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Grass Roots Collective Action: Agricultural Opportunities

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Agroenvironmental problems (e.g., contamination of ground- and surface water, feedlot odors, endangered species) often involve goods and activities with public goods attributes. Grass roots collective action—in contrast to top-down governmental collective actions of taxing, subsidizing, and regulating—provides one alternative means of helping resolve these problems. Here I suggest that agroenvironmental policy, research, and extension should consider the often forgotten grass roots collective action alternative. I also discuss how expected private benefits, communication and information, joint products, group size and heterogeneity, transaction costs, and rules and enforcement determine the success or failure of grass roots collective action.

Key words: agricultural externalities, collective action, collective choice, environment, public goods

Introduction

Those who research, provide information, and form policy to help resolve environmental and resource problems caused by agriculture seldom consider the grass roots collective action alternative. Here I make a case for grass roots collective action and discuss those factors which promote its success. Some stories help set the stage by showing typical agroenvironmental problems and contrasting grass roots collective action with other types of policy alternatives.

In January of 1969 Arizona became the first state to ban the use of a pesticide. DDT, which was used to control a variety of cotton insects, drifted onto nearby alfalfa fields in the Phoenix area and eventually was noted in chemical analyses of milk and beef produced in the region's dairies and feedlots. The state legislature acted on the livestock industry's request to ban DDT, a top-down collective action that predated the nationwide ban of the chemical by several years (Byrne; Ware; Watson).

At about the same time, cotton growers in the Safford area of southeastern Arizona had been following rigid state recommendations (regionwide, set timing, and number of pesticide applications) to control a serious pink bollworm problem. The heavy insecticide applications reasonably controlled the pinkie, but created other problems. Pesticide application costs were high and regular bollworms and cotton leaf perforators thrived as the pink bollworm treatment killed helpful parasites and other beneficial natural predators to the bollworm and leaf perforator. In addition, the insecticide applications nearly destroyed the area's commercial honeybee industry. Bees only provide minimal help in

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pollinating cotton plants, and thus they are of little economic consequence to the cotton industry. Pesticide applications to control the pinkie were felt as a negative externality by the honeybee keepers. That industry lobbied the U.S. department of Agriculture (USDA) for action.

In response to declining profits brought on by the pink bollworm, Safford area cotton farmers asked University of Arizona entomologists for help. The entomologists introduced a system of integrated management to control the pink bollworm through scouting and more timely, less frequent insecticide applications based on insect threshold levels. The farmers voluntarily and jointly hired a personnel manager and scouts to assess insect infestations. Extension entomologists trained the scouts and, based on the scouting reports, made recommendations to the board of the pest control district to spray only those fields with insect infestations beyond the threshold level. The applicator sprayed pesticides at times of low honeybee activity. Although voluntary, farmers enrolled over two-thirds of the region's cotton acreage in the program. These farmers believed the pest management recommendations of the extension entomologists would cut their high pesticide costs and reduce the negative effects of pesticides on beneficial natural parasites and other insect predators. Yields increased, pesticide use declined sharply, and the honeybees recovered. This pest control effort, and particularly the resulting revival of the bee industry, prompted the USDA to fund two similar projects in 1971: one for cotton insects in central Arizona and one for tobacco insects in North Carolina. Federally funded and organized integrated pest management (IPM) was underway (Byrne; Moore 1996; Ware; Watson).

Insects have continued to plague Arizona's farmers and indirectly the urban neighbors whose nearby homes receive drift from the sprayed fields. In response, growers added new technologies and other measures to combat the boll weevil, pink bollworm, white fly, and other pests. New pesticides replaced those deemed ineffective or unsafe. The state legislated planting and plowdown dates to reduce insect habitat. Farmers adopted new IPM tactics which were developed and explained by university researchers and extension faculty and others. Growers banded together to jointly decide on rules and on financing to eradicate or, at least, control these potentially devastating pests. They took collective action. Five separate regional groups of Arizona farmers now act collectively to combat cotton and other pests.

These stories illustrate (*a*) problems associated with externalities and public goods within agriculture and between agriculture and the urban sector and (*b*) the variety of ways in which farmers and government can attack these threats to both farm profits and the environment. My interest focuses on one of these remedies—farmer-initiated collective action to help resolve agroenvironmental problems with externality and public goods attributes.

Although I know of important exceptions, it seems to me that when we as researchers, extension specialists, and government advisors evaluate and explain the alternative means to relieve agroenvironmental problems, we usually focus on (*a*) government tax schemes, subsidies, and regulations; (*b*) research and extension; or (*c*) the adoption of profitable (or least-cost) firm-level management strategies and technologies. We pay little attention to the formation and operation of grass roots groups that take collective action to reduce environmental degradation and resource problems. Bardhan and Loehman and Dinar recognize this same deficiency with our problem-solving focus.

And yet, the world of farmers, urbanites, and consumers begs for the possibility of

successful, grass roots, collective action. No one can doubt the environmental and resource concerns stemming from agriculture, and just as surely, no one can doubt the financial bind of most levels of government, and the intense turn against top-down government regulation. The poor fit of many state and federal regulations at the local level should give us ample reason to consider the grass roots collective action alternative for externalities with public goods attributes.

Although I focus on applying grass roots collective action to agroenvironmental problems, the principles discussed apply to many other collective action opportunities including zoning and environmental issues of communities, marketing through agricultural cooperatives, and political services of commodity groups. Perhaps it is fitting after thirty-plus years of Mancur Olson's lasting and influential work, *The Logic of Collective Action,* to take stock of how grass roots collective action applies to at least one important public goods issue of agriculture and rural America—the agroenvironmental issue.

The Making of Success or Failure

What determines the success or failure of grass roots collective action by farmers? As already hinted, agriculture produces or affects the quality of many public or semipublic goods and services, and attributes of these goods and services make them candidates for collective action. But they by no means assure group-action success. Expected profits; communication and information; the opportunity to jointly "produce" private goods along with collective goods; group size, heterogeneity, and transaction costs; and organization, rules, and enforcement all affect the success of grass roots collective action. I elaborate on each of these factors, drawing on the implications of collective choice theory, published empirical studies, and anecdotal evidence to illustrate their effect.

Public Goods

Ostrom and others (for example, Ostrom, Gardner, and Walker; Schmid) divide goods and activities into four classes based on ease of exclusion and subtractability (or rivalry). Pure private goods can be withheld (excluded) until payment is received, and one person's or one firm's consumption of that good precludes its consumption by others (subtractability or rivalry). Pure public goods, such as clean air and clean water (for uses such as swimming in a lake or river), cannot be easily excluded, and one person's use and benefit of the good does not preclude that of others. Toll goods (or club goods) and common-pool resources (see Ostrom for a discussion) exhibit some of the excludability and/or subtractability characteristics of both public and private goods, and might be termed quasi-public goods. Agriculture either produces or otherwise affects the provision of (usually through negative externalities) many public or quasi-public goods and activities. We need only go to the farm press for examples: wetlands that provide habitat for migrating ducks and other wildlife and water storage during wet years to prevent downstream flooding; clean or contaminated runoff to surface waters used by recreationists, farmers, and others; clean or contaminated water that percolates into common-pool aquifers for drinking and other quality-sensitive uses; access to national forests; well or poorly maintained riparian areas; clean or polluted air associated with dust, spray, and odor-causing activities; and endangered plants and animals.

Because farmers do not capture all the benefits from producing these public and quasi-public goods and activities, or do not pay the costs of damage and disservice, individual firms and the marketplace do not provide Pareto optimal levels. In part, this inefficiency comes about because of a breakdown in our ability to buy and sell property rights in many environmental goods. And, according to the noted Coase theorem, we might make environmental improvements by fixing these property rights. (See the appendix for more discussion of the property rights issue.) Other alternatives, as noted earlier, might also improve the level of these public or semipublic goods and services. Here, however, because it has received so little attention, I focus on the grass roots collective action alternative.

Private Benefits

Not surprisingly, economists believe that expected net private benefits motivate participation in collective action (for example, Olson 1992 and Loehman and Dinar). If potential participants believe they will gain from participation in collective action, they will participate, and vice versa. White and Runge studied grass roots collective action for erosion control in erosion-prone watersheds of Haiti. They found that farmers with land most exposed to erosion participate in collective control measures more often than those with less exposure to erosion. At times participating farmers even installed check dams, the primary erosion-control measure, on nonparticipants' landholdings. Downstream participants gained by investing in erosion-control measures on upstream land controlled by nonparticipants.

Or, take the case of the Marana, Arizona, irrigation district. A few years ago the organization successfully encouraged its members, for the first time, to follow IPM practices. The group was responding to lawsuits brought on by pesticide drift, and they hoped to prevent drift and future lawsuits and to control a serious pink bollworm problem. The expected net benefits from group action seemed evident. Now, insect problems have largely disappeared, and the county extension agent reports that farmers have little interest in collective pest-control action (Thacker). Essentially the same story of an expected increase in net private benefits occurred in the Safford area of Arizona, as described above. In that case, cotton farmers believed, and were later proven correct, that the collective action IPM program would significantly reduce their chemical costs while protecting cotton yields.

The threat of top-down government regulations or penalties may also reduce expected net profits and encourage voluntary, grass roots collective action. As we shall see in an example detailed shortly, farmers in the Catskill Mountains of New York decided to take voluntary collective action to reduce runoff into streams supplying New York City's water. But their "voluntary" actions came *after* the government threatened harsh regulations. As Sandler notes in describing the need for the government stick (p. *xviii*), "In the real world some forms of collective action come naturally, while other forms need government intervention."

Of course we know that net private benefits hinge on a host of factors, many of which I discuss in the remainder of this article, but clearly the perceived bottom line has a lot to do with participation and success of grass roots collective action.

Communication and Information

Collective choice theory suggests that forces may work toward a non-optimum equilibrium in which collectives fail to form and provide public goods. The famous anecdote of the prisoners' dilemma illustrates this point. Two people accused of armed robbery each believe they can maximize their own welfare by confessing to the crime for the prosecutor's promised leniency, but in fact, both prisoners could receive even lower sentences if they act in concert to deny the charges. Olson (1992) points out that the failure to act collectively stems from the story line that the sheriff separated the prisoners to preclude communication. Had they been allowed to communicate, they likely would have arrived at the collective action that most improved their individual and collective welfare.

Communication lies at the heart of a number of recent grass roots collective actions in agriculture, all of which appear successful, but admittedly, the full stories for some are yet to be completed. McGuire, Commissioner of the Department of Agriculture and Markets for the state of New York, describes the recent New York City concern that Catskill farmers pollute one of the city's principal water sources. Manure, purchased fertilizers, and eroding soils wash into the region's many streams before flowing south and east to New York City. The city considered installing a $6 billion water filtration system costing $400 million per year to operate. Another option would have imposed stiff regulations on land-use and farming practices (berm grazing areas, prohibit application of artificial fertilizer and animal wastes within 500 feet of the many water courses, and so on). Word of this option caused observers to predict intense battles and extended litigation between the city and the region's farmers. The third option, and the one followed, brought the farmers and city interests together to *discuss* the water-quality problem and how farmers might voluntarily and as a group reduce contamination. This option included the threat of top-down government sanctions. At least 85% of the region's farmers must participate by year five of the program, or the city promises to instate the originally proposed, stiff regulations. And, program success is helped by city funding for agriculturists from Cornell University. But the Catskill collective action also illustrates the central role and importance of communication and information. Discussions between the city and Catskill farmers began the process, and information on best management practices and profitable whole farm plans, provided by Cornell agriculturists, forms the heart of the collective action effort. A council of state, city, and local government agencies, plus the farm community, monitor and assist the program. Anecdotal evidence from three demonstration farms indicates that the whole farm plans reduce water contamination and increase farm profits.

The grower-organized Levene/Tolleson, Arizona, pest control district provides another example of the importance of information and communication about individual farms. This program assumes that individual farmers are in the best position to recognize and address the complexities of field-level growing conditions and cultural practices and especially field-to-field differences in insect infestations as they evolve on an almost daily basis over the growing season. The Levene/Tolleson district assesses a per-acre fee to fund its pest control information, scouting activities, and coordination of some multifarm pesticide applications. The six-member board of growers meets about every two weeks during the growing season to recommend pesticide applications and other pest control measures. A hired program manager supervises scout sampling and communi-

cates with individual farmer-contracted pest control advisors (PCAs) to help coordinate spraying activities. University research and extension entomologists provide back-up pest control research and information, often on a real-time basis. But the Levene/Tolleson district does not provide district spraying. Uncooperative growers could upset insect control if they fail to control pests in their own fields as recommended. In a very real way the Levene/Tolleson district substitutes its information-intensive approach for the more stringent and less flexible rules of pest control, and collective pesticide applications, of some other pest control districts (Ellsworth, Diehl, and Husman; Ellsworth).

In both of these cases, public institutions provide information and/or facilitate communication. Research and extension faculty at Cornell provided extensive information on whole farm plans to reduce chemical runoff while maintaining or increasing individual farm profits. New York's Department of Agriculture and Markets led the effort to assemble and foster communication both within the farm group and between the farm and city interests. In Levene/Tolleson, extension faculty provided information to help organize the district and then more specific research-based pest control information. Casual observation of other collective actions suggests a crucial role for public institutions in providing information and facilitating communication which is not surprising given the public-goods attributes of information and communication.

My guess is that we as agricultural economists often fail to recognize the centrality of communication in addressing many agroenvironmental problems of public goods and the importance of information and communication in successful collective action.

Joint Products

Collective choice theory and empirical studies suggest that joint products, or selective private incentives, encourage collective action (Sandler). National Public Radio illustrates the connection: "And don't forget, with your donation of $50 to bring exciting, in-depth radio programming not available anywhere else, you will receive our NPR coffee mug." Your donation helps produce not only public-good radio programming, but it also provides the private-good coffee mug. Clearly public radio believes selective private incentives encourage collective action.

How might agriculture take advantage of joint products? Our New York City/Catskill Mountain story provides one example. In that case, Catskill farmers "produce" not only cleaner water for New York City but also generate higher production and profits from their own farms. The Safford, Arizona, pest control program also produced joint products. The collective action controlled the pink bollworm and increased farm profits, but it also eliminated the negative effects of heavy insecticide spraying which (temporarily) destroyed the honeybee industry. The Levene/Tolleson pest control district also provided several joint products. In that case, collective action provided environmental benefits of reduced pesticide use, a better market price for the region's cotton because it reduced whitefly infestations and the associated sticky cotton shunned by the spinning industry, and improved cotton yields.

Group Size, Heterogeneity, and Transaction Costs

In *The Logic of Collective Action,* Olson suggests that group size is a root cause of collective failure. The larger the group, the more likely potential participants will free

ride and provide little or none of the public good. Wilson and Thompson find, for example, that group size works against effective grass roots coalitions of Mexican *Ejidatarios* wanting to more effectively manage their common grazing lands. Peer pressure to join and perform collectively becomes more problematic with larger groups. Larger groups often imply greater differences in individual needs and tastes and financial ability, differences which work against cooperative action. As Sandler and Carlson, Zilberman, and Miranowski point out, the transaction costs associated with coordinating and monitoring and enforcing the rules of collective action increase with group size. Similarly, Loehman notes that costs of monitoring and of interacting among interested parties tends to decline as the level of action goes from the national to the local level.

Although group size may inhibit successful collective action, studies show that group size does not necessarily lead to underprovision of public goods, and careful specification of rules and institutions may overcome large-group disincentives (Sandler; White and Runge). Even large groups may be "privileged," that is, include at least one person or coalition whose benefits from the provision of the public good outweigh their costs and, thus, provide the public good for the benefit of all (Uphoff). Or rules (discussed later) may be formulated to assure that those who benefit the most from the provision of a public good pay the greater share of costs. Or a federated institution may divide a larger group into more homogeneous subgroups. For example, differences among Arizona cotton farmers—differences in perceived pest problems, ability to single-handedly manage pests, and attitudes of "independence"—have precluded the Arizona Cotton Growers Association from acting as a single group to provide large-region collective action to control pests. But the Cotton Growers do encourage subgroups to form pest management associations to collectively manage the white fly and pink bollworm on a more local basis (Lavis). Such groups have formed and are functioning.

Organization, Rules, and Enforcement

In this article I encourage us to look at grass roots organizations as an alternative to top-down government organization (and other approaches) to address some agroenvironmental problems. The type of organization, be it farmer controlled or government controlled, makes a difference.

Several economists have studied irrigation districts in less developed countries and suggest the importance of grass roots groups over government agencies as a means to allocate the common-pool water resource. Tang (Ostrom), for example, finds that farmer-owned irrigation systems that rely on farmer-controlled monitoring and enforcement function more effectively than government systems. According to Tang (Ostrom, p. 303), "Guards working for government irrigation bureaucracies are notorious for their inattention to major infractions . . . ," but in contrast, farmers more closely involved with monitoring often exert effective peer pressure to thwart rule violations. Violators know infractions can destroy the trust necessary for future business dealings. Peer pressure appears to notably improve pest management in at least some of the Arizona pest control districts, although "bad actors" remain an issue (Ellsworth; Watson; Thacker).

Farmer-owned systems also seem to better incorporate incentive systems (such as self-imposed pumping taxes) into rules that encourage needed maintenance (Ostrom, Gardner, and Walker). In speaking specifically about common-pool resources, but I expect the

conclusion holds for other public and semipublic agricultural goods and services as well, Ostrum and coauthors (p. 304) conclude

> While legitimate and effective rules can come from external sources, our studies suggest that a more effective source is the appropriators themselves. The rules used in a self-organized common pool resource (CPR) are often tailored to the specific characteristics of the CPR. Rules imposed by external authorities may fail to draw on knowledge of the time and place characteristics of a specific CPR. In fact, such rules may be less effective, or even counterproductive, compared to those designed locally.

It is easy to find top-down rules that make little sense at the local level. In Arizona, the conservation compliance rules of federal farm legislation provide a good example. To participate in past commodity programs, farmers had to file and act on conservation plans to protect against erosion and runoff on all highly erodible land. The USDA classifies nearly all land in Arizona highly erodible because of soil structure and wind. Thus, most Arizona farmers filed conservation plans to participate in the commodity programs. However, the federally imposed rules failed to recognize that all farmed land in Arizona must be irrigated, and irrigation and farming in normal ways prevent wind erosion of this desert land. Thus failure to recognize local conditions needlessly imposed transaction costs.

Much of the collective choice literature, including that on games and game theory, focuses on the effects of different rules. What rules encourage group formation? How do voting rules affect collective action? How do penalties change the incentives to act collectively? How do rules for cost sharing affect collective action?

Rules of group formation, even informal rules of reciprocity, help generate or thwart participation. White and Runge, for example, find that farmer A is more likely to participate in group action when other farmers participate. In White and Runge's study of watershed management to prevent erosion in Haiti, only informal assurance of reciprocity sufficed to provide effective collective action. They point out, however, that as group size expands, satisfactory informal assurance of reciprocity becomes more difficult, and the likelihood of defection increases.

In other cases, rules which govern group formation and participation may be quite formal. Arizona now permits forming pest control districts under either of two separate statutes. Under the old statute, a majority vote of the growers in a specified county area can establish a pest control district, and all growers in the district become subject to the rules established by the district's board of directors. Under the new statute, only those producers who sign the petition become members of the pest control district, and only district members must abide by district rules. Other differences exist, but these two illustrate the complexity of rule design issues. Take the new statute for example. Why might any one producer sign the petition? By signing, a producer may relinquish considerable ability to manage pests in the way he or she knows best for his or her individual farm. The producer could then be assessed for district operations, a fee that could be avoided by free riding. But pests like the white fly and pink bollworm pay little attention to fence rows, and unless a very high percentage of the region's growers act jointly, their individual actions may fail to control these pesky insects. Even under this very abbreviated specification of the rules, the outcome for district formation would seem uncertain at best—many factors affect expected net benefits from participation. To date, one district has formed under the 1994 statute, and district members account for over 90% of the area's cotton acreage (Ellsworth). Thus it would seem that the rules encouraged adequate

membership for effective collective action against the insects. Even so, the rules of the statute did not come without considerable debate, and that debate continues.

Collectives may specify cost sharing to achieve the production of public goods, and the assignment of shares affects the level of public goods production. Loehman shows for a hypothetical example how varying cost shares for pollution control activities affects the level of pollution and welfare. Although we do not know the distribution of costs for implementing the pollution control measures on Catskill farms, we do know that New York City does share some costs. Both the Loehman and the Catskill examples illustrate the possibility and potential gains from sharing costs not only by the polluters but also by the injured.

Certainly, applied game theorists and institutional design economists can contribute helpful information for forming grass roots collective action groups (see Loehman; Loehman and Rassenti; and Radner for helpful examples of the work of institutional design economists).

A Reminder and Caveat

This article focuses on grass roots collective action to draw attention to this little-considered alternative to agroenvironmental problems. By so doing I do not imply that grass roots collective action always provides a more efficient (or better distributed) allocation of environmental benefits. Indeed, I fully expect that some agroenvironmental problems will be better resolved by tax schemes, or tough government regulations (including a clearer specification of property rights), or subsidies, or research and education, or better firm-level management, or some combination of these alternatives. But in many cases, I argue, grass roots collective action may prove helpful, and I highlight some of the factors which help assure its success.

Summary and Conclusion

Agriculture produces or affects the provision of many public and semipublic goods and activities, including air and water quality, wetlands and other wildlife habitat, access to public lands, and endangered species. The public goods attributes of these agroenvironmental/resource products suggest that collective action may move production closer to a Pareto optimum than would the self-interest decisions of individuals and firms. I argue in this article that grass roots collective actions of farmers can be a promising alternative to other options to improve welfare. Several factors, including expected net private benefits, communication and information, the opportunity to produce joint products, group size and heterogeneity, transaction costs, and the organization, rules, and enforcement of collective action all affect success.

Policy advisory activities and land grant university research and extension should, in my view, include grass roots collective action as one of our potential offerings to mitigate agroenvironmental problems. Researchers, for example, can help in institutional design, showing the likely effects of alternative rules of organization, cost sharing, and penalties (among other rules) on participation and provision of public goods. Extension economists and policy advisors can more widely recognize grass roots collective action as a policy alternative, help constituents understand the conditions which promote collective action

success (but avoid capture by special interest groups), and bring reliable information on the expected benefits and costs of collective action, and their distribution, to the groups facing agroenvironmental problems.

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Appendix: The Coase Theorem and Provision of Agrovenvironmental Goods

Agroenvironmental problems such as those under the rubrics of wetlands, clean air, and water quality have generated heated debates and considerable litigation over property rights and the so-called takings. In part, our failure to provide a more socially optimal amount of environmental and resource amenities comes about because, according to the noted Coase theorem, the legal entitlements to these goods and services (that is the property rights in them) cannot be freely exchanged, or because of prohibitively high transaction costs of buying and selling the property rights, or because the legal entitlements are not exchanged in a perfectly competitive market. According to these interpretations of the Coase theorem, we will get a better allocation of agroenvironmental goods and services by (*a*) more clearly defining entitlements and enforcing private contracts; (*b*) creating legal devices to lubricate the exchange of entitlements and thereby avoid litigation; and (*c*) promoting competitive markets for the entitlements through provision of more complete price and quality information, lowering transaction costs, or other market-enhancing actions. Cooter gives an elegant description of the Coase theorem, its interpretations, and implications.

The first of these alternatives, more clearly defining, or redefining, property rights, has been the source of heated debate and legal action, often under the rubric of the "takings." Although a better definition of property rights may provide a more efficient level of public and quasi-public agroenvironmental goods and services, the distribution of the benefits from buying and selling the better-defined entitlement hinges on who holds the entitlement initially, a fact which generates much of the takings controversy.

An example of aerial spraying helps visualize the implications of the Coase theorem. If nuisance law grants urban neighbors the right to enjoin the adjacent farmer from aerial spraying, then under Coase the farmer would purchase this tradable right and spray, providing the farmer values spraying more highly than the urban dweller values clean air. On the other hand, if the law favors the farmer, by entitling the farmer with a tradable right to spray with impunity, and the farmer values spraying more than the urban neighbor values clean air, the farmer sprays without paying. The same Pareto optimal level of air quality is reached under both types of entitlements. But, the distribution of benefits is different. In one case the farmer compensates the urban dweller to pollute, but in the other case the farmer does not pay to pollute. Hence the specification of initial entitlements causes much of the debate over property rights and the takings.