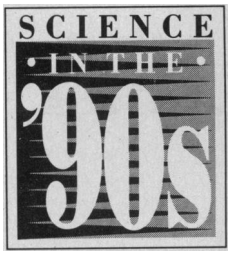
Struggling to Do Science for Society

The next decade's social issues will increasingly drive scientists into the public policy arena, where a whole new set of considerations must be taken into account. Are we ready?



Last in a series

LAST FALL, an editorial in the *Detroit News* slammed meteorologist Stephen Schneider for contributing to "the debasement of American environmental science into cheap political theater." Schneider's offense, it seems, was to step outside his role as a scientist and publicly advocate a response to the global climate change that many researchers predict will take place in the next century.

The opinion piece, one of thousands generated by the debate over global warming, shows how hot it can get for scientists involved in a public policy issue. So far, relatively few researchers have found themselves embroiled in such topics—the entire climate modeling community, for example, consists of just a few hundred scientists—but that's likely to change. Genetic engineering and the use of fetal tissue, nuclear wastes, chemicals in the environment, and low frequency electromagnetic fields—these are just a few of the policy areas where science will be called upon to make a key contribution in the 1990s.

And that raises some significant questions. What role should individual scientists play in policy debates? How can science be used to help policy-makers arrive at the best solutions? There are no easy answers.

The vast majority of scientists simply go about the business of research, arguing with their peers through journals and at meetings, and helping define a consensus that can serve as a basis for policy debates. But some researchers, either by choice or just by being in the wrong place at the wrong time, make it into the public eye.

Jim Hansen, for instance. Hansen is the meteorologist at NASA's Goddard Institute for Space Studies who ignited the current concern about global warming in 1988 when he told a congressional committee he was 99% certain the world is getting warmer and that the greenhouse effect is probably the reason. But as Hansen tells it, he wasn't trying to spark a controversy at all. "I feel I was only trying to report an accurate description of our scientific research," he says.

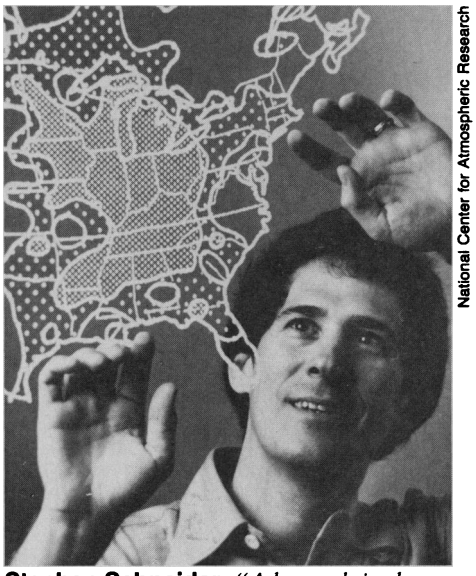
To use a religious metaphor, Hansen is a "witness"—someone who believes he has information so important that he cannot keep silent. "A couple of weeks before the 1988 testimony, I weighed the costs of being wrong versus the costs of not talking," he says; the costs of not talking seemed much heavier. "That testimony has been criticized a lot since then, but when I look back I feel as strongly as ever that my points were correct." He continues to tell Congress, the media, and the public his scientific conclusions about global warming.

If Hansen is a witness, Schneider, who works at the National Center for Atmospheric Research, is more of a preacher. "A human being has an obligation to make the world a better place," he says, so he has injected himself into the greenhouse policy debate, arguing that the consequences of global climate change could be so ruinous that steps to prevent it should be taken now. "I am an advocate for what I see to be the urgent need to 'buy insurance,' " he says. To make the case effectively, he paints explicit—some say sensationalistic—pictures of what could happen to the world if the average global temperature rose several degrees.

Should other scientists follow Schneider's example? "Everyone has the right to become an advocate," says Granger Morgan, head of the Department of Engineering and Public Policy at Carnegie-Mellon University. "But you really want to choose one role or the other—advocate or analyst. The two roles don't mix very well." A scientist who lobbies strongly for one side in a debate risks losing his objectivity.

Schneider himself recognizes the conflict and speaks of the "double ethical bind" that pulls him in opposite directions. As a scientist he must be cautious, giving all the caveats and not pushing his data too far. As an advocate, however, he must be bold and effective. In a widely quoted interview in *Discover*, he explained: "To [reduce the risk of global warming], we need to get some broad-based support, to capture the public's imagination. That, of course, means getting loads of media coverage. So we have to offer up scary scenarios, make simplified, dramatic statements, and make little mention of any doubts that we might have. . . . Each of us has to decide what the right balance is between being effective and being honest. I hope that means being both."

The double bind of effective action versus scientific objectivity is not the only problem created by the decision to become an advocate. Although one's scientific peers may recognize the difference between the roles of scientist and advocate, the media and the public may not be so sophisticated—with the result that carefully nuanced positions disappear. "I always tell the media there are two Stephen Schneiders," Schneider says, but he admits the distinction is often lost.



National Center for Atmospheric Research

Stephen Schneider: *"A human being has an obligation to make the world a better place."*

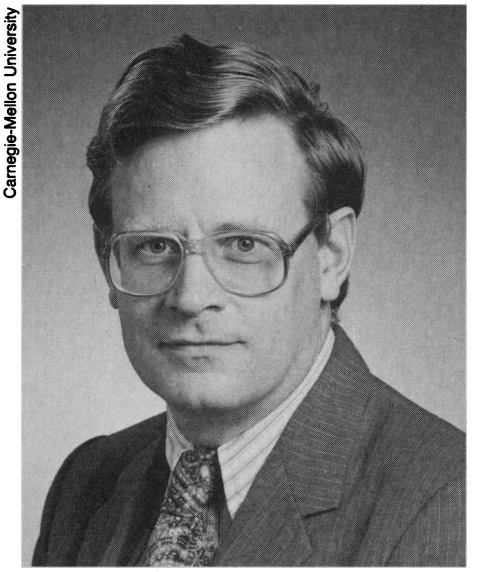
When the evening news devotes only 15 seconds to a scientist-advocate's views, the result is inevitably a blurring of the line between science and advocacy.

Whether a scientist decides to be an advocate, a witness, or simply a researcher who stays out of the spotlight, he or she will find that once a topic becomes a public policy issue, it is no longer science as usual.

Funding decisions, for instance, take on a whole new complexion when research conclusions will affect policy. By their nature, funding agencies like results that buoy their own programs and dislike results that undermine them. In 1981, Hansen lost his De-

partment of Energy funding after a front-page story in the *New York Times* reported his conclusion that the world was getting warmer and that the warming was consistent with the greenhouse effect. The energy department, Hansen says, "saw these climate concerns as being environmentalists blocking economic and industrial progress without sufficient basis, and felt that if they supported the research it would only give more publicity to these concerns." In short, indications that carbon dioxide emissions might have to be limited was not a message the DOE wanted to hear. Eventually, the Environmental Protection Agency began supporting Hansen's work.

Even if solid, unbiased research does get funded, the science behind an issue frequently does not take center stage. Many other factors enter into policy-making, particularly when the scientific evidence is not definitive. This was the case, for instance, in determining the acid rain portion of the current Clean Air Act, says economist Robert Hahn, who helped draft part of the bill while on the Council of Economic Advisers. "Once it became a salient political issue, then science no longer played a major role," Hahn says. The act calls for a reduction of 10 million tons in sulfur dioxide emissions, but there was "very little serious analysis about what that number will buy us." Instead, 10 million tons was a convenient number that had been circulating for a while, and no one was willing to even consider 6 million or 8 million tons, which would have been cheaper and might have done just as much to clean up acid rain. "Politically it was a line drawn in the sand that would have been very difficult to cross," Hahn says.



Carnegie-Mellon University

Granger Morgan: *If science is to guide policy, scientists must redirect their research.*

And once a policy becomes law, the science often fades even further into the background. "Regulations sometimes take on a life of their own," notes presidential science adviser Allan Bromley. "Even after the scientific basis is gone, the regulation lives on." The current Environmental Protection Agency regulations on asbestos removal may be one of the most egregious examples of this. Taxpayers will pay about $5 billion this year to remove asbestos from schools and other buildings, and the final bill could run from $50 billion to $150 billion. But a study published earlier this year in *Science* (19 January, p. 294) reported that more than 90% of the asbestos actually poses no health risk. The EPA regulations ignore the the distinction between different types of asbestos, some of which are dangerous and others relatively benign.

"The information in the article in *Science* is at least 10 years old as far as people in the field know it," says Ann Wylie, a geologist at the University of Maryland. But federal regulators were more concerned with the letter of the law than with the spirit, she says, and refused to accept the findings that some asbestos was relatively safe.

Do these problems mean that scientists should opt out of the arena of policy altogether? Surely that conclusion is too draconian. Perhaps the answer is that scientists should learn to understand policy-making better, so that they can at least anticipate the pitfalls. People who study policy-making have a few suggestions along those lines.

For starters, funding for research into issues with policy implications should come from several sources. If the support comes from sources with different missions, no single point of view is likely to dominate the research. With such funding, scientists will be in a better position to provide the factual base needed to base decisions on.

But Morgan of Carnegie-Mellon argues that providing this base is something scientists do not do very well. "It's hard to get the scientific community to work on policy issues when it has its own research agenda set," he says. The questions that are most interesting scientifically may not be the questions that are important to setting policy. If science is to guide policy and not just provoke it, researchers may have to redirect some of their efforts.

The key, Morgan says, is directing the research so as to narrow down the uncertainties, the unknown quantities that make it impossible to set sound policy. By working with economists and policy experts, researchers can determine which of the uncertainties are most relevant and concentrate on them. Policy-makers debating a response to global warming, for instance, might find it more valuable to know how different strategies will affect the pace of global warming, as opposed to knowing what the total rise in temperature is likely to be. In that case, researchers could focus their efforts on understanding the dynamics of the process instead of the equilibrium states.

Besides providing the scientific context to understand a problem, scientists should analyze suggested remedies, says Richard Lindzen at the Massachusetts Institute of Technology. For instance, EPA regulations aimed at curbing urban ozone pollution by cutting hydrocarbon emissions from automobiles may not work, says Gregory McRae of Carnegie-Mellon's chemical engineering department. Computer simulations show that the key to cutting ozone in such places as Los Angeles is actually reducing the amount of nitrogen oxides, McRae says.

In the case of global warming, concern over rising levels of carbon dioxide and other greenhouse gases has led some to call for a 20% reduction in carbon dioxide emissions by 2000, which is likely to be a very expensive step for the industrial nations. But there has been little discussion about the effects of such a policy, Lindzen says. According to the models that predict that a doubling of carbon dioxide will cause a 4°C rise in global temperature by 2100, cutting carbon dioxide emissions by 20% would make a difference of less than half a degree, he says. Is it worth the cost? That's a question that must be debated, but often the argument doesn't get so far.

Clearly, there is a whole new set of considerations for a researcher whose work has consequences for public policy, even though his basic role—getting answers—is unchanged. To do that job effectively, a scientist in a policy-sensitive field must decide how he should interact with the press, pay particular attention to where his funding is coming from, consider angling his research in directions of general interest, and prepare himself for the possibility that much careful work could be ignored when push comes to shove in the political process. It's a lot to ask, but some scientists do find they are compensated by the feeling that they made a difference in the world. ■ **ROBERT POOL**

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