
Environmental action groups and other NGOs as communicators of science

Steven Yearley

Introduction: the elective affinity of environmental action groups and NGOs with science communication

In conjunction with its report on the human and environmental impacts of man-made chemicals (Greenpeace 2003), in 2003 British Greenpeace ran a campaign advertisement in national newspapers showing a figure closely resembling Michelangelo's *David*, complete with its small genital endowment. The accompanying text suggested that people should begin to worry about threats to men's reproductive capacity owing to the environmental release of hormone-mimicking substances. Chemicals used in plasticisers and other applications could be 'feminising' the environment and leading to declining male fertility, in humans and in wild animals too. This advertisement was indicative of Greenpeace's strategy. It expressed in an arresting way the supposed facts of the case – here was a new form of harm arising from a novel and unanticipated form of environmental pollution – but it was also significantly misleading, as the chemicals were unlikely, on anyone's view, to lead to a threat to the size of male members. This advertisement encapsulated a key challenge in the public communication strategy of environmental non-governmental organisations (NGOs): the need to balance powerful, evocative images with the perceived demands of accuracy.

This chapter examines the increasing importance of environmental NGOs as mediators of scientific information in policy and other public arenas, and the challenges they face in positioning themselves in relation to shifting scientific orthodoxies. Environmental campaign organisations have been important in supplying arguments about, and publicising problems in relation to, a very large number of environmental issues. Rather than trying to conduct a review of these issues, this chapter focuses first on one leading example, climate change; derives some points of principle from it, then assesses their generalisability by applying them to a contrasting case – genetically modified organisms.

Opponents of Greenpeace and other environmental organisations have frequently criticised them for favouring the slick image over the accurate message, but this

criticism – although interesting and important – implicitly acknowledges something even more interesting. The key point is that environmental pressure groups can be called to account on this issue precisely because the persuasive power of their message depends on the notion that their claims have a basis in factual accuracy, that they are not matters of opinion. Environmental organisations, more than any other type of campaigning group, need to persuade the public that things are in fact the way they say things are, even when some of the claims they are making seem – at first glance at least – to be counter-intuitive or implausible: that plastics can make you infertile, or that burning fossil fuels can unsettle the entire global climate.

Thus, in what is clearly today's pre-eminent environmental debate, environmentalists are keen to assert that global warming is in fact taking place, and that humanly caused changes in the make-up of the atmosphere are responsible. Central to the campaign is the claim that, in fact, humans are causing global warming and that, in fact, warming will have specific adverse implications.

Indirect testimony to this factual and scientific orientation is given in the following observation about Friends of the Earth (FoE).¹ To celebrate its 21st birthday, the environmental organisation published a celebratory booklet (FoE 1992). With a large supporter base, active local groups, regular coverage in influential media, strong campaign teams and widespread name recognition, the organisation had a lot to boast about. 'Yet the item chosen to begin this celebratory publication, immediately after the contents page, was a quote from a leading environmental journalist praising the group as a "reliable and indispensable source of information"; this was followed by a comment from the head of Her Majesty's Inspectorate of Pollution [the forerunner to Britain's Environment Agency] lauding the quality of its "technical dialogue"' (Yearley 2005a: 113). Given all the things that could have been chosen to feature at the start of FoE's anniversary document, this selection was surprising and telling.

In short, I suggest that there is an elective affinity between environmental campaign organisations and scientific claims that is, to a large degree, distinctive among pressure groups. This gives environmental campaign groups an urgent interest in science communication issues and makes them significant science communication actors.

Climate change as an emblematic science communication challenge for NGOs

Scientists have been aware for over a century that the climate undergoes significant variation, and there has long been a concern that human society could not for ever count on a stable climate. As climate research was refined, largely thanks to the growth in computer power in the 1970s and 1980s, the majority opinion endorsed the earlier suggestion that enhanced warming, driven by the build-up of atmospheric carbon dioxide, was the likeliest problem to face humankind in the short to medium term. Environmental groups are reported to have been initially wary of campaigning around this issue (Pearce 1991: 284), as it seemed such a long shot, and with such high stakes. With acid rain on the agenda, and many governments active in denying scientific claims about even this comparatively straightforward effect, the stakes seemed too high in the 1980s to declare publicly that emissions might be

sending the whole climate out of control. Worse still from a campaigner's point of view, at a time when environmentalists were looking for concrete successes, the issue seemed almost designed to provoke and sustain controversy. The records of past temperatures, and particularly of past atmospheric compositions, were often not good, and there was the danger that rising trends in urban air-temperature measurements were simply an artefact: cities had simply become warmer as they grew in size. The heat radiating from the Sun is known to fluctuate, so there was no guarantee that any warming was a terrestrial phenomenon due to 'pollution' or other human activities. Others doubted that additional carbon dioxide releases would lead to a build-up of the gas in the atmosphere, as the great majority of carbon is in soils, trees and the oceans, so sea creatures and plants might simply sequester more carbon. And even if the scientific community was correct about the build-up of carbon dioxide in the atmosphere, it was fiendishly difficult to work out what the implications of this would be in order to build campaigns with local resonance.

Hart and Victor (1993) tracked the interaction between climate science and US climate policy from the 1950s to the mid-1970s, by which time greenhouse emissions had begun to be 'positioned as an issue of pollution' (ibid. 668); the climate, 'scientific leaders discovered, could be portrayed as a natural resource that needed to be defended from the onslaught of industrialism' (ibid. 667). Subsequently, according to Bodansky (1994: 48), the topic's rise to policy prominence was assisted by other considerations. There was, for example, the announcement of the discovery of the 'ozone hole' in 1987; this lent credibility to the idea that the atmosphere was vulnerable to environmental degradation and that humans could unwittingly cause harm at a global level. Also important was the coincidence in 1988 between Senate hearings into the issue and a very hot, dry summer in the USA. Nonetheless, most politicians responded to the warnings in the 1980s with a call for more research.

One significant outcome of this support for research was the setting up in 1988 of a new form of scientific organisation, the Intergovernmental Panel on Climate Change (IPCC) under the aegis of the World Meteorological Organization and the United Nations Environment Programme. The aim of the IPCC was to bring together the leading figures in all aspects of climate change, with a view to establishing in an authoritative way the nature and scale of the problem and identifying candidate policy responses. This initiative was accorded significant political authority and was novel in significant ways. Among its innovations were the explicit inclusion of social and economic analyses alongside the atmospheric science, and the involvement of governmental representatives in the agreeing and authoring of report summaries. 'While by no means the first to involve scientists in an advisory role at the international level, the IPCC process has been the most extensive and influential effort so far' (Boehmer-Christiansen 1994: 195).

As is widely known, the IPCC has met with determined criticism. At one end, there have been scholars and moderate critics who have concerns about the danger that the IPCC procedure tends to marginalise dissenting voices, and that particular policy proposals (such as the IPCC-supported Kyoto Protocol) are maybe not as wise or as cost-effective as proponents suggest (e.g. Boehmer-Christiansen and Kellow 2002; Boehmer-Christiansen 2003). There are also very many consultants backed by the fossil-fuel industry who are employed to throw doubt on claims about climate

change. Freudenburg (2000) offers a discussion of the social construction of ‘non-problems’. These claims-makers have entered into alliance with right-leaning politicians and commentators to combat particular regulatory moves, as detailed by McCright and Dunlap (2000, 2003). Informal networks, often web-based, have been set up to allow ‘climate-change sceptics’ to exchange information, and they have welcomed all manner of contributors, whether direct enemies of the Kyoto Protocol or more distant allies, such as opponents of wind farms or conspiracy theorists who see climate-change warnings as the machinations of the nuclear industry.

Gifted cultural players, including Rush Limbaugh and Michael Crichton, have waded into this controversy; Crichton’s (2004) novel *State of Fear* includes a technical appendix and author’s message on the errors in climate science. In his book, Crichton even goes as far as to offer his own estimate of the rate of global warming – 0.812436 degrees for the warming over the next century (Crichton 2004: 677). Crichton and others have concentrated not only on the scientific conclusions (and their disagreements with them), but have looked at putative explanations for the persistence of error in ‘establishment’ science and much of the media, to which I shall return shortly. At the same time, mainstream environmental NGOs have tended to argue simply that one should take the scientists’ word for the reality of climate change, a strategy about which they have clearly been less enthusiastic in other cases (Yearley 1993: 68–9).

The rhetorical difficulties of doing this were already foreshadowed in the strategy of FoE in London over 15 years ago: in 1990, campaign staff working on climate change issues were disturbed by a programme aired on the UK’s Channel 4 television, in the *Equinox* series, that sought to question the scientific evidence for greenhouse warming. The programme even implied that scientists might be attracted to make extreme and sensational claims about the urgency of the problem in order to maximise their chances of receiving research funding. The programme was criticised in the ‘Campaign News’ section of the FoE magazine *Earth Matters*. An unfavourable comparison was drawn between the sceptical views expressed in the programme and the conclusions of the IPCC, with whose scientific analysis FoE was generally in agreement. The FoE article invoked the weight of ‘over 300 scientists [who] prepared the IPCC’s Science Report compared to about a dozen who were interviewed for *Equinox*’.² When scientists with apparently good credentials are seen to disagree, it is very difficult for environmentalists to take the line that they are simply in the right. It seems a reasonable alternative to invoke the power of the majority. But this remedy cannot always be adopted – in many areas where environmentalists believe themselves to be factually correct, they have been in the scientific minority, at least initially. In March 2007, Channel 4 repeated this attention-seeking strategy, broadcasting a programme unambiguously entitled *The Great Global Warming Swindle*. The response of NGOs and ‘green’ commentators was essentially the same: we should trust the advice of the great majority of well-qualified scientists who accept the evidence of climate change. Environmental groups looked to invoke the possible vested interests of the critics in order to make sense of the programme-makers’ and contributors’ continued scepticism.

In the relationship between the IPCC – indeed, the whole climate change-regulation community – and its critics, not only the science, but the various ways in which the science is legitimated, have come under attack (Lahsen 2005). Critics have been quick

to point to the supposed vested interests of this community. Its access to money depends on the severity of the potential harms that it warns about; hence – or so it is argued – it inevitably has a structural temptation to exaggerate those harms. As it was working in such a multi-disciplinary area, and with high stakes attached to its policy proposals, the IPCC attempted to extend its network widely enough so as to include all the relevant scientific authorities; it was important that the IPCC should not be dominated by meteorologists or atmospheric chemists. But this meant that the IPCC ran into problems with peer reviewing and perceived impartiality; there were virtually no ‘peers’ who were not already within the IPCC (for an analysis of the accusations that could be levelled on this basis, see Edwards and Schneider 2001). Conventional peer reviewing relies on there being few authors and many (more-or-less disinterested) peers; the IPCC effectively reversed this situation. When just one chapter in the 2001 Third Assessment Report has 10 lead authors and over 140 contributing authors,³ then it is clear that this departs from the standard notions of scientific quality control.

If challenged, the IPCC tended to fall back in line with the classic script of ‘science for policy’ (Yearley 2005b: 160–2); the IPCC legitimated itself in terms of the scientific objectivity and impartiality of its members. But critics were able to point out that the scientific careers of the whole climate-change ‘orthodoxy’ depend on the correctness of the underlying assumptions. Worse, the IPCC itself selects who is in the club of qualified experts, and thus threatens to be a self-perpetuating elite community (this line of attack is described by Boehmer-Christiansen 1994: 198). This was exactly the point that Crichton picked up. Many of his speeches and articles are available on his website, alongside a very specific demand that the work not be reproduced (www.michaelcrichton.com/books-stateoffear.html). Without therefore quoting him – which he forbids – his principal argument is that the key requirements are a form of independent verification for claims about climate change, and the guarantee of access to unbiased information. However well meant, this is clearly an unrealistic demand, as there is no-one with scientific skills in this area who could plausibly claim to be entirely disinterested. There is no Archimedean point to which to retreat, and environmental groups will correctly claim that such demands for a review are primarily ways to put off taking action. Crichton further muddies the water by proposing to offer his own estimate of future climate change to six decimal places; although the ridiculous precision clearly signals some jocular intent, the idea that even he (a medical doctor turned author) can offer a temperature-change forecast implies that there are lots of people able to make independent judgements. In fact, there are relatively few, and a central science communication challenge for environmental groups is to distinguish between those who can credibly comment and those who cannot.

Although they have found it hard to participate in the central scientific debate, and have been obliged to take up the (for them) unusual position of defending the correctness of mainstream science, environmental action groups have found other activities that they have been able to pursue. For example, in the USA they have been active in trying to identify novel ways to press the government to change its position on climate change aside from simply bolstering the persuasiveness of climate science and trying to rebut the claims of critics such as Crichton. Thus in 2006 the

Center for Biological Diversity (CBD), the Natural Resources Defense Council and Greenpeace learned that their inventive use of the Endangered Species Act to sue the US government for protection of polar bears and their habitat in Alaska had won concessions from the government. In its campaigning, the CBD had argued that oil exploration in the far north would harm polar bears and their hunting grounds, but they also suggested that ice melting caused by global warming was responsible for additional habitat loss and harm to bears that need large expanses of solid ice in spring for successful hunting.⁴ Potentially, the endangered species legislation could force the government to examine the impact on polar bears of all actions in the USA (such as energy policy), not just activities local to polar bear habitat.

In this instance, environmental NGOs have been stuck in a dilemma. What they see as the world's leading environmental problem is fully endorsed by the mainstream scientific community. In January 2004, the UK government's chief scientific adviser, Sir David King, gave his judgement that climate change posed a greater threat than terrorism.⁵ The NGOs' principal efforts have accordingly been directed at restating and emphasising official findings, finding novel ways to publicise the message, and countering the claims of greenhouse-sceptics. The difficult part of the dilemma is that such statements in favour of the objectivity of the scientific establishment's views mean that it is harder to distance themselves from scientists' conclusions on other occasions without appearing arbitrary or tendentious.

Environmental organisations and GMOs: communicating safety and risks

The case of genetically modified (or genetically engineered) organisms was just the opposite of climate change in the sense that environmental groups were, initially at least, out of line with the views of the scientific establishment; the science communication issues were accordingly very different. In this case, the principal issues addressed safety and safety-testing. Here was a new product, whether GM crop, animal or bacterium, that needed to be assessed for its implications for consumers and the natural environment. Of course, all major industrialised countries had some sort of procedures for testing new foodstuffs. But the leading question was how novel were GM products taken to be, and thus what sorts of tests they should be exposed to. For some, the potential for the GM entity to reproduce itself or to cross with living relatives in unpredictable ways suggested that this was an unprecedented form of innovation that needed unparalleled forms of caution and regulatory care. On the other hand, industry representatives and many scientists and commentators claimed that it was far from unprecedented. People had been introducing agricultural innovations for millennia by crossing animals, allowing animal-based 'sports' to flourish, and so on. Modern (although conventional) plant breeding already used extraordinary chemical and physical procedures to stimulate mutations that might turn out to be beneficial. On this view, regulatory agencies were well prepared for handling innovations in living, reproductive entities (Jasanoff 2005).

In this case, the strategy of environmental action groups was much more typical of their approach in the years since the late 1960s. They argued that the regulatory

system was insufficiently demanding, and that the consequences of new technologies were not being examined closely enough. They suggested that governments, keen to promote economic success and to support agribusiness and the farm sector, were not taking enough care for consumers and the environment. Indeed, the protest over GM chiefly differed from preceding environmental controversies in just two ways. First, the GM debate closely combined worries over environmental impacts and over the health consequences of the new technology; second, the GM controversy in the late 1990s came after a period in which there had been growing cooperation between environmental groups and official bodies, with them often agreeing to work together on projects aimed at so-called sustainable development.

Despite the intensity of recent public controversies over genetic foodstuffs, work on genetic engineering has a three decade-long history. Environmental action groups were preparing their arguments before the main range of products came to market in the 1990s. In the USA, these products passed tests set by the government agencies (Food and Drug Administration, US Department of Agriculture, Environmental Protection Agency) relatively quickly. The question for environmental action groups was how to express doubts about the advisability of this new technology. Opponents were worried about specific impacts – the possibility of adverse environmental impacts and conceivable food safety issues – but they also had serious concerns over the potential direct intervention in nature that the technology (at least in principle) offered.

As the debate unfolded, a number of specific issues came to be the focus of campaigns. These included, for example, the impact of GM crops on beneficial insects, the likely difficulty of organic growers in keeping their crops free of GM contamination, the possible effects of GM foods on people with allergies (as allergy-promoting aspects of crops might accidentally be crossed into formerly innocuous foodstuffs), and contentious evidence that GM crops might be less nutritious than existing crops in unexpected ways. At the same time, campaigners were aware that there was a danger in offering very specific objections to the new technology since, if these objections were successfully countered, opposition might begin to crumble. Campaigners were literally intransigent as they feared that any accommodation to the new techniques would open the world to GM. Moreover, even if GM agriculture might arguably be less bad for the environment than present-day intensive farming, there was still a worry that the GM route was a one-way journey to a new style of relationship with nature, as one could not readily imagine how GM ‘contamination’ could be undone (see the views captured in the study reported by Stirling and Mayer 1999).

Given the campaigning need to maintain the line against GM in Europe, environmental action groups fused their scientific communication with other strategies in largely opportunistic ways (Priest 2001). Thus a broad anti-GM coalition emerged, with groups engaged in anything from direct destruction of trial GM crops to detailed research work (examining, for example, just how far pollen from GM crops could travel) and everything in between. Those with distinctively environmental concerns were joined by anti-globalisation protesters and – particularly in France – by groups devoted to protecting the livelihoods and way of life of smallholders against large seed and agrichemical companies. In many of these activities, the groups were happy to let environmental and health anxieties overlap and intensify each other. Thus, in a well-known incident in England where a Greenpeace ‘decontamination’ raid on

a farm growing GM crops went wrong and protestors were arrested, the activists were all dressed in protective suits as though simple exposure to GM vegetables might be harmful (Yearley 2005a: 172–4).

At the same time, the more professionalised campaigning organisations began to concentrate on publicising and analysing environmental harms. The scientific evidence for adverse health effects was contentious and not easy to campaign around, but there were more readily agreed mechanisms by which GM planting might be causing environmental harms. In Britain, this emphasis was further promoted as an unintended consequence of government policy. Wishing neither to accede to activists' demands to ban GM crops nor to try to impose GM agriculture against popular sentiment, the UK government opted to put off the decision about GM cultivation by organising a series of field-scale trials over several years, aimed at investigating what the results of GM agricultural practice would be on wild plants, bird species, insects and so on. This strategy neatly provided a new target for sabotage attempts, but also focused the debate around impacts on the rural environment and away from impacts on consumers. Official countryside-protection agencies and more establishment conservation groups were also keen to see such tests done. The key irony here is that, given that today's GM food crops work either by killing off pests or through allowing weeds to be controlled more easily, there was a good chance that – even if GM crops behaved exactly as predicted – they would have a negative impact on wildlife. As there would be fewer weeds, there would be fewer seeds and insects, and thus less to sustain wild birds. Naturally, it was hard to believe that the decline in field weeds was the prime concern of individual consumers who worried about whether to buy GM foods, but it provided a reasonably objective basis for claiming that GM agriculture would have a negative impact on the British countryside and thus a sound legitimisation for an anti-GM stance.

As I have pointed out, in practice the debate over GMOs in Europe was distributed over a range of issues. Despite this, the fundamental issue in EU legal assessments of GM crops and foodstuffs was the question of risk: were these new crops more risky than existing ones?

This framing of the issue was the predominant one in North America too. Disturbed by protestors' success in raising public disquiet about GM products, US companies and allied politicians felt that European resistance to GM imports should be combated by appeals to the World Trade Organization (WTO). A formal complaint was lodged in 2003: the USA hoped to use the WTO to force open European markets to US farm imports and seed companies. The USA argued there was no scientific evidence of harm arising from GM food and crops, as these products had all passed proper regulatory hurdles both in the US system and within the EU. Activists' concern over this legal move was twofold. First, they anticipated (correctly as it turned out) that the WTO would largely rule in favour of the USA; even if this has little effect in Europe, owing to developed consumer resistance, it will discourage people in other parts of the world from trying to regulate against GM agriculture. Second, there was a concern over the basis for the ruling (Winickoff et al. 2005). The WTO does not itself engage in additional scientific research on the issue, but makes a judgement about what the relevant law is and whether that legal interpretation has been followed. The WTO decision-makers took a narrow view of

the basis for the decision: it should be about risk assessment. Environmental action groups and academic authors had little success in opening up a debate around this issue and in convincing the WTO body of the shortcomings of a US-style risk assessment approach (Busch et al. 2004).

A final distinctive opportunity for science communication around GM arose in relation to the consultative exercises that were run in several EU states and elsewhere (such as New Zealand) as a way of trying to win legitimacy for, or even decide on, public policy in relation to this contested issue (Hansen, 2005). The British exercise ‘GM Nation?’ (Horlick-Jones et al. 2007; Chapters 14 and 17 in this volume) was another option adopted by the UK government around the same time as the field-scale trials, partly as a way of being seen to do something without actually yet deciding for or against GM agriculture. In the UK case, at least, environmental action groups put a lot of effort into encouraging people to participate in the public debating exercise, even though it was clear that many participants would be frustrated as the debate would inform – but not determine – national policy.

Participation, consultation and public engagement as fora for NGOs’ science communication

As the ‘GM Nation?’ and related initiatives indicate, the scope for public participation in environmental policy has grown greatly in recent years. The exact rationale for such participation has differed from one context to another, ranging from a wish to give citizens a say in democratic decision-making, to the suggestion that citizens may have insights into their local environment that are unavailable to the customary scientific experts (Yearley 1999; Kasemir et al. 2003; Chapter 12 in this volume). For the purposes of this chapter, the key issue is the response of environmental action groups to such initiatives.

On the face of it, one would expect environmental groups to have an affinity with such moves. Social movements tend to thrive in democratic societies and to espouse democratic principles. And on many occasions they call for government to respond to the supposed ‘will’ of the people, for example over GM food in Europe. But, at the same time, these organisations are aware that not all environmental objectives are popular; nor are popular policies necessarily environmentally benign. In Britain, the Blair government’s decision to allow official online petitions to be created on the Downing Street website led to an enormous response when a record number, well over a million people, expressed their opposition to road pricing in early 2007. Equally, one of the largest acts of popular opposition to Blair’s government had earlier been the protest against automatic increases in car fuel duty. In both cases, popular action appeared to favour personal consumption against environmental objectives.

Environmental groups are thus reluctant to relinquish control over the policy agenda to these public consultation initiatives, in part because they fear that such exercises might be manipulated by government (or business), but also because they are concerned that people may not favour the best environmental option. In many respects, environmental groups are as loath to hand environmental policy over to the public as are governments, even though environmental groups are happy to laud the wisdom

of the public when the public happens to favour the same objectives as them. Citizens are thus deemed wise about GM foods, but less so about wind turbines, and least of all in their devotion to car ownership and use.

Questions of public consultation and participation come to the fore chiefly in open, pluralistic societies. A contrasting situation confronts environmental action groups in more restrictive cultures, notably China, a country of enormous importance for global environmental politics. It is believed that China overtook the USA to become the largest emitter of carbon dioxide in 2006;⁶ China also has a large commitment to GM agriculture, and there are currently plans to introduce GM rice, which would move the Chinese diet from a low-GM profile to one of the world's most intensive. Although the Chinese state has a large and reasonably well resourced environmental protection agency (SEPA), environmental campaigning groups are generally not welcomed. Just a few international NGOs operate in China, and there is the curious phenomenon of the government-organised non-governmental organisations (GONGOs, Yang 2005: 50). Although some education- and membership-based environmental organisations operate, many environmental activists are attracted to alternative methods for communicating their message.

Several recent analyses in the Chinese and other East Asian and South-East Asian context have focused on the role of online communication (Yang 2003). As Yang points out:

For web-based ENGOs, the internet makes up for their lack of resources and helps to overcome some political constraints. While the restrictive regulations create barriers to registering an NGO, web-based groups can stake out an existence on the internet.

(Yang 2005: 59)

Mol (2006) also draws attention to the role of the internet in China and Vietnam in circulating information and allowing people access to information that they would otherwise have had difficulty accessing.

The potential of the internet has also been explored in the industrialised North, and not only as a forum for debate as discussed above in relation to climate change. The internet has been used for the provision of technical information: for example, FoE in Britain beat the official Environment Agency to provide online map-based information about local chemical pollution. Members of the public could search for possible sources of hazard by entering their postcode. Having shamed the Environment Agency into improving its public information, FoE has now withdrawn its site. In the USA, a similar job is handled by the well-known Scorecard site (www.scorecard.org: Chapter 13 in this volume).

Concluding remarks

The central claim of this chapter has been that environmental action groups, more than most other political and reform movements, have been obliged to act as communicators of science and technology because empirical claims about the state of the natural

environment are core to their message. Often they have had to carry out this communication in circumstances where they disagree with the orientation of large parts of the scientific and technological ‘establishment’, and they have developed tools of argumentation for tackling this job. More recently – particularly over climate change – they have had to devise a new strategy for bolstering the IPCC and other mainstream science. The internet has proved to be a rich resource for such communication, both because it can handle detailed information and because the user can ‘personalise’ it by entering geographical data (zip codes or postcodes). In China, and other countries where environmental action groups face limitations on their activities, the internet has become a particularly indispensable means of environmental communication.

Notes

- 1 More precisely, it is FoE (England, Wales and Northern Ireland) since FoE Scotland is a separate organisation.
- 2 There was no author given for this report in *Earth Matters*, Autumn/Winter 1990, 4.
- 3 My example is Chapter 2, ‘Observed climate variability and change’.
- 4 According to the CBD website: “‘Short of sending Dick Cheney to Alaska to personally club polar bear cubs to death, the administration could not have come up with a more environmentally destructive plan for endangered marine mammals,” said Brendan Cummings, ocean program director of the Center. “Yet the administration did not even analyze, much less attempt to avoid, the impacts of oil development on endangered wildlife”’. See www.biologicaldiversity.org/swcbd/press/off-shore-oil-07-02-2007.html
- 5 ‘US Climate Policy Bigger Threat to World than Terrorism’ was the headline in the UK newspaper *The Independent* (9 January, 2004)
- 6 See the report of the Dutch MNP (Milieu- en Natuurplanbureau) (last consulted on 22 June, 2007) at: www.mnp.nl/en/dossiers/Climatechange/moreinfo/Chinanowno1inCO2emissionsUSAinsecondposition.html

Suggested further reading

- Horlick-Jones, T., Walls, J., Rowe, G., Pidgeon, N. F., Poortinga, W., Murdock, G. and O’Riordan, T. (2007) *The GM Debate: Risk, Politics and Public Engagement*, London: Routledge.
- McCright, A. M. and Dunlap, R. E. (2000) ‘Challenging global warming as a social problem: an analysis of the conservative movement’s counter-claims’, *Social Problems*, 47: 499–522.
- Mol, A. P. J. (2006) ‘Environmental governance in the Information Age: the emergence of informational governance’, *Environment and Planning*, C24: 497–514.
- Winickoff, D., Jasanoff, S., Busch, L., Grove-White, R. and Wynne, B. (2005) ‘Adjudicating the GM food wars: science, risk and democracy in world trade law’, *Yale Journal of International Law*, 30: 81–123.
- Yang, G. (2005) ‘Environmental NGOs and institutional dynamics in China’, *China Quarterly*, 181: 46–66.

Other references

- Bodansky, D. (1994) ‘Prologue to the Climate Change Convention,’ in Mintzer, I. M. and Leonard, J. A. (eds), *Negotiating Climate Change: The Inside Story of the Rio Convention*, Cambridge: Cambridge University Press. 45–74.

- Boehmer-Christiansen, S. (1994) 'Global climate protection policy: the limits of scientific advice, Part 2', *Global Environmental Change*, 4: 185–200.
- (2003) 'Science, equity, and the war against carbon', *Science, Technology and Human Values*, 28: 69–92.
- Boehmer-Christiansen, S. and Kellow, A. J. (2002) *International Environmental Policy: Interests and the Failure of the Kyoto Process*, Cheltenham: Edward Elgar.
- Busch, L., Grove-White, R., Jasanoff, S., Winickoff, D. and Wynne, B. (2004) *Measures Affecting the Approval and Marketing of Biotech Products*, *Amicus Curiae* brief submitted to the Dispute Settlement Panel of the World Trade Organization.
- Crichton, M. (2004) *State of Fear*, London: HarperCollins.
- Edwards, P. N. and Schneider, S. H. (2001) 'Self-governance and peer review in science-for-policy: the case of the IPCC Second Assessment Report', in Miller, C. A. and Edwards, P. N. (eds), *Changing the Atmosphere: Expert Knowledge and Environmental Governance*, Cambridge, MA: MIT Press, 219–46.
- FoE (1992) *Twenty-One Years of Friends of the Earth*, London: Friends of the Earth.
- Freudenburg, W. R. (2000) 'Social constructions and social constrictions: toward analyzing the social construction of "the naturalized" as well as "the natural"', in Spaargaren, G., Mol, A. P. J. and Buttel, F. H. (eds), *Environment and Global Modernity*, London: Sage, 103–119.
- Greenpeace UK (2003) *Human Impacts of Man-made Chemicals*, London: Greenpeace.
- Hansen, J. (2005) 'Framing the public: three case studies in public participation in the governance of agricultural biotechnology', PhD thesis, Florence: European University Institute.
- Hart, D. M. and Victor, D. G. (1993) 'Scientific elites and the making of US policy for climate change research', *Social Studies of Science*, 23: 643–80.
- Horlick-Jones, T., Walls, J., Rowe, G., Pidgeon, N. F., Poortinga, W., Murdock, G. and O'Riordan, T. (2007) *The GM Debate: Risk, Politics and Public Engagement*, London: Routledge.
- Jasanoff, Sheila (2005) *Designs on Nature*, Princeton, NJ: Princeton University Press.
- Kasemir, B., Jäger, J., Jaeger, C. C. and Gardner, M. T. (eds) (2003) *Public Participation in Sustainability Science: A Handbook*, Cambridge: Cambridge University Press.
- Lahns, M. (2005) 'Technocracy, democracy and US climate politics: the need for demarcations', *Science, Technology and Human Values*, 30: 137–69.
- McCright, A. M. and Dunlap, R. E. (2000) 'Challenging global warming as a social problem: an analysis of the conservative movement's counter-claims', *Social Problems*, 47: 499–522.
- (2003) 'Defeating Kyoto: the conservative movement's impact on US climate change policy', *Social Problems*, 50: 348–73.
- Mol, A. P. J. (2006) 'Environmental governance in the Information Age: the emergence of informational governance', *Environment and Planning*, C24: 497–514.
- Pearce, F. (1991) *Green Warriors: The People and the Politics Behind the Environmental Revolution*, London: Bodley Head.
- Priest, S. H. (2001) *A Grain of Truth: The Media, the Public, and Biotechnology*, Lanham, MD: Rowman & Littlefield.
- Stirling, A. and Mayer, S. (1999) *Re-thinking Risk: A Pilot Multi-Criteria Mapping of a Genetically Modified Crop in Agricultural Systems in the UK*, Brighton: Science Policy Research Unit.
- Winickoff, D., Jasanoff, S., Busch, L., Grove-White, R. and Wynne, B. (2005) 'Adjudicating the GM food wars: science, risk and democracy in world trade law', *Yale Journal of International Law*, 30: 81–123.
- Yang, G. (2003) 'The co-evolution of the Internet and civil society in China', *Asian Survey*, 43: 405–22.
- (2005) 'Environmental NGOs and institutional dynamics in China', *China Quarterly*, 181: 46–66.

- Yearley, S. (1993) 'Standing in for nature: the practicalities of environmental organisations' use of science', in Milton, K. (ed.) *Environmentalism: The View from Anthropology*, London: Routledge, 59–72.
- (1999) 'Computer models and the public's understanding of science: a case-study analysis', *Social Studies of Science*, 29: 845–66.
- (2005a) *Cultures of Environmentalism*, Basingstoke: Palgrave Macmillan.
- (2005b) *Making Sense of Science: Science Studies and Social Theory*, London: Sage.