Agricultural Conservation Policy at a Crossroads

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U.S. agricultural conservation policy has focused on a range of potential policy instruments centered on voluntary approaches tied into Depression-era commodity programs. Entering the twenty-first century, conservation policy is at a crossroads between more coercive regulatory policies, more costly voluntary programs, and more facilitative market-oriented policies. What are the pitfalls, advantages, disadvantages, and tradeoffs along these paths?

As we approach the twenty-first century, agricultural conservation programs are at a crossroads because of changes in the key factors that have undergirded conservation programs since their establishment in 1935 and new forces that call for new approaches. In the first section of this paper, we define the conservation problem, recognizing that (1) distributional considerations have been historically important in agricultural policy, and (2) information limitations may preclude the development of efficient solutions. Next, we review the history of conservation and environmental policy in agriculture and present a systematic taxonomy of policy instruments used in agriculture. Finally, we discuss the changes that have brought conservation policy to a crossroads, considering the implications of three divergent policy paths.

The Conservation Policy Problem

Conservation problems associated with agricultural production generally involve damages to natural resources and to natural resource users that are not completely accounted for in the farm's economic calculus. While a conceptual distinction can be made between resource problems that are internally accounted for by the farmer (conservation problems) and those that impose externalities on others (environmental problems), most examples encountered in reality have impacts both on and off the farm. Typical examples include depletion of soil resources through erosion, pollution of water resources from runoff or leaching of sediments, nutrients, or pesticides, and destruction of wildlife habitat. The resulting depletion or contamination damages some or all members of the society, creating an unpriced externality of production (Baumol and Oates 1988, p. 36). The social problem is, therefore, to influence producers to modify their production practices to reduce or eliminate the damages created.

Dimensions of space and time pervade conservation and environmental problems because the locus of damage is frequently away (downwind or downstream) from the farm; other damages from production today may not be felt for many years. Conservation and environmental problems may occur on the intensive or extensive margins of production (Opaluch and Segerson 1991). Extensive margin problems are associated with decisions to farm, or not to farm, land of certain kinds or in certain locations. Examples include crop production on highly erodible soils, conversion of wetlands for crop production, and livestock production upwind of human population concentrations (Ribaudo 1986; Young and Osborn 1990; Heimlich and Langner 1986; Piper 1989). For intensive margin problems it is assumed that production will take place; the concern is with *how* production is carried out. Examples include the choice of tillage systems to control soil erosion, the rate and timing of fertilizer applications related to leaching or runoff, and risks of ground and surface water contamination by pesticides (Crosson 1981; Epp and Hamlett 1996; Huang et al. 1994). Over the past sixty years, U.S. conservation and environmental policies have addressed both extensive and intensive margin problems using a wide variety of programs and practices (Rasmussen 1982; Magleby et al. 1995).

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Two considerations are key to conservation policy: the limitations imposed by imperfect information and the varying distributional impacts conservation policies have on producers. Because of the diversity of physical and production circumstances under which farming takes place, and because of the variety of landscape situations in which farms are located, conservation and environmental problems associated with agriculture are characterized by imperfect knowledge on the part of both producers and environmental officials. There are few direct linkages between production practices and environmental outcomes, and myriad paths of fate and transport intervene between eroded soil, applied chemicals, and ecosystems and human populations potentially damaged by them. Direct monitoring is fraught with numerous uncertainties caused by the stochastic nature of weather events that influence the fate and transport of pollutants and the extent and nature of natural areas. Process models may give some indication of environmental performance, but they are limited by the need for calibration to specific situations and our inability to trace relationships beyond the farm with any confidence (Williams, Jones, and Dyke 1984; Arnold et al. 1995; Knisel 1980).

Most economic analyses of agricultural conservation or environmental problems begin with the assumption that efficiency is an overriding goal in designing policies and programs (Baumol and Oates 1988, ch. 15). As we show below, conservation and environmental problems have evolved from prior problems of managing farm income, agricultural production, and the agricultural economy. Consequently, policymakers are often concerned with the division of costs and benefits from programs between farm and nonfarm sectors, and between regions and commodities within the farm sector.

Gardner (1987) analyzes U.S. farm policy using a policy preference function that allows for variation in the weight placed on the economic interests of various groups within society. Because distributional impacts are such an important factor in conservation policy, economists need to expand on Gardner's approach in two ways. First, we need to consider how the distribution of welfare effects from environmental policies, particularly within agriculture, can be incorporated. Second, we need to explicitly incorporate environmental objectives.

Evolution of Agricultural Conservation Programs

Agricultural conservation and environmental policies operating at both extensive and intensive margins have always been closely tied to farm income objectives and have always served the distributional goals of farm policy. Low farm income was the key issue addressed when New Deal farm programs began in the 1930s (Luzar 1988). The Agricultural Adjustment Act of 1933 (AAA) was the nation's first attempt at controlling commodity supplies to increase prices and incomes through a linked policy of processor taxes intended to fund paid land diversions for eligible farmers who reduced planted acreages of soil depleting crops (Gaus, Wolcott, and Lewis 1940, p. 150). On October 25, 1935, President Roosevelt stated that the program served two principal objectives:

> First, to carry out the declared policy of Congress to maintain and increase the gains [in controlling commodity supply] thus far made. . . . Second, . . . to give farmers increasing incentives for conservation and efficient use of the Nation's soil resources. (Cited in Gaus, Wolcott, and Lewis 1940, p. 144)

The soil conservation aspects became critical when the U.S. Supreme Court invalidated the AAA and the administration shifted emphasis to funding for acreage retirement and soil conservation payments from the general treasury; this shift was embodied in the Soil Conservation and Domestic Allotment Act of 1936 (Benedict 1953, p. 349). Economists favoring Pigouvian taxes as the most efficient way to achieve policy objectives should note that in *U.S. v. Butler et al., Receivers of Hoosac Mills Corporation,* 297 U.S. 1 (1936) the Supreme Court argued that processing taxes required under the Agricultural Adjustment Act were unconstitutional because the avowed purpose was regulatory, rather than to raise revenue, and because the exercise of the taxing power was for a purpose not delegated to the federal government in the Constitution.

Thereafter, until 1985, participation in conservation programs was strictly voluntary. Policymakers relied on positive incentives to achieve conservation objectives, so that programs benefited both the environment and the particular producers who participated in them (Reichelderfer 1991). Examples include conservation technical assistance, land improvement cost-share programs (e.g., the Agricultural Conservation Program and the Great Plains Conservation Program), and land retirement (e.g., the Soil Bank Program and the Conservation Reserve Program). Policies were intended to meet both conservation and farm income objectives, often with farm income as a primary objective, through supply control for specific commodities (Batie 1984). Land retirement programs legislated during periods of agricultural recession had explicit farm income objectives and have generally been better funded than programs that exclusively promoted conservation.

In the 1970s the environmental movement focused attention broadly on pollution and associated environmental degradation and health effects (Unger 1979; Magleby et al. 1995). Environmental regulation of agriculture occurred only outside the bounds of traditional commodity and conservation policies. The Federal Insecticide, Fungicide, and Rodenticide Act of 1972 banned or restricted the use of a number of agricultural pesticides. The Endangered Species Act approved in 1973 had potentially significant impacts for agriculture (Goldstein 1996). Although these programs carry no explicit farm income objective, Reichelderfer (1991) argues that these and other major environmental laws affecting agriculture were more likely to be approved during periods of relative prosperity for the farm sector.

The agricultural export boom of the early 1970s led to abandonment of conservation practices that reduced the efficiency of farming operations and expansion of cropland acreage. Although these developments renewed concern about the long-term loss of agricultural productivity and provoked concern about agriculture's impact on the environment, the 1977 and 1981 farm bills focused on providing price and income support to producers. They broke little new ground on conservation or environmental protection, with the exception of provisions of the Farmland Protection Policy Act of 1981.

The incipient agricultural recession in the mid 1980s set the stage for the Food Security Act (FSA) of 1985 to usher in a new era in agricultural and environmental policy. The Conservation Reserve Program continued the tradition of land retirement programs undertaken for dual conservation and farm income support purposes. However, for the first time eligibility was targeted to highly erodible land. The definition of highly erodible land was expanded to include traditional clients of farm policy (Heimlich and Bills 1986). In another first, farm commodity program benefits were tied to environmental performance under the conservation compliance, sodbuster, and swampbuster provisions of the FSA. Unlike previous, strictly voluntary programs, the new legislation forced producers to weigh the costs of complying with conservation programs against the loss of farm program benefits. The 1985 act also completed a shift (begun in the 1970s) from price support to income support as a mechanism of redistributing income to commodity producers.

In the latter half of the 1980s, market prices declined sharply. Farmers needed to participate in farm programs to survive financially and direct income payments ballooned, creating strong incentives to meet environmental standards. These incentives still depended on Congressional willingness to provide significant federal support for farm income. Producer incentives were most significant during periods of low commodity prices, when market incentives to convert highly erodible land or wetland to crop production were low and producer needs for income support were great.

Although the 1985 FSA embodied major changes in mechanisms for accomplishing conservation policy objectives, policy continued to focus primarily on maintaining soil productivity, with the notable exception of swampbuster provisions (Zinn 1991). The 1990 Food Agriculture, Conservation, and Trade Act (FACTA) significantly broadened the environmental policy objectives of agricultural policies. The objectives of the Conservation Reserve Program were broadened to include water quality and wildlife habitat, in addition to the traditional supply management and soil productivity objectives. A new Wetlands Reserve Program (WRP) was enacted, authorizing USDA to obtain permanent easements and restore wetlands on former cropland.

Finally, the Coastal Zone Act Reauthorization Amendments (CZARA) of 1990 required, for the first time, an explicitly regulatory approach to agricultural nonpoint source pollution (Heimlich and Barnard 1995). CZARA requires that "economically achievable" agricultural nonpoint source pollution control measures be implemented by states in coastal zones, including the Great Lakes. CZARA standards are technology-based. No direct cause-and-effect linkage between observed water quality conditions is needed for a state to require implementation of specific management measures. CZARA implementation has been slow because states objected to EPA's initial broad prescriptive approach, resulting in more specific management measures (U.S. EPA 1993; Heimlich and Barnard 1995).

Environmental Problems and Policy Instruments

Table 1 provides a taxonomy of policy instruments that could be used to ameliorate agricultural resource and environmental problems. Three broad groupings organize the instruments: involuntary measures that are, to varying degrees, coercive; voluntary measures providing varying amounts of financial incentive; and facilitative measures that rely primarily on information. Involuntary pro-

Table 1. Matrix of Federal Agricultural Conservation/Environmental Policy Instruments and Problems

Characterizing Continuua	Conservation/Environmental Policy Instruments							
Participation	Involuntary			Voluntary				Facilitative
Motivation	Regulatory			Economic Incentives				Moral Suasion
Conservation/ Environmental Problem	Regulation	Conservation Compliance	Pigouvian Taxes	Land Retirement	Cost Sharing	Incentive Payments	Trading/ Banking/ Bonding	Education/ Technical Assistance
Erosion: soil productivity		sodbuster/ compliance (1985)		Soil Bank (1956) CRP (1985)	ACP (1936)			CTA (1936)
Erosion: sedimentation	CZARA (1990)	sodbuster/ compliance (1990)		CRP (1990)	ACP (1936) EQIP (1996)	WQIP (1990) EQIP (1996)		CTA (1936)
Erosion: airborne dust		sodbuster/ compliance (1990)		CRP (1996)	ACP (1936) EQIP (1996)	ACP (1936) EQIP (1996)		CTA (1936)
Wetlands	CWA Section 404 (1972)	swampbuster (1985)		Water Bank (1970) CRP (1988) WRP (1990) EWRP (1993)			Mitigation banking (1995)	
Water quality: nutrients	CZARA (1990)			CRP (1996)	EQIP (1996)	WQIP (1990) EQIP (1996)	CWA (1990)	CTA (1936)
Water quality: pesticides	FIFRA (1947) CZARA (1990)			CRP (1996)	EQIP (1996)	WQIP (1990) EQIP (1996)		CTA (1936)
Wildlife habitat	ESA (1973)			CRP (1996)	WHIP (1996)			

Acronyms:
ACP—Agricultural Conservation Program
CRP—Conservation Reserve Program
CTA—Conservation Technical Assistance
CWA—Clean Water Act
CZARA—Coastal Zone Act Reauthorization Amendments
EQIP—Environmental Quality Improvement Program
ESA—Endangered Species Act
EWRP—Emergency Wetland Reserve Program
FIFRA—Federal Insecticide, Fungicide, and Rodenticide Act
WHIP—Wildlife Habitat Incentives Program
WQIP—Water Quality Improvement Program
WRP—Wetland Reserve Program.

grams are arrayed from left to right in order of decreasing specificity of program requirements. In other words, the more closely prescribed the producer actions, the farther left a particular instrument falls on the continuum. Voluntary measures are similarly ranked from left to right, as the level of financial incentive provided decreases. The evolution of environmental concerns discussed above is echoed in the rows of the matrix, with the initial concerns about soil productivity losses from erosion occurring in the top rows, and more recent concerns appearing in the bottom rows. The approximate dates of specific policies are indicated in the body of the matrix, changing where new problems were encompassed by older policies.

Involuntary measures have not been widely used in agriculture but have begun to emerge in the past decade. We place three instruments in this group—direct controls, Pigouvian taxes, and the conservation compliance instruments first enacted in the Food Security Act of 1985 (conservation compliance, sodbuster, and swampbuster). Direct controls include pesticide regulation, the wetland dredge and fill permit review requirements of Section 404 of the Clean Water Act, and the agricultural nonpoint source pollution provisions of CZARA. The cells representing Pigouvian taxes in table 1 are blank because this instrument is not currently used in agricultural conservation and environmental programs, even in the weak form of a general tax on agricultural inputs or outputs.

The conservation compliance mechanisms defy conventional economic classification schemes: they are not taxes, subsidies, or regulations, but they have some of the characteristics of each. Arguably, they can be viewed as conditions on participation in voluntary subsidy payment programs and thus voluntary in nature. However, we categorize them as involuntary because most of the payments that could be withheld are income or price support benefits associated with commodity programs that are, rightly or wrongly, viewed as entitlements by farm operators. Because of the long history and entitlement nature of these programs, their value is capitalized into land values (Barnard et al. 1997; Duffy et al. 1994) and generally built into producers' financial calculations. These programs are voluntary in the same sense that producers' decisions are voluntary under a Pigouvian tax: producers are always free to pay the full penalty (or tax) instead of improving environmental performance.

More specifically, conservation compliance exhibits characteristics of both direct controls and taxes. Baumol and Oates provide distinctions between direct controls and taxes or fees that provide useful insight regarding these instruments:

> a direct control must involve a directive to *individual* decision makers requiring them to set one or more output or input quantities at some specified levels or prohibiting them from exceeding (or falling short of) some specified levels. If the activity levels satisfy these requirements, they are considered legal and no penalty is imposed. However, if they are violated, whether by small or large amounts, the individual is considered to be a lawbreaker who is subject to punishment. With taxes or fees on the other hand, even if they are based on standards for the community as a whole, no individual is told what input or output levels to select. Moreover, taxes and fees utilize no knife's-edge-criterion. The amount of the decision maker's payment will vary with his pertinent activity levels, with no imputation of illegality to the activity levels he chooses. (Baumol and Oates 1988, p. 191)

Like direct controls, conservation compliance prescribes limits on producer actions and provides for penalties without explicit distinction regarding the size of the violation. Like taxes and fees, however, violation does not imply illegal activity, and the prospective penalties are limited and known in advance. In essence, these programs share features of environmental tax and regulatory programs but bear little resemblance to environmental subsidy programs. For example, producers are not provided a subsidy because they do not drain wetlands; they are assessed a penalty if wetlands are drained in violation of swampbuster provisions.

Explicitly voluntary programs include land retirement, cost sharing, incentive payments, emissions trading, and conservation technical assistance. Long-term land retirement programs generally provide conservation, environmental, and commodity supply management benefits. Since 1990, for example, the Conservation Reserve Program (CRP) has increasingly incorporated water quality, air quality, and wildlife habitat considerations into bid acceptance rules. The CRP's Environmental Benefits Index (EBI) proxies for spatial variation in the contribution that retiring different parcels of land makes to achieving environmental goals (e.g., the closer land is to water, *ceteris paribus,* the higher its water quality score). The point values assigned to each part of the EBI (e.g., water quality, air quality, soil productivity, etc.) weight the multiple objectives of the program.

Emission trading is a difficult case to reflect in table 1. From agriculture's viewpoint, trading is a voluntary measure offering economic incentives because farmers are under no compulsion to participate and receive cost-sharing and incentive payments from point source dischargers. However, from the perspective of point source dischargers, trading remains an involuntary, regulatory policy that is only somewhat mitigated by the flexibility to subsidize nonpoint source control adoption at lower cost than prescribed point source controls.

Conservation at a Crossroads?

Our brief history of the evolution of programs and the policy instruments matrix highlight three points of relative constancy in policy since the 1930s. Despite significant changes in the 1985 and 1990 farm bills, (1) farm income and distributional impacts continued to be important considerations in agricultural policy of any kind, (2) conservation and environmental policies continued to be closely tied to commodity policy, and (3) the range of policy mechanisms that were widely used to combat resource and environmental problems associated with agriculture has been limited. However, developments in commodity and other policies in recent years suggest that these constants are under strain. The policy taxonomy presented in the previous section indicates both a broadening of policy objectives and mechanisms. Several recent developments may force continued change, placing agricultural conservation and environmental policy at a crossroads.

The most fundamental change occurred in the 1996 Federal Agricultural Improvement and Reform (FAIR) Act. FAIR decouples income support payments from production and from prices. Decoupling payments from production eliminates the need to maintain land in crop production to receive payments while providing leverage for sodbuster and swampbuster policies that operate at the extensive margin. A potential beneficial environmental consequence is the cyclical retirement of some land that is both economically and environmentally sensitive when market prices drop (Heimlich 1989). Price decoupling means that incentives for conservation compliance, sodbuster, and swampbuster provisions are improved: FAIR Act payments do not decline when prices rise, creating a more temporally consistent disincentive. In addition, program participation carries no opportunity cost in terms of acreage set aside, which has resulted in high participation and, perhaps, wider adherence to conservation compliance, sodbuster, and swampbuster provisions.

Price decoupling also increases the divergence of economic interests between producers who are directly affected by environmental restrictions and those who are not. Under a regulatory program with decoupling, for example, producers who farm land where little or no abatement is required would benefit from the price effect of reduced supply due to the increase in production costs for abatement on other farms. Under the deficiency payment programs of the past, however, agricultural producers had little incentive to support environmental regulation even if they would not be required to undertake abatement actions, despite relatively inelastic demand for agricultural commodities (Lichtenberg and Zilberman 1986). So long as target prices exceeded market prices, deficiency payments made up the difference between the target price and market price, and producers' market gains due to environmental restriction would be offset (at least partially) by reductions in deficiency payments. Decoupling income support payments from market prices under the FAIR Act exposes producers to price fluctuations, allowing them to benefit from price increases due to environmental regulation. For example, restricting or discouraging the conversion of wetlands for crop production reduces potential profit for producers who could otherwise convert wetland to crop production, but results in lower supplies and higher overall commodity prices (Claassen, Heimlich, and House 1997; Heimlich et al. 1997). That is, farmers who do not have wetlands to convert benefit from having restrictions imposed on farmers with wetlands that could otherwise increase commodity supplies and decrease market prices.

Exactly how this potential for new distributional impacts will affect agricultural policy decisions is unclear. Decoupling and the increasing importance of environmental considerations in agricultural policy could alter the political calculus of income redistribution by making the nature of the resource base an additional consideration.

A second factor for change is uncertainty about the future of farm income support payments. Ending direct income support to agricultural producers, as has been suggested by the FAIR Act's Congressional sponsors, would eliminate most of the economic leverage for conservation compliance programs. Other payments and benefits could still be withheld, but income support payments amount to the largest part of producer subsidies in agriculture. The end of these payments would pose at least two policy questions.

The first question is whether policymakers are willing to impose the costs of environmental compliance on producers through direct regulation, without offsetting income support payments. CZARA is the first instance of direct regulation of agricultural nonpoint source environmental problems (Heimlich and Barnard 1995). Given the 1995 change in control of Congress, however, CZARA may represent the end of a trend that began in the early 1970s, rather than the beginning of a new regulatory trend. If CZARA is a harbinger of new agricultural regulation, current program implementation may offer clues to potential future regulatory programs. Specifically, within broad federal guidelines and goals, regulations would likely be developed by states, with heavy input from the agricultural community. Regulatory programs are likely to be graduated responses to environmental problems that initially pay careful attention to the economic feasibility of required measures, moving to more extreme measures only when areawide environmental performance goals are not achieved.

The second policy question raised by the potential end of commodity programs is whether Congress would fund environmental programs even if it does not fund income support. This option may be preferable to the "polluter pays" principle embodied in environmental policy for most other sectors dominated by point source pollution. However, the availability of significant funding for exclusively environmental programs has yet to be demonstrated. Congress was willing to impose conservation compliance as a quid pro quo for income support payments and to spend money on long-term land retirement. It is not clear, however, that Congress is symmetrically willing to appropriate sufficient funds for direct subsidies to improve environmental performance when the supply control benefits of land retirement are not needed and when there is no commodity support program to leverage conservation compliance. Consolidation of previous programs (ACP, GPCP, CTA, etc.) into the Environmental Quality Improvement Program (EQIP) has come at reduced funding levels, although livestock waste problems were an exception. Cost-share and technical assistance funding for programs consolidated in EQIP averaged $966 million per year (1992 constant dollars) in the 1983–92 period, while total EQIP funding for 1997–2002 is $200 million per year, of which half is earmarked for livestock waste problems.

Regardless of preferences for kinds of conservation programs, federal deficit reduction efforts to reduce government spending may have been the most important motivation in the decision to decouple income support from current commodity production (Paarlburg and Orden 1996; Jagger and Hull 1997). Agricultural subsidies were a very visible half of all federal direct subsidies and one-third of all credit program outlays in 1995. The FAIR Act brought predictability to a previously stochastic budget element that was largely out of Congress's year-to-year control, but the level of payments has also been an issue. That level may or may not be reduced by redirection away from commodity programs to environmental and conservation goals.

A third factor is that the range of environmental and conservation problems confronting agriculture has expanded, putting more diverse and novel pressures on conservation policy. Hypoxia (oxygen deficiency) in a large "dead zone" of the Gulf of Mexico and blooms of alarmingly predatory *pfiesteria piscicida* organisms in Albemarle Sound and the Chesapeake Bay have been added to better-understood nonpoint source water quality problems (Satchell 1997; Boesch et al. 1997; Atwood et al. 1994; Rabalais, Turner, and Wiseman 1995). Agroindustrial issues such as intensification of livestock enterprises, food safety concerns with new or resistant bacteria, and the framework of phytosanitary issues permitted under GATT have emerged (Hoban et al. 1997; McBride 1997; Long and Painter 1991; Buzby et al. 1996). These new problems both raise the level of scientific uncertainty and introduce new actors and institutions.

In addition to more diverse environmental policy problems, pressures for devolution of envi-diverse set of policy responses to these problems at different levels of government and geography (Braden and Matsueda 1997). Federal conservation and environmental authorities have played facilitating or support roles, deferring to strong state initiatives in the widespread concern about environmental problems of livestock concentrations in North Carolina, New York, and Florida (Pierce and Ramsey 1997; Chapman and Coombe 1996; Boggess 1994), *pfiesteria* outbreaks in Maryland and Virginia (Satchell 1997; Boesch et al. 1997), and the San Francisco Bay–Sacramento/San Joaquin Delta water agreement in California (Zilberman et al. 1994). Whether such strong state and local initiatives expand and produce increasingly divergent environmental focii across states, or whether they are capitalized on and consolidated at the federal level (following older models of clean air, water, and coastal management legislation), remains to be seen.

A final factor putting conservation policy at a crossroads is enthusiasm for market-based incentives. Limited applications of these instruments to date include sulfur oxide emissions trading in the Clean Air Act (Tietenberg 1988), several proposals for and applications of point-nonpoint source pollution trading (Tippett and Dodd 1995; U.S. EPA 1992), the emergence of wetland mitigation banking to compensate for permitted wetland conversion (Environmental Law Institute 1993; U.S. Army Corps of Engineers 1994), proposals for environmental hazard assurance programs dictated by wholesalers and retailers, and a host of other proposals (Malik, Larson, and Ribaudo 1992; Segerson 1990). Although proponents often appeal to a kind of "smoke and mirrors" quality of getting environmental improvement at little or no cost, there is undeniable interest in avoiding expensive bureaucracies and the necessity for heavy-handed enforcement action by using market signals to modify polluters' behaviors. Often misunderstood, or deliberately downplayed, is the need for a preexisting regulatory framework that provides the incentive to reduce environmental problems, using markets to increase the efficiency with which reductions can be achieved. For example, point-nonpoint source pollution trading is motivated by the existing regulation of point sources under the Clean Water Act. In reality, what market-based schemes provide is flexibility in efficiently meeting environmental goals, rather than independent incentives to reduce externalities. Regulation provides the incentive and motivation, while these market-based incentives can ameliorate or mitigate the rigidities that command-and-control regulatory

Alternative Future Paths

Faced with these pressures for change in conservation and environmental policies, economists should consider possible alternative paths along which policy might evolve in the next century. We posit three alternative paths: direct regulation; environmentally based voluntary income support payments referred to as "green" payments; and use of market-based instruments. Direct regulation, which can include both design and performance standards, is well understood and well analyzed in the literature (Shortle and Dunn 1986; Sunding 1996). "Green" payment policies are often discussed but seldom described in detail or analyzed as policy instruments (Lynch and Smith 1994; Lynch 1994; Sorensen 1994; Smith 1995). While a myriad of market-based programs can be imagined, from wetland mitigation banking to complex environmental hazard insurance schemes, the discussion here focuses on trading between a regulated point source and unregulated nonpoint sources (Hahn 1989; Malik, Larson, and Ribaudo 1992; Letson, Crutchfield, and Malik 1993).

We examine how problems of insufficient information and the realities of policymakers' distributional goals constrain possibilities for policy design. We also draw out limited conclusions about the relative efficiencies of the alternative paths.

Insufficient Information

Ideally, all three paths would operate from a similar base of information about the causes, sources, and impacts of environmental problems caused by farming. That is, production practices could be directly linked to damages. Such information could guide regulators as to which sources to restrict and how much to restrict them. Information about economic benefits from improvements could form the basis for "green" payments and could serve as proxies for prices in marketlike transactions between point and nonpoint sources of pollution. Such proxies are needed because, as actually implemented, a government agency usually acts as broker between point and nonpoint sources, with little direct negotiation between the parties. Various studies have demonstrated that the value of such information in environmental regulation outweighs the cost of collecting it, but such studies have been attempted only on a limited geographic scale (Carpentier and Bosch 1997). As we have seen above, such detailed information is currently unavailable on a scale broad enough for environmental policy.

Because we lack sufficient information on environmental resource characteristics and relationships, we do not presently understand how to vary either economic incentives or environmental performance standards over the landscape to achieve efficient improvements. Because of this constraint, uniform standards have been, and will likely continue to be, the norm for a great deal of conservation and environmental policy. For example, under sodbuster and swampbuster provisions, converting highly erodible land and wetlands for agricultural production triggers loss of program benefits, regardless of the particular impacts on water quality or wildlife habitat. All three potential future paths are likely to combine uniformity in the standards to be met with at least some recognition of the variation in resources by using a plan-based approach (Ervin and Smith 1996). Trained planners, working for a state or local conservation authority, would work with farmers to develop whole farm plans, which the farmers would then agree to implement under threat of fines, the incentive of "green" payments, or in pollution "trades."

Distributional Goals

Who pays is not categorically determined by the selection of policy instruments. While a regulatory policy may seemingly embody the "polluter pays" principle, it may actually spread costs among producers, consumers, and foreign purchasers of agricultural commodities. This distribution can occur because the immediate effect of a regulatory policy is to impose higher costs on agricultural producers, creating a leftward shift in the supply curves for agricultural commodities. Because of inelastic demand for agricultural commodities, a significant portion of costs may be passed along in the form of higher prices to consumers and foreign purchasers. Domestic consumers, in their role as taxpayers, also fund the technical assistance, monitoring, and enforcement actions necessary to implement the policy.

Differential regulatory programs have distributional effects across sectors of the economy as well. Pollution abatement and control costs for nonagricultural sectors have averaged 1.7% to 1.8% of GDP since 1970 (Vogan 1996). Given the relatively mild regulatory treatment accorded agriculture and the voluntary, cost-sharing nature of most agricultural environmental and conservation programs, the sector is likely paying a less than proportionate share and may be receiving a net subsidy.

In terms of distributional impacts between farms, the relative effect of a regulatory policy on quasi-rents to different producers will vary widely, depending on the farm's environmental sensitivity. Lichtenberg, Parker, and Zilberman (1988) note that environmental policies affecting agriculture may significantly redistribute income among groups of producers. Claassen, Heimlich, and House (1997) find that similar redistributive effects would be expected following a relaxation of current restrictions on wetland conversion for agricultural production (i.e., the so-called swampbuster provisions and Section 404 of the Clean Water Act).

In the broader policy framework envisioned here, the same impacts could occur. Producers who are not required to take conservation or pollution control actions would enjoy the price effect without bearing any pollution control costs. The net aggregate effect on quasi-rents to producers depends on (a) price effects, (b) output effects (net of reduced costs due to reduced output), and (c) the change in costs of production for output produced under the new policy. In aggregate, inelastic demand for agricultural commodities means that net revenue will increase, but it is not clear that increased revenue will exceed increased costs.

A "green" payment program turns the "polluter pays" principle on its head because farmers now produce environmental improvement for a price established by the federal government as a joint product with agricultural commodities determined at market prices. If the marginal cost of environmental improvement is upward sloping, producers would earn economic surplus on subsidy payments, providing some income support. Despite some overlap, the distribution of "green" payments to producers is likely to be significantly different from the current distribution of income support payments. Traditional clients of farm programs (corn and soybean producers on level, well-drained land in the Corn Belt) may not have significant environmental problems, while new groups of producers (citrus producers in Florida or large, industrial hog or chicken producers in Arkansas) may become the most important targets for environmental improvement. Equity concerns, such as the notion of paying environmental "bad actors" while more environmentally responsible producers receive no payments, are also likely to be issues.

Potential changes in commodity supply with "green" payments are uncertain. Depending on how runoff baselines and subsidy rates are established, the program could serve mainly to maintain environmentally sensitive land in production, albeit with some additional conservation or pollution abatement practices, or could actually reduce production if land retirement is encouraged. Malik and Shoemaker (1993) show that, without appropriate controls, subsidizing agricultural inputs for environmental improvement will expand production at the extensive margin. To prevent the "green" payment program from subsidizing expansion of crop production at the extensive margin, land that has not previously been in agricultural production would have to be excluded from eligibility for the subsidy (just as previously unfarmed land was excluded from the Conservation Reserve Program) and producers who violate sodbuster or swampbuster rules to bring new environmentally sensitive land into production might have to be ineligible for payments on any land. On the one hand, if commodity supply decreases under a "green" payment program, price increases may ameliorate the difference in return to producers who farm environmentally sensitive land andthose who do not. On the other hand, if commodity supplies increase, price declines would hurt farmers of environmentally benign land, while farmers receiving "green" payments would be compensated. Consumers (who are also taxpayers) would pay the full cost of environmental improvement, plus the associated rents earned by producers and the costs of implementation, monitoring, and enforcement. If commodity prices decline, some of that expenditure could be offset, while those costs would be exacerbated if prices increase. The fact that government costs would be high may also be an important limiting factor in actually establishing a "green" payments program.

For producers, distributional impacts from a system of point-nonpoint source trading fall somewhere between regulation and "green" payments. Unlike regulation, under trading producers would be compensated for costs incurred from the proceeds of selling their pollution rights. Unlike "green" payments, market transactions in a trading scheme would likely limit the economic surplus that producers can gain because the price paid for pollution reductions will be driven by market forces to the marginal cost. Consumers and taxpayers would be exposed to some administrative costs, but these costs would likely be less than those for a regulatory program for agricultural producers. The change in commodity supply due to market-based trading is also unclear. Environmental improvement is usually achieved at some cost to producers either by reducing output (e.g., land retirement or strip cropping) or by reducing environmental consequences without significantly reducing output (e.g., filter strips). Technical change that reduces either polluting inputs per unit of output or environmental impacts without reducing output may be economically attractive. Abler and

Shortle (1995), based on results for static modeling, note that factor-augmenting technical change will reduce production costs and encourage expanded output, casting doubt on the idea that such change will reduce input use. However, technical change that produces cost-effective, environmentally benign substitutes for environmentally damaging inputs would have an unambiguously positive environmental impact.

A corollary of distributional impacts from environmental programs is that there is likely to be a strong political focus on seemingly technical issues, such as the establishment of baselines from which subsidized abatement or trades are counted, and the practices and standards required for payment. As an example, consider the debates concerning the definition of highly erodible land and the need to attain tolerable soil erosion (T value) levels in the relatively well known area of soil erosion control when conservation compliance requirements were enacted in the 1985 Food Security Act. Because these parameters are key factors in determining who pays or who is paid, policymakers concerned with the distribution of costs or benefits from environmental improvement will seek to understand and control them. Producers who have already reduced environmental problems (or who have been producing on land with few problems) would benefit from baselines stricter than current levels in the case of a "green" payments program or trading, and less strict than current levels for a regulatory program. However, setting standards too high for "green" payments or trading can be costly, constrain the trades that can be expected, limit funds available for real environmental improvement, and—in extreme situations—create an incentive to produce on land with environmental problems.

Relative Efficiency

When environmental problems can be monitored or effectively predicted and interrelationships between farm practices and ultimate environmental impacts are understood, a Pigouvian tax is superior in terms of economic efficiency, regardless of whether policy objectives involve maximizing social welfare (Shortle and Dunn 1986) or achieving environmental outcomes at least cost (Baumol and Oates 1988). The tax provides producer incentives for actions ranging from adoption of alternative production technologies (e.g., no-till) to land retirement. Efficiency is achieved because producers are free to choose (1) the level of environmental improvement, ensuring that improvement will be undertaken by those who can achieve it at lower cost, and (2) their own strategy for achieving those improvements, ensuring that it is achieved at least cost.

Regulation is generally less efficient because it does not allow producers to choose the level of environmental improvement they are required to achieve. Indirect policies that apply to specific inputs (e.g., a tax on nitrogen fertilizer) or require specific practices (e.g., land retirement) are generally less efficient than a Pigouvian tax because they provide incentive only for a restricted range of abatement actions that may be less efficient.

In the real world of insufficient information about environmental problems, the relative efficiency of alternative policy instruments is unclear. For example, when runoff can be reasonably predicted but fate and transport are not well understood, runoff standards or economic incentives may be uniformly imposed. However, without knowledge of transport coefficients, the relative efficiency of uniform standards is unknown. Using a simple model, Russell (1986) showed that when sources that contribute a larger share to ambient pollution also have high pollution abatement costs, relative efficiency is an empirical question. It can be more efficient to impose a uniform percentage reduction in emissions on all firms rather than imposing a uniform fee on emissions, because of the high fees necessary to induce the level of control required to meet ambient pollution standards. Miltz, Braden, and Johnson (1988) estimate the relative efficiency of an erosion fee and a uniform erosion standard (based on T values) for various levels of erosion reduction in a small watershed in Illinois. They find that erosion charges are more efficient when erosion reduction targets are between 2T and 5T, but that uniform erosion standards minimize control costs when the standard is set at T. Carpentier and Bosch (1997) show that such disaggregated empirical analysis can actually be done, albeit on a limited geographical scale, and that the value of the information exceeds the cost of collecting it.

It is likely that similar, detailed empirical analyses will be necessary to determine the relative efficiency of direct regulations, "green" payment subsidies, and point-nonpoint source trading or other market-based instruments where transfer coefficients are not known and policies are applied uniformly. "Green" payments, trading, and Pigouvian taxes tend to direct environmental control to low-cost sites. Efficiency is improved to the extent that these sites also contribute substantially to environmental problems, but there is no bargain if more expensive sites actually produce greater marginal gains, in terms of actual damage reductions, per dollar spent. Differences between low marginal costs of source control and low marginal costs of damage reduction are directly related to the transformation of pollutants across time and space (fate and transport), about which regulators and producers alike have very little knowledge.

Conclusions

As we enter the twenty-first century, agricultural conservation and environmental policy stands at a crossroads. While environmental protection is becoming increasingly important in agricultural policy decisions, the future of commodity policy is uncertain. Yet farm income and the distributional impacts of policies are likely to remain important considerations in making environmental policy related to agriculture. Although economists view economic efficiency as the primary goal of environmental policy because it can lower the the overall cost of environmental protection, policymakers may favor relatively inefficient policies on the basis of income and distributional impacts. Given the limited information on the physical processes of agricultural environmental problems, it will not always be clear, a priori, which policy alternative is relatively efficient.

Can agricultural policy meet multiple environmental objectives while satisfying demands for farm sector income maintenance and reducing government costs? Will these goals be consistent with increasing the overall efficiency of environmental policy in agriculture? Without a clear understanding of the preferences of policymakers for the economic interests of particular groups, balancing the federal budget, and environmental protection, it is impossible for economists to answer these questions definitively.

What economists can do is to conduct the detailed studies necessary to determine the relative distributional and efficiency consequences of various policy instruments. We have argued that, within the current commodity policy framework and under realistic assumptions about information, these questions are more empirical than theoretical, depending critically on observable differences in resource conditions. While there have been a few suggestive studies addressing these issues in localized contexts, a great deal more work will be needed to extend these models across the geographic scope necessary to estimate industry-level changes that are critical to understanding the distributional consequences of national environmental policies.

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