. A report by Rep. George E. Brown, Jr., Ranking Democratic Member to the Democratic Caucus of the Committee on Science, US House of Representatives, 23 October. Available at: www.house.gov/science_democrats/archive/envrpt96.html [accessed 13 March 2005].

⁶Facts About Newspapers: a statistical summary of the newspaper industry (US daily and Sunday newspaper readership audience). Available at: www.naa.org/info/facts04/readership-audience.html [accessed 7 February 2005].

⁷According to the NAA, in 1993 the weekday readership was 61.7%; Sunday readership was 69.0%.

newspaper coverage of scientific findings relating to climate change and to conduct an analysis of the framing of press reports made by newspapers and their wire/news service sources. The organisation of this paper is as follows. A brief review of the existing literature on media coverage of science and climate change is followed by a discussion of my methods and data. After a short account of framing techniques, I set forth my analysis of the media-constructed frames that shaped one year of articles on climate science before finally concluding with a discussion of my findings.

2. The fourth estate

During the first half of the twentieth century, US journalism was transformed into a profession with its own set of standards that emphasised non-partisanship and factual accuracy (McChesney, 2004). However, this development did not come without complications as the practices of *news professionalism*, along with modern news organisational systems, have been found to reinforce and legitimate the existing status quo (Tuchman, 1978). One of the paradoxes, explains Bennett (2005), is that professional standards intended to prevent bias, such as *objectivity*, can create conditions that lead to systematic distortion of the news. Further compounding this predicament, observes linguist George Lakoff (2002), is the false presumption that the language of journalism is conceptually neutral when in fact it can reinforce certain value systems.

A number of different academic approaches explicate media representations and their influence upon public comprehension. Considerable work has focused on the detrimental effects of US corporate media control, such as how the same might cause bias in news reporting (e.g. Herman and Chomsky, 1988; Chomsky, 1989, 1997; McChesney, 1998, 1999, 2004; Bagdikian, 2004; Goodman and Goodman, 2004; Bennett, 2005; McChesney, et al., 2005), and upon successful efforts by the public relations (PR) industry to influence and shape the news (e.g. Manheim and Albritton, 1984; Blyskal and Blyskal, 1985; Nelson, 1989; Stauber and Rampton, 1995; Chomsky, 1997, 2002; Davis, 2000; Rampton and Stauber, 2001).

Science journalism has long been a popular topic of academic study (e.g. Kriehbaum, 1967; Friedman, et al., 1986, 1999; Nelkin, 1995; Lewenstein, 1995; Gregory and Miller, 1998; Allan, 2002) and includes a branch concerned with media coverage of environmental risk (e.g. Wilkins and Patterson, 1987; Dunwoody and Peters, 1992; Mazur and Lee, 1993; Beck, 1995; Friedman et al., 1996; Mazur, 1998; Ungar, 1998; Allan et al., 2000; Sachsman et al., 2004; Major and Atwood, 2004). Our understanding of media portrayals of climate change has advanced through works that have explored various dimensions of this realm, such as sources of reporter knowledge (Mormont and Dasnoy, 1995; Wilson, 2000a, b); misreporting or miscommunication (Schneider, 1990; Bell, 1991a, b, 1994a; Henderson-Sellers, 1998a, b); public

misunderstanding (Bell, 1994b; Wilson, 2000b; Hargreaves et al., 2003); the social construction of scientific uncertainty (Zehr, 2000; Corbett and Durfee, 2004); and prominent trends in the way climate change is communicated (Wilkins and Patterson, 1991; Wilkins, 1993; Weingart et al., 2000; Friel, 2005).

Further, textual analyses of newspaper coverage of science have been performed on an international scale (e.g. Einsiedel, 1992 [Canada]; Hansen, 1994 [UK]; Pellechia, 1997 [US]) and include studies that concentrate on newspaper reporting of climate change (e.g. Trumbo, 1996 [US]; McComas and Shanahan, 1999 [US]; Nissani, 1999 [US]; McManus, 2000 [Australia]; Taylor and Nathan, 2002 [UK]; Dispensa and Brulle, 2003 [US, New Zealand, and Finland]; Boykoff and Boykoff, 2004 [US]; Carvalho, 2005 [UK]).

It is well-recognised that in order to maintain an illusion of intense controversy, industry lobbies as well as special interest groups and PR firms have manipulated climate science and exploited the US media (e.g. Gelbspan, 1998, 2004, 2005; Beder, 1999; Leggett, 2001; Rampton and Stauber, 2001; Pollack, 2003; Lahsen, 2005; McKibben, 2005; Mooney, 2005a,b; Austin and Phoenix, 2005). In light of the continuing influence of climate sceptics upon US media and policy, there is need for a more current and comprehensive analysis of newspapers and their newswire sources that also examines the pervasiveness of frames constructed with rhetoric of the sceptical counter-movement.

Zehr (2000) determined that the popular press uses a number of methods to frame climate science as uncertain, including 'through the practice of interjecting and emphasizing controversy or disagreement among scientists'; this often creates drama and provides journalists 'with a guise of objectivity' (p. 90). In order to provide *balance* while reporting on climate change, some journalists include rebuttals by *experts* who, often through think-tanks, are affiliated with the fossil fuel industry (Gelbspan, 1998, 2004, 2005; Leggett, 2001; Lahsen, 2005). Regrettably, this creates the impression that scientific opinion is evenly divided or completely unsettled.

Boykoff and Boykoff (2004) analysed the journalistic norm of *balance*⁸ as it related to coverage of global warming by four prestigious US newspapers⁹ (from 1988 to 2002) and concluded (p. 134):

[A]dherence to the norm of balanced reporting leads to informationally biased coverage of global warming. This bias, hidden behind the veil of journalistic balance,

⁸These authors here refer to the work of W.L. Bennett [1996. An introduction to journalism norms and representations of politics. *Political Communication* 13(4), 373–384] in listing three normative orders of journalism: political norms, economic norms, and journalistic norms; in addition to *balance*, other journalistic norms are *objectivity*, *fairness*, and *accuracy*.

⁹The *New York Times*, the *Washington Post*, the *Los Angeles Times*, and the *Wall Street Journal*.

creates both discursive and real political space for the US government to shirk responsibility and delay action regarding global warming.

Gelbspan (2004), a long-time US reporter and editor, proposes that the ethic of journalistic balance should be evoked when the story involves opinion; but when there is a question of fact reporters should research the story to discover which claims are factual.

3. Methodology

The National Newspaper Association estimates that more than 150 million US citizens read regional or community newspapers.¹⁰ Most of the foregoing textual analyses have been concerned with a small number of newspapers that are read nationwide. While this study also includes climate science coverage by nationally read newspapers, due to the prevalence of regional newspapers, hundreds of community newspapers are incorporated into this review. The body of newspaper articles examined here consists of reports that contain scientific content relating to climate change collected from five Internet sources, all of which supply abstracts¹¹ of articles. The primary source is the online database NewsLibrary.com,¹² which at the time of data collection encompassed 251 US newspapers (including the

¹⁰About Community Papers. Available at: <http://www.nna.org/CommunityCenter/AboutCommNewspapers.htm> [accessed 25 July 2005]. To illustrate the importance of regional papers, in the Puget Sound/Western Washington region there is a combined readership of 1,326,200 for the two largest dailies, the *Seattle Times* and the *Seattle Post-Intelligencer* (including Sunday); there are 86,100 readers of the Sunday *New York Times* (Sunday readership for the *NYT* is higher than weekday in this region). *Seattle Times*. Newspaper Readership. Available at: <http://seattletimescompany.com/advertise/readership.htm> [accessed 25 July 2005].

¹¹Abstracts supplied by NewsLibrary.com consisted (approximately) of the first 75–80 words of the article and most often included all of the lead (or introduction) paragraph(s). According to Bell (1991b): 'The lead is the most distinctive feature of news discourse ... Framing the lead is arguably the journalist's primary writing skill ... The lead is a microstory. [It] concentrates the news value of the story ...' (pp. 176–177). The headline of an article is derived 'principally from the lead' and the length thereof is 'dictated by the constraints of page layout' (Bell 1991b, p. 186).

¹²During deliberation over which database to employ, I discovered that NewsLibrary.com (using the 'custom list') contained abstracts from a greater number of newspapers than LexisNexis (approximately 161). Although NewsLibrary.com excluded the *New York Times*, the *Los Angeles Times*, the *Chicago Tribune*, and *USA Today*, the websites of these newspapers contained searchable archives. I also detected significant limitations with LexisNexis for this type of research. When performing a LexisNexis search under 'US news' either by region (LexisNexis breaks the US into four regions) or by individual state, sources include not only newspapers but also wire services; magazines; legislative reports; and legal, business, ethnic, trade, and international affairs publications. A researcher can select the individual sources (newspapers) rather than use the blanket region or state, but when doing so is limited to a search of only five sources (newspapers) at a time. Also, when reviewing the list of sources on LexisNexis it is not always simple to determine the type or location of a publication. NewsLibrary.com also includes wire articles and other publications but it is relatively easy to eliminate these from the search.

Washington Post). To complement this data, the electronic versions of four newspapers (that were not included in NewsLibrary.com) have been employed as supplementary sources: the *New York Times*, the *Los Angeles Times*, the *Chicago Tribune*, and *USA Today*. These 255 newspapers are based in 43 states and the District of Columbia.

Many of the studies referred to above analysed newspaper coverage of climate change, including the political dimension, over multiple years or decades, but this study should be viewed as a snapshot of the socially constructed news of climate science during the time period of 1 March 2003 to 29 February 2004.¹³ This cross-section is not intended to be representative of prior years but would prove instructive for comparative studies of historical and future journalistic phenomena. Data collection was performed in three stages. First, I conducted a search of all 251 newspapers in the NewsLibrary.com database using the search terms ‘climate AND change’. By reading the abstracts it was possible to narrow the population generated by this search by excluding political stories, commentaries, editorials, interviews, book reviews, and letters to editors. During the screening process, I took notes on each climate science article and collected qualifying abstracts. I repeated this process with the search terms ‘global AND warming’ and then replicated this routine using the websites of the aforementioned newspapers. A review of my data allowed me to eliminate a number of duplicates that had occurred due to the appearance of both ‘climate change’ and ‘global warming’ in some stories. I was then left with a total of 544 climate science articles.

The population of 544 newspaper articles included 246 unique accounts that were reported only by single newspapers. The remaining (non-singular) 298 articles (55% of the population) were published by 93 newspapers and covered 32 discrete scientific claims (that is, 32 scientific studies had been reported by more than one newspaper). As this study compares themes and frames within the press, and against the scientific texts, the frame analysis that follows is directed towards the press coverage of these 32 scientific claims.

Next, using the database LexisNexis, I gathered all wire and syndicated news service articles relating to the 32 scientific studies. And finally, scientific texts, published and when available unpublished, were located by using various Internet websites and databases; during this process some press releases were discovered. The 32 collective specimens—the scientific claims/findings along with concomitant newspaper and wire articles—have been assigned numbers and within the following analysis are referred to as numbered *items*.

4. Part I: climate science in the news

My frame analysis of the 32 items was guided by a reading of the original research, press releases, wire stories, and newspaper abstracts (in some cases full newspaper articles). The 32 items all related to new research findings, but to provide context, the 246 non-item or single newspaper articles touched upon a variety of issues relating to climate change: the effects upon certain geographical locations, habitats, or endeavours such as farming; forecasts of future changes and threats; introductions to new technologies or forthcoming studies; and various ideas relating to mitigation. Other non-item articles described such topics as the role of carbon sinks, non-anthropogenic causation (such as solar variations), scientific arguments relating to human caused versus natural climate change, carbon dioxide (CO₂) mandates, and general science that mentioned climate change.

Table 1 provides details on the scientific research upon which the 32 items were based and includes sum totals of newspaper articles.¹⁴ The three climate studies that received the broadest degree of newspaper coverage, as in number of articles, are situated within the following items: 30—2003 was *third-hottest year on record* (42 articles); 28—*Soot is a factor in global warming* (34 articles); and 26—*Warming effects upon ski resorts* (29 articles). Twenty-five (78.12%) of the items involved 10 or fewer newspaper articles; three (9.38%) had 11–20 reports; two (6.25%) had 21–30; and two (6.25%) were covered in 31–42 articles.

A survey of the scientific texts that provided the foundation for the 32 items presented scientific claims or findings that fell within six broad categories: effects predicted, effects documented, anthropogenic causation, causation unrelated to CO₂ or methane (CH₄), clean energy or mitigation, and adaptation. These studies generally encompassed more than one of the above issues.

5. Part II: framing the science

Societies choose (culturally determine) what they shall consider as *events* (Galtung and Ruge, 1973). By disseminating information about these events, news organisations ‘circulate and shape knowledge’; they also play an important role in setting the political agenda (Tuchman, 1978, p. 2). A powerful component of journalism is the construction of news *themes* and *frames*. The theme of an article is the idea that connects various ‘semantic elements of a story’, such as descriptions of action, quotations, and background information, ‘into a coherent whole’ (Pan and Kosicki, 1993, p. 59).

Goffman (1974) used the term frame to describe the identifiable basic elements each of us uses to mentally organise social events or situations. The concept of framing

¹³Research began early spring 2004 and sampled the immediate past one year period.

¹⁴A comparative analysis of the number of words per newspaper article revealed no trend.

Table 1
32 sample stories

Story 1	(8 newspaper articles)
Source:	Press release from World Water Council: Number of killer storms and droughts increasing worldwide (27.02.03)
Story 2	(5 newspaper articles)
Source:	Press release from NASA's Goddard Space Flight Center: Climate changes may increase extreme rain/snow events in California (06.03.03)
Researcher:	Jinwon Kim
Story 3	(5 newspaper articles)
Source:	Science, 299:1725–1728
Title:	Recent trends in Arctic surface, cloud, and radiation properties from space
Authors:	Xuanji Wang and Jeffrey Key
Story 4	(6 newspaper articles)
Source:	Nature, 422:292–294
Title:	Detection of human influence on sea-level pressure
Authors:	Gillett, Zwiers, Weaver, and Stott
Story 5	(3 newspaper articles)
Source:	Science, 299:2052–2054
Title:	Climate sensitivity uncertainty and the need for energy without CO ₂ emission
Authors:	Ken Caldeira, Atul Jain, and Martin Hoffert
Story 6	(7 newspaper articles)
Source:	Press release from the Union of Concerned Scientists (joint effort with The Ecological Society of America) (08.04.03) RE: below report:
Title:	Confronting climate change in the Great Lakes Region: impacts on our communities and ecosystems
Story 7	(2 newspaper articles)
Researcher:	John Christy
Story 8	(2 newspaper articles)
Sources:	(1) Nature, 423:528–531 and (2) Earth Interactions, vol. 7 (2003) Paper 4
Titles:	(1) Impact of urbanization and land-use change on climate (2) Detection of urban-induced rainfall anomalies in a major coastal city
Authors:	(1) Eugenia Kalnay and Ming Cai (2) J. Marshall Shepherd and Steven Burian
Story 9	(5 newspaper articles)
Source:	Science, 300:1280–1284
Title:	Influence of satellite data uncertainties on the detection of externally forced climate change
Authors:	Santer, Wigley, Meehl, Wehner, Mears, Schabel, Wentz, Ammann, Arblaster, Bettge, Washington, Taylor, Boyle, Brüggemann, and Doutriaux
Story 10	(4 newspaper articles)
Source:	Science, 301:65
Title:	Acclimation capacity underlies susceptibility to climate change
Author:	Jonathon Stillman
Story 11	(4 newspaper articles)
Source:	Press release by UN World Meteorological Organisation: Extreme weather events might increase (02.07.03)
Story 12	(7 newspaper articles)
Source:	Science, 301:958–960
Title:	Long-term region-wide declines in Caribbean corals
Authors:	Gardner, Côté, Gill, Grant, and Watkinson
Story 13	(13 newspaper articles)
Source:	Arctic Climate Impact Assessment (ACIA) team and others
Story 14	(4 newspaper articles)
Source:	Rocky Mountain Biological Laboratory (Re: wild flowers)
Story 15	(2 newspaper articles)
Source:	Nature, 424:766–768
Title:	Climate change decreases aquatic ecosystem productivity of Lake Tanganyika, Africa
Authors:	O'Reilly, Alin, Plisnier, Cohen, and McKee
Story 16	(7 newspaper articles)
Source:	PNAS (Proceedings of the National Academy of Sciences of the USA), 100:11225–230
Title:	Observations of a 'weekend effect' in diurnal temperature range
Authors:	Piers M. de F. Forster and Susan Solomon
Story 17	(8 newspaper articles)
Source:	Geophysical Research Letters, 30(20), 2031, doi:10.1029/2003GL017931, 2003: 1–1 to 1–4
Title:	Break-up of the largest Arctic ice shelf and associated loss of an epishelf lake
Authors:	Derek Mueller, Warwick Vincent, and Martin Jeffries
Story 18	(7 newspaper articles)
Source:	Nature, 425:365
Title:	Anthropogenic carbon and ocean pH
Authors:	Ken Caldeira and Michael Wickett
Story 19	(10 newspaper articles)
Source:	Appears to be interviews with researchers who have conducted recent surveys of glaciers in Sierra Nevada mountains (October 2003)

Table 1 (continued)

Researchers:	Hassan Basagic, Nathan Stephenson, and Slawek Tulaczyk
Story 20	(10 newspaper articles)
Source:	Journal of Climate, 16(21):3498–3510
Title:	Warming trends in the Arctic from clear sky satellite observations
Author:	Josefino Comiso
Story 21	(2 newspaper articles)
Source:	Science, 302:391
Title:	The threat to cone snails
Authors:	Eric Chivian, Callum Roberts, and Aaron Bernstein
Story 22	(14 newspaper articles)
Source:	Press Release from The Geological Society of America: Climate change in the vineyards: the taste of global warming (03.11.03)
Researchers:	Gregory Jones, Michael White, and Owen Cooper
Story 23	(12 newspaper articles)
Source:	PNAS (Proceedings of the National Academy of Sciences of the USA), 100(24):14063–8
Title:	Modeling current and future potential wintering distributions of eastern North American monarch butterflies
Authors:	Karen Oberhauser and A. Townsend Peterson
Story 24	(4 newspaper articles)
Source:	Geophysical Research Letters, 30(19), 1992, doi:10.1029/2003GL018126, 2003:5–1 to 5–4
Title:	Atmospheric methane levels off: temporary pause or a new steady-state?
Authors:	Dlugokencky, Houweling, Bruhwiler, Masarie, Lang, Miller, & Tans
Story 25	(4 newspaper articles)
Source:	Journal of Climate, 16: 3650–3664
Title:	A reanalysis of the MSU channel 2 tropospheric temperature record
Authors:	Carl Mears, Matthias Schabel, and Frank Wentz
Story 26	(29 newspaper articles)
Source:	Press Release by UN Environment Programme (02.12.03) RE: below report:
Title:	Climate change and winter sports: environmental and economic threats
Researchers:	Rolf Bürki, Hans Elsasser, and Bruno Abegg
Story 27	(3 newspaper articles)
Source:	Climatic Change, 61:261–293
Title:	The anthropogenic greenhouse era began thousands of years ago
Author:	William Ruddiman
Story 28	(34 newspaper articles)
Source:	PNAS (Proceedings of the National Academy of Sciences of the USA), 101(2):423–428
Title:	Soot climate forcing via snow and ice albedos
Authors:	James Hansen and Larissa Nazarenko
Story 29	(27 newspaper articles)
Source:	Nature, 427:145–148
Title:	Extinction risk from climate change
Authors:	Thomas, Cameron, Green, Bakkenes, Beaumont, Collingham, Erasmus, Ferreira de Siqueira, Grainger, Hannah, Hughes, Huntley, van Jaarsveld, Midgley, Miles, Ortega-Huerta, Peterson, Phillips, and Williams
Story 30	(42 newspaper articles)
Source:	Press releases from the Met Office and National Oceanic and Atmospheric Administration (16.13.03)
Story 31	(6 newspaper articles)
Source:	Press release from WWF (21.02.04) RE: below report:
Title:	Implications of climate change for Australia's Great Barrier Reef
Researchers:	Hans Hoegh-Guldberg and Ove Hoegh-Guldberg
Story 32	(2 newspaper articles)
Source:	Science, 303:1337–1341
Title:	Smoking rain clouds over the Amazon
Authors:	Andreae, Rosenfeld, Artaxo, Costa, Frank, Longo, and Silva-Dias

provides a way to 'describe the power of a communicating text'; frame analysis illuminates the manner in which influence over consciousness is exerted by the transfer of information (Entman, 1993, p. 51). Entman (1991) identifies two levels of news frames: mentally retained principles for processing information; and traits or devices of news text, such as 'importance judgments, agency, identification, [categorisation], and [generalisation]' (p. 25). According to Entman (1993, p. 52) framing involves

selecting certain 'aspects of a perceived reality and [making] them more salient'. A more recent description of framing put forth by Entman (2004, p. 5) is to select and highlight certain 'facets of events or issues' and make 'connections among them so as to promote a particular interpretation, evaluation, and/or solution'. Keywords, metaphors, and concepts are some of the tools used to construct news frames that encourage readers to develop certain understandings about reported events, issues, or remedies; these

promoted interpretations ultimately lead to evaluations (Entman, 1991, 2004).

Social actors available to the media are known as *primary definers* (Hall et al., 1978); these individuals help to ‘frame and define not only what the issues are but also ... the terms of reference for their discussion’ (Hansen, 1993, p. xviii). Correspondingly, the framework of a *primary definition* operationally limits future discourse (Hall et al., 1978). *Interpretive packages*¹⁵ (Gamson, 1981) have ‘a central [organising] idea or frame’; these packages (such as *progress*) are sustained by ‘constructing meaning over time, incorporating new events into their interpretive frames’ (Gamson and Modigliani, 1989, pp. 3–4).

McCright and Dunlap (2000) analysed the claims-making and framing techniques promoted by certain US conservative think-tanks in their efforts (between 1990 and 1997) to dismiss the reality of climate change. Three major frames were identified: criticism of scientific evidence, substantial benefits of climate change, and actions to ameliorate would be too great a threat to the nation’s economy and sovereignty. These researchers discovered that the failure to keep climate change on the public agenda is not caused simply by waning media attention or the complexities of the science, but is largely a result of concerted efforts and exercise of power by the influential counter-movement.

Within the cross-section of this study I encountered four discernable frames: *valid science*; *ambiguous cause or effects* (indicating a degree of disregard for the gravity of climate change); *uncertain science*; and *controversial science*. For the purposes of this paper, if each wire and newspaper article within an item was constructed with a valid science frame, the item is classified here as having such a frame. Conversely, although some news organisations reporting the science on which an item was based may have framed their articles as valid science, if one of the remaining three frames had been constructed by any of the newspapers or wire services, that item has been set forth under the particular *non-valid science* frame most prominent within the item. The results of my frame analysis indicate that valid science frames were constructed in most of the items (21) and non-valid science frames were evident within the news coverage of the remaining 11 items (roughly one-third of the total 32 items). Three items included the frame of ambiguous cause or effects, three contained an uncertain science frame, and five embodied a controversial science frame. While the majority of items were constructed with frames of valid science, I hypothesize that these non-valid science frames were sufficiently prominent as to effect substantial confusion among readers.

5.1. *Valid science*

The articles framed as valid science did not discuss scepticism of the research or of climate change and often engaged the authors of the scientific study as primary definers. Valid science frames were constructed by newspapers in articles that examined the following: extreme weather events in California (item 2, which included ‘Climate change creating problems: warmer globe would bring more storms, floods to state, researchers say’, *Daily Review*, Hayward, Calif., 11 March 2003); climate sensitivity /stabilisation along with the need for a transition to clean energy (item 5); and the viability of a particular tropical snail that is under threat by climate change as well as other factors (item 21).

In addition to encompassing newspaper articles constructed as valid science, the following items contained wire/news service articles that were also framed in this mode. These items covered an array of issues: increasing extreme weather events (items 1 and 11); the effect of cloud cover on the warming Arctic (item 3); the impact of climate change in the Great Lakes region (item 6, which included ‘Climate change could dry Great Lakes’, United Press International, 8 April 2003); the influence on climate from urbanisation and land use change (item 8); the Arctic Climate Impact Assessment (ACIA) (item 13); and the effects of climate change on certain species in the Rocky Mountains (item 14, which contained ‘Feeling the heat: scientists say mountain flowers harbingers of global-warming changes’, *Southern Illinoian*, Carbondale, Ill., 3 August 2003). Items 10, 12, 15, and 31 recounted how certain marine species are susceptible to increasing habitat temperatures; and item 23 described similar vulnerabilities for monarch butterflies (‘Monarch butterfly may face climate threat’, the Associated Press [AP], 10 November 2003; ‘Climate change could threaten monarch habitat’, *Star Tribune: Newspaper of the Twin Cities*, Minneapolis, Minn., 11 November 2003). Lastly, valid science frames were constructed in articles relating to the following: an anthropogenic link to the (climate indicator) diurnal temperature range¹⁶ (item 16); adverse effects of CO₂ emissions to ocean pH (acidification) (item 18); studies of the Sierra Nevada glaciers (item 19); atmospheric CH₄ levels (item 24); prehistoric anthropogenic greenhouse gas emissions (item 27); and Amazon forest fires and their effect on climate (item 32).

5.2. *Ambiguous cause or effects*

Beginning with the second class of frames, ambiguous cause or effects, my analysis now turns to the remaining 11 items that embodied frames that diverged from a theme of valid science. First is a case in which a frame was crafted in

¹⁵For an extensive presentation of this model, see also: Gamson, W., Lasch, K., 1983. The political culture of social welfare policy. In: Spiro, S. (Ed.), *Evaluating the Welfare State: Social and Political Perspectives*. Academic Press, New York, pp. 397–415; Gamson, W., Modigliani, A., 1987. The changing culture of affirmative action. *Research in Political Sociology* 3, 137–177.

¹⁶DTR is the ‘difference between the daytime maximum and nighttime minimum temperatures’ (Forster and Solomon, p. 11225, see item 16 in Table 1).

such a manner that the scientific findings were de-emphasised. The subject of item 17 was the break-up of the Ward Hunt Ice Shelf, the largest Arctic ice shelf, and the associated loss of an epishelf lake.¹⁷ The AP issued ‘Ice breakup in Canada blamed on warming’ (22 September 2003). The AP explained that ‘Calving of ice shelves into giant icebergs is seen regularly from Antarctica and many scientists believe that is caused by global warming, though research continues to try and verify that. [A] similar ice breakup in the Northern Hemisphere was reported...’. However, the rather explicit frame created by the AP was replicated by only three of the eight reporting newspapers, such as the *Los Angeles Times*: ‘Arctic’s biggest ice shelf, a sentinel of climate change, cracks apart’ (23 September 2003). In comparison, the *New York Times* constructed an ambiguous frame in their article headlined: ‘Huge ice shelf is reported to break up in Canada’ (23 September 2003); the remaining four newspapers used similar headlines.¹⁸ The above news coverage was based on a paper published in *Geophysical Research Letters* by Mueller, Vincent, and Jeffries. These researchers found that the thinning and fragmentation are ‘evidence for climate change’ (pp. 1–1). While avoiding the keywords ‘global warming’ or ‘climate change’, the *Times* article noted that these scientists had observed that this event provides ‘fresh evidence that the region is warming past thresholds that can produce abrupt changes’.

If an article reflects a sardonic theme, the effects of climate change are obscured. This is the case with item 22 which was based on a press release from the Geological Society of America (GSA) headed: ‘Climate change in the vineyards: the taste of global warming’ (03 November 2003) that described a study of the world’s top 27 wine regions. The headlines used by most of the 14 reporting newspapers were upbeat, for example, ‘Global warming tastes fine in a bottle of good Cabernet: higher temperatures linked’ (*Tri-Valley Herald*, Pleasanton, Calif., 3 November 2003). A *Washington Post* article under the caption ‘Serving wine globally warmed’ (10 November 2003) began: ‘For wine lovers, global warming may not be such a bad thing: research indicates that warming temperatures are improving the quality of fine wines’. An AP article, titled ‘US scientists link global warming and wine quality’ (14 November 2003), led with: ‘Global warming may become a worldwide catastrophe, but at least the wine should be better’. Although a cheerful theme reverberated, it belied trouble ahead for the wine industry. The GSA release had quoted one of the researchers who warned ‘[s]urvival of today’s wine regions will depend on how well viticulturists adapt to and mitigate the effects of climate change’.

¹⁷Low-salinity water floating on the sea which is retained by ice shelves (Mueller et al., p. 1–1, see item 17 in Table 1).

¹⁸Although it may not be the case in this instance, in addition to wire and commercial news services, media outlets have access to news services provided by newspapers such as the *New York Times*, the *Los Angeles Times*, and the *Washington Post*.

A United Nations Environment Programme (UNEP) press release with the title ‘Many ski resorts heading downhill as a result of global warming’ (2 December 2003) introduced a research paper prepared for a world conference associated with the Olympic Games. This release spurred an AP article that was carried by 29 newspapers (item 26). The AP story, headlined ‘U.N. reports warming effects on ski areas’ (3 December 2003), included the comments of Klaus Toepfer, Executive Director of UNEP, who emphasised: ‘Climate change is happening now. We can measure it’. The AP then included a bewildering comment: ‘*Many scientists believe that [CO₂] and other so-called “greenhouse” gases trap heat in the atmosphere*’ (emphasis added). Although the theme of the UNEP press release related to the ski industry, it included the following words of Toepfer:

Climate change in the form of extreme weather events such as hurricanes, floods and droughts, is the greatest challenge facing the world. Clearly it is the poorest of the poor on continents like Africa, Asia and Latin America who are at the greatest risk, who are the most vulnerable.

The press release concluded with:

The researchers argue that, while winter sports tourism is clearly a potential victim of climate change, it also has a responsibility towards reducing [CO₂] and the other emissions linked with global warming.

While the AP mentioned the Kyoto Protocol, the underlying theme remained focused on ski resorts. Meanwhile, item 26 holds dual significance as some of the coverage that the UNEP press release received may have been attracted by a *news peg* (Baldwin and Beach, 1940) which is a recent event, public statement, etc. on which journalists can *hang* stories (Gans, 1979). The subject news peg was a story relating to Russia’s stance on the Kyoto Protocol that was covered by a flurry of wire articles. Many of the newspapers reporting item 26 also published the Russia/Kyoto story on the same day.

5.3. *Uncertain science*

Boykoff and Boykoff (2004) also examined the balanced newspaper coverage of climate mitigation options, ranging from cautious to urgent and from voluntary to mandatory, and these researchers found bias through balance here as well. An updated analysis might incorporate *adaptation* — a concept just entering US newspaper climate discourse. Pielke (1998, 2004) complains of an incompatibility of the definitions for climate change used by the United Nations Framework Convention on Climate Change (UNFCCC) and the IPCC. Pielke (1998, 2004) argues that this quandary has led to a problematic framing of the issues, hindering policy-making and creating a bias against adaptation.

In addition to an uncertain science frame within item 20, the issue of adaptation was raised despite the fact that the reported scientific study contained no such reference. NASA's¹⁹ Goddard Space Flight Center issued a press release headed 'Recent warming of Arctic may affect worldwide climate' (23 October 2003) that presented a study published by Josefino Comiso in the *Journal of Climate*. In the conclusion of this journal article, Comiso noted, among other findings, that 'A sustained warming of the magnitude observed would cause profound changes in the Arctic region, especially in the sea ice cover, parts of the Greenland ice sheet, the permafrost, glaciers, and snow cover over northern Eurasia and North America' (p. 3509). NASA's press release included an explanation by David Rind, of NASA's Goddard Institute for Space Studies, of the correlated positive feedback processes: '[T]hawing Arctic soils may release significant amounts of [CO₂] and [CH₄] now trapped in permafrost, and slightly warmer ocean water could release frozen natural gases in the sea floor, all of which act as greenhouse gases in the atmosphere'.

This research received coverage from 10 newspapers and the following three wire/news service agencies: Cox News Service (Cox), Scripps Howard News Service (Scripps Howard), and the AP. The Cox article 'Dramatic drop in Arctic ice documented' (23 October 2003) was an early release of an article by the *Atlanta Journal-Constitution*.²⁰ Although Comiso, in the introduction to the journal article, mentioned 'the recent change in phase of the Arctic Oscillation that has been linked to increasing greenhouse gases in the atmosphere' (p. 3498), the Cox/AJC article falsely averred a lack of scientific consensus with the inclusion of: 'there is little agreement on the reasons for climate change' (emphasis added). The AP quoted Comiso in emphasising '[t]he warming rate is quite high compared to what we observed previously', and Scripps Howard included the following from the author: 'When compared to ground-based surface temperatures, the rate of warming in the Arctic between 1981 and 2001 was eight times the rate of warming over the last 100 years ... [t]he Arctic is in the process of being transformed'. While the Cox/AJC article was relatively detailed, it included no such direct quotes from Comiso, but did include the following comments of Rind: '[W]e have evidence that the climate of the Arctic is changing right now and changing rapidly. *Whatever* is causing it, we are going to have to start *adapting* to it' (emphasis added).²¹ It is noteworthy that neither the AP nor Scripps Howard had incorporated the adaptation theme into their articles.

A paper published in *Nature* under the headline 'Extinction risk from climate change' was co-authored by

19 researchers and assessed extinction risks for sample regions covering 20% of the Earth's terrestrial surface. This study was reported by the AP and 27 newspapers (item 29). The AP (7 January 2004) article included the remarks of lead author Chris Thomas: 'We're already seeing biological communities respond very rapidly to climate warming'. The AP also noted: 'The *researchers concede that there are many uncertainties* in both climate forecasts and the computer models they used' (emphasis added). A comparison between this last AP statement and the following excerpts from the *New York Times* (8 January 2004) coverage reveals a striking difference in the way the uncertainty theme was constructed:

There's a huge amount of uncertainty [said Dr. Thomas].

...

[But] *despite the significant uncertainties*, the researchers assessed the raw data on species numbers, current habitats and past extinctions *from as many angles as possible*.

...

Although the results vary widely ... *even the most conservative* estimates show that global warming, which [Dr. Thomas] and most other scientists attribute to emissions of [CO₂] and other greenhouse gases in the burning of fossil fuels, presents a 'very serious risk to huge numbers of species and at least ranks alongside habitat destruction' as a threat. (Emphasis added.)

The *Boston Globe*, under the headline 'A sacrifice of species' (19 January 2004), moved beyond the science to include political commentary that began '[this study] should spur President Bush and Congress to end their irresponsible neglect of climate change and its consequences'.

A press release issued by NASA captioned 'Black soot and snow: a warmer combination' (22 December 2003) described a study published in the *Proceedings of the National Academy of Sciences of the United States of America (PNAS)* that investigated the effect of soot on the reflective quality of snow and ice. This research was covered by the AP and 34 newspapers (item 28). The authors of this paper, James Hansen and Larissa Nazarenko, summarised (p. 428):

The soot effect [produced by incomplete combustion of carbonaceous material, mainly fossil fuels and biomass (p. 423)] on snow albedo²² may be responsible for a quarter of observed global warming. Restoration of snow albedos ... would have the double benefit of reducing global warming and raising the global temperature threshold at which dangerous anthropogenic interference with climate occurs.

¹⁹National Aeronautics and Space Administration.

²⁰Some news service agencies reflexively distribute stories written by subscribing or affiliated newspapers.

²¹For a more recent and in-depth exchange with Rind on the issue of adaptation see: Kolbert, E., 2005. The climate of man—II (the second part of a three-part series of articles). *The New Yorker*. 2 May.

²²[A] measure of how much radiation, or light, is reflected from a body'. NASA, 2003. 'Recent warming of Arctic may affect worldwide climate'. 23 October. Available at: www.gsfc.nasa.gov/topstory/2003/1023esuice.html [accessed 30 May 2004].

The AP's headline: 'Scientists blame soot for global warming' (23 December 2003) was especially disingenuous considering that Hansen and Nazarenko clarified: '[S]oot contributions to climate change do not alter the conclusion that anthropogenic greenhouse gases have been the main cause of recent global warming and will be the predominant climate forcing in the future' (p. 423). Once again, the AP provided a perplexing exposition: '*Many* scientists believe the burning of fossil fuels is causing an increase in atmospheric [CO₂], triggering what is called the *greenhouse effect*. A higher concentration of CO₂ in the atmosphere would trap more of the sun's heat, possibly causing the Earth to warm' (emphasis added). With no mention of federal policies relating to greenhouse gas emissions, the AP asserted: 'The Bush administration in 2001 ordered pollution cuts from heavy-duty diesel engines and diesel fuel used in highway trucks and buses'. Notwithstanding the above, many of the newspapers improved upon the AP headline, for example: 'Soot linked to global warming' (*Philadelphia Inquirer*, 23 December 2003). The *Cincinnati Post* (23 December 2003), however, simply shortened the AP's deceptive headline to: 'Soot is warming cause'.

5.4. Controversial science

A number of articles in the cross-section included rhetoric from climate sceptics with known fossil fuel industry ties. The first in this set, item 4, was exclusively an AP story, picked up by six newspapers, based on findings published in *Nature* that detected an influence by anthropogenic greenhouse gases and sulphate aerosols on sea-level pressure. The AP article 'Study suggests greenhouse gases affect atmospheric pressure' (19 March 2003) opened by explaining that 'greenhouse gas increases already blamed for global warming also may be shifting wind and rainfall patterns ...'. The AP then quoted study leader Gillett: 'There is a detectable human influence [upon air pressure and weather patterns via greenhouse gas production], and it is an appreciable effect'. The AP also quoted Jim Hurrell of the National Center for Atmospheric Research (NCAR), who observed that this study 'offers the first major statistical evidence of greenhouse gas influence on atmospheric pressure.... With a change or trend like this you can rule out that it's some sort of random variable'. But then the AP invoked bias through balance by including comments from 'another climate expert' George Taylor, Oregon State University researcher and state climatologist, who discounted the study as speculative, and proposed natural variability as the probable cause. Regrettably, the AP had not provided all pertinent details of Taylor's background²³; he is a board member of the Center for the Study of Carbon Dioxide and Global Change.²⁴ The website for this group claims:

²³The website www.exxonsecrets.org was the original source for some of the background on climate sceptics discussed in this paper.

²⁴www.co2science.org [Accessed 28 December 2004]. Reference this group, see also: Beder (1999); Gelbspan (2004); Mooney (2005a).

Atmospheric CO₂ enrichment brings growth and prosperity to man and nature alike.... [T]here is much more real-world evidence for the encouraging scenario we paint here than for the doom-and-gloom predictions of apocalypse that are preached by those who blindly follow the manifestly less-than-adequate prognostications of imperfect climate models.

In 2003 Taylor's group received US\$40,000 from ExxonMobil.²⁵ Taylor, in one non-peer-reviewed article, wrote: 'I believe that the human contribution to climate change is a great deal smaller than natural variations'.²⁶ In another non-refereed work titled 'Science wake-up call: there's more hype than truth', Taylor wrote: '[E]xtreme [weather] events are becoming LESS common.... The warmest decade in the last 100 years in the US was the 1930s; the warmest year was 1934'.²⁷ And in a lengthy essay, Taylor criticised the intergovernmental ACIA report. Although Taylor had not thoroughly read this paper, based on his review it 'appear[ed] to be guilty of selective use of data' and was essentially 'bad science'.²⁸ Not surprisingly, Senator Inhofe has cited Taylor while contributing to the 'bad science' package.²⁹

Another known climate contrarian who appeared several times within the cross-section of articles is John Christy of the University of Alabama in Huntsville. National Public Radio (NPR) has reported that Senator Inhofe's proclamation that global warming is a hoax was based in part on the work of Christy (Harris, 2004). According to the website of the conservative Independent Institute, Christy (2003) is on this group's panel on global warming. A press release (28 July 2003) from this organisation stated that a report based on the research of Christy and others, which appears to be non-peer-reviewed, included findings that satellite data show 'significantly less [warming] than forecast by climate models that are based on bad science' and governmental bias is traceable to 'a Clinton [a]dministration product that was based on bad science'.³⁰ According to corporate records, ExxonMobil contributed

²⁵2003 ExxonMobil Contributions Report. Available at: www.exxonmobil.com/corporate/Citizenship/Corp_citizenship_Com_contributions.asp [accessed 28 December 2004].

²⁶Weather matters. (20 August 2000). Available at Oregon Climate Service website: http://www.ocs.orst.edu/reports/wm/wm_000820.html [accessed 11 January 2005].

²⁷(May 2004) Available at the National Association of Manufacturers (NAM) website: www.nam.org [accessed 11 January 2005]. Reference the NAM, see also Beder (1999) and Mooney (2005a).

²⁸What's going on with the Arctic? (22 November 2004) Available at Tech Central Station website: www2.techcentralstation.com/112204A.html [accessed 11 January 2005]. Reference Tech Central Station, see also Mooney (2005a,b).

²⁹2005. Climate Change Update, Senate Floor Statement. 4 January. Available at: <http://www.inhofe.senate.gov/pressreleases/climateupdate.htm> [last accessed 26 March 2005].

³⁰Nation's leading global warming experts unveil new findings on climate change: groundbreaking new research shows political influence at [the Environmental Protection Agency] EPA'. Available at: www.independent.org/newsroom/news_detail.asp?newsID=19 [accessed 6 February 2005].

US\$10,000 to the Independent Institute in 2002 and US\$10,000 in 2003.³¹

In 2002 Christy contributed a chapter, ‘The global warming fiasco’, to *Global Warming and Other Eco-Myths: How the Environmental Movement Uses False Science to Scare Us to Death*.³² This book was a project of the conservative think-tank Competitive Enterprise Institute (CEI),³³ which has also received financial contributions from ExxonMobil (US\$405,000 in 2002; US\$465,000 in 2003; and US\$270,000 in 2004).³⁴ Christy, in written testimony before a US House Committee (2003), has argued: ‘[N]umerous studies indicate the present biosphere is being invigorated by the human-induced rise of CO₂... [T]he increasing concentration of CO₂ does not pose a toxic risk to the planet... CO₂ is not a pollutant’.

Christy, identified as a ‘long-time’ climate sceptic by Gelbspan (2004, p. 48), is the leader of a study, which appears to be unpublished at this time, concerning rising night-time temperatures in the San Joaquin Valley of California (item 7). The AP covered this research with an article headlined ‘Irrigation blamed for warming San Joaquin’ (15 April 2003) that was carried by two publications. Christy, quoted by the AP, postulated: ‘One of the big issues right now is human-induced climate change from [CO₂]. Actually, it appears temperature change in the valley could be due to a different human factor, and that is irrigation’.

Christy was consulted by the *New York Times* for their (non-item) article ‘Pollution blamed for thinner air at edge of the atmosphere’ (10 February 2004), based on a study published in the *Journal of Geophysical Research*.³⁵ The ubiquitous term *pollution* is fallacious as researchers, Emmert et al. (p. 1), had implicitly referred to ‘increasing concentrations of *anthropogenic greenhouse gases*,

especially CO₂’ (emphasis added).³⁶ Emmert’s team detected that the increase in greenhouse gases could affect the thermosphere and near-Earth satellites. The *Times* article cited Emmert as explaining: ‘The findings provide some of the clearest evidence that emissions of [CO₂] and other ... greenhouse gases can significantly change the dynamics and even the dimensions of the atmosphere. We’re impacting the environment all the way out to space’. Christy was first quoted in relation to composition of gases but the article concluded with an incongruous remark from Christy: ‘Near the surface, the influences driving temperature shifts are far harder to discern’.

Christy and Roy Spencer have published studies in which they analysed data from polar-orbiting National Oceanic and Atmospheric Administration (NOAA) weather satellites (microwave sounding unit [MSU] data) in order to extract temperature records. Christy and Spencer had detected little or no warming of the troposphere. A re-analysis of this satellite data by Mears et al. (Remote Sensing Systems, or RSS) published in the *Journal of Climate* detected significantly more tropospheric warming (which is closer to climate models). Four newspapers reported on this re-analysis (item 25). Although the lead of a *New York Times* (18 November 2003) article began: ‘One of the last gaps ... to a human cause for global warming appears to be closing’, the *Times* once again quoted Christy: ‘We’ve had enough years of this human-induced forcing to get some boundaries on it, and it’s just not going in the dramatic and catastrophic direction’.

A study comparing the Christy/Spencer MSU data set with that of Mears et al. (RSS) was published in *Science* by Santer et al. (item 9).³⁷ This comparative analysis was published prior to the RSS re-analysis and, therefore, newspaper reports (five total) of the Santer et al. paper appeared prior to the RSS press coverage. According to Santer et al. (p. 1280):

On the basis of [the Christy/Spencer] records, it has been argued that the troposphere has not warmed over the satellite era [since 1979], thus casting doubt on the usefulness of climate models (which predict that anthropogenic warming should have occurred), the reliability of thermometer-based observations of surface warming, and the reality of human-induced climate change.

A Scripps Howard (1 May 2003) article on the Santer et al. work included a misguided statement: ‘Until recently, only a research team led by [Christy and Spencer] had worked with the [MSU] data to produce temperature records’. In fact, Prabhakara et al. had published several

³¹2002 ExxonMobil Public Information and Policy Research Report. Available at: www.exxonmobil.com/corporate/files/corporate/public_policy1.pdf [accessed 6 February 2005]. ExxonMobil 2003 Contributions Report (Public Information and Policy Research). Available at: www.exxonmobil.com/corporate/Citizenship/Corp_citizenship_Com_contributions.asp [accessed 6 February 2005].

³²Publisher: Prima, Roseville, CA.

³³According to Rampton and Stauber (2001), the CEI has been backed by major oil companies; funders have included: the American Petroleum Institute, Amoco, the ARCO Foundation, Ford Motor Co., General Motors, and the Texaco Foundation. McCright and Dunlap (2000) reviewed the literature of the CEI. Reference the CEI, see also: Gelbspan (1998, 2004); Beder (1999); Mooney (2005a,b); Austin and Phoenix (2005).

³⁴2002 ExxonMobil Public Information and Policy Research Report. Available at: www.exxonmobil.com/corporate/files/corporate/public_policy1.pdf [accessed 28 December 2004]. ExxonMobil 2003 Contributions Report. Available at: www.exxonmobil.com/corporate/Citizenship/Corp_citizenship_Com_contributions.asp [accessed 28 December 2004]. ExxonMobil Corporation 2004 Worldwide Contributions and Community Investments (Public Information and Policy Research). Available at: www.exxonmobil.com/corporate/files/corporate/giving04_publicpolicy.pdf [accessed 18 July 2005].

³⁵Emmert, J., Picone, J., Lean, J., Knowles, S., 2004. Global change in the thermosphere: compelling evidence of a secular decrease in density. *Journal of Geophysical Research* 109, A02301, doi:10.1029/2003JA010176.

³⁶Nissani (1999) had found equivocal usage of the term ‘pollution’ by the *Washington Post*.

³⁷I am indebted to Qiang Fu for his insight into the nuances of this area of research.

papers relating to this data.³⁸ Mears et al. (RSS) had stated in their abstract (p. 3650):

Results presented herein show a global trend of 0.097 ± 0.020 K decade⁻¹, generally agreeing with the work of Prabhakara et al. but in disagreement with the MSU analysis of Christy and Spencer, which shows significantly less (~ 0.09 K decade⁻¹) warming. (Emphasis added.)³⁹

Although Scripps Howard did not attempt to balance their coverage with a sceptical rebuttal, four of the five newspapers reporting the Santer et al. work included remarks from Christy. The *Press Democrat* of Santa Rosa, Calif., used the headline '[Santa Rosa] firm quietly fuels global-warming debate' (12 June 2003). The *Press* also inaccurately stated that the Christy/Spencer work had been, for a decade, 'the only research available'. According to the *Press*, Christy contends that his prior work indicates 'global warming is a natural Earth cycle'. The *Press* noted: 'Christy questioned the accuracy of the [RSS] data.... The *Press* also mentioned that the RSS study 'has its critics on some Internet message boards, some even suggesting the data is made up'. It is noteworthy that a 1996 *New York Times* article included the following admission by Christy: '[E]ven the rate of warming measured from the satellites has begun to move into the range scientists expect to result from human-caused warming'.⁴⁰

Now moving to the last case in this analysis, item 30 involved reports by two weather agencies, the UN's World Meteorological Organisation (WMO)⁴¹ and the NOAA's National Climatic Data Center (NCDC), which had determined that 2003 was the third warmest year worldwide on record. A later release by the NCDC reported that 2003 tied with 2002 for the world's second hottest year.⁴² An AP reporter (17 December 2003) commented: '[According to the WMO] warmer weather could not be attributed

to any one cause but was part of a trend that global warming was likely to prolong'. Cox (16 December 2003) and Scripps Howard (16 December 2003) covered this news as well. Between mid-December 2003 and mid-January 2004 there were 42 newspaper articles covering these climate reports—the largest number in this study. Within the AP story, no space was allotted to climate sceptics; however, the same cannot be said for the Cox and Scripps Howard articles. Cox stated that Spencer and Christy 'continue to question whether global warming is a serious problem', with Christy adding: 'Human life and the environment are threatened more by air and water pollution, and by habitat destruction than they are by a climate that is changing this slowly'.

After a synopsis of the topic at hand, Scripps Howard mentioned an article published in *Science* by Thomas Karl and Kevin Trenberth,⁴³ whom Scripps Howard referred to as 'two of the government's top atmospheric scientists'. Scripps Howard reported that Karl and Trenberth had stated:

[T]here is no doubt that human activity is already having a measurable impact on global climate. [And that in their *Science* article, they] predicted that if current trends continue, the world would face the fastest rate of climate change in at least the past 10,000 years [which] could radically change existing weather patterns, including more frequent heat waves, droughts, floods and extreme storms.

Incredibly, Scripps Howard concluded the article by giving equal space to the CEI:

Myron Ebell,⁴⁴ a global-warming expert with the industry-funded [CEI], said the Karl-Trenberth analysis is nothing new—it's just kind of a summary of what the establishment thinks is true. [According to Ebell] the warming of recent decades is not surprising since the planet had been in a 'little ice age' until the early 19th century ... It isn't much to worry about.

The press coverage of Ebell's views has not been limited to the US. A recent article relating to climate sceptics in the

³⁸Prabhakara, C., Nucciarone, J., Yoo, J., 1995. Examination of 'global atmospheric temperature monitoring with satellite microwave measurements': 1) theoretical considerations. *Climatic Change* 30, 349–366; Prabhakara, C., Iacovazzi, R., Yoo, J., Dalu, G., 1998. Global warming deduced from MSU. *Geophysical Research Letters* 25(11), 1927–1930; Prabhakara, C., Iacovazzi, R., Yoo, J., Dalu, G., 2000. Global warming: evidence from satellite observations. *Geophysical Research Letters* 27(21), 3517–3520.

³⁹Reference the disagreement with MSU findings of Spencer and Christy, see also: Fu, Q., Johanson, C., Warren, S., Seidel, D., 2004. Contribution of stratospheric cooling to satellite-inferred tropospheric temperature trends. *Nature* 429, 55–58; Fu, Q., Johanson, C., 2004. Stratospheric influences on MSU-derived tropospheric temperature trends: a direct error analysis. *Journal of Climate* 17, 4636–4640; Fu, Q., Johanson, C., 2005. Satellite-derived vertical dependence of tropical tropospheric temperature trends. *Geophysical Research Letters* 32, L10703, doi:10.1029/2004GL022266; Hurlley, S., Szuromi, P., (Eds.) 2005. This week in Science: Lapse in understanding. *Science* 309, 1453.

⁴⁰Stevens, W., 1996. '95 is hottest year on record as the global trend resumes'. *New York Times*, 4 January, p. A1.

⁴¹Compiled by the Met Office and the University of East Anglia.

⁴²Climate of 2003, 2003 in historical perspective, major highlights. (15 January 2004) Available at: <http://www.ncdc.noaa.gov/oa/climate/research/2003/ann/ann03.html> [accessed January 11, 2005].

⁴³2003. Modern global climate change. *Science* 302, 1719–1723.

⁴⁴Myron Ebell is also the 'group leader' of the Cooler Heads Coalition (CHC). The CEI and The Independent Institute are members of the CHC. The website for the CHC is designed and maintained by Consumer Alert; writings of John Christy appear on this website. Available at: www.globalwarming.org/article.php?uid=562 [accessed 2 March 2005]. Consumer Alert received US\$10,000 from ExxonMobil in 2002, US\$15,000 in 2003, and US\$25,000 in 2004. 2002 ExxonMobil Public Information and Policy Research Report. Available at: www.exxonmobil.com/corporate/files/corporate/public_policy1.pdf [accessed 2 March 2005]. ExxonMobil 2003 Contributions Report. Available at: www.exxonmobil.com/corporate/Citizenship/Corp_citizenship_Com_contributions.asp [accessed 2 March, 2005]. ExxonMobil Corporation 2004 Worldwide Contributions and Community Investments (Public Information and Policy Research). Available at: www.exxonmobil.com/corporate/files/corporate/giving04_publicpolicy.pdf [accessed 18 July 2005]. Reference Ebell and the CHC, see also Mooney (2005a). Reference Consumer Alert, see also: Leggett, J. (2001); Rampton and Stauber (2001); Austin and Phoenix (2005).

Independent (UK) reported that on BBC Radio 4 Ebell declared that Sir David King, chief scientific advisor to the government of the United Kingdom,⁴⁵ ‘is an alarmist with ridiculous views who knows nothing about climate change’ (Connor, 17 January 2005).

6. Conclusions

Historically, the wire services have played a vital role in US newspaper reporting. Starr (2004, p. 186) found that the AP, a monopoly wire service during the second half of the nineteenth century, wielded extraordinary influence as ‘[i]n a sense, it was the first institution in America capable of “broadcasting” national news’. The results of this study indicate that the collective newswire/news service community is not only an essential but a dominant source of climate science news. Although the science of climate change does not appear to be a prime news topic for most of the 255 newspapers included in this study, there were numerous examples of frames constructed as valid science. Nonetheless, articles that framed climate change in terms of debate, controversy, or uncertainty were plentiful. Not only were there many examples of journalistic balance that led to bias, but some of the news outlets repeatedly used climate sceptics—with known fossil fuel industry ties—as primary definers. Worse yet, in some instances, such articles originated from wire or news service providers (including newspapers that provide such services or are affiliated with news service agencies)—which caused the exponential spread of misinformation.

For years, sceptics have referred to mainstream scientists as *alarmists* and to mainstream science as *junk science* (or similar terms). The above instances of the *bad science* concept should be appreciated as a fundamental tool used by sceptics in their construction of climate change as a controversial issue. This study has shown that by enlisting the media, climate sceptics continue their ‘very cynical and deeply interested campaign to discredit the science of climate change’ (Demeritt, 2001, p. 328) and that these efforts are facilitated by professional journalism practices employed by both newspapers and wire services.

The attack on climate science, observed Pollack (2003), replicates previous assaults on science, such as by the pesticide industry (DDT), coal-burning electric utilities (acid rain), and the chemical industry (effect of CFCs⁴⁶ on stratospheric ozone). Furthermore, Nissani (1999, p. 37) stressed that the ‘phoney’ controversy surrounding anthropogenic climate change has been preceded by controversies on such issues as slavery, child labour, and civil rights. There have always been experts willing to back up a ‘profitably mistaken viewpoint’; there have always been efforts ‘to cover the issue in a thick fog of sophistry and

uncertainty’ and to ‘unearth yet one more reason why the status quo is best for us’ (Nissani, 1999, p. 37–38).

The results of this study reflect a need for further exploration of current newsroom dynamics and protocols involved in the selection, de-selection, sourcing, and framing of climate science news. Such investigation should take into account observations by researchers, as far back as Breed (1955), who examined the social forces within the newsroom that support conformity to unwritten news policy. It would also be useful to examine the prominence of climate science within the newspaper format, such as to quantify how many such articles appear on the front pages of US newspapers.

This study builds upon a growing literature that substantiates the media-created obstructions that prevent a more extensive understanding of climate change by the public and policy-makers. As Wilson (2000a) maintains, public confusion is exacerbated by reporters who misunderstand the basic scientific principles of climate change. It is disturbing that Wilson (2000a) found newspapers to be the ascendant source of knowledge on climate change for reporters themselves; interviews with scientists and the use of science journals were distant second and third sources, respectively. The above frame analysis indicates that this educational impediment remains.

In conclusion, it should be noted that 20 of the 32 items were based on scientific research that had been published in refereed journals, and this raises one last issue to consider. Media attention granted to the non-peer-reviewed comments of climate sceptics disregards the fact that if one disagrees with a certain study, one may attempt to publish their dissenting analysis within the forum of peer-reviewed literature. I recognise that there may be studies published in refereed journals that contradict the scientific research reported in the above cross-section. Notwithstanding, the above analysis highlighted a number of articles reflecting frames constructed with rhetoric of the sceptical counter-movement. These press reports perpetuate the myth of a lack of international scientific consensus on anthropogenic climate change—and thereby succeed in maintaining public confusion.

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References

- Allan, S., 2002. *Media, Risk and Science*. Open University Press, Buckingham.
- Allan, S., Adam, B., Carter, C. (Eds.), 2000. *Environmental Risks and the Media*. Routledge, London.
- Austin, A., Phoenix, L., 2005. Beyond the Texas oil patch: the political ascendancy of anti-environmentalism. In: Hamm, B. (Ed.), *Devastating Society: The Neo-Conservative Assault on Democracy and Justice*. Pluto Press, London, pp. 163–182.
- Bagdikian, B., 2004. *The New Media Monopoly*. Beacon Press, Boston.

⁴⁵See King, D., 2004. Climate change science: adapt, mitigate, or ignore? *Science* 303, 176–177.

⁴⁶Chlorofluorocarbons.

- Baldwin, W., Beach, B., 1940. McKesson & Robbins: a study in confidence. *The Public Opinion Quarterly* 4 (2), 305–310.
- Barnes, T., 2003. Definition of social construction. In: Johnston, R., Gregory, D., Pratt, G., Watts, M. (Eds.), *The Dictionary of Human Geography*, fourth ed. Blackwell, Oxford, pp. 747–748.
- Beck, U., 1995. *Ecological Enlightenment: Essays on the Politics of the Risk Society*, tr. Mark Ritter. Humanities Press, Atlantic Highlands, NJ.
- Beder, S., 1999. Corporate hijacking of the greenhouse debate. *The Ecologist* March/April, 119–122.
- Bell, A., 1991a. Hot air: media, miscommunication and the climate change issue. In: Coupland, N., Giles, H., Wiemann, J. (Eds.), “Miscommunication” and Problematic Talk. Sage, Newbury Park, CA, pp. 259–282.
- Bell, A., 1991b. *The Language of News Media*. Blackwell, Oxford.
- Bell, A., 1994a. Media (mis)communication on the science of climate change. *Public Understanding of Science* 3, 259–275.
- Bell, A., 1994b. Climate of opinion: public and media discourse on the global environment. *Discourse & Society* 5 (1), 33–64.
- Bennett, W.L., 2005. *News: The Politics of Illusion*, sixth ed. Pearson Longman, New York.
- Blyskal, J., Blyskal, M., 1985. PR: How the Public Relations Industry Writes the News. Wm. Morrow, New York.
- Boykoff, M., Boykoff, J., 2004. Balance as bias: global warming and the US prestige press. *Global Environmental Change* 14 (2), 125–136.
- Breed, W., 1955. Social control in the newsroom: a functional analysis. *Social Forces* 33 (4), 326–335.
- Carvalho, A., 2005. Representing the politics of the greenhouse effect: discursive strategies in the British media. *Critical Discourse Studies* 2 (1), 1–29.
- Chomsky, N., 1989. *Necessary Illusions: Thought Control in Democratic Societies*. South End Press, Boston.
- Chomsky, N., 1997. What makes mainstream media mainstream: from a talk at Z Media Institute, June 1997. *Z Magazine* (October) 10 (10), 17–23.
- Chomsky, N., 2002. *Media Control: The Spectacular Achievements of Propaganda*, second ed. Seven Stories Press, New York.
- Christy, J., 2003. John R. Christy, Written Testimony. US House Committee on Resources; Kyoto Global Warming Treaty’s Impact on Ohio’s Coal Dependent Communities. 13 May. Available at: <http://resourcescommittee.house.gov/archives/108/testimony/johnchristy.htm> [accessed 19 January 2005].
- Connor, S., 2005. ‘Americans are trying to discredit me, claims chief scientist’. *Independent*, 17 January, p. 8.
- Corbett, J., Durfee, J., 2004. Testing public (un)certainty of science: media representations of global warming. *Science Communication* 26 (2), 129–151.
- Davis, A., 2000. Public relations, news production and changing patterns of source access in the British national media. *Media, Culture & Society* 22, 39–59.
- Demeritt, D., 2001. The construction of global warming and the politics of science. *Annals of the Association of American Geographers* 91 (2), 307–337.
- Demeritt, D., 2002. What is the ‘social construction of nature’? A typology and sympathetic critique. *Progress in Human Geography* 26 (6), 767–790.
- Dispensa, J., Brulle, R., 2003. Media’s social construction of environmental issues: focus on global warming—a comparative study. *The International Journal of Sociology and Social Policy* 23 (10), 74–105.
- Dunwoody, S., Peters, H., 1992. Mass media coverage of technological and environmental risks: a survey of research in the United States and Germany. *Public Understanding of Science* 1 (2), 199–230.
- Einsiedel, E., 1992. Framing science and technology in the Canadian press. *Public Understanding of Science* 1 (1), 89–101.
- Entman, R., 1991. Framing US coverage of international news: contrasts in narratives of the KAL and Iran Air incidents. *Journal of Communication* 41 (4), 6–27.
- Entman, R., 1993. Framing: toward clarification of a fractured paradigm. *Journal of Communication* 43 (4), 51–58.
- Entman, R., 2004. *Projections of Power: Framing News, Public Opinion, and US Foreign Policy*. University of Chicago Press, Chicago.
- Friedman, S., Dunwoody, S., Rogers, C. (Eds.), 1986. *Scientists and Journalists: Reporting Science as News*. Free Press, New York.
- Friedman, S., Villamil, K., Suriano, R., Egolf, B., 1996. Alar and apples: newspapers, risk and media responsibility. *Public Understanding of Science* 5 (1), 1–20.
- Friedman, S., Dunwoody, S., Rogers, C. (Eds.), 1999. *Communicating Uncertainty: Media Coverage of New and Controversial Science*. Lawrence Erlbaum Associates, Mahwah, N.J.
- Friel, H., 2005. All George W’s men. *The Ecologist* 35 (6), 50–54.
- Galtung, J., Ruge, M., 1973. Structuring and selecting news. In: Cohen, S., Young, J. (Eds.), *The Manufacture of News: Social Problems, Deviance, and the Mass Media*. Constable, London, pp. 62–72.
- Gamson, W., 1981. The political culture of Arab–Israeli conflict. *Conflict Management and Peace Science* 5 (2), 79–93.
- Gamson, W., Modigliani, A., 1989. Media discourse and public opinion on nuclear power: a constructionist approach. *The American Journal of Sociology* 95 (1), 1–37.
- Gans, H., 1979. *Deciding What’s News: A Study of CBS Evening News, NBC Nightly News, Newsweek, and Time*. Pantheon, New York.
- Gelbspan, R., 1998. *The Heat is On: The Climate Crisis; the Cover-Up; the Prescription*, updated ed. Perseus Books, Cambridge, MA.
- Gelbspan, R., 2004. *Boiling Point: How Politicians, Big Oil and Coal, Journalists, and Activists have Fueled the Climate Crisis—and What We Can Do to Avert Disaster*. Basic Books, New York.
- Gelbspan, R., 2005. Snowed. *Mother Jones* (June), 42–43.
- Goffman, E., 1974. *Frame Analysis: An Essay on the Organization of Experience*. Harvard University Press, Cambridge, MA.
- Goodman, A., Goodman, D., 2004. *The Exception to the Rulers: Exposing Oily Politicians, War Profiteers, and the Media that Love Them*. Hyperion, New York.
- Gregory, J., Miller, S., 1998. *Science in Public: Communication, Culture, and Credibility*. Perseus, Cambridge, MA.
- Hacking, I., 1999. *The Social Construction of What?* Harvard University Press, Cambridge, MA.
- Hall, S., Critcher, C., Jefferson, T., Clarke, J., Roberts, B., 1978. *Policing the Crisis: Mugging, the State, and Law and Order*. Macmillan, London.
- Hansen, A., 1993. Introduction. In: Hansen, A. (Ed.), *The Mass Media and Environmental Issues*. Leicester University Press, Leicester, pp. xv–xxii.
- Hansen, A., 1994. Journalistic practices and science reporting in the British Press. *Public Understanding of Science* 3 (2), 111–134.
- Hargreaves, I., Lewis, J., Speers, T., 2003. *Towards a better map: science, the public and the media*. Economic and Social Research Council (ESRC), Swindon, UK. Available at: <http://www.esrc.ac.uk/esrccontent/DownloadDocs/Mapdocfinal.pdf> [last accessed 13 March 2005].
- Harris, R., 2004. Three views on global warming: research, and life experiences, put scientists at odds. Morning Edition, National Public Radio. 14 May. Transcript available at: <http://www.npr.org/templates/story/story.php?storyId=1893089> [accessed 30 January, 2005].
- Henderson-Sellers, A., 1998a. Communicating science ethically: is the “balance” achievable? *Annals of the Association of American Geographers* 88 (2), 301–307.
- Henderson-Sellers, A., 1998b. Climate whispers: media communication about climate change. *Climatic Change* 40, 421–456.
- Herman, E., Chomsky, N., 1988. *Manufacturing Consent: The Political Economy of the Mass Media*. Pantheon Books, New York.
- Inhofe, J., 2004. The science of climate change. *Congressional Record* 11 October, S11291–S11297.
- Intergovernmental Panel on Climate Change (IPCC), 2001. *Climate Change 2001: Working Group I: The Scientific Basis*. (Preface). Cambridge University Press, Cambridge.
- Krieghbaum, H., 1967. *Science and the Mass Media*. New York University Press, New York.

- Lahsen, M., 2005. Technocracy, democracy, and US climate politics: the need for demarcations. *Science, Technology, & Human Values* 30 (1), 137–169.
- Lakoff, G., 2002. *Moral Politics: How Liberals and Conservatives Think*, second ed. University of Chicago Press, Chicago.
- Leggett, J., 2001. *The Carbon War: Global Warming and the End of the Oil Era*. Routledge, London.
- Lewenstein, B., 1995. Science and the media. In: Jasanoff, S., Markle, G., Petersen, J., Pinch, T. (Eds.), *Handbook of Science and Technology Studies*. Sage, London, pp. 343–360.
- Major, A., Atwood, L., 2004. Environmental risks in the news: issues, sources, problems, and values. *Public Understanding of Science* 13, 295–308.
- Manheim, J., Albritton, R., 1984. Changing national images: international public relations and media agenda setting. *The American Political Science Review* 78 (3), 641–657.
- Mazur, A., 1998. Global environmental change in the news 1987–1990 vs 1992–1996. *International Sociology* 13 (4), 457–472.
- Mazur, A., Lee, J., 1993. Sounding the global alarm: environmental issues in the US national news. *Social Studies of Science* 23 (4), 681–720.
- McChesney, R., 1998. This communication revolution is brought to you by US media at the dawn of the 21st century. In: Phillips, P., Project Censored (Eds.), *Censored 1998: The News that Didn't Make the News—The Year's Top 25 Censored Stories*. Seven Stories Press, New York, pp. 95–108.
- McChesney, R., 1999. *Rich Media, Poor Democracy: Communication Politics in Dubious Times*. The New Press, New York.
- McChesney, R., 2004. *The Problem of the Media: US Communication Politics in the 21st Century*. Monthly Review Press, New York.
- McChesney, R., Newman, R., Scott, B. (Eds.), 2005. *The Future of Media: Resistance and Reform in the 21st Century*. Seven Stories Press, New York.
- McComas, K., Shanahan, J., 1999. Telling stories about global climate change: measuring the impact of narratives on issue cycles. *Communication Research* 26 (1), 30–57.
- McCright, A., Dunlap, R., 2000. Challenging global warming as a social problem: an analysis of the conservative movement's counter-claims. *Social Problems* 47 (4), 499–522.
- McKibben, W., 2005. Introduction to a special report on global warming, big money, junk science, and the climate of denial. *Mother Jones* (June), 34–35.
- McManus, P., 2000. Beyond Kyoto? Media representation of an environmental issue. *Australian Geographical Studies* 38 (3), 306–319.
- Mooney, C., 2005a. Some like it hot. *Mother Jones* (June), 36–49.
- Mooney, C., 2005b. *The Republican War on Science*. Basic Books, New York.
- Mormont, M., Dasnoy, C., 1995. Source strategies and the mediatization of climate change. *Media, Culture & Society* 17, 49–64.
- Nelkin, D., 1995. *Selling Science: How the Press Covers Science and Technology*, revised ed. W.H. Freeman, New York.
- Nelson, J., 1989. *Sultans of Sleaze: Public Relations and the Media. Between the Lines*, Toronto.
- Nissani, M., 1999. Media coverage of the greenhouse effect. *Population and Environment: A Journal of Interdisciplinary Studies* 21 (1), 27–43.
- Oreskes, N., 2004. Beyond the ivory tower: the scientific consensus on climate change. *Science* 306, 1686.
- Pan, Z., Kosicki, G., 1993. Framing analysis: an approach to news discourse. *Political Communication* 10, 55–75.
- Pellechia, M., 1997. Trends in science coverage: a content analysis of three US newspapers. *Public Understanding of Science* 6, 49–68.
- Pielke, R., 1998. Rethinking the role of adaptation in climate policy. *Global Environmental Change* 8 (2), 159–170.
- Pielke, R., 2004. What is climate change? *Issues in Science and Technology* (Summer), 1–4.
- PIPA/Knowledge Networks Poll: Americans on Climate Change: 2005, 2005. 5 July. Available at: http://www.pipa.org/OnlineReports/ClimateChange/Report07_05_05.pdf [accessed 10 July 2005].
- Pollack, H., 2003. *Uncertain Science ... Uncertain World*. Cambridge University Press, Cambridge.
- Rampton, S., Stauber, J., 2001. *Trust Us, We're Experts! How Industry Manipulates Science and Gambles with Your Future*. Tarcher/Putnam, New York.
- Sachsman, D., Simon, J., Valenti, J., 2004. Risk and the environment reporters: a four-region analysis. *Public Understanding of Science* 13, 399–416.
- Schneider, S., 1990. Cooling it. *World Monitor* (July), 30–38.
- Starr, P., 2004. *The Creation of the Media: Political Origins of Modern Communications*. Basic Books, New York.
- Stauber, J., Rampton, S., 1995. *Toxic Sludge is Good for You: Lies, Damn Lies and the Public Relations Industry*. Common Courage Press, Monroe, ME.
- Taylor, N., Nathan, S., 2002. How science contributes to environmental reporting in British newspapers: a case study of the reporting of global warming and climate change. *The Environmentalist* 22, 325–331.
- Trumbo, C., 1996. Constructing climate change: claims and frames in US news coverage of an environmental issue. *Public Understanding of Science* 5, 269–283.
- Tuchman, G., 1978. *Making News: A Study in the Construction of Reality*. Free Press, New York.
- Ungar, S., 1998. Bringing the issue back in: comparing the marketability of the ozone hole and global warming. *Social Problems* 45 (4), 510–527.
- 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.
- Wilkins, L., 1993. Between facts and values: print media coverage of the greenhouse effect, 1987–1990. *Public Understanding of Science* 2, 71–84.
- Wilkins, L., Patterson, P., 1987. Risk analysis and the construction of news. *Journal of Communication* 37 (3), 80–92.
- Wilkins, L., Patterson, P., 1991. Science as symbol: the media chills the greenhouse effect. In: Wilkins, L., Patterson, P. (Eds.), *Risky Business: Communicating Issues of Science, Risk, and Public Policy*. Greenwood Press, Westport, CT, pp. 159–176.
- Wilson, K., 1995. Mass media as sources of global warming knowledge. *Mass Communication Review* 22 (1 and 2), 75–89.
- Wilson, K., 2000a. Drought, debate, and uncertainty: measuring reporters' knowledge and ignorance about climate change. *Public Understanding of Science* 9, 1–13.
- Wilson, K., 2000b. Communicating climate change through the media: predictions, politics and perceptions of risk. In: Allan, S., Adam, B., Carter, C. (Eds.), *Environmental Risks and the Media*. Routledge, London, pp. 201–217.
- Zehr, S., 2000. Public representations of scientific uncertainty about global climate change. *Public Understanding of Science* 9, 85–103.