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Environmental Economic Research Has an Audience But Not a Sponsor: Discussion

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There exists no mechanism for federal agencies, national laboratories, industry, and academic institutions to set a national environmental research agenda. Moreover, funding for social science research is inadequate for providing a sound scientific basis for making environmental policy. Despite this lack of leadership, it is quite possible to define an environmental economic research agenda that could lead to improved policies for protecting and managing the environment. The present paper makes some recommendations from an insider's viewpoint.

Introduction

Understanding the behavior of humans and institutions is central to enhancing protection and management of the environment, which is aimed at modifying behavior. The present and future quality of the environment is related directly to the activities of these entities. Despite broad recognition of this basic truth, numerous reports, including most recently, National Research Council (NRC) have argued that funding for social science research is inadequate for providing a sound scientific basis for making environmental policy. The present paper makes some recommendations for areas of environmental economic research that could lead to improved policies for protecting and managing the environment. However, to provide insights into the prospects for receiving national leadership on shaping a social science environmental research agenda and for funding the research, I first summarize some of the more important insights from the recent NRC report.

I will begin my remarks with an overview of federally funded environmental research. Then, I will reiterate two criticisms of federal environmental research that were raised by the NRC and by complimentary studies (Carnegie Commission, 1992a; Carnegie Commission, 1992b; and the National Commission on the Environment). The first type of criticism relates to the culture and the organizational structure of federally funded research

and the second type of criticism involves content. Third, I will mention some of the changes that the NRC believes are necessary for defining and implementing an environmental research agenda. I will leave it to the reader to form her own subjective probability about the likelihood of such changes occurring. Less than optimal national leadership and funding for social science research notwithstanding, I devote the remainder of my remarks to environmental economic research areas that I believe would contribute most toward improving policies to achieve environmental goals.

National Environmental Research

The American Association for the Advancement of Science (Gramp et al.) estimates federal expenditures on environmental research of about \$5 billion. The life and physical sciences receive the majority of these funds (\$3.1 billion); an additional \$1.2 billion is for engineering; studies of relationships between human health and the environment receive about \$.7 billion in funding; about \$.2 billion is expended on environmental data and information; and finally, the social sciences receive less than \$50 million.

The AAAS estimates that EPA accounts for about \$350 million of the federal expenditures, but this figure only includes research conducted by the Office of Research and Development. I believe that ORD only expends about \$1 million on social science research. The program offices at EPA conduct scientific activities to support EPA's mission

of protecting human health and the environment. In addition, my office, the Office of Policy Planning and Evaluation conducts research on technical and policy issues. However, the AAAS was unable to obtain information on total expenditures for research by the program and policy offices. Taking a wild guess, I estimate that well under 10 million dollars is expended on intramural and extramural social science research. Again, these funds are to support EPA's mission and are not for basic research. Other than in the Office of Research and Development, there is no extramural research program *per se*.

Thus, social science research is not well integrated into high-level research planning at EPA. As the NRC concluded, "It is usually no one's job to ask such broad questions as 'How can we improve methods for assessing the social, economic, and environmental consequences of environmental policies?'" or "What knowledge base do we need to predict the response of industry X to new environmental incentives or regulations or to price changes for energy or other natural resources?" When good environmental social science research is carried out, "it is usually despite incentives for short term goals and the bolstering of political agendas" (NRC, 1993:47-48). One may conclude from this that if you are not conducting policy-relevant research, it is probably not your fault, at least not entirely.

Recently, the National Research Council (NRC, 1993) identified the strengths and weaknesses of current federal environmental research programs and offered recommendations for reorganizing the nation to improve upon the status quo. The emphasis of their report is on the cultural and organizational changes needed to ensure a more efficient allocation of funds toward increasing knowledge and understanding of the environment as well as toward ensuring that the best science is utilized in making policy decisions. However, they also raise a few issues related to the content of social science environmental research.

NRC Criticisms/Recommended Changes in Culture and Organization of National Environmental Research

The NRC concluded that there is no mechanism for federal agencies, national laboratories, industry, and academic institutions to set a national research agenda. Currently, the Office of Science and Technology has responsibility for coordinating federal research, and they have a number of mechanisms by which they accomplish this, but they can not

provide the high level leadership required by a large-scale national program. The NRC recommended establishing a National Environmental Council in the executive office of the president to provide such national leadership. It would be composed of heads of the federal environmental agencies who would establish advisory committees to represent the scientific community, public, state government, and private sector. This council would develop and oversee implementation of a coordinated National Environmental Plan that identifies the nation's environmental research agenda.

Furthermore, the NRC called for the establishment of a Department of Environment. They made it clear that they did not intend for EPA to be elevated to the cabinet post, unless EPA were changed substantially. This Department would play an influential role on the newly established National Environmental Council in developing and implementing the National Environmental Plan. In addition, the Department would have a basic research program separate from the mission program. The separation of functions may be necessary for ensuring stable funding for basic research that is not constrained by the needs of any one particular agency's mission. And yet, with both research and regulatory responsibilities, NRC argues that the Department would provide leadership in the nation's programs for protection, restoration, and management of resources. Cabinet level status would elevate environmental issues to the same level as other national issues.

A second major problem requiring cultural and organizational changes in federal environmental research is that we do not know the current status of and changes in the resources that we are supposed to protect, restore, and manage. The NRC recommends initiation of the National Status and Trends Program to inventory and monitor the status and trends of the nation's resources. The program would be coordinated by the National Environmental Council. In the absence of such a program, the federal agencies are nonetheless struggling to address this critical and unglamorous task.

One such effort of potential benefit to agro-environmental research is the Intergovernmental Task Force on Monitoring Water Quality (ITFM).¹ This federal/state/tribal partnership with representatives from 20 agencies and organizations is

¹ For more information and copies of ITFM reports, contact: U.S. Geological Survey, Office of Water Data Coordination, 417 National Center, Reston, Va. 22092.

charged with developing and implementing an integrated, nationwide, voluntary strategy for water-quality monitoring. The program includes national coverage of surface, ground, and coastal waters and atmospheric deposition using a range of monitoring approaches as part of an organized process. The emphasis is on such things as: 1. watershed, ecosystem and geographically based programs; 2. biology, ecology and habitat; 3. non-point source remediation programs; 4. wetlands and coasts; and, 5. sediment quality.

A third, related problem is the lack of a system for organizing information and making it available for the integrated use of the biological, physical, social, and engineering sciences. The NRC recommends establishing a National Environmental Data and Information System to be coordinated by the National Environmental Council and conducted by the federal agencies. Their model would use the best available technology to collect and make easily accessible a wide range of environmental data.

Agro-environmental researchers may be interested in such a system under development at EPA. The Gateway/Envirofacts System is evolving to provide an easy to use graphical user interface that integrates ENVIROFACTS attribute data (e.g., STORET, soils, habitat) in an ORACLE Relational Data Base Management System (RDBMS) and spatial data (e.g., Census, land use) in an Arc/INFO geographic information system (GIS). Currently, this system is in the demonstration stage where it provides a testbed for information technology innovation and assessment with a focus on ecosystem management.

Economic Research Relevant to EPA's Mission

The NRC identified a few research areas of critical importance for protecting and managing the environment that are relevant to EPA's mission. I elaborate upon two of them and then suggest additional topics related to agro-environmental issues. The NRC states that "The biggest and most difficult environmental problems include alterations of ecosystems (including extermination of species) and alterations of habitats, sometimes on a global scale. As a result of such alterations, environmental services can be interfered with or interrupted—also sometimes on a global scale" (NRC, 1993: 71). Thus, basic research is needed on how the system works, including the interactions between humans and the ecosystem. Given the tremendous influence that humans will continue to have on ecosystems, and thus the ability of ecosystems to

generate services, it is clear that the social sciences have a critical role to play in multidisciplinary research. This multidisciplinary research should provide insights into "innovation in management of natural resources to ensure sustainable use of our resources that will protect and enhance environmental quality while improving standards of living and quality of life" (NRC, 1992:71). Related recommendations were made by EPA's Science Advisory Board (U.S. EPA Science Advisory Board) and by EPA's Ecosystem Valuation Forum (Bingham, et al.).

Ecological economic modeling is perhaps the one research area that is widely viewed as important across all offices in EPA and by managers and staff alike. Despite this and all of the lip service paid to the need to develop sustainable resource management policies, I know of only two extramural research projects being funded currently by EPA. This is a classic example of an important issue that requires long term basic research and yet the EPA does not view such research to be a part of its mission.

I believe that if we had more research funds, the Policy Office at EPA would attempt to develop a research program in this area. This program would address such questions as: 1. "What is it about the ecosystem that really matters?" and, 2. "What do we need to know about the interactions between humans and the ecosystem to manage the ecosystem in a manner that contributes most positively to quality of life of present and future generations?" For economists working in the valuation field, addressing such questions may require going beyond those components of the ecosystem that have immediate value to individuals. Instead, economists may have to work cooperatively with ecologists to model the important interactions between economic and ecological systems to account for reversible and irreversible changes in the ecosystem over time and space. Agriculture is certainly a human activity with significant interactions with the ecosystem and therefore a good place to start with developing integrated models.

A second research area identified by the NRC and consistent with EPA's mission is in the development of cost-effective pollution control and pollution prevention technologies. Technological innovation is needed, if we are to protect public health and sustain viable ecosystems at an affordable cost. Economics can play a critical role in identifying the market failures and distortions due to government policies as well as the institutional barriers and constraints that impede innovation in this area. In addition, economics can identify opportunities for creating incentive structures that en-

courage cost minimization as well as investments in research and development on pollution prevention. Research is also needed to determine why farmers and companies may adopt or fail to adopt new, cost-effective best management practices and pollution prevention or pollution control technologies. The characteristics of farms and companies that are leaders in innovation need to be identified. Methods of evaluating the effectiveness of alternative market-based incentive policies must be developed. This research is a high priority because of the very high cost of current investments in environmental protection. These costs are expected to reach \$200 billion by the year 2000 (Carlin).

Agro-environmental economists could contribute to the theoretical and applied literature on market-based incentives that could be implemented under authority of the Clean Water Act. They also can contribute to improved understanding of farmers' behavior regarding policies to control pesticides and to introduce integrated pest management practices. The NRC identified some additional high cost items that make good targets for more cost-effective solutions, including: management of hazardous materials, solid wastes, waste-treatment residues, and radioactive wastes already released into the environment; Superfund clean-ups; remediation at DOE sites and sites with underground storage tanks; and, Resource Conservation and Recovery Act (RCRA) actions. For example, we have expended billions of dollars on Superfund and yet it is reasonable to question whether we are any safer. Most of the expenditures have been on transaction costs related to litigation. Economists may work on incentive compatible schemes that minimize the costs of the entire process including transaction costs. In addition, empirical research demonstrating the cost-savings from applying more flexible standards using a cost/benefit approach is becoming more relevant. The environmental engineers may be charged with developing an array of remediation technologies and the health scientists, ecologists, and economists may be charged with estimating the reductions in risks to humans and the ecosystem and their economic significance, respectively. Although there is resistance to applying different standards at different sites, when billions of dollars are involved, the rational economic arguments will be heard eventually. Moreover, as costly as the Superfund program is, costs associated with implementing RCRA are substantially higher.

At a practical level, EPA is part of an Environmental Technology Initiative (ETI), which has a focus on encouraging long-term research and pollution prevention by EPA, other Federal agencies,

and the private sector (U.S. EPA, 1994). The goal is to stimulate industry to develop more advanced environmental systems and treatment techniques that can yield environmental benefits and increase exports of "green" technologies. The Program is funded at \$36 million in FY 1994, approximately half of which will be invested in partnership with other federal agencies. It is anticipated that funding levels will increase over the next few years.

EPA formed an Innovative Technology Council (ITC) to promote cross-Agency approaches to stimulate and accelerate development of innovative environmental technologies. The ITC is developing strategic approaches in four areas: 1. adapt EPA's policy, regulatory and compliance framework to promote innovation; 2. strengthen the capacity of technology developers and users to succeed in environmental technology innovation; 3. strategically invest EPA funds in the development and commercialization of promising new technologies; and, 4. accelerate diffusion of innovative technologies at home and abroad. However, it is not clear the extent to which resources will be devoted to academic research on these issues.

Two other economic research areas of increasing policy relevance are both related to valuation of non-market environmental amenities and natural resources. The first includes the establishment of a body of empirical literature that provides estimates of the value of a clean environment. Methods of utilizing that literature (e.g., benefits transfer and meta-analysis methods) to address a variety of environmental policy issues is also needed (Kealy). This is in contrast with most of the published applied valuation literature that attempts to develop a new methodological twist, but where the welfare estimates are merely illustrative.

The second area for valuation research involves the contingent valuation method (CVM). This method relies upon survey methods to obtain data on people's stated economic values, generally for goods and services not exchanged in markets. Contingent valuation method applications have the potential to influence the allocation of billions of dollars worth of resources. For regulations involving the protection or enhancement of environmental quality, the CVM is the only known method for estimating passive use values. Estimates of such values could be quite large when multiplied by a large enough population size. With the scientific uncertainty regarding the reliability and validity of valuation estimates, particularly passive use values, obtained using the CVM, research to more clearly delineate its potential as well as its limitations is relevant. Last May the Department of Energy (DOE) and EPA co-sponsored a workshop on

Using Contingent Valuation to Measure Non-Market Values.² The objective of the workshop was to begin to frame a research agenda for addressing the validity and reliability of using the contingent valuation method to estimate the economic value of non-market goods and services related to the environment as well as other public goods. In one workshop, one cannot expect to identify all of the unresolved issues, but I believe that it contributed to the stimulating debate. The topics are too numerous to list here as they range from fundamental questions about the ways in which people formulate their economic values for public goods to issues involving the survey administration method (e.g., personal interview, telephone, or mail survey). EPA and DOE are working cooperatively with other federal agencies to obtain support for funding research in this area.

Conclusions

Many of the national environmental research issues identified as important by the National Research Council coincide with some specific examples of economic research areas that are increasingly relevant for policy-making at EPA. I am more reluctant to label any particular research areas as irrelevant. The importance of economic arguments in making decisions about the environment appears to be increasing, due to the economic significance of the environmental decisions. However, the relevance of economic research for making policy decisions depends upon the extent to which the economic analysis adequately considers the political context in which decisions are made and the institutional context in which policies are implemented. Economic analysis can also play a role in framing the debate or in changing the political context. Thus, analyses that used to be irrelevant (i.e., economic incentive approaches toward controlling pollution) are now potentially of

great interest, particularly if they take institutional barriers and constraints into consideration.

Funding for environmental economic research has never been a national research priority despite numerous recommendations and arguments for making it one. It does not appear that this will change any time soon.

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² To obtain information on publication of the proceedings from the DOE/EPA Workshop on Using Contingent Valuation to Measure Non-Market Values contact Dr. David J. Bjornstad, Oak Ridge National Laboratory.