



# **STATES OF KNOWLEDGE**

**The co-production of science  
and social order**

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### 3 Climate Science and the Making of a Global Political Order

*Clark A. Miller*

The sum of research into the science and impacts of climate change makes it clear that nothing less than dramatic reductions in emissions of greenhouse gases will stop the inexorable warming of the planet. Nothing short of action which affects every individual on this planet will forestall global catastrophe.

(Mostafa Tolba, Executive Director, UN Environment Programme, 1991)

Taking a co-productionist idiom seriously is essential to understanding the processes of globalization transforming the postwar world order as we commence the twenty-first century. In recent years, public concern about a host of environmental, economic and security issues has given rise to a growing demand for global political cooperation.<sup>1</sup> Perhaps the most surprising and important is the transnational mobilization of public opposition to the US war in Iraq grounded on the failure of the Bush administration to secure multilateral backing for its aims. Not since the creation of the League of Nations immediately following World War I, and the United Nations after World War II, has the belief that humanity must act in global concert achieved a comparable level of public support. Responding to these concerns, policymakers have created a host of new global institutions, such as the World Trade Organization and the UN Framework Convention on Climate Change. None of these new institutions yet shares the comprehensive mandate of the UN. Nevertheless, their collective consequences for world governance in the next 100 years may ultimately rival changes made by 200 years of liberal individualism, and the spread of national expressions of political identity and the Enlightenment ideal of a rational politics geared to social needs.<sup>2</sup>

To date, the globalization of politics has not only failed to settle into a stable institutional framework, but has, in fact, exacerbated many of the uncertainties that haunt international relations. What is the proper division of authority between global and national political institutions? When is global intervention in national political choices legitimate? As global institutions acquire greater authority, do political actors other than nation-states – e.g. non-governmental organizations (NGOs), industry trade lobbies, local and regional governments, and individual citizens – acquire the right to participate in global policymaking? In what ways? Under what conditions and through what institutional arrangements are states willing to cede authority to experts and expert knowledge in global decisions? What normative principles will guide global procedural and distributive choices? Who will have the right to speak to those principles, and how will those rights be managed in practice? These questions, familiar from ongoing debates within a variety of new international organizations, demonstrate just how destabilizing the new global politics can be to an existing political order founded on the primacy of nation-states.<sup>3</sup>

Where does the power come from to call into question such entrenched political

settlements? Part of the answer, I propose, is that existing normative and organizational frameworks for making public policy choices are now seen as inadequate for solving the kinds of problems humanity faces – problems that are conceived as explicitly global in scope. Faced with an array of challenges that seem to outstrip the knowledge and capacity of even the most capable states and multilateral institutions, people have begun to challenge and renegotiate the basic organization of global governance – founded on the sovereignty of nation-states, the exclusive legitimacy of national identity as a basis for political representation, and the exclusive rights of national governments to contract international legal agreements. Calls for a new, global politics draw an important part of their force from the work of transnational social actors – government officials, scientists, activists, business leaders and citizens alike – who have articulated persuasive accounts of the global nature of biological, geophysical, economic and/or social systems (cf. Takacs 1996; Jasanoff 2001; Miller and Edwards 2001). Hence, to understand where the impetus comes from to undermine existing, state-based political arrangements, we need to examine three issues: first, how and why people articulate their understandings of nature and society in explicitly global terms; second, how these global narratives become persuasive to diverse public and policy audiences; and third, how these audiences ultimately connect up global narratives to new moral and institutional frameworks for achieving social order.

I begin this chapter by inquiring into how and why people come to conceptualize the world in global terms. I then trace the process of globalization, so conceived, for the issue of climate change, using a detailed case study of the Intergovernmental Panel on Climate Change (IPCC). Subsequent sections explore two strategies of co-production the panel used to shore up its fledgling authority. First, I describe how the IPCC globalized the atmosphere by constructing a discourse that framed climate change as a risk to the global environment. This view differed from earlier discourses that had framed climate change as changes in the weather in specific locales. I then describe how, to further reinforce its authority, the IPCC articulated a new model of science and politics. In contrast to patterns of international governance founded on the power of states, the IPCC offered a model of global politics in which experts and expert knowledge, as politically neutral agents, were accorded significant power to define problems of global policy. The IPCC's efforts to shore up its contested authority in this manner have led it to draw on a variety of cultural norms and practices for warranting public knowledge, legitimating the use of power, and building trust. Most importantly, these included increasingly sophisticated institutional mechanisms and rhetorical strategies for drawing boundaries between – and in this way co-producing – distinct domains of science and politics in global forums. In the chapter's final section, I examine some of the implications of these observations for the politics of globalization.

The IPCC appears in this account as both an agent and a product of co-production. This is not a contradiction. The absence of an independent causal prime mover typifies co-productionist accounts, which ideally capture the messy reality of rapid intellectual and social change. A co-productionist idiom attunes the analyst to ways in which micro- and macro-categories, actors and dynamics connect up, directing careful attention to how, in their day-to-day routines and practices, institutions like the IPCC simultaneously reconfigure their ideas, their institutional forms, and the cognitive and social landscapes they inhabit.



## What Is Globalization?

The sovereign state, which a decade ago appeared a permanent fixture on the global stage, today is frequently described if not as at death's door then at least as diminished in relation to suprastate and sub-state collectivities. The state is undergoing a "crisis of authority", we are told, stemming from its inability to address prominent issues on its agenda adequately in the eyes of its increasingly skeptical and skilled citizens (Rosenau 1992; Ezrahi 1990; 1984). Constructivist writers have reinterpreted the concept of sovereignty, arguing that it is properly understood not as the ability of autonomous states to exclude other states from their jurisdiction, but rather as a convergence of norms and practices in global society that change over time. Some have proclaimed "the end of sovereignty" (Camilleri 1996). Others that "sovereignty is being greened" (Litfin 1998). What seems clear is that many of the characteristics of sovereignty, at least as described by international relations theorists of past decades, will at least be subject to question in the new era. Most authors in the field today seem committed to the notion that there is something qualitatively different about world politics in the new millennium.

Less clear are questions such as how much change has occurred, precisely how and where discrete changes have taken place, and what drives processes of global change. Considerable attention has focused on the increasingly global reach of human networks and interconnections, built on new technologies of production, transportation and communication. Keohane and Nye (2001), for example, point to advances in technology that have increased the number and density of interactions among people in different parts of the globe, and to the emergence of new classes of policy problems, like terrorism and environmental change, that defy national solution. Working in a different intellectual tradition, Rosenau (1992) offers a similar account of dynamics of globalization:

Stated summarily, one of the five global dynamics involves the shift from an industrial to a post-industrial order and focuses on the dynamics of technology....A second is the emergence of issues, such as atmospheric pollution, terrorism, the drug trade, currency crises, and AIDS, that are the direct products of new technologies or the world's greater interdependence and are distinguished from traditional political issues by virtue of being transnational rather than national or local in scope....A third dynamic is the authority crises that stem from the reduced capacity of states and governments to provide satisfactory solutions to the major issues on their political agendas.... partly because the compliance of their citizenries can no longer be taken for granted. Fourth, with the weakening of whole systems such as states, subsystems have acquired a correspondingly greater coherence and effectiveness.... Finally, there is the feedback of the consequences of all of the foregoing for the skills and orientations of the world's adults who comprise the groups, states, and other collectivities that have had to cope with the new issues of interdependence and adjust to the new technologies of the post-industrial order.

(Rosenau 1992)

From a co-productionist perspective, however, globalization raises a different

kind of question: why is it that, in the late 1980s and 1990s, people came to reconceptualize a number of prominent issues in explicitly global terms? Without inquiring into the changing categories in which people make sense of their world, discussions of long-term trends offer at best weak explanatory bite. Consider Rosenau's third and fourth dynamics, for example. Historically, it is difficult to argue that the capacity of states to implement effective policies and to compel citizen compliance is today at an all-time low. In the West, states today may have retreated somewhat from their peak powers in the 1950s and 1960s. Nevertheless, their ability to manage social conflict, mobilize force, and discipline citizens' beliefs and actions through such practices as the collection and standardization of information, surely remains at near-historic highs. If modernization programs succeeded at anything, it was in strengthening the capacity of states to know and manipulate their subjects (Scott 1998; Foucault 1979). If there is a crisis of authority in the West today, it is not because of absolute levels of state incapacity. At best, it is a crisis of expectations. Ironically, crisis conditions are arguably more prevalent in just those countries of the global South that have little or no presence at the forefront of globalization.

Other aspects of Rosenau's explanation seem similarly ahistorical. For each issue he lists as somehow more international today – e.g. AIDS, currency crises, terrorism, atmospheric pollution – one can point to earlier parallels that seemed equally world-spanning at the time: malaria, polio, recession in the 1930s, World Wars I and II, nuclear weapons, radioactive fallout, to name only a few. What, if anything, distinguishes the problems of this turn of the century so that people view them as beyond the capacity of even greatly expanded states, acting in consort? Moreover, if much of what underlies Rosenau's (and others') accounts of globalization are continuous long-term trends in interdependence and technological change, how do such developments account for the specific timing of globalization? Why have global discourses come to the fore just now? And, to wander back into history again briefly, why did similar "one world" discourses arise so prominently in the late 1940s, only to fade away again subsequently? If interdependence has been building for many centuries, why has the late twentieth century been framed as a discrete disjunction in world affairs? If people today seem to be simultaneously reworking the categories in which they understand the world and the institutions through which they address perceived problems, can we identify and explain the processes by which this reworking is taking place?

### **Aggregating the Weather**

Co-productionist accounts emphasize the power of ideas in shaping world order. In this, they build on recent neo-institutional approaches to international environmental politics, which highlight the role of scientific knowledge of transboundary environmental problems as a stimulus for the creation of new international institutions and regimes (e.g. Litfin 1998; Young 1998; Keohane and Levy 1996; Hampson and Reppy 1996; Haas *et al.* 1993; Choucri 1993). They depart from such studies, however, in inquiring into the sources of scientific ideas, as well as their credibility and authority, in international settings (Jasanoff and Wynne 1998). Studies of environmental politics generally hold that ideas acquire political authority because they mirror the realities of nature; correspondingly, expert

organizations acquire authority from their monopoly on objective knowledge (Haas 1990; 1992). Considerable scholarship in the field of science and technology studies indicates, however, that this answer is inadequate. Scientific accounts of nature exhibit persistent interpretive flexibility (Collins and Pinch 1982), and these interpretations can be taken up into competing frames of environmental and policy discourse (Miller 2000; Cronon 1992). Compelling accounts of the power of ideas must therefore specify how ideas come to be framed in particular ways, as well as how those particular framings acquire the power to shape social and political order (see e.g. Jasanoff 1996b for an explicit critique of Haas).

The historical evolution of climate change as a public policy issue exemplifies the problem. In a speech to the Second World Climate Conference in November 1990 (see quote at the beginning of this chapter), Mostafa Tolba, then Executive Director of the UN Environment Programme (UNEP), highlighted new scientific evidence for global warming and called for worldwide action to combat the problem. Tolba imagined a new, worldwide political order of unprecedented scope that could affect, as he put it, “every individual on the planet”. The following month, the UN General Assembly authorized the formation of a new international institution – the Intergovernmental Negotiating Committee – to develop an overall framework for global policy responses to climate change. Eighteen months later, at the 1992 UN Conference on Environment and Development in Rio de Janeiro, Brazil, the Committee completed the UN Framework Convention on Climate Change. The treaty, ultimately signed by over three quarters of the world’s countries, established a suite of permanent global institutions to make global climate policy, and began the process of determining the norms and practices that would govern those institutions.

Tolba’s views typify contemporary perspectives that link the global politics of climate to scientific understanding of the issue. They depart noticeably, however, from earlier framings of climate change. The claim that climatic changes will result from carbon dioxide buildup in the atmosphere has a long history. Nevertheless, prior to the late 1980s, scientists and other policymakers rarely connected this idea to a need to reorganize global politics. Why not? I will argue in the following two sections that they did not make these connections in part because, until recently, they represented and articulated their understandings of the atmosphere primarily in local and regional, not global, terms. Only when the Earth’s climate was re-imagined as a *global* system, bringing views of the atmosphere into line with assumptions about the jurisdiction of international institutions, did claims about climate change begin to engage with debates about international politics.

For most of the twentieth century, the development of climatology as a field of scientific inquiry took place as part of the broader field of meteorology, and stemmed from the interests of meteorologists in understanding long-term weather patterns. From this perspective, climate and weather were not just intimately connected, they were essentially identical. The 1941 Yearbook of Agriculture, *Climate and Man*, published by the US Department of Agriculture in response to the events of the dust bowl years, presented the conventional mid-century view:

The distinction between climate and weather is more or less artificial, since the climate of a place is merely a build-up of all the weather from day to day and the weather is merely a day-by-day break down of the climate. It seems to be a useful distinction, however, and there will probably continue to be mete-



orologists concentrating on the daily weather and climatologists concentrating on the long-term.

(Hambidge 1941: 4)

This equating of weather and climate was reinforced by meteorological and climatological practices. Climatological knowledge derived from measurements of specific atmospheric variables (temperature, wind, humidity, etc.) made at specific locations over long periods of time. Historical records provided the data for deriving and verifying meteorological and climatological relationships and forecasting weather. Climatological conditions were computed for microclimates, local climates, and even regional climates by averaging data from one or more weather stations. Their day-to-day activities, then, as much as their philosophical predilections, connected meteorologists and climatologists with specific local and regional understandings of the relationships between human societies and long-term weather and climatic patterns. *Climate and Man* exemplifies these traditions, with the bulk of the volume (over 1,100 of 1,200 total pages) devoted to three related topics: (1) regional patterns of climate and agricultural settlement; (2) regional distributions of grain crops mapped onto climatic variations; and (3) specific climatic data for each state in the United States. As late as 1978, Robert White, Chief of the US National Weather Service and chair of the 1979 World Climate Conference, defined climate in almost the same terms as *Climate and Man*:

The definition of “climate” and “weather” is a topic of endless discussion among meteorologists. For purposes of this paper, I consider climate to pertain to the statistics of weather parameters over time periods that are greater than those for which deterministic predictions of day-to-day weather are theoretically possible. As a practical matter, this means that the statistics of weather parameters over periods of two weeks and greater would qualify as climate.

(White 1978: 109)

Put simply, climate remained merely another way of describing the weather, a statistical artifact constructed through mathematical averaging.

The ontological status of climate as an aggregation of local weather conditions over various spatial areas had important consequences for the politics of climate change, not least of which was the absence of any perceived need for international cooperation. The first formal, government assessment of anthropogenic climate change, published by the US National Academy of Sciences in 1966, wandered seamlessly across scales, making little distinction among various human activities that modified climate, such as urbanization, air pollution and smog, forest cover change, agriculture, supersonic transports, deliberate weather modification, and a host of other human activities, including carbon dioxide emissions. What linked these activities together in the report’s discursive framework were their effects on “atmospheric properties and processes” that control long-term weather patterns:

The subject of weather and climate modification is concerned with any artificially produced changes in the composition, behavior, or dynamics of the atmosphere. Such changes may or may not be predictable, their production may be deliberate or inadvertent, they may be transient or permanent, and



they may be manifested on any scale from the microclimate of plants to the macrodynamics of the worldwide atmospheric circulation.

The report did acknowledge the potential seriousness of climate change, but framed the risks very carefully:

[E]ven in the more extreme estimates of the possible climatic consequences of increased atmospheric CO<sub>2</sub>, the calculated temperature changes have been of the order of a few degrees, generally less than five or ten. From glacial-geologic data, it is known with some certainty that North America and Europe have, since the last maximum of the Wisconsin Glaciation, experienced climates that have averaged several degrees warmer than present. As mentioned earlier, *although some of the natural climatic changes have had locally catastrophic effects, they did not stop the steady advance of civilization.*

(NRC 1966: 88, emphasis added; for comparison, the IPCC today predicts a 1.5–4.5 degrees Celsius temperature rise for a doubling of carbon dioxide concentrations)

Far from linking changes in climate to a need for global policymaking, the report argued exactly the opposite. Carbon dioxide-induced climate changes, the report concluded, may very well have significant consequences for *local* communities, but they do not pose a *global* risk.

## The Climate System and Global Authority

Arguments such as those made by the National Academy in 1966, or Robert White in 1978, provide little support for the creation of an intergovernmental institution with the authority to make global climate policy. And yet that is exactly the step governmental leaders from around the world chose to take in November 1988, when they created the Intergovernmental Panel on Climate Change (IPCC). Prompted by a resolution of the UN General Assembly, the IPCC was created as a joint initiative of the UN Environment Programme and the World Meteorological Organization. Its brief was to “conduct a comprehensive review of the issue and make recommendations comprising ‘elements for inclusion in a possible future international convention on climate’”.<sup>4</sup> If, however, climate change was best understood in terms of long-term changes in local weather patterns (and those changes did not pose a global risk), why was an international convention on climate deemed necessary or desirable? One possible answer is that enough people around the world saw their local weather patterns at risk and came together to do something about it. In actuality, however, something very different happened: the *representation* of the Earth’s climate in scientific and policy discourses changed dramatically between the mid-1960s and the late 1980s. What was this change, and how did it come about?

Two decades after its 1966 report, the Academy restated its sentiments that the risks of climate change were primarily local, not global, in its 1983 report, *Changing Climate*:

Viewed in terms of energy, global pollution, and worldwide environmental damage, the “CO<sub>2</sub> problem” appears intractable. Viewed as a problem of

changes in local environmental factors – rainfall, river flow, sea level – the myriad of individual incremental problems take their place among the other stresses to which nations and individuals adapt. It is important to be flexible both in definition of the issue, which is really more climate change than CO<sub>2</sub>, and in maintaining a variety of alternative options for response.

(NRC 1983)

As it had before, the Academy stressed in 1983 the local specificity of the natural and human systems involved, and sought to dissociate discussions of rising concentrations of carbon dioxide and other greenhouse gases from the need for global political action. This time, however, the Academy faced an uphill battle. By the early 1980s, there was an alternative to viewing climate as merely the aggregation of the weather. Based on computer models of the general circulation of the atmosphere, climate scientists increasingly represented the Earth's climate as an integrated, global system.<sup>5</sup> Conceptually, this system not only represented the atmosphere as a single entity, but also linked atmospheric dynamics and energetics to the world's oceans, vegetation, glaciers and ice caps. Moreover, it was this entire system that was now viewed as at risk from human emissions of greenhouse gases. The term climate had gone from signifying an aggregation of local weather patterns to signifying an ontologically unitary whole capable of being understood and managed on scales no smaller than the globe itself. Many scientists and other policymakers increasingly viewed climate change as posing risks to something that could reasonably be called the global environment. By pointing to the potential flexibility in framing climate change as either a global or a local problem, the authors of *Changing Climate* sought to reassert the credibility of prior, local interpretations of the risks of climate change against this global alternative. They thus hoped to counter what they viewed as an "intractable" framing of the issue. But the tide had turned. By 1988, a scant five years later, the IPCC's creation signified the ascendance of the view that climate change constituted a global environmental risk that could only be addressed through global political cooperation.

When formed in 1988, the IPCC derived its understanding of climate from the work of climate modelers. The IPCC produced its first assessment report in 1990 and its second in 1995. Building on earlier Academy reports on climate modeling and climate research from 1979 and 1982, as well as a subsequent report, *The Greenhouse Effect, Climatic Change, and Ecosystems*, published in 1986 by ICSU's Scientific Committee on Problems of the Environment (SCOPE), the IPCC reports adopted the climate system as their central metaphor and explicitly eschewed concerns with local weather and climates.

Although the common definition of climate refers to the average of weather, the definition of the climate system must include the relevant portions of the broader geophysical system which increasingly interacts with the atmosphere as the time period considered increases. For the time-scales of decades to centuries associated with the change of climate due to the effect of enhanced greenhouse warming, the United Nations Framework Convention on Climate Change defines the climate system to be "the totality of the atmosphere, hydrosphere, biosphere, and geosphere and their interactions"

(Houghton *et al.* 1996: 57)

The IPCC's second assessment report, *Climate Change 1995: The Science of Climate Change* (Houghton *et al.* 1996), opens with "The climate system: an overview", and proceeds to organize its entire account around the systemic view of climate and climate change. At its heart are three chapters devoted to the processes that govern the climate system, and climate model simulations of those processes. Three subsequent chapters examine environmental changes associated with changes in the global climate system: sea level rise, changes in terrestrial ecosystems, and changes in marine ecosystems. Other chapters examine radiative forcing of the climate system, observations available to validate climate models, and future work needed to narrow uncertainties in the assessment of human influence on the climate system.

The IPCC's internal organization and reporting strategy further reinforced this view of the atmosphere. Following a suggestion in the UN General Assembly resolution requesting its creation, the Panel divided into three Working Groups responsible for: (1) the science of climate change; (2) the impacts of climate change; and (3) possible response strategies. In the IPCC's 1990 assessment, Working Group I described the behavior of the climate system as a natural phenomenon being perturbed by human activities. Working Group II's report subsequently discussed the potential impacts of changing the state of the climate system. Working Group III's report concluded by describing the potential response strategies available to global society for inclusion in an international treaty. In all, policymakers were presented with a common (i.e. shared) global policy issue, and a set of possible responses for collective adoption.

In elaborating and reinforcing this global, systemic understanding of climate and climate change, the IPCC thus contributed to a vision of natural order that made clear the necessity for, and possibility of, a global politics of climate. By shifting the grounds of deliberation from changes in local and regional weather patterns to degradation of the global environment (that is, by globalizing the climate), the IPCC shifted consideration from what the US National Academy of Sciences report *Changing Climate* termed "local environmental factors...which take their place among the other stresses to which nations and individuals adapt" to what, only four years later, the World Commission on Environment and Development called "a common concern of humankind" (WCED 1987).

### **The Globalization of Science Advice**

In delineating the organization and work of the IPCC, I have thus far focused on the relationship of ideas about nature to ideas about the organization of politics. The creation of the IPCC in the late 1980s reflected the emergence of a global view of the Earth's climate and atmosphere. This view in turn helped underpin belief in the necessity of global political cooperation to prevent planet-wide environmental catastrophe. The IPCC helped strengthen both beliefs by further clarifying and extending the cognitive framework describing the global, systemic understanding of climate and climate change. Its efforts to depict climate change in global terms helped integrate that framework with conventional understandings of the jurisdiction and form of international organizations, thus reinforcing belief in the need for and possibility of global cooperation. By bringing concepts of natural order and political order into line with one another, the IPCC served to co-produce new arrangements of global nature and global civil society.



In this section, I turn to the normative, institutional and rhetorical resources with which the IPCC shored up its scientific claims. This is a second dimension of the Panel's role as an agent of co-production. Research in science studies has demonstrated that political institutions play a number of important roles in enhancing scientific credibility in public contexts. At a procedural level, legislative, executive and judicial bodies commonly participate in setting public standards for the conduct of policy-relevant scientific research, establishing criteria for scientific evidence in administrative and judicial proceedings, determining who counts as an expert in public forums, and demarcating boundaries between scientific and political authority (Jasanoff 1990; 1996a). At a more fundamental, ideological level, policy processes and political institutions also draw on deep-seated, cultural norms and practices for securing trust and credibility to repair scientific and social uncertainty (Brickman *et al.* 1985; Jasanoff 1986; Shapin 1994).

The IPCC, too, has deployed such resources, as we see if we track institutional changes in the panel's organization over the first several years of its existence. The initial authorizations of the IPCC by the UN General Assembly, UN Environment Programme, and World Meteorological Organization were deliberately vague on institutional specifics as a consequence of profound disagreements about how to organize the Panel. The UN Environment Programme, basking in the successful completion of the Montreal Protocol in late 1987, wanted to replicate the structure of the ozone negotiations in which a small group of internationally recognized experts participated directly in the negotiations alongside government representatives. The World Meteorological Organization, concerned that the structure of the ozone negotiations had allowed a small group of scientists to dominate the proceedings without satisfying the broader scientific community, wanted to strengthen the applicable peer-review requirements. Several governments, and particularly the United States, were concerned that the ozone negotiations had allowed experts to get too far ahead of political realities; they wanted to retain closer control over the production of scientific knowledge by appointing the Panel's members.

Differences between the US and German delegations to the initial meeting of the IPCC in November 1988, illustrate the confusion generated by these competing desires. The official purpose of the initial meeting was precisely to settle organizational issues. Invitations to the meeting went out from the World Meteorological Organization to their national contacts, the national meteorological services. The US government, interpreting the IPCC as a formal international institution dedicated to global policymaking for climate, sent a full national delegation of over twenty individuals from numerous agencies, headed by a delegation leader from the US State Department. Since the German meteorological office has no responsibility for either climate science or climate policy, however, it did nothing with the invitation until the week before the meeting. At that point the office forwarded the letter to the German climate research committee, which sent a single, academic researcher to the meeting. Once the meeting began, he quickly contacted the German embassy in Geneva, asking them to send a diplomatic representative as well.<sup>6</sup>

The organization that emerged from the initial meeting of the IPCC reflected a negotiated compromise among a variety of positions. The overarching plenary was established as a body of formal governmental representatives who would carry final authority over all actions taken by the Panel, including the publication



of all reports. The plenary also established the IPCC Bureau, composed of a smaller number of government representatives chosen one from each of the six regional associations of the World Meteorological Organization. The IPCC established three working groups, with the six Bureau members acting as the chair and vice-chair of each. Working Group I was assigned the task of assessing the science of climate change; Working Group II was assigned the task of assessing the impacts of climate change; and Working Group III was assigned the task of developing response strategies. To accommodate the views of scientists present at the meeting, the rules for Working Group I provided for extensive peer review of the group's assessment, and allowed the group to recruit any scientist to work on the assessment, with the approval of the individual's national government. No comparable procedures were established for Working Groups II or III. Finally, the IPCC also established a secretariat, under the auspices of the World Meteorological Organization, and invited Bert Bolin, a prominent Swedish scientist, to chair the panel.

Here we see a variety of important efforts to draw upon political resources to shore up the authority of the IPCC. One involves the appeal to democratic norms and traditions of openness and participation in the Panel's organizational framework. Governments and experts from all sovereign states were invited to participate in the IPCC's activities, conforming to generally accepted practices of multilateral organizations within the UN system. IPCC reports prominently documented this widespread participation and drew on it rhetorically to support implicit and explicit claims regarding the fairness, impartiality and objectivity of the Panel's findings. In a paragraph similar to ones found in each of its reports, the Panel's *1992 Supplementary Report to the IPCC Scientific Assessment* notes:

Generation of the background papers involved, either as lead authors or contributors, 118 scientists from 22 countries. A further 380 scientists from 63 countries and 18 UN or non-governmental organizations participated in the peer review of both the background material and the Supplement. The text of the Supplement was agreed in January 1992 at a plenary meeting of [Working Group I] held in Guangzhou, China, attended by 130 delegates from 47 countries. It can therefore be considered as an authoritative statement of the contemporary views of the international scientific community.

(Houghton and Bolin 1992: xi)

The distinction between “delegates” at the Guangzhou plenary meeting and “scientists” in the production of the report refers to the formal approval of the final document by government representatives from forty-seven countries (even though many of these delegates were also scientists). Compared to the SCOPE assessment that preceded the IPCC, this reflects a substantial increase in the level of government oversight. Much as the US National Academy of Sciences legitimates many of its activities through formal relations with federal executive and legislative bodies, so, too, the IPCC has drawn legitimacy from the sanction of the government representatives who make up its plenary body.<sup>7</sup>

Differences arose in the first year of the Panel's operation, however, over how and why developing countries should participate in the IPCC, and what benefits the IPCC could expect to gain from developing country participation. In part, these differences reflected uncertainty about whether the activities of the IPCC were entirely scientific, clearly political, or somewhere in between – in other words, un-

certainty about how to draw the boundaries of science and policy in international discussions of climate change.<sup>8</sup> To address the question of developing country participation, the IPCC established a Special Task Force in 1989 that reported in 1990, at about the time the IPCC's first report was published.

Some participants in the Task Force argued that the IPCC was a scientific organization. If so, developing country participation was only necessary insofar as scientists from these countries brought knowledge that was unavailable to other participants (e.g. of southern hemisphere climates and ecosystems). Developing country participants, by this reasoning, had to be disciplinary specialists. Other participants argued, by contrast, that the IPCC played an important policy role by helping to educate leaders about the dangers of climate change and possible policy responses. From this perspective, developing country participants could properly be generalists with the ability to digest the information presented in IPCC meetings and assessments, as well as with the political connections necessary to bring that information back to decisionmakers in their own countries. Still others saw the IPCC as necessary to confirm authoritatively that states needed to respond to climate change. From this perspective, the most appropriate developing country participants were well recognized experts who might or might not be connected to policymakers, but whose participation would lend credibility to the IPCC process back in their own countries.

Uncertainties also prevailed about how the IPCC should set criteria and develop policies for improving the effectiveness of developing country participation. For those who viewed the IPCC entirely in scientific terms, improving participation in the IPCC required the development of new research and training programs in developing countries. If the goal was to encourage social learning about climate change, however, then more broadly based information workshops seemed a better response. Finally, for those who viewed credibility as the most important reason for increasing developing country participation, the best short-term policy appeared to be to raise the status of those developing country representatives who already participated, and to add participants from other developing countries as quickly as possible.

Over time, the last indicated model of participation has received the greatest attention. The IPCC has increasingly funded the travel of developing country participants, but has used its limited resources primarily to fund individual representatives from each country to attend IPCC plenary meetings (Agrawala 1997). Donor countries have, for the most part, proved unwilling to extend large sums of money to developing countries to enable them to send multiple participants to the meetings of the IPCC working groups, or to begin to build credible climate science programs of their own. Developing countries, in turn, have opted to use their limited resources in other ways. Thus, while the number of non-OECD countries participating in the IPCC plenary rose to nearly a hundred by 1995 (Agrawala 1997), the number of individuals from developing countries listed as authors and contributors to the 1995 IPCC assessment remained much smaller and essentially constant over time (Kandlikar and Sagar 1997).

Many developing country participants, however, saw the need to participate in entirely different terms. In the 1990 report of the Special Task Force, for example, developing countries noted that many issues relevant to climate change are political. Poverty, development, equity, and access to technological and financial

resources (including intellectual property rights) are fundamental, they argued, to any effort to respond effectively to climate change. At the Second World Climate Conference in November, 1990, Jean Ripert, the chair of the Task Force, noted:

the struggle to master a very important aspect of the future of our planet cannot be dissociated from other efforts which the international community must make to favour a general process of development, to ensure an equitable rise in standards of living, and to equalize opportunities between peoples.

(Ripert 1991)

If these were the objectives, developing country participation in the IPCC was woefully inadequate. Developing country leaders were certain that the IPCC could not act as an appropriate forum for formulating global responses to the problems of climate change, when framed in these broader political terms. This perception led them to reject the IPCC during UN debates over how to organize international climate negotiations. Between June and December 1990, the UN Environment Programme Governing Council and the UN General Assembly debated whether the IPCC should become the official institution for negotiating the Framework Convention. Although UNEP supported this choice, along with many industrialized countries, developing countries voted overwhelmingly to authorize the UN General Assembly to form another body for this purpose – the Intergovernmental Negotiating Committee.

To understand these events more fully, it is important to consider another resource that the IPCC has drawn upon over time to shore up its authority, namely the rhetorical and institutional separation, or bounding, of science and politics. Scientific judgments, we now know, inevitably involve tacit value assumptions and choices that can have important social and political consequences. At the same time, “boundary work” separating scientific and political domains of authority and action can be an important source of legitimacy in public policy contexts, although the boundaries drawn in any given instance inevitably involve negotiations among scientists, government officials, citizens and other policy actors. By appealing to widespread public understandings of science and politics as separate spheres of social activity, boundary work thus helps bring the forms and processes of public policymaking into line with prevailing Western expectations about the nature of democratic governance and rational inquiry (Gieryn 1996; Jasanoff 1990).

The confusion prevalent at the initial November 1988 meeting of the IPCC provided an ideal site for boundary work, and the separation of Working Group I (the science of climate change) from Working Groups II and III (the impacts of climate change and response strategies) demonstrates early efforts to distinguish between the scientific and political activities of the Panel. Not surprisingly, this separation took place not only in physical terms (separate working group meetings) but also in the rules and practices governing the production of the working group reports, as described earlier in this section. Over time, however, this separation proved inadequate in pragmatic terms as the IPCC grappled with the day-to-day problems of formulating and carrying out its work plans.

The problems of developing country participation offer one example of the IPCC’s challenges in successfully presenting science and policy as bounded within the organization. When Mostafa Tolba, then UNEP Executive Director, began preparations for the climate negotiations to follow the publication of the IPCC’s



first report, he requested that the IPCC be delegated as the negotiating body for the Framework Convention. Tolba proposed to convene, under the Panel's auspices, technical working groups nominated by governments to establish parameters for various treaty components. These would then form the basis for subsequent negotiations by government representatives to the IPCC. Developing countries objected, however, arguing that many of the issues facing negotiators were political and not technical, and that the IPCC was an inappropriate body for undertaking such activities. Instead, as noted above, they supported, and obtained, the creation in early 1991 of a separate negotiating forum – the International Negotiating Committee – under the auspices of the UN General Assembly.

The institutional separation between the “political” domain of the International Negotiating Committee and the “scientific” domain of the IPCC had a number of important stabilizing effects for the climate regime as a whole. Developing countries, who had actively lobbied throughout the first two years of the IPCC for greater participation, eased their criticism of the organization with the apparent decrease in the Panel's ability to make political decisions. Subsequently, in late 1991, scientists, who had been highly critical of what they viewed as the political machinations and negotiations that had characterized Working Groups II and III, prevailed upon the IPCC to extend the rules of procedure and peer review initially established for Working Group I to the other two bodies as well. At the same time, the IPCC also established Technical Support Units for each of the three working groups, whose self-described purpose was to act as a buffer between the experts working on the IPCC reports and the special interests who would inevitably want to influence those reports. Finally, the IPCC set formal procedures for the production, review and acceptance of its reports, which established clear roles for both experts and government representatives. All of these activities went a long way toward bringing the Panel's institutional apparatus into line with the increasingly accepted view of the organization as a technical advisory body for the formulation of global policy. Some three years, and one complete report cycle after its creation, the IPCC had co-produced a global science and politics of climate change that would lead, in the subsequent five years to two major international treaties and the establishment of regular, ongoing global deliberations about the future of the Earth's climate.

## **Warning Signs**

One value of the co-productionist idiom is that it enables the observer to become attuned to the multiple ways that knowledge and order become coupled in the emergence of a new phenomenon like climate change. The IPCC, as we have seen, has actively engaged in two co-production processes. First, as a key component of its authority to speak on global policy issues, the IPCC worked to intertwine knowledge and power by explicitly representing the climate as a global-scale natural system. Second, the IPCC consolidated its own technical authority by articulating a narrative of global politics in which experts play a powerful role as politically neutral agents. Presented with a global science and politics of climate change, certified by an established technical authority, negotiators moved quickly to reach agreement on the UN Framework Convention on Climate Change. Even US president George Bush, who was initially skeptical of the issue, attended and signed the



treaty in deference to public concern catalyzed by the IPCC report and the perceived need for global cooperation. The Framework Convention was signed in June 1992, two years after the publication of the IPCC's first assessment report. Article 2 of the Convention states: "The ultimate objective of this Convention and any related legal instruments...is to achieve...stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system". Three years later, citing authoritative evidence in the Panel's second assessment, published in 1995, the Clinton administration accepted legally binding targets for greenhouse gas emissions, clearing the way for the negotiation of the 1997 Kyoto Protocol.

The co-production idiom is also useful, however, for the insights it provides into where coupled knowledge-orders remain unconsolidated, tentative and fragile. As the world seeks to bring into being new forms of global governance, such insights will be particularly valuable. The global science and politics put in place by the IPCC, for example, faces at least two major challenges. First, the global view elides major differences among human populations, treating everyone as a citizen of planet Earth. How such differences will be accommodated, especially between rich and poor, is a growing question mark. Skepticism toward the IPCC's "one world" vision of climate change persists in developing countries, and the place of these countries in the global order of the climate regime remains contentious. Critical voices in the global South have charged the IPCC and others who support worldwide action to reduce greenhouse gas emissions with a not-so-subtle form of neo-colonialism (Agarwal and Narain 1991). Developing country diplomats have insisted that rich, industrial states should take the first steps to reducing emissions, collectively refusing to adopt any emissions reductions targets themselves. In turn, this unwillingness on the part of developing countries to participate in a global regulatory framework has become a frequently wielded argument by opponents of climate policies, especially in the United States.

The failure of the IPCC to incorporate developing country voices and concerns about global politics into its "technical" framing of the problem, has also contributed significantly to concerns about IPCC science. Developing country researchers express doubt about the credibility of a picture of climate change that is founded on the work of laboratories and modeling centers in North America, Europe and Japan, and that ignores major features of the South's climate, such as the Indian monsoon (Kandlikar and Sagar 1997). Even when the IPCC has sought to accommodate critiques emanating from developing countries, its framing of the issue and its organizational norms and procedures have as frequently exacerbated controversy as reduced it. One major controversy occurred during the run-up to publication of the second assessment report, when calculations of the long-term economic costs of climate change turned out to have been based on assumptions that valued the lives of inhabitants of developing countries at only one tenth that of their counterparts in the West. More recently, during its third assessment report, completed in 2001, IPCC efforts to develop regional perspectives on climate change quickly ran into difficulties when the Panel could find few regional scientists who met its standards of expertise, and few regional studies that satisfied its stringent peer-review requirements. To build an understanding of climate change that speaks credibly to developing country audiences may well require the IPCC to renegotiate what counts as reliable knowledge and expertise within its

assessments.

During the negotiation of the Kyoto Protocol, the climate regime also began to encounter significant resistance in the West. Particularly in the United States, conservative organizations and energy companies funded extensive media efforts to discredit IPCC science (Edwards and Schneider 2001). In early 1997, the US Senate voted 99–0 to oppose any treaty that appeared to disproportionately favor the economic interests of developing countries over those of the US by exempting them from global emissions reductions regulations. The Clinton administration never submitted the Kyoto Protocol for ratification, and when the George W. Bush administration took office in January 2001, it unilaterally declared the Kyoto Protocol dead, at least as far as the US was concerned.

Growing US opposition to the climate regime reflects several important features of the global science and politics co-produced by the IPCC. First, any vision of global government raises potential red flags for America's long-cherished traditions of sovereignty, political independence and individualism. When it declared the Kyoto Protocol dead, the Bush administration also declared the IPCC's conclusions to be "UN science", drawing on discursive repertoires in American political culture that paint the United Nations as an inept, highly political bureaucracy seeking to subjugate Americans to the capricious whims of a global state. The IPCC succeeded in quickly reasserting its technical authority, pointing out that well over half of its authors and peer reviewers were American scientists, and forcing the Bush administration to back down from its comments and at least formally accept the IPCC's scientific conclusions. In an ironic twist, however, the US government took advantage of the IPCC's effective boundary work by agreeing with the IPCC's science but nonetheless retaining its sovereign right to disagree over the political necessity of a global regulatory solution. In other words, the boundary drawing that the IPCC undertook allowed the very kind of unilateral exit that the United States made from the climate regime.

Similar challenges plague the IPCC regarding the boundary work it has done to differentiate its global view of climate change from more localized perspectives. Although people seem to respect the credibility of global climate science, and often point to global warming as a major policy concern, especially when in the throes of a hot summer or warm winter, their concerns remain locally grounded. Visions of global climate change have failed to generate much demand for costly policy responses. A great deal of uncertainty remains, for many, about just what climate change implies for their own individual lives and livelihoods, as well as about the capacity of global political institutions to map out and follow through on a strategy for achieving global sustainability. They fear global solutions that will impose unacceptable burdens and distribute them unfairly among the Earth's many inhabitants. The kind of incremental solutions proposed by the Clinton administration in 1993 (a 5 cent per gallon gasoline tax) and the Kyoto Protocol (a 7 per cent reduction in emissions from Western countries) fail to reassure people either that these are adequate to the task, or that the benefits they may bring from avoiding uncertain local risks will offset their very real costs.

The proper relations between the local and the global in a reconstituted global order remains a central dilemma faced by institutions of global environmental governance. Even if climate change is successfully projected as a global phenomenon, and even if a global perspective on the natural environment continues to



permeate public discourse, just how human societies will rearrange themselves socially and politically to cope with the “demands of planet Earth” remains unsettled. Will we arrive at a world in which, as Karen Litfin puts it, sovereignty has been “greened” (Litfin 1998)? That is, will the nation-state, with potentially significant changes in its norms and practices, nonetheless remain the obligatory passage point of international governance? Or will, by contrast, some real or virtual institutional locus of global policymaking emerge in the twenty-first century, much as Washington DC replaced the fifty states of the United States as the locus of national policymaking in the late nineteenth and early twentieth centuries?

The evidence we have to date is ambiguous. Depictions of a new, global empire paint at best sketchy landscapes of its institutional and power relationships (Hardt and Negri 2000). Likewise, even the most forward-looking accounts of the need to reshape political order to redress global risks, such as the World Commission on Environment and Development’s now canonical report *Our Common Future* (1987), are ambivalent about how to think about the new world order. The “our” of the report’s title seems to presage the need for a single voice to speak for all humanity,<sup>2</sup> a sentiment reinforced by the report’s opening line: “The Earth is one but the world is not”. This simple phrase captures the challenge that global environmental discourses are said to pose to existing political institutions and arrangements. It is precisely the distinction between the global interconnectedness of environmental systems and the local dis-connectedness of social institutions for regulating and managing human behavior and natural environments, that the Commission singles out as the greatest cause for concern. Yet the report talks throughout not only of, but also to, nation-states. It seeks to imagine one new world, but it fails to escape existing political divisions.

## Conclusion

In the case of climate change, the construction of a category of “global natural systems”, at risk from human activities, has undermined important aspects of the postwar political order. No longer are sovereign nation-states viewed as an adequate organizational foundation for global governance. New global (as opposed to international) institutions must be created to cope with these new kinds of global environmental degradation. Precisely what form those institutions will take is not yet clear. The IPCC offers an increasingly influential model, although far from the only one, which several other regimes of emerging global governance have begun to emulate, including the Millennium Ecosystem Assessment of the Earth’s ecological health and the InterAcademy Panel, an institution that aims to perform a scientific advisory role for global governing bodies comparable to that currently performed by the National Academy of Sciences for the US government. What is clear, however, is that the constitution of these new institutions will involve substantial changes to conventional political categories, such as sovereignty, the state, civic identity, and even science.

The history of the IPCC demonstrates that new constructions of natural and social order on global scales are highly interdependent. The nominally scientific construction of global environmental risks has helped underpin the legitimacy of claims about the need for new institutions of global political cooperation. Simultaneously, global political cooperation has proved equally necessary to underpinning

the legitimacy and credibility of scientific claims about the existence of global environmental risks. Even as the IPCC has sought to portray climate change as a global phenomenon, the credibility of that view has depended on the IPCC's ability to construct itself as a legitimate institution of global cooperation. So long as the idea that the environment can be understood and managed on planetary scales was championed only by a handful of scientists from the United States and Europe, its credibility remained suspect in the eyes of elites and publics elsewhere. Only by re-presenting this idea through an institution that could credibly claim universal (i.e. global) representation could the idea secure the necessary authority to motivate global political change.

Much the same can be said for the IPCC's reconfiguration of the role of science and the state in global politics. For over a century, Western democracies have struggled to integrate expertise into the formulation and implementation of public policy. As comparative studies of scientific advisory processes have demonstrated, Western governments arrived at a broadly shared normative sentiment that science should inform policy but should be separate from politics. Over time, however, countries encapsulated this shared sensibility in very different institutional forms. Everything that one might normally expect to be universal to science – from evidentiary standards to norms of openness, transparency and public participation – is subject to different interpretation in the design and management of national expert advisory systems (see, especially, Jasanoff 1986; Brickman *et al.* 1985). Today, as supranational bodies like the IPCC seek ways of incorporating science advice in global policymaking, these same sets of value-laden questions face policymakers. Who will count as an expert? What will count as evidence? Who will be responsible for deciding such issues?

Science, in any event, will clearly retain considerable power to legitimize global policy institutions. Yet, as I have tried to illustrate in the case of the IPCC, the articulation of what counts as “good science” in global contexts will depend heavily on political institutions for support and legitimacy. This dynamic of co-production reinforces an observation made by Sheila Jasanoff. Securing the credibility of policy-relevant science in global contexts may well result not from seeking better science, in and of itself (which, as Jasanoff points out, “falsely presupposes the autonomy of scientific inquiry”) but also and simultaneously from constructing more morally authoritative institutions of global governance (Jasanoff 1997).

Science and politics – as orderings of nature and society – are co-produced; solutions to the world's most critical problems of social order will require solutions to problems of knowledge, and vice-versa.

## Notes

- <sup>1</sup>Note that the adjective “global” – pertaining to the globe in its entirety – differs from other adjectives, such as international or transnational – pertaining to relations among nation-states – that are often used interchangeably.
- <sup>2</sup>On the spread of nationalism, see Anderson (1983). On the rise of the instrumental state and its articulation in various Western democracies, see Ezrahi (1990) and Rueschemeyer and Skocpol (1995).
- <sup>3</sup>Demonstrations against the WTO in Seattle illustrate the increasing significance attached to global institutions and their potential to upset existing political settlements. Discussions of other case studies can be found in Chayes and Chayes (1995), who discuss



the participation of countries in international legal regimes; Slaughter (1997), who discusses increases in networking among judges, legislators and other political officials from around the world; and Miller (2001a), who discusses the challenges in constructing global expert advisory arrangements that can achieve credibility among multiple national audiences.

<sup>4</sup>WMO *Bulletin* 38(2): 113.

<sup>5</sup>The transition from a local to a global view of climate coincided with the development and spread of general circulation models as the principal tool for scientific inquiry into the nature of the climate. The history of this shift in the practices of climate scientists has been detailed by Paul Edwards, who describes climate models metaphorically as a “world in a box” (Edwards 2001). The construction of general circulation models began in the 1960s, and climate modeling gained credibility thereafter. The US National Climate Program, created in the early 1970s, specifically emphasized computer modeling as the central tool for climatological research. The 1979 World Climate Conference included discussions of climate models and statistical research alongside one another, particularly in its discussions of the impacts of climate change (WMO 1979). With the publication of two Academy reports in 1979 and 1982, these models began to displace statistical aggregation as the central focus of climatology in policy discourses (NRC 1982; 1979). The 1979 and 1982 Academy reports (also known as the Charney and Smagorinsky reports) are the first reports in which carbon dioxide is treated independently of other human activities that affect the weather on local scales. Another indicator of how climate models shifted the discourse of climatologists is the “First Annual Conference on Statistical Climatology” held in 1979. Prior to the late 1970s, there was no reason to refer to *statistical* climatology, as there was no other form of climatology to distinguish it from.

<sup>6</sup>I conducted interviews with several individuals who attended this meeting.

<sup>7</sup>Overall, the IPCC's organization was a hybrid mix of elements borrowed from the practices of scientific advisory committees and international diplomacy. For a more theoretical discussion of hybrid institutions like the IPCC, see Miller 2001b.

<sup>8</sup>Similar boundary drawing occurs all the time within nation-states in accordance with well established procedural understandings in legal, administrative and advisory settings. See Jasanoff 1990.

<sup>9</sup>Cf. Anderson (1983) for a similar account of the emergence of possessive language as an indicator of new forms of identity in the case of nationalism.