

9. In search of certainty and applying uncertainty

I am not a scientist but it's always seemed to me that one of the strongest arguments about climate change is that ... if I were to say to you that there was a 60 per cent chance your house might burn down, you would take some insurance.

British Prime Minister David Cameron, speaking in the wake of typhoon and tidal surge Hainan that killed thousands in the Philippines and flooded Vietnam ('British PM's warning on climate', *Canberra Times*, 17 November 2013)

When advising politicians, the scientific community has devoted considerable attention to uncertainties, and has sought to adopt a position of 'objective neutrality' that has allowed advocacy groups with vested interests to dominate the advice on options for policy response.

H. Hengeveld, '1994–95 in review: an assessment of new developments relevant to the science of climate change', *Climate Change Newsletter* (DPIE and BRS) 1997

There is ample evidence that scientists, journalists and policymakers expressed 'certainty' in the early 1990s about how humans are warming the planet by producing excess greenhouse gases with industrial and consumer activities. This was a key driver of the political and public understanding exhibited between 1987 and 1992.

The evidence then shows that the language of scientific certainty not only changed, but that uncertainty was also deliberately constructed to throw doubt on the scientific conclusions. In the 1990s this occurred in all the Western, English-speaking democracies and globally to the extent that organisations like the corporate Global Climate Coalition and sympathetic news media had influence.

In the United States, where climate change discussions closely resembled those in Australia, atmospheric scientist James Hansen (who has spoken out about the risks of anthropogenic climate change over the course of two decades) addressed the US Congress in 1988 about the certainties. He said he was 99 per cent certain that global warming had begun, based on the series of warm years in the 1980s.

As reported by Robert M. White, then president of the US National Academy of Engineering, 'The public took notice. His opinion prompted Congress to

consider whether the prudent course was to move rapidly to *legislation* aimed at preserving the habitability of the planet from catastrophic consequences' (White 1990: 22). I emphasise legislation in this quote because it is indicative of the times, when regulation to lower public risk was not considered politically out of bounds.

In his comprehensive review of US climate change public communication up to mid-1990, White recounts that internationally, political leaders took action between 1988 and 1990 based on the certainty of scientists' language and also thanks to the widespread drought at the time, which greatly focused attention on the issue. White's historical account of the issues and influences in the early 1990s is more significant because his own reaction was caution about accepting the science, therefore he cannot be accused of being an activist for mitigating emissions. He writes that after the politicians got on board with the climate science, the counter-framing started and sceptics in the scientific community joined open debate in the pages of *Science* on the certainty and validity of climate science.

Discussion in the public arena at that time expressed no doubt that the energy economy of current civilisation was the issue, along with land and water use and the effects of population increase. While sympathetic to the sceptics, White had no quarrel with the concept of human agency, saying that this understanding has deep historical roots within science. He also describes intervention in the policy process by advocates of uncertainty in the form of sceptics Richard Lindzen and Frederick Seitz who, together with a long-range weather forecasting expert and several other scientists, wrote to President George H.W. Bush questioning the science and urging research rather than action: 'Thus the great climate debate had been joined' (White 1990: 22).

A 2004 study by US science historian Naomi Oreskes tested the argument that behind the conventional scientific language, couched in degrees of certainty or uncertainty, there is no published consensus on the occurrence of anthropogenic climate change. Oreskes showed this is not so.¹ She analysed 928 abstracts published in the refereed literature between 1993 and 2003, and listed in the ISI database with the keywords 'global climate change'. She found no disagreement and wrote:

Scientists publishing in the peer-reviewed literature agree with the IPCC, the National Academy of Sciences, and the public statements of their professional societies. ... Politicians, economists, journalists and others may have the impression of confusion, disagreement, or discord among climate scientists, but that impression is incorrect. (Oreskes 2004a: 1)

¹ Oreskes told a reporter she decided to test the consensus after her hairdresser said *she* wasn't worried about global warming because scientists 'don't know what's going on'.

Five years later, a survey published by Peter Doran and Maggie Zimmerman of Earth and Environmental Sciences at the University of Illinois came to a similar conclusion. They canvassed more than 10,000 earth scientists and received responses from 3,146. Of these, more than 97 per cent of the specialists on the subject (i.e., 'respondents who listed climate science as their area of expertise and who also have published more than 50% of their recent peer-reviewed papers on the subject of climate change') agreed that human activity is 'a significant contributing factor in changing mean global temperatures' (Doran & Zimmerman 2009: 23).

The researchers commented: 'It seems that the debate on the authenticity of global warming and the role played by human activity is largely nonexistent among those who understand the nuances and scientific basis of long-term climate processes'. Relevant to the disciplinary beliefs of some geologists and meteorologists (discussed in a previous chapter), they found that these two fields had the lowest 'yes' response to the question about whether human impact is changing mean global temperature (47 per cent and 64 per cent respectively, compared with 82 per cent for the group as a whole.)

The demand for unarguable 'proof' of climate change arises both from a misunderstanding of scientific conventions and the deliberate deployment of uncertainty by critics. Since environmental impacts often raise costs for some sectors that can influence the policy process, demanding proof of impacts has long been a convenient stalling mechanism.

Certainty and the Rachel Carson case

The historical record shows that no major scientific shifts in understanding on how the planet works (e.g., the once radical and contested evidence for continental drift or ice ages) have waited for absolute proof. More recent history shows the certainty debate about climate change bears a startling similarity in creating controversy to marine biologist Rachel Carson's seminal 1962 popular science book *Silent Spring*. But the political response at the time to Carson's work was also significantly different to the response I have outlined for climate change, and is worth noting as another way to look at the uncertainties of predicting environmental impacts.

Carson's work was about the effect of pesticides on biological systems, including humans. The book was the first to give the public insight into the potentially disastrous effects when synthetic chemicals enter the environment and about environmental pollution generally. At the time Carson was fiercely attacked (an onslaught that continues to this day on contrarian websites). Among other

things she was charged with engendering fear (therefore charged as being emotional and unscientific) about the consequences if humans continued down a reckless path *vis a vis* the natural environment (Oreskes 2004b).

For the scientists who attacked Carson and her work in the 1960s, doing good for humanity was a major theme. Carson's opposition came principally from industries that made or relied on environmental chemicals, including the food industry and their related scientists. Some had ties to the pesticide industry, but others had beliefs and values dedicated to a large and inexpensive food supply, which was challenged by Carson's work and ecological concerns.

Similarly, some of the more aggressive but persuasive arguments for demanding proof and certainty from climate change science have come from people committed to equity and 'progress' for developing societies through fossil fuel energy technologies. In Australia, the mental acrobatics between the desire to lower greenhouse gases while being the world's largest coal exporter is often justified by talk about helping China and other developing countries attain Western living standards—a value that often accompanies other, deeply held ideals like 'freedom' and democracy.

Carson's classic case highlights the difficulties that continue to face many environmental scientists dealing with complex and evolving systems in a scientific culture that is used to counting and measuring. Similarly to climate change research, and before that the decade of industry resistance to evidence about the hole in the ozone layer, Carson's work had measurable evidence lagging behind modelling and proxy data, leaving the door open to arguments about certainty and proof.

But on the political front and with regard to respecting risk, the Carson story is notably different from the contemporary response to climate change. Carson was supported by a 1962 President's Science Advisory Committee (PSAC) review (under President John F. Kennedy). The review was brief and easy to read and acknowledged the trade-offs of all human activities, but concluded on balance that more harm than good might be the long-term outcome of pesticides for plants and animals including humans.

PSAC never claimed that the hazards of persistent pesticides were 'proven', 'demonstrated', 'certain', or even well understood; they simply concluded that the available data were adequate to show that harms were occurring, warranting changes in the pattern of pesticide use. (Oreskes 2004b: 374)

The panel took seriously suggestions for alternative technologies, did not accuse Carson of hidden agendas, and did not use uncertainty as a justification for inaction. Perhaps most significantly, PSAC placed the burden of proof and

certainty not on the public interest scientists but on the emitters or polluters, in this case, those who argued that persistent pesticides were safe. The climate change analogy is that those who argue that humans are *not* having an impact would face the burden of proof.

How science-speak contributed to uncertainty and delay

During the 1990s and since, most specialist climate change scientists returned to the scientific conventions of cautious communication, often stressing uncertainties, after a brief period characterised by plain English communication with the public. Journalists were not the only ones to comment on this. It was noted as early as 1989 that there was a disjunct between scientific and public understanding of percentage uncertainties. Climatologist Ann Henderson-Sellers told a reporter:

There was a big furore in the USA during the past year when a scientist told a Senate enquiry, he was 99 per cent sure that the Greenhouse Effect was with us now. Unfortunately, a number of my colleagues disagreed with him because they're only 95 per cent sure, and the media had fun with that. Yet when I surveyed a number of people about what level of confidence they wanted from the scientific community—before they'd start planning for the future—the answer was 50 per cent. (McKenzie 1989: 34)

In 1997, Canadian researcher Henry Hengeveld examined the contribution of scientists' own style of communication in promoting the confused public discussion that had taken hold by the mid-1990s and has continued since. He reviewed 885 papers published on climate change in 1994–1995 and noted the effects on policy. A report on his work appeared in the federal government's *Climate Change Newsletter*. He wrote:

Although misinformation spread by self-interest groups is a factor, the scientific community has been ineffective in communicating its information and concerns in a manner useful and comprehensible to lay audiences. Furthermore, when advising politicians, the scientific community has devoted considerable attention to uncertainties, and has sought to adopt a position of 'objective neutrality' that has allowed advocacy groups with vested interests to dominate the advice on options for policy response. Some authors have suggested that scientists should take a more proactive role as policy advisors, while in Australia pretty well the opposite happened over the 1990s. (Hengeveld 1997: 21)

Melbourne *Age* journalist Geoff Strong has pondered why it has taken so long for the scientific messages about climate change to push through to real action. He decided that a problem is the scientific definitions of uncertainty/certainty, which sound like hedging to the general public and to their elected and often scientifically ignorant representatives. Strong has noted that he was reporting on the greenhouse phenomenon 20 years ago and that some scientists emphasised the uncertainties even then, and continued to do so during subsequent years. He says they wrote in terms like:

Well we are not 100 per cent certain but ... in science-speak, that means they could have been 95 to 99 per cent certain but were leaving the 1 per cent margin for error in case somebody ripped them apart in a scientific paper ... The world's greatest gamblers, the insurance industry, didn't need that level of certainty. It had been banking on scenarios being right since at least 1995. (Strong 2005: 1)²

CSIRO Division of Atmospheric Science former administrator and communicator Willem Bouma told Strong that, in hindsight, perhaps scientists should have worded their predictions differently and conveyed more certainty because two decades have since been lost. Strong commented: 'By appearing uncertain, they might have protected their backsides, but allowed a whole army of vested interest groups such as the fossil-fuel lobby and right-wing think tanks to attempt to lever apart the argument and create 20 years of delay' (Strong 2005: 2).

The evidence from government, business and other public documents, and several hundred popular news articles (see chapter 4) clearly shows that in contrast to the later science-speak, a certainty of language framed the discussion about climate change up till 1992. Further evidence can be drawn from the following examples from the language characterising the 1990 Intergovernmental Panel on Climate Change (IPCC) report, in comparison to later reports in the 1990s and since.

The 1990 IPCC report

The first, 1990, IPCC report has been all but forgotten in contemporary discussion of the IPCC assessments that are delivered to national governments every five to six years. Two things stand out from the 1990 report in comparison to the 1995 and 2001 reports, and compared with the knowledge of the 2007 reports. Firstly, the 1990 report confirms that the basic findings of science and impacts hardly

2 The quoted article by Strong found its way, via the internet, to a climate change blog—desmogblog.com ('we're here to clear the PR pollution that clouds the science on climate change'). The writer, Jim Hoggan, contrasts Strong's article to the US *Cape Cod Times* for 30 October 2005, which, he says, provides a perfect example of why climate change deniers are still in there with a fighting chance. The *Times* lauds a climatologist for perfect integrity 'the absolute insistence on total scientific certainty' (desmogblog.com 2005).

changed during the following decades. Secondly, the communications style and language were clear and definite—in marked contrast to later reports where the language was marked by uncertainty and, worse, reverted to disciplinary jargon and technical detail.

The 1990 report is characterised by a notable level of plain English. The scientific assessment report executive summary starts: [my emphasis in italics]

We are *certain* of the following:

There is a natural greenhouse effect which already keeps the Earth warmer than it would otherwise be.

Emissions *resulting from human activity* are substantially increasing the atmospheric concentrations of the greenhouse gases: carbon dioxide, methane, chlorofluorocarbons (CFCs) and nitrous oxide. These increases *will enhance the greenhouse effect*, resulting on average in an additional warming of the Earth's surface. The main greenhouse gas, water vapour, will increase in response to global warming *and further enhance it*.

We calculate *with confidence* that:

inter alia

[Impacts] Under a business as usual scenario a global mean temperature increase *of about 0.3 degrees C per decade* with an uncertainty range of 0.2–0.5 degrees C—this is greater than that seen over the past 10,000 years. With controls under different scenarios, the rates of increase could drop by 1/2 or 2/3.

The authors admit many *uncertainties in predictions* of timing, magnitude and regional patterns due to incomplete scientific factors such as sources and sinks, clouds, oceans polar ice sheets. (Houghton, Jenkins & Ephraums 1990: xi)

The introduction that follows this executive summary again speaks plainly and with confidence, which makes the document accessible to a politician, journalist or other lay reader. This first IPCC scientific report was described by its chairman, John Houghton, as the work of 'most of the active scientists working in the field. Some 170 scientists from 25 countries have contributed either through international workshops or written contributions'. A further 200 scientists were involved in the peer review of the draft report (Houghton, Jenkins & Ephraums 1990: v). It therefore summarised the known body of research at the time and felt able to report with certainty.

Houghton acknowledges minority opinions, but says the peer review of the draft report helped to ensure a high degree of consensus amongst authors and reviewers of the information presented (and presumably of the language used to communicate). 'Thus the assessment is an authoritative statement of the views of the international scientific community at this time.' This foreword, written in July 1990, concludes on a hopeful note, lauding: 'a significant step forward in meeting what is potentially the greatest global environmental challenge facing mankind' (1990: v, vi).

1989–1992: government reports showed little doubt

Even without the IPCC report, expert advice had convinced Australian Government deliberations by the late 1980s. In December 1989, an inquiry by the Senate Standing Committee on Industry, Science and Technology showed its certainty and looked at ways to reduce the impact of the greenhouse effect with these words:

The experts with whom the Committee met confirmed that there is irrefutable scientific evidence that the composition of the atmosphere has been, and continues to be, altered significantly by human activity.

There is the risk that if the response to this problem is delayed until the evidence of significant climatic change is irrefutable, it may be too late to avoid some of the more extreme changes that could occur ... slowing and reversing the changes in the atmosphere will be slow and difficult. Consequently, it is essential that an early start be made in implementing changes. (Senate Standing Committee on Industry, Science and Technology 1989: 1)

In its own words, this Senate committee accepted the scientific evidence of atmospheric change, and that it was induced by humans. It did not require 100 per cent measured certainty of climate change in order to take action, which was understood to become more costly with delay. The committee communicated all this in certain language.

In 1989 the Australia and New Zealand Environment Council (ANZEC), in an agenda item on the draft National Greenhouse Strategy, urged all state governments 'as a matter of priority to pursue all available measures to reduce greenhouse gas emissions' (ANZEC 1989). As we have seen, by 1990 many states had developed response plans.

Also in 1989, the Labor government under Bob Hawke released a state of the environment report wherein a response to anthropogenic climate change featured prominently. ‘Significant climate change ... would have major ramifications for human survival’ (Hawke 1989: 28). This document (which also ushered in the era of Landcare and tree planting) agreed that waiting for ‘conclusive scientific evidence’ was not necessary, but an early start on action was. A year later, in October 1990, the federal government drafted its interim planning target to reduce greenhouse gas emissions by 20 per cent (from 1988 levels) by the year 2005 (Commonwealth 1990).

As late as 1992, as the Rio Earth Summit introduced the UN Framework Convention on Climate Change to drive the international agenda on this topic, one continues to find certainty of language in Australian federal government documents. For example, a 1992 federal government *Climate Change Newsletter* confirms that the discussion had gone well beyond debating whether the greenhouse phenomenon exists or not and was dealing with the emission reduction targets. Significantly, this newsletter acknowledges that energy demand management (i.e., efficiency) could make a major contribution to achieving the government’s reduction targets (Department of Primary Industries and Energy 1992).

At the time, the newsletter was edited by the Department of Primary Industries Climate Change Group, where it remained until late in the 1990s, produced by the Bureau of Rural Resources. The change in its language in the 1990s is telling. In the early years the language is certain and direct and frames do-able responses that were later reframed as being unacceptable or undo-able.

The February 1992 newsletter’s lead article, for example, outlines the government’s ESD (ecologically sustainable development) Greenhouse Working Group report to the Department of Arts, Sports, Environment and Territories with the good news that energy services could be upheld while emissions were reduced with innovative management of both supply and demand.

The sticking point was likely the next sentence ‘but that achievement would require high levels of government intervention’ (Kretschmer 1992: 1). The high level of government ‘intervention’ (the market term for regulation or incentives)—principally through managing demand by mandating efficiency, fuel substitution and urban planning—would become unacceptable, ideologically, during the remainder of the 1990s. But while it was a real option, it shows how certainty appeared in tandem with strong policy response.

Uncertainty marks the reframed story after 1992

To assume that the economy and the environment were basically opposed, an old tradition in Australia, offered a valuable tool for those who framed Australia's 'national interests' as synonymous with the existing energy and export system. It helped to characterise the environmental science and talk of risks as 'uncertain', thereby neutralising a challenge to the economic policy agenda. Marginalising environmental scientists and advocates helped as well.

Energy consultant Alan Pears advised the Victorian Government on changing its energy policies before the politics in that state shifted to economic rationalism by 1992. He saw how discrediting the science proved a powerful weapon to keep energy supply unchanged in the 1990s. Economic modelling on costs and manufactured uncertainty about the science reframed the public story by the mid-1990s to a focus on jobs and costs. 'By 1994 ABARE had convinced the Department of Energy with its [economic] modelling,' he said.

Pears also saw 1992 as a tipping point—away from policy progress on climate change action backed by public knowledge, definite communication and positive leadership. This switch correlated with a change of government in Victoria and also with the ascent of Paul Keating to prime minister. Public messages became framed as 'any action is going to hurt', while competition policy and deregulation guided energy sector 'reform'.

Lobbyists win with job talk while 'degrees of uncertainty' lose

At the federal level by the mid-1990s, former policy adviser Sue Salmon saw firsthand the weak position of the Department of Environment, which was the conduit for the science. She told me, 'there was a whole lot of that "bring in a sceptic" strategy and it was understood that public confusion made it easier to continue with business as usual.'

She also recalls the strong presence of lobbyists from the coal and paper industries. 'Their message was effective and powerful. It was about income and jobs while we were talking about degrees of uncertainty.' These trends only intensified with the marginalisation of the environment movement under Prime Minister John Howard (1996 on) and the lack of interest in what the science, including the IPCC, said.

The media then amplified for the public the climate of uncertainty coming from politicians and this was topped by the more deliberate campaign of scepticism encouraged by News Limited and the right wing think tanks. Claire Miller, a journalist who was then working at *The Age*, a Fairfax publication, remembered the uncertainty that crept into Australia's politician-driven news system:

The question was, is it real or scaremongering? Legitimacy comes when the government is taking it seriously. Under Hawke it was big profile. Under Keating it went back to a junior ministry; the media follows what politicians are talking about so then politicians stopped talking about it and the media stopped too; meanwhile the community thinks it is being 'fixed'.

Retreat from definite language becomes the norm

By 1995, the IPCC too had started to mute its language with jargon, highlighted uncertainty and retreated to technical discussions in the summary for policymakers. The late US atmospheric scientist and IPCC member Stephen Schneider told me that commentators from the (anti-greenhouse science) Global Climate Coalition were pressuring IPCC members after the first, 1990 IPCC report. At the same time, politicians got more involved in the reporting process. It was a far cry from the 1988 Toronto conference of scientists and government officials that led to the establishment of national emission reduction targets in the first place.

At that conference, Schneider convinced delegates that plain and forceful communication was the way to go. Then *Sydney Morning Herald* journalist Leigh Dayton, backgrounding the 1995 IPCC report, painted a vivid picture about the urgency to communicate that emerged at the Toronto conference:

The anxious experts feared that if human beings continue to load the atmosphere with heat-trapping greenhouse gases like carbon dioxide—produced largely by burning coal, oil and wood—the world would be doomed to an 'impending crisis' of unbridled climate change: global warming, increased storms and droughts, sea-level rises and other extreme and hard-to-predict weather events, not to mention the human chaos and suffering that would ensue.

But what could a group of scientists, administrators and environmental hangers-on do? 'Give the public and politicians firm answers, not

statements of scientific uncertainty,' vehemently argued one young turk, Dr Stephen Schneider, now a leading climate modeller at Stanford University in California.

And so they did. To this day the final statement from that extraordinary meeting remains one of the most unnerving scientific pronouncements ever made: 'Humanity is conducting an enormous, unintended, globally pervasive experiment whose ultimate consequences could be second only to a global nuclear war'; it is 'imperative to act now'. (Dayton 1995a: 29)³

A few years later Schneider had changed his mind. Looking back in 2007, he cited the pressure from corporations in oil, coal and gas on the international IPCC process following the plain English 1990 report. In response he said he was the driving force behind correlating the terms 'likely' and 'very likely' to percentages of certainty in subsequent IPCC reports in an effort to standardise the language. 'Did it work?', I asked him. He answered:

Well it worked for scientists. Not sure what the public got out of it. But I believed that the public would settle for lower percentages if framed by credible scientists. Credibility of the scientists is key. (However) there is the related problem of scientists not drawing conclusions under the framework of not overstepping the policy line because of politicians' censure.

IPCC reports from the mid-1990s, cautious and technical

So we see that from the 1995 report on (compared to 1990), language in the IPCC science summary for policymakers (which may be the only document most politicians and journalists read or are briefed on) became more diffuse and technical and open to interpretation. In 1995, while saying the 1990 predictions and scenarios had held, the science summary is considerably less to-the-point than in 1990 and also focused on measurement or quantifying impacts. Here's a taste. The reader must get to page four before learning:

3 Leigh Dayton and Gavin Gilchrist, her colleague at *The Sydney Morning Herald*, wrote a number of detailed and unequivocal articles in the months following the 1995 release of the 2nd IPCC assessment report—outlining the extreme weather and other risks posed by ongoing global warming and climate change. These articles, like others from the period from the *Herald* and the *Age*, provide an excellent historical record showing that many environmental or science reporters remained certain of the problem's existence and that most of what is currently understood about climate change was understood then as well—despite the possible communication barriers of a less than user-friendly IPCC report.

The balance of evidence suggests a discernible human influence on global climate; any human-induced effect on climate will be superimposed on the background ‘noise’ of natural climate variability ... our ability to *quantify* the human influence on global climate is currently limited because the expected signal is still emerging from the noise of natural variability, and because there are uncertainties in key factors. These include the magnitude and patterns of long term natural variability and the time-evolving pattern of forcing by, and response to, changes in the concentrations of greenhouse gases and aerosols, and land surface changes. (IPCC assessments 1995, Working Group I, pp. 4–5)

The communication effort is not helped by the 1995 summary for policymakers on potential social and economic responses, which reads like an academic economics treatise, perhaps reflecting its authors’ disciplines (Lee & Haites 1996). It sends no urgent signals and may well have remained unread by policymakers because of its style. Retreating into the difficult, technical and inaccessible was another safe strategy to avert criticism, along with stressing uncertainty.

Such a deliberate strategy to sow disinterest or uncertainty, was identified by two US science policy pressure groups: the Government Accountability Project (GAP) and the Union of Concerned Scientists (USC). The report, *Atmosphere of pressure: political interference in federal climate science* (2007), looked at tactics during the George W. Bush administration in US federally-funded departments and agencies dealing with resource and environmental matters.

The 2001 IPCC science report continues with a technical style of language and delivery. The summary for policymakers announces within the second paragraph that it describes the current state of understanding of the climate system and ‘its projected future evolution and their uncertainties’ (IPCC assessments, 2001, Working Group I, p. 2). It lays out its ‘judgmental estimates of confidence’ along the likely, very likely continuum suggested by Schneider. The reader is told that it is ‘very likely’ (which the scientists equated to a high 90–95 per cent chance) that the 1990s was the warmest decade and 1998 the warmest year in the instrumental record since 1861. Proxy record data going back thousands of years is ‘likely’ to be certain, which translated still allows a range up to 90 per cent certainty.

It is not hard to see the uncertainty and desire for another opinion that this language is liable to cause in a lay audience, let alone an unfriendly policy audience. In 2001 the anthropogenic or human influence is described as: ‘The influence of external factors on climate can be broadly compared using the concept of “radiative forcing”’, footnoted with a technical explanation.

What the 1990 report called ‘emissions resulting from human activities that are increasing concentrations of greenhouse gases’ is called ‘increased concentrations of atmospheric constituents’ in 2001. It is not until the second last page of the executive summary that the reader learns human activities have continued to increase greenhouse gases and ‘their radiative forcing’ since the 1995 report and that this is due to fossil fuel burning and ‘land-use changes’—a benign-sounding jargon term that mostly refers to deforestation.

By this time the federal government’s *Climate Change Newsletter* had also largely retreated into technical reports compared with its earlier direct and accessible news reports. The overall picture is that a focus on measurement and technical, quantified reporting became the yardstick of credibility and also a way to justify ‘go slow’ as the 1990s turned into the 2000s.

How that scientific uncertainty frame was interpreted can be seen from an exchange between scientist/science communicator Tim Flannery and journalist Tony Jones on the Australian Broadcasting Corporation’s (ABC) *Lateline* in May 2007. Flannery was asked to comment on a sceptical documentary. He said the documentary did not reflect the consensus of scientists globally, namely: that it was ‘90 per cent certain’ that human activity produced the increased greenhouse gases leading to global warming that caused climate change. Phrasing it this way, caused Jones to respond ‘yes but, that means there is 10 per cent uncertainty, which surely leaves an opening for this sceptic debate?’.

Risk assessments conservative

While at CSIRO, earth systems scientist Michael Raupach, (now heading the ANU Climate Change Institute), commented in an interview in 2008 on the language of uncertainty and its effects at the IPCC at that time and on domestic response:

The sceptics [internationally] have been very active in throwing ‘sand in the gears’ causing the IPCC to use very carefully calibrated language. Lots of people including me think that this has led IPCC statements to fall on the conservative side. Likewise, sceptics have been very influential on our government so scientists have had to moderate their language to reach people in policy.

[In so doing] CSIRO has been pulling its punches on climate change. Especially in the mitigation area we have failed at plucking the real ‘low-hanging fruit’ such as energy efficiency. We are not doing anywhere near what is needed. [At the same time] sceptics like the Lavoisier Group

have wedged open and magnified uncertainties, but only on one side; they stress the possibility that climate science may overstate the threat, but ignore the equal possibility that climate science is understating it.

Raupach also offered a scientist's unvarnished view of how governments had failed to grasp the necessity for steady emission cuts and said: 'all this talk about cap and trade [emissions trading], nuclear and clean coal, is just "greenwash" to avoid confronting the need for real strategies for rapid, sustained reductions in fossil fuels.' In 2014, Raupach said:

Much has changed since 2008. In Australia, climate science is under renewed and coordinated attack from three directions simultaneously: the fossil fuel industry, much of government, and sections of the media. This means that there is now an even stronger need than in the past to defend evidence-based science against anti-science attacks. The recent (2013–2014) IPCC Fifth Assessment provides a detailed, authoritative and fundamentally challenging account of what the realities are: the emission reduction rates that are needed to stay below a warming target of 2 degrees above preindustrial temperatures are very, very steep, and their direct policy implications are enough to draw the triple fire attack.

Greatly assisting the climate of uncertainty was the media trend to frame climate change as debate, opinion and in need of balance, as I have shown. There was also a trend to treat each IPCC report as if discovering for the very first time that humans were causing global warming. For example a 2001 *Sydney Morning Herald* story is typical of the coverage. In 'Six degrees hotter: global climate alarm bells ring louder', we learn that 'World temperatures may increase by as much as six degrees Celsius over the next century, leading climate change scientists say in an alarming report that adds new urgency to the warnings on global warming (Schauble 2001). ... *And for the first time scientists agreed that the warming is mostly due to human activity*' (my italics).

This 'just discovered' human agency hook can be identified in media reports on successive IPCC assessments. It shows how the story is reframed in the media and it also shows how reporters dispense with context and background.

Atmosphere of pressure on media

As this uncertain framework unfolded, journalists who remembered the history, understood the science and reported it in plain English, found themselves under pressure. Geoff Strong remembered: 'I was taken to the Press Council in 1999 by a reader for writing about global warming a decade on. My alleged crime was I hadn't given oxygen to those who didn't believe.' Former ABC environmental

journalist Alan Tate, who says the ABC was 'completely supportive' during most of the 1990s of reporting on climate change, recalled that his bosses there were inundated with emails from sections of corporate Australia decrying that coverage and calling for his sacking.

Tate said the strategy he saw coming from industry complainants was to 'sow doubt about the climate science'. This was done through seminars, forums, and climate sceptics. 'The coal industry and Rio Tinto had the ear of the Prime Minister and the Canberra press gallery and [most of] corporate Australia was disengaged until after 2000 ... while the green movement was still heavily focused on forests and also disengaged.' He believed that this led to 'a completely confused public discussion'. By the time he left the ABC in 1998 the 'deep uncertainties idea' had settled with the editors at the national broadcaster.

Murray Hogarth, another environmental journalist active in the 1990s, said it was easy to find an opposing point of view and that often there was a problem with finding Australian scientists willing to be quoted at all, or quoted in a simple and understandable way. In this way, public information was nudged towards more manufactured balance that became a normal part of reporting on climate change, and balance was hedged by uncertainty.

Institutional change silenced scientists

Part of the problem of finding scientists willing to communicate as the 1990s unfolded was the chilling effect of institutional changes on scientists' ability to publicly communicate the consequences of climate change on society. This came to be seen as commenting on government policy and it was forbidden. As early as 1987, change was affecting the major scientific body involved in Australian atmospheric research. An October 1987 government internal memo on climate change work at CSIRO sounded the alarm saying restructuring might require finding a 'major funding sponsor'; that is, government financial support would wane (Department of Arts, Sports, the Environment, Tourism and Territories 1987).

In the view of former federal politician Bob Chynoweth, who was on the advisory board of the Division of Atmospheric Research at the time, the public interest science in the CSIRO was gradually 'squeezed down' as the organisation was reorganised. So too was government-funded scientists' ability to communicate freely, particularly from 1996 on with the Howard Coalition government.

A scientist who never stopped reporting on climate change, Griffith University professor Ian Lowe, wrote what others had been saying privately: that the CSIRO under former Chief Executive Geoff Garrett during the Howard years developed 'a culture of managerialism so wary of offending government, that scientists

have been instructed not to comment on issues that have policy implications. Even within universities ... there is now increasing pressure to conform' in the face of a disapproving government that controls the purse strings (Lowe 2007: 60–61).

As the organisation was restructured to serve the needs of industry, CSIRO climate change and other environmental researchers came to face a double barrier: a government employer who discouraged scientists from talking about impacts of climate change, along with energy and resource industry 'partners', many of whom came to sit on the CSIRO Board and on cooperative research centre (CRC) and flagship boards (Pearse 2007).

Graeme Pearman told me that the defined role of the CSIRO changed and became a directive 'to build wealth' at the expense of sharing with society the outcomes of public-good research. He was in a position to observe this as chief of the Division of Atmospheric Research for 10 years. Veteran science journalist Peter Pockley agreed. 'A policy line is set, often on the basis of ideology or whim, and science is effectively urged to get on board the policy bandwagon ... it has taken four reports and 15 years to say what people like Graeme Pearman were saying in 1990' (Pockley 2007: 31).

John Williams, former chief of CSIRO Land and Water, says in the same 2007 article: 'we must get around the view that there is a clear definition between science and policy. It's nonsense to say that presentation of scientific information is a form of advocacy which must be avoided.'

The long-term effect was that those who agreed with the government policy position felt free to speak out while those who did not were intimidated into silence (Lowe 2007: 61). Pearman told Lowe in an account of the organisational trouble he encountered in 2004, while still a prominent member of the CSIRO Division of Atmospheric Research:

As a climate scientist, I might inform [media] that the lifetime of carbon dioxide in the atmosphere means that the only way of stabilising global climate is by reducing emissions by 50 per cent by 2050 and by 80 per cent by 2100. In the current environment, that is seen as commenting on government policy of not setting reduction targets. (Lowe 2007: 63)

Reaping the longer term impact of these stifling trends that started in the later 1990s, Pearman found himself in trouble in 2004, when a report was released by The Climate Group, a business scientific alliance, convened by the insurance company IAG and the World Wide Fund for Nature. It involved Pearman for

scientific advice and included some of Australia's major corporations outside the mining and resource sector. The report brought together evidence that climate change was starting to affect Australia.

In 2006, the ABC *Four Corners* television program, 'The greenhouse mafia', reported that Pearman came under CSIRO administrative pressure as a result of his work with The Climate Group. In the television program, reporter Janine Cohen asked, 'Talking about the need for a reduction in emissions and how much would be a safe level, is that really government policy? Isn't it about good science?' Pearman said, 'Well, I believe it is ... for 30 years all I've tried to do is convey to the community and to sectors of the community what good science suggests is the way forward' (Cohen 2006: 7).

Pearman says he was subsequently made redundant by the CSIRO, in the division that he had led as chief from 1992–2002. His communication work, together with that of scientific colleagues with the groundbreaking greenhouse conferences in 1987 and 1988 and definite public communication thereafter, made a significant contribution to the early good public understanding of the risks inherent in climate change. Pearman, his colleague Barrie Pittock and also Lowe are among the small group of Australian scientists and technologists who have withstood the pressure from the mid-1990s into the 2000s and continued to speak out clearly and publicly about the risks of climate change. More have joined their ranks in recent years, indicating a hopeful change for environmental scientists' ability to publicly communicate.

The muzzling of research findings was not confined to climate change. Another public sector scientist has told of his experience dealing with the federal bureaucracy during the 1990s. He said analyses he was contracted to produce for the federal government on the likely environmental impacts of population growth were never published because, he believes, they did not give the desired answers in line with population growth policies.⁴

Public interest research goes quiet too

Communication restrictions accompanied a more fundamental redrawing during the late 1990s under the Howard government of what constitutes 'the public interest'. Research into renewable energy, integrated pest management, tropical rainforests and the Great Barrier Reef was defunded (Lowe 2007) along

⁴ A detailed account of this 1990s collision between science and official immigration policy can be found in Lowe (2007: 65–70).

with the wind-down of the former CSIRO Division of Wildlife and Ecology and eventually Land and Water. The federal government redirected funding into commercial pursuits, including research for the coal industry.

The government was steering a course that equated the good of the private sector with the good of the community, implying that there was no separate public sector interest. This is consistent with the ideology of economic rationalism and its influence on public policies and public narratives in Australia in the past 20 years.

The muzzling of scientific conclusions and the downgrading of public interest environmental research helped cement the dominant narrative of uncertainty and 'scientists can't agree' enveloping Australia after 1996. Uncertainty was also helped by feuding bureaucracies representing environment and industry/trade, and by previously neutral media executives backing down in the face of persistent corporate complainants whenever reports linked climate change to on-ground weather impacts.

Combined, these influences resulted in a level of public confusion that paralysed further calls for action from the grassroots up while the path was cleared for business as usual: status quo polluting energy providers, inefficient industries and consumer products, government policies that favoured cars and roads over public transport, in sum a vision of growth that was guaranteed to increase emissions.

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