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The Political Economy of Water Quality Protection from Agricultural Chemicals

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Growing evidence of surface-water and groundwater contamination has led to demands for federal and state water quality protection policies. Agriculture will be an important target of such policies. Numerous instances of surface-water and groundwater contamination by pesticides and fertilizers have been recorded, and one study estimates that the drinking water of 50 million people in the U.S. is potentially contaminated by agricultural chemicals (Hallberg, Nielsen and Lee).

A number of policy approaches for reducing agricultural impacts on water quality are being discussed or implemented. These include extending the cross-compliance provisions of the 1985 and 1990 Farm Bills to include water quality protection, prohibitions on the use of certain chemicals (e.g., Proposition 128 in California), incentive payments for water quality protection schemes in the 1990 Farm Bill, and research and development on "low-input" production methods. In this paper we outline several of these approaches. We consider general approaches rather than specific proposals so that the outline is framed in broad terms. We also present economic and political criteria for evaluating the policy options and some tentative rankings.

Evaluation Criteria

In this section we present economic and political criteria for evaluation of the policy options. Clearly, no one policy approach will dominate all criteria. Indeed, there can be significant trade-offs. For example, a Draconian measure, like banning all pesticides, would be very effective, but the economic costs and political fallout would be enormous. Generalizations about how different approaches compare on different criteria must be made cautiously because it is often the specific features of an approach that determine its performance. However,

any good policy should be politically viable while avoiding unnecessary harm to economic well-being.

Economic Efficiency and Fairness

Economic criteria for evaluating alternative policy options include (1) the benefits of achieving water quality protection goals; (2) costs of adjustments in agricultural production practices; (3) costs of administration and enforcement; (4) incentives created for the development and adoption of less-polluting production methods, shifts to products which are less intensive in polluting inputs, and reallocation of production away from environmentally sensitive areas; and (5) distribution of the costs among different groups. These criteria follow from the efficiency/fairness paradigm of modern welfare economics and are developed in a much broader form elsewhere (e.g., Bohm and Russell).

The economic benefits of water quality protection in an area depend on the effectiveness of the protection program and the economic value of surface water and groundwater in various uses. Programs that would have comparable effects on water quality would have comparable benefits. In comparing alternative programs in this analysis, we will usually assume that the alternatives can yield comparable benefits. When this assumption holds, the economic efficiency of a program is measured by its cost-effectiveness.

Changes in fertilization, pest management, and other practices to reduce surface-water and groundwater contaminants will generally increase production costs. Other things being equal, a policy that allows lower cost control is economically preferred to one that is more costly. The costs of agricultural production adjustments in achieving water quality protection will depend on the costs of changes in production practices on individual farms and the allocation of control among farms. Variations between farms in productivity and the physical determinants of water pollution mean that some farmers may be able to take actions to protect water quality at a lower cost than others. Programs that allocate greater reductions in pollution to farms

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with low cleanup costs relative to farms with high cleanup costs are desirable.

Administration and enforcement costs are related to a variety of factors, some of which depend on the characteristics of the program being considered, others that depend on the agency charged with enforcement efforts, and still others that relate to the legal system. The Environmental Protection Agency (EPA) monitoring and enforcement efforts in the air and point-source water pollution areas illustrate the difficulties that can occur (Russell). The technological complexities of monitoring and enforcement, underfunding of EPA efforts, and legal wrangling have led to half-hearted enforcement and widespread violations. While these problems do not preclude effective action, they increase the cost of achieving any given level of enforcement.

In the area of water quality protection, problems would be even worse if U.S. Department of Agriculture (USDA) agencies were responsible for enforcement. There are strong pressures on county-based USDA personnel to be lenient with farmers, as evidenced by enforcement of the environmental provisions of the 1985 Farm Bill (Rosenthal). Problems might also be worse if a program were administered at the state/local level rather than the federal level. States have historically been very reluctant to do anything that would reduce their commercial competitiveness (although the recent "green" propositions in California are a major deviation from this norm).

Political Viability

The key political criteria for evaluating water quality protection policies are (1) the effect of each policy on the influential political interest groups with a large stake (one way or another) in the policy; (2) impacts on federal, state, and/or local government budgets; and (3) administration and enforcement costs. Political viability is clearly not independent of economic efficiency and fairness, since policies that score poorly on economic grounds are likely to be politically doubtful. Budgetary impacts and administration/enforcement costs are also key economic criteria. However, political viability is not identical to economic considerations. The interests of groups with more political clout will be weighted more heavily in designing water quality protection policies.

It is useful to think in terms of a revealed political preference function that is a weighted sum of welfare measures for various groups. A simple preference function would include consumer surplus, producer surplus, net government revenue, and environmental losses. When the weights on these items

are the same, we have a simple social welfare function. In this case, maximizing the preference function with respect to a pollution-control policy and subject to the constraint that environmental damages are limited to some level yields the economic criteria outlined above. When the weights differ (e.g., producer surplus is weighted more heavily than consumer surplus), solving this maximization problem yields the political criteria discussed here. This revealed political preference approach is developed more fully and formally elsewhere (e.g., Gardner).

Farm organizations are the most important of the influential political interest groups with a large stake in groundwater policies for agriculture. Among farm organizations, there is agreement that the commodity-specific groups, like the National Association of Wheat Growers, wield the most power (Browne). These groups have clout because of their relatively small size and homogenous member interests. In politics, size is generally a disadvantage because the incentives for group members to "free ride" on the lobbying activities of their fellow members grow as group size grows.

In determining the impact of each policy on the farm commodity groups, it is necessary to determine how existing farmland owners would be affected. It is generally recognized that farm organizations act mainly as representatives for this group. Some of the policies discussed below would have the effect of discouraging entry by new farmers or otherwise raising production costs for new farmers relative to established farmers. In so doing, they would give existing farmers a competitive advantage. If the competitive advantage were large enough, the farm groups might actually lobby in favor of policies that at first glance appear contrary to their interests. Some of the policies would also have the effect of raising farmland values, which would reduce opposition or increase support by the farm groups.

The experience under the Clean Air Act is especially relevant here. One important effect of this act has been to retard the growth of new industry in the southern and western parts of the country (Pashigian). EPA regulations require new plants to meet tighter standards than old ones. In addition, plants in areas of the country that are cleaner than national standards must meet tighter standards than plants in areas with poor air quality. This has given older industry in the Northeast a large competitive advantage. Indeed, this competitive advantage more than offsets the direct costs of the Clean Air Act to industry in the Northeast (Bartel and Thomas).

Environmental groups also have both significant political clout and an important stake in water qual-

ity policies. These groups have clout for the same reasons as the farm groups—a relatively small number of active, “core” members (although many have long lists of contributors) and relatively homogenous member interests. Groups like the National Audubon Society and the National Wildlife Federation are very active in farm policy (Browne). The 1985 Farm Bill was significantly influenced by environmental interests, and their influence has been even greater in the drafting of the 1990 Farm Bill. However, given the assumption that the programs being examined yield comparable environmental benefits, the environmental groups presumably would give each one equal support. The relative political merits of each program then turn on effects on other groups.

Chemical input suppliers are politically important and would seem to have a strong incentive to oppose groundwater policies that reduce the use of chemical inputs. Indeed, organizations like the Fertilizer Institute and the National Agricultural Chemicals Association do lobby in Washington. However, their stake in these policies is limited. This is because, in the long run, resources devoted to the production of agricultural chemicals can be shifted at relatively low cost to the production of chemicals for other sectors (Gardner).

Impacts on federal, state, and/or local government budgets are politically important because of competition among interest groups for government funds. Some of the policies (e.g., subsidies to farmers) could potentially involve huge expendi-

tures. Conversely, a tax on chemical inputs would raise funds that could be spent on other programs. In an era of large federal budget deficits and a multitude of claimants on federal dollars, large new federal expenditures on water quality production are politically doubtful. Budgetary pressures are also intense at the state and local levels.

Depending on how a policy is implemented, administration and enforcement costs will be borne primarily by farmers or primarily by the government. If the costs are small, this is unimportant. However, if the costs are large and borne primarily by farmers, their opposition could easily doom the proposed policy. If the costs are large and borne primarily by the government, competing pressures on government funds would make the policy politically doubtful. The conclusion is that a policy is economically and politically questionable if the costs of administration and enforcement are large.

Policy Options and Their Merits

A list of groundwater protection methods is found in Table 1. The list is classified into five types of methods: moral suasion, design standards, performance standards, economic incentives, and research and development. For each method, examples are provided. Each of the policies listed has either been proposed or tried at the federal, state, and/or local level. This is an important fact to keep in mind when considering economic and political vi-

Table 1. Policy Evaluations

Political Options	Potential Effectiveness	Cost-Effectiveness		Incentive Effects	Administration & Enforcement Costs	Budgetary Impacts ^b	Farmland-Owner Impacts ^c
		Farm-Level	Allocative ^a				
Moral suasion	Poor	d	d	Poor	Low	Small (-)	d
Direct regulations							
Limits on chemical input use	Good	Fair/Good	Poor	Good	Medium	Small (-)	Good
Enterprise-Choice regulations	Good	Poor	Poor	Poor	Medium/High	Medium/High (-)	Good
Performance standards	Good	Good	Poor	Good	High	Large (-)	Good
Economic incentives							
Taxes on chemical inputs	Good	Fair/Good	Fair/Good	Good	Medium	(+)	Poor
Subsidies for reduced chemical-input use	Good	Fair/Good	Fair/Good	Fair/Good	Medium	Large (-)	Good
Taxes on chemical loss	Good	Good	Good	Good	High	(+)	Poor
Subsidies for reduced chemical losses	Good	Good	Good	Good	High	Large (-)	Good
Conservation compliance	Good	Poor	Poor	Good	Medium	Large (+)	Poor
Research & development	Poor	d	d	Good	Low	(-)	d

^aAllocative cost-effectiveness pertains to the ability of a policy to allocate pollution control among farms in a least-cost way.

^bThis category is a combined assessment of all budgetary impacts, including administration and enforcement costs.

^cThis category refers to impacts on farmland prices.

dGood if there is any impact on chemical losses.

ability since it means that each policy has at least some degree of acceptability. Missing from the list are alternatives that are either prohibitively expensive or politically naive.

Moral Suasion and Education

One approach to water quality protection is moral suasion combined with education. The premise of this approach, which is widely discussed and implemented in many states in varying degrees, is that farmers will voluntarily adopt pollution control practices if they are informed of the possible inefficiency of their current use of pesticides or fertilizers, and their own risk and social responsibility, educated on what they can do to help reduce the problem, and given some technical assistance in implementing the pollution control practices.

Voluntary programs have excellent short-run political appeal. Politicians can appeal to the virtues of a clean environment, safe drinking water, and other desirable goals without having to do anything. Indeed, moral suasion has a long political history. However, the long-run political viability of moral suasion is only fair because it is unlikely to be effective in satisfying the public demand for water quality protection.

Agricultural markets are competitive and pressures on producers are increasing as markets become increasingly national and international in scope. At the same time, reducing government support of farmers and further liberalization of trade are on the national agenda. It is unrealistic to believe that the average farmer will adopt costly pollution control measures under these circumstances (Bohm and Russell).

Of course, farmers may take some voluntary action to protect water quality if only to protect their own water supplies, but it would be unwise to rely on self-protection as public policy. First, levels of protection would be based on individual farmers' perceptions of health effects and standards of safety rather than societal standards. Second, many farmers may find it cheaper to find alternative sources of water or to treat their existing supplies than to change production practices.

Some farmers may also voluntarily cut back on chemical use to improve profits. There is widespread belief that farmers use more fertilizer and pesticides than needed to maximize profits. If true, there may be some gains from education. However, alternative explanations of what appears to be irrational behavior may exist. For example, risk-averse farmers uncertain about pest hazards may prefer to reduce expected profit by applying pesticides in exchange for reducing the risk that profits

will fall below some minimum level. Moreover, reductions in chemical use motivated by profits may not yield sufficient reductions to achieve water quality goals. Again, farmers' individual goals, even when pursued with full information, may not correspond to societal goals.

Our conclusion is that moral suasion cannot be relied on to protect water quality. It can help, but real progress will require regulatory measures or significant economic incentives.

Design Standards

Direct regulation through design standards is the traditional method of pollution control in the U.S. Design standards for agricultural sources involve regulations pertaining to the ways farmers produce and manage their land. For example, to reduce nutrient losses, regulations could be imposed on the levels, timing, and forms of nutrient applications to cropland, and barnyard waste management practices. Similarly, pesticide losses can be controlled by regulations on the level, timing, and forms of pesticide applications. Another type of design standard would be a restriction on land use in critical recharge areas.

The potential performance of alternative policy approaches in achieving least-cost control at the farm level depends on information available to farmers as opposed to public planners. If they have equal information or if the public sector has better information about the costs of changes in production needed to meet water quality goals, then design standards make considerable sense for cost-effective control. Public planners could give each farm a plan that maximizes its profits subject to the water quality goals being satisfied. However, the more likely case is that farmers have specialized information that they could use to figure out cheaper ways of achieving these goals than public planners, provided that farmers are informed about the relevant effects of different management practices. Design standards, therefore, rate poorly in terms of their ability to promote cost-effective control.

The ability of different types of programs to allocate pollution control among different farms in a least-cost manner is also dependent upon information available to the public planner. If the public planner has perfect information about the economics of specific farms and the physical environment, then the planner can, in principle, construct regulatory or incentive programs that will induce each farmer to choose the optimal course of action. However, planners have highly imperfect information about costs and getting information can be very costly. Hence, standards are generally con-

sidered to perform poorly in allocating pollution control among sources in a least-cost manner. The regulator, with little information about individual costs, cannot set standards that correspond to the relative costs of control.

Design standards have advantages from the perspective of administrative and enforcement costs. Planners can choose easily observed designs, like bans on certain pesticides, land-use restrictions, or requirements that animal manures be stored in certain types of facilities in order to achieve substantial reductions in the application and percolation of polluting inputs. There is no need to monitor or estimate pollution flows or determine the level of incentives needed to achieve desired results. On the other hand, past problems in enforcing environmental laws that impose restrictions on individual firms argue against any proposal that requires one to observe farm-level behavior.

Finally, design standards must be ranked poorly with respect to incentive effects. Unless new and potentially more profitable designs can be easily tested and registered for use, design standards do not allow for improved profits with improved performance.

The political viability of design standards is clearly dependent on the economic considerations discussed above. However, the effect of these standards on existing farmland owners is also critical. Suppose that the standards significantly increase farm production costs without leading to higher farm product prices, an increase in the demand for farmland, or a competitive advantage for existing farmers over new farmers. In this case, opposition from the farm groups argues against political viability. Their opposition would not be so large if higher production costs were borne in part by consumers in the form of higher food prices. From an economic perspective, this is not important since it merely reallocates these costs. From a political perspective, however, this shifts the burden from those with substantial political clout (farmers) to those with much less influence (consumers).

Opposition by existing farmland owners would also be reduced if the design standards increased the demand for farmland. Consider a restriction on chemical input use. If the increase in the demand for land were large enough, some landowners would actually lobby for this policy. As an approximation, landowners gain in aggregate from restrictions on chemical inputs if the elasticity of substitution between chemical inputs and land exceeds the price elasticity of demand for farm products (Gardner). Simulations for the U.S. indicate that restrictions on chemicals on the major cash grains would in fact increase land rents (Abler and Shortle). Of

course, landowners in chemical-intensive regions may lose relative to those in less chemical-intensive regions.

In addition, opposition would be reduced if the design standards were written and enforced so as to favor existing farmers over new farmers. Existing farmers could be favored in many ways. For example, zoning or enterprise-choice regulations could contain grandfather clauses that exempt existing farms. Restrictions on chemical input use could be applied more stringently to new farms. Experience under the Clean Air Act suggests that design standards would be written and enforced in this way. Given that economic costs are not too great, then the political viability of design standards is rated as good.

Performance Standards

An alternative to design standards is performance standards, which involve regulations pertaining to an observable outcome of the polluter's decisions, such as chemical residues in groundwater. Emissions-based standards are not practical for agricultural control because the pollution contributions of individual farms are unobservable for all practical purposes. However, models for estimating chemical losses that utilize information on farm management practices, weather, soil characteristics, and other relevant factors have been developed. They can be used to evaluate technologies for managing nonpoint pollution and to diminish the uncertainty associated with the monitoring problem (Decoursey). Estimates obtained from such models could also be used as a measure of performance (Harrington, Krupnick, and Peskin; Shortle and Dunn). Therefore, rather than limiting farm chemical applications, limits could be imposed on chemical losses as determined by an accepted formula.

Performance standards are ranked highly with respect to least-cost control because farmers have an incentive to use their specialized information to minimize costs. Similarly, performance standards are ranked well with respect to incentive effects since they give farmers the ability and interest in adopting lower-cost methods of pollution control. On the other hand, given imperfect information about the costs of control facing different producers, performance standards must be ranked poorly with respect to their ability to allocate control among farms in a least-cost way. Performance standards require observations of farming practices to monitor and enforce compliance. The complexity of this may be substantial and, as discussed above, diligent enforcement simply may never occur.

From a political perspective, all of the arguments

in favor of design standards also apply to performance standards. Limits on estimated chemical losses would reduce the use of chemical inputs to at least some extent. This would raise the demand for farmland, benefiting existing farmland owners. In addition, the standards would probably be written and enforced so as to benefit existing farmers at the expense of new farmers. However, the complexity of the standards would result in high administration and enforcement costs. Just as this complexity reduces economic viability, it reduces political viability. Therefore, the political viability of performance standards is rated as fair.

Economic Incentives

As with direct regulation, economic incentives can be applied to farmers' actions or to outcomes of their actions. For example, to diminish nitrogen or pesticide losses, taxes could be imposed on nitrogen and pesticide applications or to an estimate of chemical losses provided by an accepted formula. Conversely, subsidies could be given for reductions in chemical use or chemical loss relative to some benchmark. Subsidies could also be used to help defray some portion of the cost of soil testing, scouting, and other services. Cost-sharing subsidies for conservation practices are a long-standing feature of agricultural policy. The 1990 farm bill continues this tradition by offering incentive payments to farmers who adopt water quality protection measures. Incentives that apply to pollution control performance are referred to here as performance incentives, while those based on design factors, such as polluting inputs, are called design incentives.

An important current example of design incentive is cross-compliance. Under the 1985 and 1990 Farm Bills, farmers with highly erodible land are required to develop and implement farm plans to meet conservation performance standards if they are to remain eligible for USDA commodity program benefits. There are calls for extending these eligibility criteria to include water quality protection measures. Another incentive approach with interesting possibilities is marketable permits granting farmers rights to chemical use and/or loss. Control of the total supply of permits in a region would give government the ability to control the total application or loss of chemicals, while the market for the permits would determine the allocation of use or loss among farms.

When faced with taxes, subsidies, or other incentives, farmers will compare the gains in terms of reduced taxes or increased subsidies for pollution control to the costs of adopting pollution prac-

tices. Their incentive will be to increase the subsidy base or reduce the tax base as long as it is profitable. If the tax base is chemical loss or the subsidy base is reduced chemical loss, then least-cost control is achieved. Accordingly, performance incentives induce least-cost control at the farm level. If the tax base is closely correlated with chemical loss or the subsidy base is closely correlated to the reduction in chemical loss (e.g., nitrogen application rates), least-cost control will not generally be achieved but may be closely approximated. Hence, design incentives may be constructed to perform relatively well in promoting least-cost control when the tax or subsidy base(s) are closely correlated to pollution control performance.

Performance and design incentives also have relatively desirable properties with respect to allocating pollution control among alternative sources. Low-cost abatements are those who will suffer a smaller loss or realize a larger profit from adopting pollution control practices. Accordingly, low-cost abatements will exercise more control than high-cost abatements when faced with uniform incentives.

The costs of administering and enforcing performance incentives should not differ much from the costs of administering and enforcing performance standards in a relatively static economic environment. Depending on their complexity, design incentives may be as costly to administer and enforce as performance incentives and standards or approximate the cost of simple design standards. However, unlike performance or design standards, programs involving the use of economic incentives may need periodic revision in response to changes in the economic environment in order to maintain their effectiveness. This clearly increases their administration costs in a rapidly changing economic environment. A case in point would be extension of the cross-compliance approach mentioned above.

A farm's decision to participate in a commodity program is not based on the social costs of water pollution caused by its activities. Rather, it is based on the net gain to the farmer from participation. During periods of high market prices, farmers have strong incentives to apply more fertilizer, pesticides, and other chemical inputs to each acre in order to raise yields. During these periods, then, the incentives to engage in environmentally damaging activities are greatest. Yet it is precisely during periods of high prices that the incentives to participate in the commodity programs are lowest. During the farm price boom of the mid-1970s, for example, market prices for wheat and feed grains were well in excess of loan rates. As a result, participation in the programs for these crops was negligible.

An important aspect of performance incentives is that they will induce research and development to discover less environmentally harmful practices. The incentive for innovation increases as the relative profitability of alternative practices increases. Taxes or fees will give incentives to find methods of production which are both lower in cost and less polluting, as will subsidies for improved performance. Indeed, there is probably no more effective way in the long run to reduce chemical use than to impose economic penalties. The penalties would induce technical innovation to facilitate substitution of other resources for chemicals and shifts in crop mix toward those crops that are less chemical-intensive. In addition, if regions intensive in chemical use were also those at greatest environmental risk, the penalties would induce shifts in production to regions where chemical use poses less of an environmental problem.

The political implications of economic incentives vary considerably, depending on the type of incentive studied. Subsidies for cutbacks on chemical input use or chemical losses would benefit existing farmland owners. They would benefit both from the subsidy directly and from the increase in demand for farmland caused by reductions in chemical-input use. If conservation compliance were applied mainly to new farmers, existing farmland owners would gain. However, they would probably lose if it were applied equally to all farms. Simulations indicate that the net gain to farmers from participation in the farm commodity programs, given cross-compliance, can be small or even negative (McSweeney and Kramer).

The effects of taxes on chemical inputs or estimated chemical losses on farmland owners are more difficult to gauge. If the taxes were applied mainly to new farmers, existing farmers would realize a competitive advantage. If applied equally to all farms, existing farmland owners would be hurt by the taxes themselves but helped by the increase in demand for farmland that reductions in chemical input use would cause. Simulations indicate that the former effect would substantially outweigh the latter (Gardner).

The effect of each economic incentive on federal, state, and/or local government budgets is fairly clear. Taxes would raise money that could be spent on other programs and would be supported by groups with no direct stake in water quality protection on that basis. Subsidies could involve potentially huge expenditures, depending on the desired level of water quality, which argues against their political viability. Conservation compliance reduces federal outlays on the farm commodity programs by discouraging program participation.

Research and Development

Another option is to promote public and private research for alternative production practices. This approach has been implemented most notably by recent funding of LISA (low-input sustainable agriculture) research intended in part to reduce chemical use on farms. The 1990 Farm Bill authorizes \$40 million for LISA research, although this is less than 4 percent of the bill's total annual agricultural research authorization. Encouraging private research is also a possibility and has been the objective of some aspects of tax policy, such as tax credits based on qualifying expenditures in other contexts.

There have been some genuine successes in cutting pesticide use on cotton through integrated pest management. However, cutting chemical use on other crops through alternative techniques has proven much harder. It is generally accepted that research and development has not yet yielded any practical, large-scale substitutes for agricultural chemicals. There are many possibilities (National Research Council), but developing them will take a long time. For example, nitrogen-fixating cereal varieties are years, if not decades, away.

The political viability of research and development is hard to determine. The existence of modest LISA funding implies that there is at least some political viability. Politicians are always attracted by the idea of a "technological fix" that leaves everyone better off. However, since technological solutions for water quality problems are years away, politicians concerned with short-run outcomes will not rely exclusively on research and development. The political viability of a large-scale research and development program must be rated as poor, but the prospects for a moderate expansion of the LISA program are fair to good.

Summary and Conclusions

Economic and political evaluations are summarized in Table 1 for selected policy options. The focus is on key options for modifying farm decision making, and hence the options listed are by no means exhaustive. The rankings are the authors' subjective assessments of the potential performance of the selected options with respect to the criteria. The actual performance of any given measure would depend on details of its implementation and on the economic and political environment in which it was enacted and administered.

The potential effectiveness criterion in Table 1 was not introduced explicitly in the foregoing dis-

cussion but was implicit. This criterion refers to the potential of the policy option to have a significant impact on chemical loss from farms. For reasons previously discussed, we rank both moral suasion and research and development poor with respect to this criterion. However, we must note that there are some who would disagree, especially those who support "alternative agriculture" as an economically viable alternative to conventional production systems without regulatory or economic intervention. Other policies were assumed to be of equal effectiveness. Of course, disagreement may exist with respect to other rankings as well.

It is evident that no policy dominates the others with respect to all criteria. An overall ranking would therefore require weights on the items. In practice, the political criteria (potential effectiveness, administration and enforcement costs, budgetary impacts, farmland owner impacts) are likely to be given greater weight than the economic criteria. This is not inappropriate since little or nothing may be accomplished otherwise. However, it is in the society's interest to take the economic criteria into consideration so as to avoid policies that waste resources by imposing unnecessarily high costs of control.

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