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Economic Issues in Controlling Agricultural Pollution

by

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Our present problems of environmental pollution result from more intensive use of our natural resources and from slow rates of collective adjustment to rapid technological changes. They also result from rapidly rising standards of environmental quality demanded by a better educated, better informed, more affluent and more mobile population. Environmental pollution may be defined as those interactions of men with their physical surroundings that result in diminished levels of well-being. This definition emphasizes the importance of changes in perception of the observers as well as changes in the characteristics of the physical environment. Thus, pollution problems result from changes in the presence or perception of the "victims" as well as from changes in the activities of the "pollutors."

Discussion, controversy and confusion concerning pollution of our physical environment has risen sharply in the past few years. Increasing anxiety about pollution among the general public is leading to actions through all levels of government. The agricultural industry and rural people are directly involved in their roles as both pollutors and victims of pollution. However, the major issues involved are much broader than agriculture alone and the problems of agricultural pollution can seldom be considered in isolation from the general problems of environmental quality.

The objectives of this paper are to: (1) stress the multiple decisionmaking aspects of controlling environmental pollution; (2) highlight a number of significant economic issues involved; and (3) suggest some significant areas where economic research can contribute to reduction of agriculturally related pollution.

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Agricultural economists have a unique opportunity to provide the economic information that can facilitate adjustments to emerging environmental controls at reasonable social costs.

Agriculturally Related Pollution--the problem areas

The agriculturally related pollutants now considered problems are pesticides, animal wastes, sediment, plant nutrients, inorganic salts and minerals, forest and crop residues, agricultural processing wastes, and smoke, dusts and other air pollutants [11]. The discussion of pesticide residues is particularly audible at the moment. The persistent chlorinated hydrocarbons are of major concern. Several States have imposed or are considering spray bans or other stringent controls on the use of persistent pesticides.

Animal waste production is approximately two billion tons per year. Roughly half of this waste is associated with concentrated livestock production. This problem is expected to become more serious as economies of livestock production are exploited through fewer and larger operations and as cheaper chemical fertilizers more completely replace the use of animal manures.

Sediment is our largest single pollutant of surface waters. Approximately a billion tons reaches major streams annually. Sediment is important as a carrier of plant nutrients, pesticide residues and infectious agents.

Plant nutrients from soils, animal wastes and fertilizers have contributed to locally serious problems of excess aquatic growth (eutrophication) and nitrate contamination of ground water supplies. Saline irrigation drainage waters are an important problem in arid areas.

The high organic content of forest and crop residues and agricultural processing wastes is a major problem in many areas. Low utilization values present solid waste disposal problems. Burning may create air pollution. Serious water pollution can result from placement or wash into surface waters.

Decisionmaking for Environmental Management

A recent publication asserts, "We are as Gods and might as well get good at it" [14]. Modern man, relatively speaking, is as the Gods in his present power to mobilize resources, knowledge and energy to alter the environment in drastic ways. We must "get good at it" for our own protection and well-being.

We differ, however, from Gods, economic men and philosopher kings in a number of singificant ways. Our objectives are multiple and conflicting. Our information is limited. Our decisions are sequential and constrained. Furthermore, our political economy and social value systems have so evolved as to make it relatively easy to mobilize sufficient power to effect rapid technological changes. But at the same time it is more difficult to launch efforts of similar force and speed to attack pressing social problems that may, in fact, result from on-going technical changes.

Decisions on environmental management are made at different points in time by millions of individuals and organizations. I propose to highlight a number of economic issues within a three-tier hierarchy of decisionmaking levels [4]. These levels are: first, the individual or firm; second, the bureaucratic and legal systems that operate to facilitate and constrain decisions at the first level; and top most, the arenas of the legislatures, the commissions, the high courts, and even the industry board rooms where broad decisions affecting the second level framework are made.

Decisionmaking in the Legislative Arenas

Much of the present turmoil over environmental quality results from inadequate representation of the perceptive pollution "victims" in the political decisionmaking process. These "third parties" are currently being represented to a large extent in the national communications media. What is a socially desirable and

economically efficient means for their representation within the political process? Citizen advisory groups? Scientific advisory boards? Court actions? Or should extraordinary powers be granted to independent subgovernments? Wolman and others have argued for an organization to control environmental management at the Federal level similar in power and authority to that of the Pentagon [12, p. 1100].

What level of government should assume responsibility for control of specific environmental problems? Involved are the specific instruments appropriate for program action--taxation, subsidy, education, regulatory powers; the representation of concerned parties; and the capability to build effective bureaucracies with adequate technical competence and research support. To oversimplify, the preponderance of discretionary spending power rests at the Federal level, the broadest regulatory powers reside with the States and it is widely believed that the views of the citizens are best represented through their local governments. Allee and Clavel, in their study of poultry waste pollution, concluded that effective compulsory regulation would probably require the technical capability and legal powers residing at the State or regional level [1].

It is analytically frustrating when legislatures do not specify clear and definitive objectives for public programs. Part of this situation results from sequential decisionmaking on problems at hand combined with a general lack of capability to simultaneously review previous decisions for inconsistencies. However, part of the specification problem results from uncertainty about the probable effects of alternative decisions. The responsibility for this vagueness lies partly with those individuals and institutions who should anticipate information needs and make it their business to reduce the areas of uncertainty at the time of decision. In the complex area of environmental quality, the probability is particularly great that legislative objectives will be either vague or on the other hand, overly narrow.

Decisionmaking in Bureaucratic and Legal Systems

The issues at the second level are concerned with the structure and performance of systems of constraints and incentives influencing decisions and actions by individuals, firms and groups. We know relatively little about the influence of our legal framework, e.g., courts, tax systems and financial regulations, within the web of constraints and incentives surrounding our individual environmental managers [8]. In action programs, what are the effects on management decisions of subsidy, regulation, education, or technical assistance activities?

At the institutional and program levels, there is the same universal need to make decisions based on incomplete information about feasible alternatives. How much time and resources can be allocated to reduce areas of uncertainty? Under recent Federal legislation, air and water quality standards are established on a Federal-State basis. How can these standards be met? Which instruments or combinations of regulation, financial incentives, education and technical assistance are effective, efficient and desirable for different environmental problems and situations?

If regulations and police power are to be employed, the regulations must be reasonable, equitable, effective, enforceable, widely understood, and reasonably "popular." What will various systems of regulation cost? Given the relatively high tolerance of Americans for illegal activity, what are reasonable assumptions as to levels of compliance under compulsory regulations?

McNabb has observed, regarding feedlot pollution control, that the effectiveness of extension education programs in achieving satisfactory voluntary regulation is in doubt. But that, if compulsory regulation is eventually needed, it will be achieved more easily and will no doubt be more effective if based on widespread understanding achieved through earlier efforts toward voluntary regulation [5, p. 36].

The economic issues surrounding the use of financial incentives for pollution control; subsidies, loans, general and specific taxes or fines are familiar to us. Who benefits? Who pays? What is efficient and what is equitable? However, if A pollutes B's environment, does A owe B or should B pay A to control pollution. What is an effective and/or efficient cost sharing arrangement?

There are also the issues of income distribution. Carlson has pointed out that the current establishment of air and water quality standards is a struggle between the groups who will bear the burden, e.g., municipalities and industry, and the beneficiary groups, often of higher socioeconomic status, such as outdoor recreation enthusiasts [3, p. 85]. He feels, in the case of water pollution, there is evidence that redistribution of income will be regressive, benefiting higher income groups. However, in our political decisionmaking process, we may anticipate some adjustments between the setting of standards and the achieving of them.

Pollution controls may result in redistribution of incomes from upstream to downstream water users and from established resource users to subsequent resource users. Stepp has discussed the interregional income distribution issue regarding the nondegradation requirement that Federal-State waters be maintained at least at present quality levels. Had the Founding Fathers enforced a nondegradation erosion standard, as part of our land policy, agriculture might be limited to the thirteen original States [10, p. 6]. The point, of course, is the necessity to consider the distributional effects of environmental controls in as broad a context, as is possible.

The establishment of environmental controls requires compromises between the need to maintain a reasonably stable system of constraints and incentives for efficient programming of production and consumption and the need to provide sufficient flexibility to adapt the incentive system to changing technology, changing

sets of tastes and preferences or new pollutants. (One begins to feel that every magazine informs him he is polluted by something new.)

The question of bureaucratic flexibility has both organizational and technical information aspects. Are generally coordinated groups of environmental agencies with narrow objectives more effective and flexible over time than superagencies with broad objectives? Federal-State programs may be more or less flexible than separate programs. How effective are advisory groups or expert consultants in achieving bureaucratic flexibility?

Decisionmaking by Individuals and Firms

In considering decisions by individuals and firms, it appears we have returned to more familiar ground. Perhaps, but there are still the continuing unresolved issues of benefit-cost analysis. There are the continuing ignorances surrounding the incentive effects of various taxation systems and the continuing lack of research effort on them. One of the most important questions is how governmental actions can be designed to strengthen incentives for private or voluntary decisions to manage the environment in socially desirable ways. Voluntary action in our society is considered the key to solving social problems. Even the use of police power must be predicated on voluntary compliance by the vast majority. What are the feasible and effective alternatives for achieving a widespread sensitivity about relationships between individual actions and environmental problems? What legal or program changes would reward ingenuity, development of new technology or changed patterns of operation to reduce environmental problems?

There is the question of how individuals in various situations and various roles perceive environmental pollution situations. What do they want changed? How should it be changed? Who should change it? Who should pay for it? Because of the technical complexity of many environmental problems, large groups may be

unaware, misinformed or apathetic. If so, how can this situation be reflected in decisionmaking on environmental control?

A Strategy for Socioeconomic Research

Having considered some of the issues, what research should we undertake? It would be fine to be able to conclude that we should research the economic aspects of all these issues plus those new questions uncovered in the process. (Sadly, even committees projecting research needs seldom reach such ethereal ecstasy.) Realistically we must content ourselves with some selected efforts.

Empirical Studies

Although there are some serious deficiencies in our theoretical concepts, the pressing need for improving the pollution control decisions, that will affect agriculture in the next few years, involves empirical economic information. The lead priorities should be given to the empirical problems, most of which are within range of our present conceptual grasp.

Empirical case studies of pollution situations are needed. There is little information on costs and benefits for specific situations. We need to determine who is really burdened by pollution by tracing through the effects in real situations. Information is needed on the timing of pollution damages. The costs of alternative means of control are often very sensitive to the probabilities of critical pollution occurrences. It is only through development of valid information from empirical studies that the widely conflicting claims of benefits and costs can be narrowed and significant progress made toward the development of efficient means of environmental control.

Systems Approach

The complexity and interrelated aspects of environmental management support a systems approach to many of the problems involved. Both the economic effects and environmental effects should be considered. The economist and ecologist share

a common systems concept in the initial stages of problem solving at least. The potential for mutually beneficial collaboration on environmental problems should be more fully explored.

Ayres and Kneese, in considering solid wastes as a materials handling problem, have demonstrated the usefulness of the systems approach for considering possible alternative actions and for highlighting critical needs for additional research [2]. For example, there has been some agitation for banning chemical fertilizers because of high nitrate incidence in food and drinking water supplies. Smith has pointed out, however, that a third of our present crop production is dependent on chemical fertilizers [9, p. 174]. A general study of nitrates using the systems approach could be useful in delineating the possible effects and costs of various fertilizer use controls.

Reaction Patterns

Relatively little information is available on the reaction patterns to environmental control programs that might be anticipated from firms and groups in various representative situations. Pollution regulation may have a significant effect on the location of individual agricultural firms and the competitive positions of various producing and processing areas. Water pollution regulations, for example, might be expected to give those areas with heavy rainfall and fast moving streams a competitive advantage for firms generating large volumes of oxygen-demanding waste water [6, p. 148].

Analysis of Firms

More information is needed on the costs to the agricultural firm of alternative means of pollution control. In addition, we need to look ahead and design efficient systems of food and fiber production that will minimize pollution as a way of doing business.

Data Sources

While the present sources of agricultural data are not completely adequate to support environmental control decisions, there is still considerable potential for useful exploitation. Additional sources of data on the extent, location and severity of agricultural pollution will need to be developed. Some efforts have been made toward developing indicators of social welfare [13]. These efforts should be continued and expanded to more accurately guage trends in environmental conditions.

Interdisciplinary Research

For many important questions, it is obvious that the economic researcher will be dependent on inputs from other disciplines. Studies of environmental perception, for example, will require collaboration with other social scientists. The agricultural economist, by training and experience, is often able to work effectively in this type of situation. The particular vehicle for including other disciplines in the research approach--literature review, consultation, coordinated projects or operations research groups--depends on the nature of the problem, the resources available and the personalities involved. However, the complexity of the problems of environmental control makes it extremely difficult to keep adequately on research developments in the several related disciplines. (The proliferation of professional journals alone promises to undo anyone who may consider himself up-to-date at the present time.)

The complexity and dynamic aspects of environmental quality problems insures that we will not lack for challenging research questions. In fact, the variety of questions provides abundant opportunity to satisfy both our intellectual curiosity and our professional obligation for relevancy to pressing social issues.

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