The Emergence of Climate Change as a Global Problem

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Timeline:

1960s: The climate emerges as an object of serious scientific study. While a number of scientists had previously explored the potential connections between human emissions and global warming, the mechanisms were now modelled for the first time. However, temperatures were cooling, and there was some debate about whether humans would warm or cool the climate.

1970s: At the beginning of the decade, climate research was conducted mainly in a few national labs. The U.S. Government did support research, but it was not a political issue. Over the course of the decade climate change garnered more attention. Weird weather was linked to human influence. The 1972 UN conference in Stockholm and accompanying scientific reports popularized environmental issues and raised the possibility that human action could create a crisis. The Department of Energy and other governmental agencies study the issue and release reports.

1979: The "Charney Report" by the National Research Council predicts that doubling CO2 will lead to 3°C warming. This is the first report to clearly state climate change as a policy problem.

1983: The first of three reports from the National Academy of Sciences expresses concern (but not alarm) about climate change. Throughout the 1980s, Senators conducted hearings and requested scientific studies, which kept attention on the issue.

1985: International scientific conference at Villach produces first "scientific consensus" about global warming. Villach was organized by UN Environmental Program (led by President Mostafa Tolba), in conjunction with the World Meterological Organization, and scientist Bert Bolin. Villach was the first in a sequence of scientific international conferences and assessments that culminated in the 1988 creation of the IPCC.

1987: U.S. *Climate Protection Act* directs EPA and State to prepare policy options for climate change.

1988: An unusually hot summer catalyzes U.S. political action. NASA scientist James Hansen appears before congress. Newspaper coverage of climate change spikes around the world. The Toronto scientific conference, organized by the same people who organized Villach, called for a 20% reduction in emissions. This all coincided with the creation of the IPCC, which was established partially so that governments could reassert control over the international scientific process.

1990: First IPCC report published. Another National Academy report was released. Foreign ministers meet for the first time to discuss climate change at Second World Climate Conference, calls for negotiation of a framework convention on climate change.

1991: UN establishes Intergovernmental Negotiating Committee (INC) to produce a framework convention outlining climate cooperation.

1992: UN Conference on Environment and Development in Rio, results in the UN Framework Convention on Climate Change (UNFCCC), the principal negotiating forum for global climate issues.

1997: Kyoto Protocol, the first major global climate change treaty. U.S. Senate unilaterally passes legislation saying they will not ratify the treaty unless developing countries make commitments to reduce their emissions.

2002: All of the elements of the Kyoto treaty finally settled, and entered into force in 2005.

Note: The texts are presented in thematic order, beginning with a good overview, followed by texts concentrating on scientific developments (U.S. emphasis), those focusing on translating science into policy, and finally some literature on the global politics of the climate regime.

Daniel Bodansky, "The History of the Global Climate Change Regime." In Urs Luterbacher and Detlef F. Sprinz, eds. *International Relations and Global Climate Change* (MIT Press, 2001), pp. 23-40.

Bodansky divides the history of the global climate regime into 5 phases:

1. Rising scientific concern in the 1980s;
2. 1985-88, Agenda-setting;
3. 1988-90, Pre-negotiation (when government officials enter the process by conducting hearings, creating institutions, attending international conferences, and so on).
4. 1990-92, Negotiations (leading up to the creation of the UN Framework Convention on Climate Change (UNFCCC));
5. 1992-97, Implementation (meetings under UNFCCC to work on Kyoto Protocol).

Bodansky argues that the development of *scientific knowledge itself is probably insufficient to explain why climate change went from scientific concern to a political problem* on the agenda of major states. He cites three additional factors. First, a small group of activist, environmentally-oriented scientists, led by Bert Bolin, with ties to the World Metereological Organization (WMO) and United Nations Environmental Programme (UNEP), publicized the scientific knowledge. Second, the emerging regime was bolstered by general concern for the environment in the mid-late 1980s, stoked by the discovery of the "ozone hole," the politics of the trade in hazardous waste, deforestation, and so on. Finally, there was a heat wave and drought in North America in the summer of 1988 that raised public concern and catalyzed the will for action.

The Intergovernmental Panel on Climate Change (IPCC) was created in 1988 to "reassert governmental control" over the scientific process that had been driven by UNEP and scientific activists.[1] At the same time, climate emerged as a genuine global political problem. Between 1988 and 1990 there were five major political events: the UN General Assembly debated the issue, seventeen heads of state attended a summit in the Hague, large ministerials were held in Noordiwjk and Bergen, and the Second World Climate Conference in 1990 (unlike the First in 1979) was well attended. After this, states institutionalized negotiations under the UN Framework Convention on Climate Change (1992) which produced the Kyoto Protocol (1997).

While this provides a good overview of the political developments, I think that the relevant history of the climate regime has to start earlier, with the creation of the basic science in the 1960s and 1970s.

Spencer Weart, *The Discovery of Global Warming* (Harvard University Press, 2003)

Weart's account focuses on scientific developments, but he provides details on three key

[1] The IPCC initially gave states more control because in the IPCC, government representatives are able to influence which scientists would be involved, and offer some input into the language and tone of its assessments. In the prior UNEP and WMO-led process, states had no say in who was involved, or what the reports conclusions would be.

moments in which climate change threatened to break onto the U.S. political agenda. In the final analysis, the issue was only politicized in the 1980s because the scientific community found high-level political leaders (congressional representatives) to take up the issue, thereby pulling it from a diffuse interagency discussion and into the public eye.

The first moment was shortly after the climate as we know was first conceptualized (in coupled atmosphere-ocean computer models) in the mid-1960s. In 1963, a private scientific conference hosted by the Conservation Foundation concluded that doubling CO2 would lead to temperature rise of 4°C. The federal government responded by convening a President's Science Advisory Committee which led to a 1966 National Academy of Science (NAS) report that said humans *could* influence the climate and the issue should be studied more. It was put on the political back burner. Evidently, there was not yet enough evidence to create sustained governmental involvement in the issue.

In the 1970s, two NAS reports linked climate change into the national conversation on energy, but climate change was still not placed on the political agenda. There was still too much uncertainty in the science to press for government action. Nonetheless, throughout the 1970s Government departments, first NOAA (created in 1970) and then the Department of Energy, coordinated and conducted climate research. Weart concludes that by the late 1970s, scientists had convinced their low-level government contacts that climate change was an important political issue, but "these officials themselves had scant influence in higher reaches." (98)

In the 1980s, climate science broke through into Congress and Presidential politics. In 1981, congressional representative Al Gore (who had been a student of oceanographer Roger Revelle at Harvard) held hearings designed to shame the Reagan administration for its cuts to science funding. In 1983, an NAS report finally stated that it was "deeply concerned" about global warming and an EPA report warned of potential catastrophe.

Meanwhile, the 1985 Villach conference on climate science came to an "international consensus" that there was potential for unprecedented warming. All of this built momentum for the summer of 1988, which was unusually hot. Hansen appeared before Congress to warn that climate change constituted a "present danger." While most scientists disagreed with Hansen at this time, his warning picked up widespread media coverage. This coincided with the creation of the IPCC and subsequent international negotiations leading to the UN Framework Convention on Climate Change.

Industry funded skeptics (Marshall Institute, Global Climate Coalition) then entered the public arena. Under pressure from oil and gas interests, the Bush administration raised uncertainties as justification for resisting robust targets and timetables in international negotiations. But Clinton and Gore pushed for a global climate treaty. In 1997, international negotiations produced the Kyoto Protocol, which included voluntary targets and timetables for emissions reductions by developed countries. The White House was rebuffed by the Senate, which voted 95-0 against any treaty that did not contain developing country commitments, before the U.S. even signed the Kyoto Protocol.

Weart shows that climate change moved from early research in the 1960s to international action in the 1990s.

Alan D. Hecht and Dennis Tirpak, "Framework Agreement on Climate Change: A Scientific and Policy History." *Climatic Change* Vol. 29 (1995): 371-402.

Hecht and Tirpak show that the climate issue went from a modeling exercise involving a handful of U.S. laboratories to an important global issue *in about 20 years (1970-1992*).

In 1970, climate models at NOAA's Geophysical Fluid Dynamics Lab (GFDL), the National Center for Atmospheric Research in Boulder, UCLA, and RAND were still in their infancy. During the 1970s, anomalous weather events (droughts, cold winters) raised awareness and generated financial support for more research from the Nixon and Carter administrations.

Hecht and Tirpak portray the 1980s as a flurry of U.S. congressional action, scientific reports, and international conferences that laid the groundwork for international action between 1988 and 1992. The story is focused on the evolution of U.S. policy. In brief, congress (especially Senators Chafee, Stafford, Bentsen, Durenberger, Mitchell, Baucus, Leahy and Gore) requested multiple reports from National Academy of Sciences (NAS), which broadly vindicated the prediction of long term warming and spurred debate on policy options. This put the issue in the public eye and kept pressure on a White House intent on cutting funding for scientific research. Legislative efforts culminated in the 1987 *Climate Protection Act* which "directed EPA and the Department of State to develop policy options for dealing with greenhouse climate change and for coordinating international activities." (383)

Meanwhile, at the international level, UN Environmental Program President Mostafa Tolba convened the 1985 Villach conference on climate science, which produced a summary report and a request for negotiations on a climate convention to begin. But the U.S. Department of Energy dismissed the Villach report because it was not prepared by government officials. So, the U.S. proposed an "intergovernmental" or state-led scientific assessment, leading to the creation of the Intergovernmental Panel on Climate Change (IPCC) in 1988.

Between 1988-1992 the first international scientific assessments were released and the first political negotiations took place. In 1990, the IPCC released its first assessment, which produced an intergovernmental consensus on the physical basis for global warming and reaffirmed the use of models. Also in 1990, foreign ministers met to discuss the climate for the first time at the World Climate Conference. The conference called for negotiations on a framework convention on climate change. The idea was that this would be modeled on the ozone framework convention which was signed in 1985 and yielded an effective protocol to limit ozone destroying gases in 1987.

The UN General Assembly picked up where the IPCC and the World Climate Conference left off. In 1991, it established Intergovernmental Negotiating Committee (INC) to lead negotiations for framework convention to be concluded before the UN Conference on Environment and Development in 1992 (aka "Rio" or the "Earth Summit"). During these negotiations, the U.S. stalled, citing economic costs and scientific uncertainties, while the Europeans pushed hard. The eventual product, the UN Framework Convention on Climate Change (UNFCCC), was a weak agreement (it merely sets up a negotiating forum and contains no commitments).

Why 1988-1992? While it is easy to focus on the proximate causes (the summer of 1988 was very hot, Time and Newsweek ran big stories on global warming, Presidential candidate Bush picked up the issue on the campaign trail), *I believe Hecht and Tirpak show that the scientific groundwork laid in the 1970s and 1980s was essential.* Without multiple NAS reports (1983, 1988, 1990), the international scientific consensus at Villach (1985) and the IPCC assessment (1990), it is unlikely that there would have been sufficient U.S. or international support for a framework convention.

The framework convention might have happened earlier (closer to Villach 1985) had the key U.S. representatives – John Sununu (Bush Chief of Staff), Michael Boskin (Chair of Council of Economic Advisors), and Richard Darman (Director of Office of Management

and Budget) – not concluded that climate policy would be very costly. Based on in-house macroeconomic analyses, they remained "unconvinced that the scientific evidence for global warming justified the cost of mitigation." (389)

Shardul Agrawala, "Context and Early Origins of the Intergovernmental Panel on Climate Change." *Climatic Change* Vol. 39 (1998): 605-620.

Agrawala follows Hecht and Tirpak in suggesting that the U.S. was responsible for delaying international action on climate change. He argues that in the late 1970s, there simply was not enough scientific evidence to justify action. But he contends that after the international conference at Villach in 1985, climate science was just as advanced as ozone science was when it successfully spurred a framework convention treaty, and probably further along than the science of acid rain when a major treaty regulating air pollution was signed. Agrawal argues that a framework convention did not happen in 1985 for two reasons. First, climate change is a political problem that requires restructuring energy sectors, "the heart of most economies" (612). Second, climate change is truly global and requires both developed countries and developing countries to participate and the groundwork for the latter had simply not been laid. So the U.S. proposal to delay by creating the IPCC and calling for more research instead of a producing framework convention had lots of backers internationally.

Agrawala reframes much of the other work reviewed here on the role of science. Science can put an issue on the agenda, but if there are no good policy options and states don't know what a negotiated solution looks like, no amount of scientific uncertainty reduction will resolve the issues.

Paul N. Edwards, *A Vast Machine: Computer Models, Climate Data, and The Politics of Global Warming* (MIT Press, 2010).

Edwards' account is the single best history of climate science. He makes the case that computer models are essential to our understanding of the climate and the maturation of climate science.

For Edwards, climate change would not have become a political problem without the development of climate models precise enough to be adapted as policy tools. He argues that throughout the 1970s and 1980s climate modelers cut their teeth on political debates on supersonic transport pollution, *Limits to Growth*, ozone depletion, and nuclear winter. This experience helped make their work more policy relevant.

But Edwards also recognizes that scientific acts alone will not create a political problem. He sets out three preconditions for a problem to "arrive" on the political agenda: i) there must be a crisis; ii) a constituency that cares about the crisis; and iii) there must be a theory to explain why the crisis is occurring and how to resolve it. But Edwards also notes that theory and data need to be precise enough to guide policy. In the 1960s, none of these conditions were met. Climate change could only be taken up into the political process in the 1980s under the influence of three factors:

i) Climate science had matured enough to eliminate the cooling hypothesis and offer confident, precise predictions about the effects of climate change. Edwards highlights the 1979 National Research Council report "Carbon dioxide and climate" (aka, the "Charney Report" after its Chairman) as a key moment. The Charney report predicted that a doubling of CO_2 would lead to a 3°C warming (±1.5°C). He also notes the 1983 EPA study that warned of alarming sea-level rise.

ii) The environmental movement and international environmental conferences (especially 1972 UN Convention on the Human Environment, aka "Stockholm") prepared the public for the idea of an environmental crisis. More proximate, however, was that the politics of acid rain, ozone depletion, and nuclear winter created a "surge" in public awareness and political activity around environmental issues.

iii) Modelers offered concrete predictions with policy implications. That is, they began to provide a range of emissions scenarios, and arguing that emissions should be frozen at given levels to avoid warming.

For Edwards, all of this laid the groundwork for the summer of 1988 in which Hansen's testimony launched global warming onto the political agenda and led to activity at the UN, the creation of the IPCC, etc. The IPCC then dominated the run up to the 1992 UN Conference on Environment and Development in Rio, the start of global environmental negotiation.

Edwards emphasizes *the role of policy relevant knowledge in catalyzing political action*. But policy knowledge must be supported by a well-developed scientific community. That said, Edwards doesn't really show that modelers were successful in creating programs of action – merely that they offered precise enough predictions to make government officials convinced the problem required their attention (Cf. Pielke below, on the issue of moving from prediction to policy).

David M. Hart and David G. Victor, "Scientific Elites and the Making of US Policy for Climate Change Research, 1957-74." *Social Studies of Science* Vol. 23 (1993): 643-680.

Hart and Victor show how elite entrepreneurs mediate between scientific communities and political institutions. On the one hand, elite brokers transmitted political influence into the scientific community, shaping which problems were deemed important. On the other, they allow scientific knowledge to enter political discussions.

Hart and Victor deploy John Kingdon's model of policy making: knowledge and politics develop in separate streams, but on occasion, windows open and allow the streams to interact. For Hart and Victor, "Scientific elites may play a central role in identifying policy windows and seizing advantage of them." (646)

Hart and Victor argue that climate science first tried to obtain research funding by framing climate science as "weather modification." This was meant to indicate potential military applications (if only there was more money for research). This strategy had limited success in the 1960s. In the 1970s, the environmental movement provided a new strategy that helped to justify research on the climate as a threat to the human environment. The key events were two reports organized by Carroll Wilson (MIT): Study of Critical Environmental Problems (SCEP, 1970) and Study Man's Impact on Climate (SMIC, 1971). These provided a new model of interdisciplinary research and raised awareness in the run up to the 1972 UN Conference on the Human Environment in Stockholm.

There are two important lessons here. First, consistent government funding for a scientific issue depends on a good discourse to justify and legitimate basic research. Second, Hart and Victor's analysis suggests that scientific developments alone are insufficient for generating political attention. *Scientific knowledge matters when it is framed and packaged in opportune moments by elite brokers*. Moreover, when windows open, policy entrepreneurs often use knowledge that the scientific community has had for some time. However, entrepreneurs must wait for major events that focus attention on issues and

provide the opportunity to influence political processes.

Reiner Grundmann and Nico Stehr, *The Power of Scientific Knowledge: From Research to Public Policy* (Cambridge University Press, 2012)

Grundmann and Stehr argue that scientific knowledge has to be rendered practical and usable in order to be politically effective. In the climate case, they follow the consensus position articulated elsewhere that the mid-1980s was a threshold moment, whereby scientific warnings (not necessarily developments in knowledge), ozone politics, and Hansen's testimony stirred global fear of "climate catastrophe" and spurred political development.

They argue that awareness of climate change has not translated into robust action for a couple reasons. First, unlike in the ozone crisis, which erupted quickly and seemed to demand immediate action, it remains unclear to what extent climate crisis is already present, imminent, or someway off. Second, the scientific and technical center of gravity has been thus far on geophysical research, rather than on practical proposals that would allow policy makers to act. Namely, they point to three unanswered questions: What alternative energy technologies should be developed? What policies will the public support? How can the interests of North and South be aligned?

In short, "The view that a consensus on the part of climate science could provide the solution to climate policy has failed spectacularly." (178) Part of the problem is that reducing uncertainty does not always generate political action. *Policy relevant proposals are often necessary to generate political action.*

Roger A. Pielke Jr., "Policy History of the US Global Change Research Program: Part I. Administrative Development." *Global Environmental Change* Vol. 10 (2000): 9-25.

Pielke suggests that the US climate policy conversation has been stunted because the main inter-agency process was oriented to prediction, not policy relevant programs of action. The result is that congress does not have a well-functioning climate policy system, and though the White House could have one (involving the EPA and DOE), it did not because the principals in the Reagan and Bush administrations had no interest in creating climate policy. In Pielke's view, congressional action, like the 1987 *Climate Protection Act*, was unable to alter this.

He adds more helpful details to the story told above (in Weart, Hecht and Tirpak). One useful detail is that for Pielke, the international conferences were important because they offered U.S. senators a chance to respond to them with hearings that picked up lots of public attention (Cf. Haas 2002 below). Press attention itself was short-lived, but hearings educated other senators and kept issues alive within congressional circles. But, as I noted above, this is insufficient without healthy congressional policy support.

In short, Pielke supports the conclusion of Grundmann and Stehr: climate change requires not just scientific knowledge of the causes and predictions of effects, but policy relevant knowledge about courses of action.

Peter M. Haas and David McCabe, "Amplifiers or Dampeners: International Institutions and Social Learning in the Management of Global Environmental Risks." In William C. Clark et al, Eds. *Learning to Manage Global Environmental Risks, Vol. 1* (MIT Press, 2001), pp. 323-348.

Haas and McCabe argue that a small group of scientists and international institutions was instrumental in putting climate change on the global political agenda and pushing states to make environmental commitments. In fact, international scientists and institutions were so effective that states (especially the U.S.) became concerned they were exerting too much pressure, and thus sought to wrest control over the process by creating an *inter*governmental scientific panel.

Haas and McCabe actually compare three cases (as mandated by the larger study this report is part of) – ozone, acid rain, and climate – to conclude that "collective framing and policy identification in each case was the result of a small transnational network of experts already actively involved in policy-relevant science who gained access to the process through the timely intercession of international institutions." (327) Experts quantified risk and developed policy options which were taken up by international institutions which then shared policy with national governments.

After the 1985 Villach conference, a small group of scientists ("the Villach group," nine core organizing members) kept up the momentum, followed up with more scientific research, and created pressure for an international policy response. The Villach Group helped organize the 1988 Toronto Conference which proposed governments cut emissions levels 20% by 2005.

The endorsement of the 20% cut, against the wishes of U.S. and other industrial governments, "demonstrated to politicians that activist scientists could shame them publicly. Moreover, many of the diplomats from industrialized countries had grown weary of [UNEP President] Tolba's strong leadership and hectoring ways." (332)

Thus, the U.S. and others backed the IPCC as a way to directly control risk assessment and policy option development. IPCC experts were selected by governments, and the policy working group would be staffed by government officials directly.

Haas and McCabe note, however, that states were not entirely successful – independent scientists continued to play an important role via the IPCC. That said, the process after 1988 was quite political, with adaptation and mitigation cost estimates overshadowing scientific advice on the causes and drivers.

So Haas and McCabe conclude that international institutions supported and legitimated scientific networks as they developed policy measures. However, this led to a backlash as states sought to regain control of the process. This marginalized independent international institutions like UNEP.

We could interpret their conclusions in two ways: i) that experts clarified the costs of inaction, persuaded states they needed to address the issue, and provided a clear policy goal; ii) the experts were threatening to create high domestic political costs for governments who would prefer to move slowly, thus motivating them to reassert control over the process. Either way, it *seems activists and international institutions accelerated the timeline, hastening the creation of the IPCC and the UNFCCC.*

Although not directly relevant to the main line of their argument, Haas and McCabe provide this useful comparison of how long it took the issues to mature politically:

"In the ozone case it took four years from the first scientific warning…to a political

international planning meeting, eight years until intergovernmental negotiations began, and fourteen years until strong international measures. The climate case was much more protracted. The first scientific warnings appeared in the nineteenth century. It took twenty-one years from the renewal of scientific concern (Keeling's Moana Loa study is representative) to a political international planning meeting (establishment of the INC) and twenty-three years from the first warning until weak international measures." (336) They attribute this variation in part to differences in the leading international institutions (UNEP was more independent and flexible than the WMO, which initially took lead in climate) and in part to the issues themselves (higher scientific uncertainty, greater economic costs, etc., in climate case).

It is important to note that the "weak international measures" they refer to are either the 1992 UN Framework Convention (the establishment of a negotiating forum) or the 1997 Kyoto Protocol (the first treaty with targets and timetables). Moreover, the Kyoto Protocol was a failure. It was watered down in subsequent negotiations (1998-2002) and even then was unenforceable in practice.

Miranda A. Schreurs, William C. Clark, Nancy M. Dickson, and Jill Jäger, "Issue Attention, Framing, and Actors: An Analysis of Patterns across Arenas." In William C. Clark et al, Eds. *Learning to Manage Global Environmental Risks, Vol. 1* (MIT Press, 2001), pp. 349-364.

In this chapter, the authors analyze data from newspapers to map the "issue attention pattern" for the ozone, acid rain, and climate cases. When did the issue first come to public attention and when did it spike? Consistent with the other studies surveyed here, newspaper coverage of climate change spiked in 1987-88 almost simultaneously in Canada, Germany, Japan, Mexico, Netherlands, UK, and US.

This provides some evidence that *international scientific momentum and public events in the 1980s, culminating in the creation of the IPCC in 1988, was central to catalyzing political attention on climate change*. This supports Haas and McCabe's finding to some extent.

But the authors also interestingly note that in some cases basic science issues are picked up by governments *prior to* international attention. In this avenue, government bureaucracies have research capacities, reach out to basic scientists and do their own in house policy development and option assessment. These bureaucracies, as in the U.S. case, then typically like to hold onto their own frames and analyses, despite international pressure. From this perspective, we can reinterpret Hecht and Tirpak: the U.S. took up climate issues early (because the science was domestic), developed its own policy analyses (relying on macroeconomic studies), shaping a unique response to climate change, which it did not change in the face of either scientific evidence or European bargaining.

Jill Jäger, Josee van Einjdhoven, and William C. Clark, "Knowledge and Action: An Analysis of Linkages among Management Functions for Global Environmental Risks." In William C. Clark et al, Eds. *Learning to Manage Global Environmental Risks, Vol. 2* (MIT Press, 2001),

Jäger et al helpfully break down the policy process for complex scientific problems into six tasks:

1. Risk Assessment: scientific study of nature, causes, consequences, likelihood, and timing of potential risks
2. Monitoring: measurement of risk, e.g., concentrations of CO2 emissions
3. Option Assessment: exploring alternative actions
4. Goal and Strategy Formulation: developing statements of objectives for outcomes and capacity building
5. Implementation: creating institutional capacity at domestic and international levels
6. Evaluation: how effective is management?

In their view, climate risk assessment begins in 1971 with the Study of Man's Impact on Climate (SMIC) [which was part of the buildup to the 1972 Stockholm Conference]. Goal statements also begin here, culminating in the declarations at the 1992 UN Conference in Rio.

Option assessment begins at Villach in 1985, and implementation shortly thereafter via the IPCC and its precursors. But the central institutional implementation does not happen until 1992 when the UN Framework Convention on Climate Change was created.

For the authors, it is notable how long purely scientific risk assessment and monitoring dominated the frame (1970-1985). Implementation dominates proceedings from 1985-1992. During this phase, climate moved up the policy agenda steadily, "science was proving much of the impetus." (176)

This is helpful, but we have to remember that implementation did not end in 1992. Goal and strategy formulation and options assessment continued not just until 1997, when the Kyoto Protocol was signed, but through 2002, when all the elements of that treaty were finally settled. I would say *a more accurate time estimate from risk assessment to implementation is 30 years*. Revising the number from Weart earlier, *the time from early research to implementation is probably 40 years*. But there is not yet an enforceable treaty, so that could be understating it.

Alexander Thompson, "Rational Design in Motion: Uncertainty and Flexibility in the Global Climate Regime." ***European Journal of International Relations*** **Vol. 16, No. 2 (2010): 269–296.**

Thompson does not speak directly to the question of when and why the international community began climate negotiations. However, his theoretical account provides a good Rational Choice explanation for this process that dovetails nicely with some of the articles under review:

States take up problems when it is clear that their interests are at stake and address them seriously only when information lowers uncertainty enough that they can accurately calculate their interests. Thompson argues that states in the current climate negotiations promote carbon sinks and other environmentally dubious policies because they are seeking flexible responses to a problem with uncertain economic and political costs. Consensus on the fact of climate change may not be enough to catalyze action, if states don't know enough about the effects of climate change on politically relevant phenomena.

Peter Haas, "UN Conferences and Constructivist Governance of the Environment." ***Global Governance*** **Vol. 8, No. 1 (2002): 73-91.**

Many of the works I have outlined here focus on U.S. domestic politics. In this piece, Haas

provides a potential mechanism for the spread of climate science to other countries. After all, global negotiations require the global diffusion of scientific ideas. Haas argues that large UN conferences serve this purpose. The key conferences were:

1972 UN Conference on the Human Environment (UNCHE), Stockholm, Sweden
1974 World Food Conference
1992 UN Conference on Environment and Development (UNCED), Rio de Janiero, Brazil
1994 International Conference on Population and Development
1997 UNCED+5
2002 UNCED+10, Johannesburg, South Africa

Though these conferences have not produced a large body of international environmental law, they have still had important effects: "Accumulated global environmental conferences over the last thirty years have contributed to an aggregate shift in international politics by extending participation and access to environmental diplomacy to national environmental agencies and to nongovernmental organizations (NGOs) and networks of scientists – a process that Fomerand describes as a "large-scale process of social mobilization." Over the last thirty years, governments have added the inspirational norm of ecological integrity to the traditional goals of wealth and power." (74-75)

Moreover, UNCHE aimed to teach states how to establish the administrative framework of environmental assessment and management. UNCED presented a social-political analysis of the causes of environmental problems. Preparatory meetings, information sharing, and resource transfers helped globalize the concern for and capacity to address environmental problems.

This is useful, but as Haas concedes, he does not offer clear causal inferences about the effects of international conferences.

Clark A. Miller, "Climate science and the making of a global political order." In Sheila Jasanoff, ed. *States of Knowledge: The Co-Production of Science and Social Order* (Routledge, 2001), pp. 46-66.

Miller argues that we cannot explain the rise of a *global* regime for climate change without looking at how scientists, activists, business leaders, and citizens articulated climate as a global problem, necessitating a global, cooperative response. Cutting against Bodansky, Haas and McCabe, who highlight the IPCC as agent of states, Miller contends that "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." (47-48)

Miller speaks directly to the question of why the IPCC was created, alongside other developments, in 1988. He concedes that it could have been "that enough people around the world saw their local weather patterns at risk and came together to do something about it." But he is convinced that the real driver is changes in the representation of the earth: "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." (54) That is, what really creates success at the international level is not beliefs about local weather, but beliefs about a global system.

In my view, Miller cannot really explain the precise timing of the global regime with a deep, structural claim about the nature of public perceptions of the climate as a global system. Instead, both likely matter, but in a way Miller doesn't quite put it: *changing*

perceptions of the climate as a global system requiring intervention from the global level lay the groundwork for local weather changes and public events to catalyze public opinion, in turn putting pressure on political systems. But, as we have seen, pressure too, is insufficient to generate action.