PERGAMON

Global Environmental Change 10 (2000) 133–144

GLOBAL ENVIRONMENTAL CHANGE

www.elsevier.com/locate/gloenvcha

Policy history of the US Global Change Research Program: Part II. Legislative process

Roger A. Pielke Jr.*

Environmental and Societal Impacts Group, National Center for Atmospheric Research[1], P.O. Box 3000, Boulder, CO 80307-3000, USA

Received 23 September 1999

1. Introduction

As recounted in Part I of this paper (Pielke, 2000), in the late 1980s, some members of Congress grew increasingly frustrated with the Bush Administration's approach to global climate change policy. When the administrative development of the US Global Change Research Program (USGCRP) expanded to the legislative process, it provided Congress with a convenient opportunity to influence the executive branch to serve congressional goals.

This paper tells the story of the US Global Change Research Program, the centerpiece of the US response to global warming, in the legislative process in 1989 and 1990. Important elements of the story include personalities, bureaucracies, presidents, members of Congress, advocacy groups, and experts. At its core, it is a story of how science was enlisted in support of policy development through the institutions of US government.[2] With debate about policy responses to climate change continuing more than a decade later, documentation of the formative years of the nation's primary source of information underlying the debate has yet to be published. Understanding decisions made in those years, and their consequences, is critical to improving the linkages of science and policy.

The central thesis of the two papers is that how policy makers, administrators, and scientists define the role of science in the policy process is critical to success or failure of policies that depend on scientific input. Policy makers established the Global Change Program to support policy development, and its administrators subsequently structured the program to develop predictive knowledge of the earth's climate. However, rather than forcing a political consensus, scientific research has been selectively used (and misused) by opposing camps in the global warming debate to support previously held positions. As a result, the program has achieved notable bureaucratic and scientific successes while falling short of its ultimate goal to support policy development (Pielke, 1995).

The Global Change Program is in many respects a tremendous success story. It represents years of hard work, political maneuvering, and scientific progress by individuals and institutions who feel strongly that global warming is an important matter of societal concern. At the same time, through at least 1995 the program had yet to meet is mandate: it did not meet the needs of policy makers (Pielke, 1995). As one Congressman asked in 1992,

> How much longer do you think it will take before [the USGCRP is] able to hone [its] conclusions down to some very simple recommendations, on tangible, specific action programs that are rational and sensible and cost effective for us to take... justified by what we already know? (HCSST, 1989, 244).

The answer could have been "never", because the program was structured to develop a predictive understanding of the earth's climate, and not to provide recommendations on "action programs". It did not systematically provide information useful to policy makers. This represents a performance shortfall in program

* Corresponding author. Tel.: +1-303-497-8111; fax: +1-303-497-8125.

E-mail address: rogerp@ucar.edu (R.A. Pielke Jr.).

[1] The National Center for Atmosphere Research is sponsored by the National Science Foundation.

[2] The story of the program told in this paper is a synthesis based on materials found in the public record (notably Congressional and administrative documents), published analyses, and in interviews with numerous outside observers, as well as individuals closely involved with the program, from their perspectives on science, administration, and policy. The interviews were conducted over the period 1993–1997, some on record and some off record. I have chosen not to identify by name many interview sources cited in the text out of consideration for their candor and in recognition that the US Global Change Research Program is an ongoing effort with many interviewees having continued involvement in the program. In the text the interviews are cited simply as ([I]nterview with [A]author [year]), e.g. (IA, 1994). See Pielke (1995) for an appraisal of USGCRP implementation through 1994.

0959-3780/00/$ - see front matter © 2000 Elsevier Science Ltd. All rights reserved.
PII: S0959-3780(00)00007-8

implementation that persisted because of breakdowns in the policy process (Pielke, 1995).

The story of the program can be understood from two distinct, but related, points of reference. The first point of reference is the story of the Committee on Earth and Environmental Sciences, an interagency body established in law in 1990 with instructions to develop and implement a Global Change Research Program. The Committee was terminated and replaced in 1994 by the Clinton Administration. The second point of reference is the unfolding story of the program, which existed before the Committee had responsibility for its implementation, and continues following the Committee's termination under a different institutional structure. The program has continued to evolve and thus allows for only tentative conclusions subject to reinterpretation as events unfold.[3]

2. The Global Change Research Act in the legislative process: 1989 and 1990

On 25 January 1989 Senator Ernest Hollings (D-SC), and a number of cosponsors, introduced the Senate version of the bill (S. 169) that became the Global Change Research Act of 1990, or P. L. 101-606. The text of the bill is consistent with the activities mandated by the charter of the Committee on Earth Sciences (hereafter, simply "the Committee"): the proposed program's priority goal was the development of a predictive understanding of global change. One month later the Senate Commerce Committee held the first congressional hearing on the bill. In that hearing Robert Corell, of the National Science Foundation, testified representing the Committee. He characterized the priority goal of the proposed program: "It will principally address the question: What scientific knowledge is required to predict future change reliably (SCCST, 1989a, 46)?" The initial bill justified the program in terms of scientific research and contained only indirect references to policy, consistent with the Committee's desires for the program to emphasize scientific research and to leave consideration of policy issues to others (see Part I).

Two weeks later, on 8 March 1989 during its fifth meeting, Committee representatives from the Office of Management and Budget (OMB), Agriculture, National Science Foundation (NSF), National Aeronautics and Space Administration (NASA), and State agreed that in the future the Committee and Program should deal with issues of science, and not of policy.[4] A participant recalled that Committee officials interpreted the initial bill as a "simple codification" of the Committee's 1987 charter (IA, 1994).

As happens with many pieces of legislation, S. 169 began to evolve and change as it worked its way through the legislative process. An important change from the standpoint of the Committee's mandate occurred with the introduction of the House Version of the bill (H.R. 2984) on 24 July 1989. The House version called for the proposed program to provide "usable information" to support policy development. The Hollings version included similar language.[5] Committee officials testified before the House Science Committee three days later, and presented testimony identical to that of the February Senate hearing. In follow-up questions to the House hearing, a congressman asked Dallas Peck (of the US Geological Survey), who was Committee chair, to clarify the Committee's position "with respect to the proposed legislation" (HCSST, 1989, 249). In his reply Dr. Peck made no mention of "usable information on which to base policy decisions", but reasserted that the advancement of scientific predictions was the driving factor behind the program.

> It has always been our intention to create an integrated, comprehensive program and not just a collection of ongoing agency programs. All of the programs must be weighed against an evolutionary research priority framework which was developed based on the data, process, and modeling needs required *to improve our ability to predict global change. The credibility of the USGCRP can be evaluated based on the programs' ability to address this goal* (HCSST, 1989, 250, emphasis added).

A member of the Science Committee also asked Peck about the role that policy development activities would play in the Committee. The question indicates that, at that time, the Science Committee did not have a clear perception of the role that the proposed program would play in policy development.

> Is the CES a good model for coordinating policy research? If so, is there an existing bureaucratic entity, such as the Domestic Policy Council, that could parallel the CES by coordinating policy research and assessments (HCSST, 1989, 248)?

In reply, Peck chose not to answer the question directly, but his answer re-enforced the Committee's desire to keep considerations of research separate from policy development. He replied

> I would prefer not to speak for the policy community; they make their own decisions for the best structures to

[3] For more background on the issue, see Part I.

[4] CES (1989a) minutes of meeting five, 8 March 1989.

[5] The Senate bill stated that CEES would be responsible for "development of an information base, the assembly of the information essential for effective decision making to respond to the consequences of global change" (SCCST, 1989b, 18). SCCST (1989b, 14–28) reprints the entire text of the Senate version of the bill.

coordinate their activities. However, I should note that international global change science policy is currently being coordinated through the National Security Council's Policy Coordinating Committee for International Oceans, Environment, and Science Affairs [i.e., the Bernthal Committee, described in Part I] (HCSST, 1989, 252).

Peck indicated, by distinguishing between policy development and the Committee's activities, that the proposed program would emphasize science and leave consideration of policy to others. Peck claimed that global climate change policy was coordinated by the Bernthal Committee in the State Department, although (as documented in Part I) the Bernthal Committee's role in policy development had been rendered effectively moot by Bush Administration officials: it was really just for show.

The Senate passed S. 169 on 6 February 1990 with little debate. However, due to a jurisdictional dispute between the House Science Committee and the House Merchant Marine Committee, the House delayed passing its version until 26 October 1990 (Kennedy, 1992). According to Robert Palmer, a House Science Committee staff member who worked on the Global Change Research Act, the jurisdictional dispute involved access to sensitive budget documents.

> A lot of fighting that went on during that legislative process involved getting access to [White House science policy] documents. We had a provision in the bill, at one point, that required the administration to share the agency budget documents with us... The White House fought that real hard, and the Merchant Marine Committee fought really hard over it. They wanted [the budget documents] and this was the thing that held up the bill for a long time, until we found out that Merchant Marine didn't actually have the jurisdiction and didn't really need them. We went forward eventually without [Merchant Marine] (IA, 1994).

During the 16-month period between the July 1989 House hearing and the final House vote on the bill, Congress held only one hearing on the legislation. That hearing is illuminating because it shows the growing frustration in Congress with the Bush Administration's reticence to develop policy with respect to global climate change.

The Senate Appropriations Subcommittee with jurisdiction over the Office of Science and Technology Policy held the hearing on 8 February 1990. D. Allan Bromley, science advisor to President Bush, was the sole witness. Senator Barbara Mikulski (D-MD) explained that the oversight hearing was called because of concerns in Congress about the Bush administration's apparent lack of attention to the development of global climate change policies and she criticized a recent Bush speech on the topic.

> There is increasing concern that U.S. policy and global climate change is adrift... perhaps most troubling in the President's speech was that is lacked any sense of urgency on the need to develop both a short-term and long-term policy on global warming other than beyond doing more research. This Senator has a great respect for research, and good science should lead to good policy, but good science shouldn't lead to a delay in policy (SCA, 1990, 1–2).

Mikulski's opening statement was among the first to link explicitly the proposed research program with global change policy development. Demands for policy development, such a Senator Mikulski's created pressures for Committee officials to define more explicitly the role of the program in the policy process.

In the question and answer period, Senator Mikulski pressed Bromley on the relationship of science and policy in the proposed Global Change Program, noting the Bush Administration's apparent bureaucratic shell game of creating powerless committees to be "in charge" of policy development. She asked, "Could you tell me what is the policy structure, in terms of the way you are going to arrive at it, who has been tasked to do it... it looks like we were lurching from advisor to advisor... who is in charge? (SCA, 1990, 77–78)" Bromley responded that, "at the moment", he linked the Committee on Earth Sciences to President Bush's Domestic Policy Council Working Group responsible for global change policy, providing "essential intragovernmental cross-communication" (SCA, 1990, 78). The Working Group, he continued, reported to the full Domestic Policy Council under the attorney general, who reported to the president. Senator Mikulski was unhappy with the answer and asked a follow-up question: "Doctor, which individual, if there is one within the administration, has the President tasked to coordinate and develop specific government-wide policy options on global warming (SCA, 1990, 80)?" Bromley replied that he was this person.

Sensing the tight spot that they were in, Committee officials found it politically expedient to encourage Congress to link the proposed program with the development of policy as the issue of climate change became increasingly controversial. This in spite of the earlier Committee efforts to restrict the program to research only.[6] Representatives of the Committee walked a tightrope between

[6] The developing relationship between USGCRP science and global change policy was defined further in follow-up questions to OSTP budget justification hearings in May 1990. Bromley used the Intergovernmental Panel on Climate Change (IPCC), as an example of an "interface between science and policy", a phrase that came to characterize the USGCRP following its approval (SCA, 1990, 233–234).

demands for policy action from Congress and the policy reticence of the Bush Administration. They discovered that walking the tightrope meant promising to Congress that the scientific research to be conducted in the program would be policy relevant, while asserting to the Bush Administration that the program would not be involved with policy development. An agency participant recalled that

> From the standpoint of the greenhouse issue, you couldn't even contemplate saying "we're serving the people who want to negotiate agreements on greenhouse gas emissions" because you weren't supposed to admit anyone needed to negotiate (IA, 1994).

The participant said that Committee officials had to be very careful in the polarized political environment.

> We learned over the years how to finesse words [in program reports and testimony] very carefully to get a little bit of the flavor in to people who knew, the people who were close [to the program] would recognize what we were trying to say, but to the outside reader, they don't mean anything (IA, 1994).

The program became more closely connected to the development of global change policy through the efforts of a frustrated Congress seeking to gain an upper hand in its dealings with the Bush Administration over the issue of global warming.[7] Political polarization forced issues of science and policy closer together in the program as Committee officials sought to maintain a balance between those in Congress with interests in policy development and an Administration interested in avoiding policy development.

A result of the interbranch conflict was that some members of Congress appropriated ambiguous "words that don't mean anything" — such as "usable information" — from the global change community and used them to forge an explicit link between science and policy. One Congressional staff member describes the evolution of the Committee's mandate: At the beginning of the legislative process

> what you had was a simple codification of what CES was doing. There wasn't much in the way of anything broader. What ended up happening was just like what happens in most legislation. [it] became the vehicle to get at a lot of other problems (IA, 1994).

In the case of the Global Change Research Act, Congress expanded the Committee's existing mandate to include a provision calling for the program to "provide usable information on which to base policy decisions relating to global change" (P.L. 101–606). The end result was a different mandate for the program and its overseeing Committee than was originally envisioned by the Committee on Earth Sciences.

3. Legislative and administrative intent for P.L. 101–606

President George Bush unceremoniously signed the bill into law on 16 November 1990. The Global Change Research Act of 1990 is quite explicit in its call for research to support policy development. The purpose of the legislation was to

> provide for development and coordination of a comprehensive and integrated United States Research program which will assist the Nation and the world to understand, assess, predict, and respond to human-induced and natural processes of global change (P.L. 101–606, Section 101).

The law directs the White House, through the Federal Coordinating Council on Science, Engineering and Technology (FCCSET), to create a Committee on Earth and Environmental Sciences (CEES) "for the purpose of increasing the overall effectiveness and productivity of Federal global change research efforts" (P.L. 101–606, Section 102). Thus, Congress gave the three-year old Committee on Earth Sciences a new name along with its new mandate.

The law gave the Committee responsibility to develop the program's 10-year research plan (to be updated every 3 years), to coordinate federal global change research budgets, to review periodically the program's performance (with external assistance from, e.g., the National Academy of Sciences), and to cooperate with the State Department when the US participates in international global change conferences, meetings, and programs.[8] The law also gave the Committee an explicit role in the development of alternative policy responses. It states that the Committee shall consult "with actual and potential users of the results of the program to ensure that such results are useful in developing national and international policy responses to global change" (P.L. 101–606, Section 102). Finally, the Committee was also directed to communicate annually the results of the program to

[7] An OTA (1993a) evaluation of the USGCRP ignores interbranch conflict as an explanation for why Congress explicitly linked the USGCRP to policy development. Instead, the OTA (1993a, 110) argues that "the primary questions of policy makers have changed since 1989 in the wake of the world climate treaty and the publication of several key reports" including the IPCC reports. This may be true, but OTA neglected to observe that Congressional demands of the USGCRP changed during 1989 and 1990, primarily due to conflicts with the Bush Administration. See GAO (1990).

[8] Title II of the law gives the State Department responsibility for overseeing participation in international global change negotiations.

Congress through a series of reports that cover research priorities, policies, and programs (P.L. 101–606). The 10-year research plan was to be a key element shaping the program's research direction and its connection to policy development. The plan would establish the goals and priorities for Federal global change research which most effectively advance scientific understanding of global change and provide usable information on which to base policy decisions relating to global change (P.L. 101–606, Section 104). The legislation defines "usable information" in terms of an "information management" strategy that would, in part,

> combine and interpret data from various sources to produce information readily usable by policy makers attempting to formulate effective strategies for preventing, mitigating, and adapting to the effects of global change (P.L. 101–606, Section 104).

In other words, "usable information" would help policy makers define and select effective prevention, mitigation, and adaptation action alternatives for consideration in the decision making process. In short, the program was developed to do more than just produce scientific predictions of global change: it was created to produce information usable in the development of policies in response to the many potential effects of global change. (The full text of P.L. 101–606 is available on-line at http://www.gcrio.org/gcact1990.html).

As is characteristic in moving from words in law to program implementation, in calling for "usable information" P.L. 101–606 provides insufficient guidance to what "usable information" is and how it would be achieved. In order to resolve these issues it is necessary to consult the historical record to determine legislative and administrative intent for the program. The record indicates that what "usable information" is and how it would be achieved was never resolved by Congress or program administrators. How scientific information was to be turned into usable information was left unnecessarily ambiguous. Consequently, some in Congress expected the program to focus on science and exclude considerations of policy, while others expected it to focus science *on* considerations of policy. In this atmosphere of ambiguity, program administrators continued to emphasize the scientific aspects of the program, but justify the program in terms of its relevance to policy. These different, and sometime conflicting, interpretations of the intent of P.L. 101–606 led to different expectations for program performance and thus set the stage for a performance shortfall.

3.1. Legislative intent: two different interpretations

In spite of formal agreement in law on the goal of usable information, how usable information was to be developed or what the term meant was never defined in the legislative process.[9] As a consequence, participants in the policy process understood differently how usable information was to be achieved, with two significantly different interpretations evident in the public record. One group of participants defined usable information exclusively in terms of global change science. That is, scientific research would be completely separate from consideration of prevention, mitigation, and adaptation responses, and the program would be responsible only for the scientific research. Some were concerned that global change research would be *politically driven*, in the sense that *predetermined political views* would drive research findings. Thus, this first subset of participants wanted to separate global change science from consideration of policy issues. A second subset of participants defined usable information in terms of the clarification of action alternatives to feed policy development. The remainder of this section documents and defines in greater detail each of these two different interpretations of usable information.

3.2. One interpretation: development of a scientific understanding

The logic behind calls to separate global change science and policy can perhaps best be illustrated by the metaphor of the assembly line (cf. Pielke and Byerly, 1998). In an assembly line, one task is completed before the next begins. Or perhaps more accurately, the completed output of one task is the basic input to another. On the global change assembly line, science would be conducted as a first task by one community, and global change policies would then be made by a second community as a second task. As science advances, the argument's reasoning goes, new and presumably better policies could then be built upon the growing foundation of scientific research. Under this model, the program would conduct scientific research and leave consideration of policy issues to others.

Calls to separate global change research from consideration of policy issues were heard in the congressional hearings which led to program approval, and separation was espoused by scientists, politicians, and program administrators.

Several program administrators argued straightforwardly for the separation of global change science and policy. For example, Francis Bretherton, former chair of NASA's Earth System Science Committee which established the scientific basis for program, testified before

[9] There was minimal floor debate in either chamber on the proposed program. This indicates that the bills were uncontroversial. P.L. 101–606 was considered by the Senate on 6 February and 27 October 1990 and by the House 26 October 1990.

Congress in 1988 that to be successful, research required separation from the process of policy development:

> In structuring a national program on Global Change, it is essential that the basic research be loosely coupled to, but conducted separately from, consideration of policy issues... [because of] the long time scales required for making significant progress in basic research, the realization that such progress must draw upon a wide spectrum of existing capability spread through the agencies... and others which have other responsibilities besides global change, and the imperative to keep the process of scientific discovery free from suspicion that it could be manipulated to justify any particular policy (SCCST, 1988, 34).

The substance of Bretherton's remarks was often repeated by global change program officials and by members of Congress as well. Consider written testimony presented before the House Science Committee in 1989 by Robert Corell, the NSF representative to the Committee. He argued that a scientific focus in the program would also serve the needs to global change policy:

> Broad trust in the objectivity of science is essential for the success of policy making efforts, particularly in international negotiations with far-reaching economic implications. Independent and objective science, therefore, serves both science and policy needs (HCSST, 1989, 99).

Corell added that global change science would best serve policy through communication between high-level Committee officials and their counterparts in policy making bodies.

> Scientific independence does not imply isolation; for the Nation's interests to be well served by the program, its science-coordinating forum must communicate effectively with policy-formulating forums. The CES can stimulate such exchange, because [its] members... are agency directors or assistant directors, whose positions allow and encourage them to communicate effectively with the Office of Management and Budget, the Domestic Policy Council... and other appropriate bodies (HCSST, 1989, 99–100).

In other words, Committee officials would explain the significance of science produced in the program to other high-level officials in the Executive branch on an ad hoc basis.[10]

Consider also the statement of Shelby Tilford, the NASA representative to the Committee, in the same hearing. He testified in greater detail why science and policy must be separate, arguing that

> it is vital for there to be a clear separation of responsibilities between the scientific agencies and the policy makers... Policy directed programs are generally focused on the policy needs of today, with a limited vision of relating longer term scientific issues, and often risk being viewed as intellectually too restrictive to attract the best scientific minds to participate (HCSST, 1989, 129–130).

Tilford argued that if the program emphasized today's policy needs, the best scientists would not participate in the program. He also argued that the program needed to consider long-term issues without political pressure for results. As Bretherton had testified, consideration of policy issues by the program could lead to "politicized" science that would damage the scientific quality of research in the program. Concerns that science would become "politicized" have a basis in experience. For example, Congress found in 1976 that scientific research in an EPA program had been tailored for political reasons to meet predetermined conclusions (HIFCC, 1976).

Policy makers supported the separation of science from considerations of policy when they stated that scientific answers would be necessary to formulate policies to respond to global changes. Such statements imply that science must be in some sense completed before policy decisions could be made. For instance, Senator Ernest Hollings (D-SC) stated his purpose in sponsoring S. 169: To produce information necessary to make global change policy.

> It is my attempt to formalize the current interagency research effort, to require sound planning, and to provide good budgetary information and coordination. *My hope is that a long-term coordinated research effort will one day give Congress the information it needs to take corrective action and avert a future disaster* ... Good answers to the pressing questions we face will not come easily... We need a determined and coordinated research effort... to get the *facts about the exact causes and consequences* of global environmental change (SCCST, 1988, emphasis added).

In Senator Hollings' terms usable information is "facts about the exact causes and consequences" of global change, which is usable because it is what Congress "needs to take corrective action". In floor debate on 27 October 1990 Senator Hollings repeated an analogy first used by Francis Bretherton in hearings. Hollings likened the earth to a car noting that "when we have a car problem, we take the car to a repair shop or fix it ourselves using the operator's manual. For the global environment, however, there are no mechanics or manuals". Holling concluded that the purpose of the program was therefore "to obtain the knowledge we need to train

[10] The answers of Robert Watson, of NASA, to written questions submitted by Senator Hollings in SCCST (1988, 90–94) follow a similar line of reasoning.

the mechanics and write the manual before this global machinery is irreversibly damaged" (Hollings, 1990). Congressional hearings are replete with examples of policy makers expressing the desire for "answers" or "reduced uncertainty" in the context of global change. Many similar examples have been put forth based on the belief that to properly deal with the problems posed by global change, scientific certainty must precede policy action.[11]

A number of scientists also supported focusing the program on science and not on issues of policy. Of the scientists who testified before Congress on the need for a global change program, many restricted their discussion to science issues only. However, a number of scientists were more vocal about the relationship between science and policy. For example, during a 1987 Senate hearing on global change Senator Tim Wirth (D-CO) asked a panel of authoritative scientists what type of policy advice each would give the President, if given the chance. One scientist responded that he could not give any recommendations, because "we do not understand the details well enough to give detailed advice at this time" (SCENR, 1987). The scientist's implication was that more research was needed before the clarification of policies in response could begin.[12]

Some held concern that if the program considered policy issues, then research would be politically driven. An example of concerns over politically driven research is contained in written questions from Senator Gore to D. Allan Bromley following an April, 1991 hearing. Senator Gore asked

> Are there safeguards in the U.S. Global Change Research Program which will ensure that policy makers do not end up telling the scientists not only WHAT questions need to be answered, but also HOW to answer them? (SCCST, 1991, 72, emphasis in original)

Bromley responded that traditional scientific evaluation tools such as advisory panels and peer review would "ensure that policy does not interfere with science" (SCCST, 1991, 72). When science is "politically driven" the assembly line presented above is shifted into reverse, with research built upon a foundation of politics, and thus, used expediently.[13]

The call to separate scientific research from consideration of policy issues is, ironically, a point of agreement between opposing perspectives on the global warming issue. For example, then-Senator Al Gore, whose climate change policy preferences were then well known, stated in the Senate prior to the Program's approval that

> more research and better research and better targeted research is (sic) absolutely essential if we are going to *eliminate the remaining areas of* [scientific] *uncertainty* and build the broader and stronger *political consensus necessary for the unprecedented actions* required to address this problem (SCCST, 1989a, emphasis added).

From Senator Gore's perspective, usable information referred to that information which would force a scientific consensus, and would allow little room for his political opponents. Such a scientific consensus, Gore intimated, would make obvious the need for the "unprecedented actions" needed to deal with global changes.[14]

On the other side of the political spectrum, similar conclusions about the need for more research were reached from a much different starting point. For instance, President George Bush also often expressed the need for more research.[15] In a February 1990 speech before the Intergovernmental Panel on Climate Change, President Bush stated that global change policies must be carried out in the context of

> [the] reconciling of environmental protections to the benefits of economic development. ... Wherever possible, we believe that market mechanisms should be applied and that our [global change] policies must be consistent with economic growth and free market principles in all countries (Shabecoff, 1990a; Weisskopf, 1990).

In the following months the Bush Administration was frequently accused of using scientific uncertainty to justify political inaction.[16] A political strategy of inaction would emphasize the lack of scientific consensus or certainty, and thus would emphasize the need to conduct additional research prior to (i.e., separate from) policy development).

While Senator Gore and President Bush began from distant points on the political spectrum, their different concerns resulted in similar conclusions about the structure of global climate change research: before policy could move forward, scientific uncertainty must be addressed through research. Therefore, when Senator Gore advocated a global change program it is likely that

[11] Not all calls for answers or reduced uncertainty support such an "assembly line" model. Some policy makers probably called for more research simply to maintain the status quo with respect to global change policy. This interpretation is considered below under the label of politically driven science.

[12] It is worth noting that this statement was made by James Hansen who, less than a year later, stated in congressional testimony that he was "99% certain" that global warming was underway.

[13] Of course, the phrase "policy driven" is used to describe research that is conducted appropriately to serve policy. The two definitions are almost opposites, and are used frequently enough to merit careful attention.

[14] By "unprecedented actions" Senator Gore was referring to banning chloroflurocarbons, halting deforestation, and reducing carbon dioxide emissions (SCCST, 1989a).

[15] See, for example, Roberts (1990).

[16] See, for example, Wirth (1990), Scheuer (1990), and Shabecoff (1990b).

he expected it would demonstrate conclusively and convincingly the need to respond comprehensively to global warming. At the same time, when President Bush signed the bill establishing the program it was consistent with his policy of "no regrets" which also called for certainty in research prior to any comprehensive policy actions. President Bush likely expected that such certainty would not be immediately forthcoming. "Certainty" versus "uncertainty" were common points of reference between the opposing camps and thus it was in this manner that measures of scientists' opinions and estimates of levels of uncertainty became important in the climate change debate. Global climate change became a matter of narrow debate over "yes" or "no" on whether global warming was actually underway. Alternative notions of "usable information" to aid in the process of policy development was lost in the clamor of this narrow political debate.

In short, a number of participants, including program administrators, policy makers, and scientists, supported focusing the program solely on research and not on considerations of policy in spite of P.L. 101-606. In other words, the program would focus on the development of a predictive understanding of global change and not on any other issues related to the needs of policy development.

3.3. *A second interpretation: contribution to the process of policy development*

Some participants did, however, question the ability of a program that focused exclusively on predictive science to meet the goal of providing information usable by decision makers. This group of participants, which included some scientists but mostly policy makers, believed that scientific research would be insufficient to meet the mandated objectives of the program.

Robert Corell, who had earlier advocated before Congress keeping science and policy separate, contributed the ambiguity of the program's mandate by further testifying that integration of science and policy in the context of global change required new ways of thinking. This seems to contradict his statements in which he stated a need to keep global change science and policy separate:

> Historically, we worked in what I call the "serial mode". Science planning occurs within the community and it comes to the federal government some time later and a plan is then put in effect and implemented. Later on you get some results, upon which policy decisions occur... We are operating in a "parallel mode"... Instead of having research results published and then do policy making, we see a need to work in parallel (SCCST, 1989a: 63–64).

Corell did not define what working in parallel meant in practice for the implementation of the program, and Congress failed to press him on the issue. Other program administrators did not explicitly define or discuss the provisions of the legislation calling for usable information.

Some policy makers contributed to the mandate's ambiguity. Unlike their counterparts who sought to complete research prior to the development of policy, many policy makers saw the need to consider policy issues before scientific uncertainty was eliminated. One Senator offered an amendment to the legislation that would establish the program to clarify the implications of the call for a 10-year research plan, arguing that

> such a reference improperly suggests that a 10-year program will resolve the uncertainties and provide us with the answers we need to take action... Such false promises often become barriers to the adoption of measures designed to address the problem [of global change] in the intervening 10 years (Baucus, 1990).[1]

The amendment passed the Senate, but was overturned in the House.

Representative James Scheuer (D-NY) expressed the tone of many hearings on global change when he asked a witness the following question.

> We [in Congress] are in desperate need of policy assistance. What are the ways — what are some of the things that we could do to increase the policy relevance of scientific research on global change? (HCSST, 1989, 244)

Rep. Scheuer was more specific in a hearing several years later when he asked

> How much longer do you think it will take before [the USGCRP is] able to hone [its] conclusions down to some very simple recommendations, on tangible, specific action programs that are rational and sensible and cost effective for us to take... justified by what we already know (HCSST, 1992, 88)?

In general, the questions raised by Mr. Scheuer were unanswered and unaddressed as the proposed program passed through the legislative process. Mr. Scheuer reaffirmed the program's policy mandate when he noted that "in passing the Global Change Research Act of 1990, Congress mandated the development of an integrated US research program designed to produce information readily usable by policy makers attempting to formulate effective strategies for preventing, mitigating, and adapting to the effects of global change" (HCSST, 1992, 2).

[1] Other similar concerns about the need to act under uncertainty can be found in SCCST (1987), SCENR (1987), SCCST (1988), SCCST (1989), and HCSST (1989). See especially questions submitted for the record. In these questions, policy makers often expressed concern about the link between science and policy.

Several witnesses called before congressional committees did suggest in greater detail implementation of a global change program that would result in contributions to policy development. Two witnesses, in particular, suggested alternative ways that the program might provide usable information.

"Assessment" was defined before Congress by Christopher Bernabo, formerly head of another large-scale research project focused on policy consensus, as "an iterative process of synthesizing and integrating technical information into a form relevant for decision making". In other words, "policy-relevant scientific assessments" should be based upon what information policy makers desired, and would also explicitly define levels of technical detail and policy preferences (HCSST, 1989). However, these comments were noted only in passing, and at enactment the program had no planned capability for any sort of assessment.

William Clark of Harvard testified at the same hearing that a policy-relevant global change program would include, in addition to assessment, research into adaptation and mitigation based upon academic research into public policy (SCCST, 1989a). From his perspective, the program would be focused primarily on research that supported the needs of policy makers. Clark discussed "policy tools" that could be used to generate usable information, including models, simulations, and games (cf. Brewer, 1986). Under Clark's notion of integrative global change science and policy, science would remain an important focus of the program, but not its driving mechanism. While the program's mandate did call for information on "preventing, mitigating, and adapting to the effects of global change", at enactment it had no planned capabilities to address this provision of the law (P.L. 101–606, Section 104.d.3). Like discussion of assessments in the hearings, discussion of strategies to produce usable information was brief and in passing.

In short, in spite of general consensus on the goal of usable information expressed in P.L. 101–606, policy makers, administrators, and scientists alike paid little attention to how the program's science elements related to its broader goal. The lack of consensus on how the Committee was to link research with policy makes it difficult to answer precisely the question "what was congressional intent for the US Global Change Research Program at enactment"? While it is clear that the program was created to provide "usable information", what usable information was and how it was to be produced was left unnecessarily ambiguous. The record documents that various participants had different, and conflicting, interpretations.

3.4. *Administrative intent: a science program*

The program, as presented in its first program report, *Our Changing Planet: A US Strategy for Global Change Research* published in July 1989, four months before enactment of P.L. 101–606, acknowledges the program's policy goal, but discusses primarily its scientific content (CES, 1989b). The report suggests that program officials defined the program exclusively in terms of scientific research (AGU, 1990). These reports did not clarify the ambiguities of the Congressional hearings. Specifically, program reports did not address the relationship between the scientific information described in the reports and "information readily usable by policy makers" called for by P.L. 101–606.

Program officials clearly viewed the program as focusing on the scientific aspects of global change. A statement by Dallas Peck, Committee on Earth Sciences chair and Director of the US Geological Society, at the 29 August 1989 news conference announcing the Bush Administration's support for the proposed program illustrates the perception that the program would focus on science and not policy. Peck stated that "Our [the USGCRP] goal is not to make policy recommendations but to develop the scientific understanding so that the policy apparatus can make those decisions" (FNS, 1989). At the same news conference, Robert Corell stated the program's mission and relationship to policy development as follows:

> [The program's goal] is to gain an understanding in how this magnificent planet ticks, how it works, what are the interactions between the various components, and working at levels that are different from our experience because the dynamics of the science tend to be at the interfaces between our more comfortable biological, chemical, physical understanding of natural processes. And how those interrelate, how they interconnect, is essential to the framework we set here, and that framework, as we begin, over the decade ahead, to more clearly understand how it works, *will naturally feed into policy formulation and decision making* (FNS, 1989, emphasis added).

At a later point in the news conference these views were restated:

> I want to make it clear that what we're talking about is the science planning — the science program that underpins the U.S. and the United States [sic] federal interests in global change... This [research plan] is the next step in the evolution to help us in a coordinated fashion address a national response to these issues that will *feed into policy planning and development* within this government (FNS, 1989, emphasis added).

These statements reflect the idea that the program would address science and not policy issues, with the information produced by the program automatically feeding into the policy process. Program officials consistently

emphasized the program's science objectives over any mention of its broader policy goal. If program officials ever considered the phrase "usable information" in implementation of the program, there is no indication of it in the public record.

Yet, while program officials were distancing the proposed program from issues of policy development, program documents discussed a need to more closely connect science and policy. Program documents oriented the program in the context of what it identified as an emerging relationship between science and policy on global scales (CES, 1989b). One report claims that

> Reliable information and predictions regarding global changes are required at many decision levels within society: individuals (e.g. farmers), industries (e.g., energy and chemical producers), and regulators (e.g., governments)... Many such decisions are immediate, demonstrating that global change and the needed scientific input to prudent policy making are not abstract concepts to be dealt with at some future time (CES, 1989b).

The report links scientific research questions with contemporary policy issues. For example, it linked scientific questions about global changes with policy issues.

> Scientists ask --
>
> — Has a "greenhouse" warming already been detected?
>
> — What is the uncertainty in the prediction of the magnitude and timing of global warming corresponding to trace-gas increases?
>
> Policy makers ask --
>
> — Should Congressional actions, particularly those with multiple payoffs, be initiated to reduce the growth rate of "greenhouse" gases in the atmosphere?
>
> — What land- and water-management decisions could be made now to make water supply systems more robust in the face of possible precipitation pattern changes (CES, 1989b)?

The framing of these questions indicates the program administrators believed that scientists and policy makers each had questions that could be answered simply with the development of a predictive understanding of global climate change. In other words, the report argues that the achievement of the science objectives would be sufficient to simultaneously meet the needs of scientists and policy makers. The reports argues that

> The scientists rightly seek a defensible understanding of their problems. The policy makers rightly request useful advice on their problems. The points here are twofold: (1) the always challenging dialogue between science and policy is occurring in a new arena – *global change*, and (2) it is occurring *now* (CES, 1989b, emphasis in original).

According to program documents, the goal of the program was to advance science in order to support policy. This point is made many times in the research plan. For example,

> The underlying premise ... of the U.S. Global Change Research Program is that wise use of the Earth for human habitation and survival is inextricably linked to an improved understanding of the systems that are undergoing change at varying rates in response to natural and human-influenced processes. A vigorous, well-coordinated Federal research emphasis will be critical to improving predictive understanding and will support the formulation of sound policy decisions. The U.S. Global Change Research Program has been established to provide that vigorous, coordinated effort (CES, 1989b).

But was the predictive science to be produced in fact equivalent to the "usable information" promised in its legislative mandate? This question was never formally addressed in program reports, just as it was never discussed in depth during congressional hearings. Instead, reports either assumed or ignored the relationship.

According to the reports, the program was to meet its mandate through achieving three scientific objectives: monitoring, understanding, and predicting global change. The result of achieving the three objectives would be a "predictive understanding" of the global earth system on time scales up to 40 years into the future (CES, 1989b). The report clearly states that the program was not intended to consider issues other than science. It states (p. 7) that

> It is not the role of the Program to formulate policies regarding global change, nor does its mandate cover the research required to develop new technologies that might be used to mitigate or adapt to a changing environment.

P.L. 101–606, enacted four months later, *explicitly called for research into mitigation, adaptation, and environmental technologies* in addition to the three scientific objectives. Committee officials never explained how the program would meet its new mandate, and instead continued to focus on the program's science elements, in spite of the broader policy provisions in its mandate.

The implications of the program's scientific objectives for program evaluation are clear: "good science" means a successful program. Hence, the evaluation task would be to assess the state of the science using accepted science evaluation mechanisms, such as peer review. The first three (of five) evaluation criteria in the original program plan are based upon assessing whether

the program is producing good science (CES, 1989b).[18] They are:

Relevance/contribution
The research addresses the overall goal and the three key scientific objectives of the program.

Scientific merit
The proposed work is scientifically sound and of high priority.

Readiness
The level of planning is high, the capabilities are of high quality and in place, and the research is likely to produce early advances.[19]

Based upon these criteria, the program would be judged a success if judged to be progressing towards the three scientific goals of monitoring, understanding, and predicting. None of the evaluation criteria address whether the scientific information is, in fact, useful in policy development.

4. Conclusion

The review in Parts I and II of the early policy history of the US Global Change Research Program illuminates a number of currents underlying the current national and international debates over whether or not to ratify the Kyoto Accord to the Framework Convention on Climate Change.[20]

The Global Change Program was not structured to provide answers to policy questions. The Global Change Program was originally structured by scientists and science administrators to develop a predictive understanding of the global earth system. In the early administrative development of the program, there was no explicit link to the needs of policy makers. As the topic of climate change grew in visibility, some in Congress became interested in the program. But congressional interest was a double-edged sword. On one hand, it promised the possibility of larger budgets, while on the other, it meant more closely linking the program to policy objectives, a departure from the program's original formulation. The linkage to policy objectives was made in program documents and public law, but not in the initial program implementation (Pielke, 1995).

Program officials supported a linear relation of science and policy development. In order to preserve the scientific objectives of the program, officials linked its research to the policy process in a linear fashion. That is, program officials argued that policy would be built on the information (answers) supplied by research. Hindsight shows that research often results in many more questions than answers. Experience has shown that a linear relation of science and policy is unlikely to result in answers to policy questions (Pielke, 1994; Pielke and Byerly, 1998). Therefore, the initial structure of the program did not lend itself to answering the questions most important to policy makers, i.e., "What is to be done?"

The Program's mandate was interpreted differently by different participants in the policy process. It is not unreasonable to conclude that program administrators simply equated "usable information" promised in P.L. 101–606 with simply advancing the science of global change as was defined by the Committee on Earth Sciences before Congress had a chance to express its intent for the program. However, from congressional hearings on the proposed program it is clear that some policy makers believed that the program would provide either answers to their near-term policy questions, or if not answers, information that would help to clarify action alternatives relating to the need to develop policies with respect to global climate change. With the advantage of hindsight, it is clear that the differences between the program's scientific objectives and the various expectations of participants for program performance led to a mandate that would be difficult to enforce and easy to evade (Pielke, 1995).

Since the time period covered in Parts I and II of this policy history, the US Global Change Research Program has taken a number of steps to shape its agenda in ways that better support the needs of policy makers. Such steps include emphasizing shorter-term predictive capabilities (e.g., such as that associated with El Niño) and supporting constituent workshops around the nation as part of a National Assessment of Climate Change. These actions support the notion that the program was not originally well designed to support the needs of policy makers. As the nation continues to debate what to do about climate change, it will be important for the program to continue to systematically refine these efforts, not only to enhance the future political prospects of the program, but also to assist decision makers in finding the information that they need in order to deal with the problem of climate change.

[18] Of the remaining two, one refers to national and international partnerships, and the other to adequate funding.

[19] See also the response of Robert Corell to written questions submitted by Senator Larry Pressler (R-SD) (SCCST, 1987).

[20] See Pielke (1998) and Pielke and Betsill (1998) for additional discussion of international climate policy.

References

AGU (American Geophysical Union), 1990. Global change research. EOS: Transactions of the American Geophysical Society 70 (46), 1489–1490.

Baucus, M., 1990. Floor statement. U.S. Senate. Congressional Record, 6 January p. S 81".

Brewer, G., 1986. Methods for synthesis: policy exercises. In: Clark, W., Nunn, R. (Eds.), Sustainable Development of the Biosphere. Cambridge University Press, London.

CES. 1989a. Minutes of CES Meeting 5. 5pp.
CES. 1989b. Our Changing Planet: The FY 1990 Research Plan OSTP. WA. DC.
FNS (Federal News Service). 1989. White House Office of Science and Technology Policy New Briefing. Regarding: Comprehensive Plan for Implementing President Bush's U.S. Global Change Research Program. 31 August.
GAO (General Accounting Office). 1990. Administration Approach Cautious Pending Validation of Threat. Report to the Chairman. Subcommittee on Oversight and Investigations. Committee on Energy and Commerce. House of Representatives. NSIAD-90-63. January. US GPO. WA. DC.
HCSST. 1989. The Global Change Research Act of 1989. 101: 74. 27 July US GPO. WA. DC.
HCSST (House Committee on Science. Space. and Technology). 1992. Report of the Task Force on the Health of Research. 102-Serial L. July. US GPO. WA. DC.
HIFCC (House Interstate and Foreign Commerce Committee). 1976. Report on Joint Hearings on the Conduct of the Environmental Protection Agency's Community Health and Environment Surveillance System' (CHESS) Studies. April 9.
Hollings. E.. 1990. Floor statement. U.S. senate. Congressional Record. p. H 17739.
Kennedy. D.. 1992. This Far and No Further: The Rise of the Committee on Earth and Environmental Sciences. Case C16-92-1122.0. John F. Kennedy School of Government. Harvard University.
OTA (Office of Technology Assessment). 1993a. Preparing for an Uncertain Climate – Volume I and II. OTA-O-568 US GPO. WA. DC.
Pielke Jr.. R.A.. 1994. Scientific information and global change policy making. Climatic Change 28. 315–319.
Pielke Jr.. R.A.. 1995. Usable information for policy: An appraisal of the U.S. Global Change Research Program. Policy Sciences 28. 39–77.
Pielke Jr.. R.A.. 1998. Rethinking the role of adaptation in climate policy. Global Environmental Change 8 (2). 159–170.
Pielke Jr.. R.A.. 2000. Policy history of the U.S. Global Change Research Program: Part I. Administrative development. Global Environmental Change 10. 9–25.
Pielke Jr.. R.A.. Betsill. M.. 1998. Policy for science for policy: a commentary on Lambright on ozone depletion and acid rain. Research Policy 26. 157–168.
Pielke Jr.. R.A.. Byerly. R.. 1998. Beyond basic and applied. Physics Today February. 42–46.
Roberts. L.. 1990. Climate extravaganza bombs. Science 248. 436.
SCA (Senate Committee on Appropriations). 1990. Global Climate Change. 8 February. US GPO. WA. DC. pp. 101–965.
SCCST. 1987. Global Environmental Change Research. S. Hrg. 100–301. 16 July. US GPO. WA. DC.
SCCST. 1988. Global Change Research. S. Hrg. 100–816. 13 July. US GPO. WA. DC.
SCCST. 1989a. National Global Change Research Act of 1989. S. Hrg. 101–32. 22 February. US GPO. WA. DC.
SCCST (Senate Committee on Commerce. Science. and Transportation). 1991. Policy Implications of Greenhouse Warming. 25 April. US GPO. WA. DC. pp. 102–259.
SCENR (Senate Committee on Energy and Natural Resources). 1987. Greenhouse Effect and Global Climate Change. S. Hrg. 100–461. 9 and 10 November. US GPO. WA. DC.
Scheuer. J.. 1990. Bush's 'Whitewash Effect' on warming. New York Times. 3 March. A15.
Shabecoff. P.. 1990a. Bush asks cautious response to threat of global warming. New York Times. 6 February.
Shabecoff. P.. 1990b. Bush denies delaying action on averting shift in climate. New York Times. A14.
Weisskopf. M.. 1990. Bush pledges research on global warming. Washington Post. 6 February.
Wirth. T.. 1990. Hotter and hotter in the greenhouse. The Washington Post. 20 February.