INDUCING FARMER PARTICIPATION IN A WATERSHED LEVEL PROGRAM TO IMPROVE WATER QUALITY

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Key Words: agricultural non-point pollution, team approach

ABSTRACT

This paper describes part of a field experiment involving performance-based economic incentives to improve water quality that is being conducted on a small 3,000 ha watershed in Hardy County, West Virginia. It serves as a companion paper to Maille and Collins (2007) which describes development of the economic incentives. To effectively address agricultural non-point pollution in this experiment, farmers need to utilize a team approach based on voluntary participation, group interaction and decision-making. In this paper, the logic of a team approach is explained and farmer recruitment strategy is discussed. Elements of successful recruitment include having sufficient water quality data to provide evidence of a problem, conducting informational meetings with immediate benefits to attendees, creating partnerships with local organizations and elites to build trust among farmers, assisting group decision making with an advisory committee, and development of clearly written contractual provisions with numerous review and feedback opportunities provided to farmers. To date, participation of about one-half of the farmers in the watershed has been achieved.

INTRODUCTION

The current approach to addressing agricultural non-point pollution (ANP) is focused on voluntary conservation measures that are implemented by farmers with cost-share assistance and technical support from the government (Ribaudo *et al*.1999). These conservation measures are generally directed by federal agencies to conform to strict behavioral guidelines in order to receive the assistance. Some states are moving towards increased regulatory control of agricultural operations. For example, the state of Maryland, under the Water Quality Improvement Act of 1998, has implemented a requirement of nutrient management plans on all farms. In either case, farmer input into water quality improvement strategies is limited.

As total maximum daily load planning and implementation show, water quality represents a watershed-wide problem that can not be solved one discharger, landowner or farmer at a time, but within the context of an entire watershed. Thus, coordinated action at a watershed level is required. However, in order to induce a coordinated, team approach to ANP among farmers, economic or regulatory incentives are required. A companion paper (Maille and Collins 2007) explores the development of performance-based payments at the watershed level that provide economic incentives to farmers. These payments provide an opportunity to change farmer perspectives of water quality conservation from an operational constraint to an income generating opportunity. In order to be effective, however, watershed level payments need interaction and decision-making among a group of voluntary participants within the watershed

(i.e. a team approach). The objectives of this paper are to explain why a team approach is needed for ANP and to discuss the essential elements utilized for recruitment of farmers into acting as a team in a field experiment setting.

The literature on team approaches to water quality has examined theoretical and laboratory experiment aspects (see Spraggon 2002, Romstad 2003, Poe *et al.* 2004, Taylor *et al.* 2004, Millock and Salanie 2005, and Vossler *et al.* 2006). In contrast, this research involves a field experiment using actual farmers and real monetary payments. Therefore, there are real consequences for farmers from the research outcomes. Thus, the recruitment aspect of this paper covers an unexplored area in previous research on water quality economics.

The study site for this field experiment is Cullers Run watershed. This stream is a tributary of the Lost River in the eastern panhandle region of West Virginia that occupies 2,978 hectares in West Virginia's largest poultry production county. Sixteen percent of the watershed is devoted to agriculture, mostly pasture or hay land. Row crops comprise only 3.63% of the agricultural land, primarily in the floodplain (Cacapon Institute 2002). The rest of the watershed is forest. There are approximately twelve poultry houses conducting intensive poultry production in the watershed. Most agricultural fertilizer use in the watershed is provided by poultry litter.

The Cullers Run watershed has advantage of being small enough to limit the number of farmer households that could participate in the project. Small group size reduces the information burden on farmers (see Ribaudo *et al.* 1999). In addition, this watershed was included in federally-funded research project that generated water quality data prior to the experiment (Cacapon Institute 2002).

WHY A TEAM?

Figure 1 provides a schematic description of technical assistance and cost share that have been traditionally provided by the government for ANP. Acting as a principal, the government provides information and cost share opportunities to farmers and treats farmers as autonomous units with regard to their impacts on water quality. Farmers, acting as individual decision making units, decide whether or not to undertake water quality protection actions. Only a portion of farmers (C and F in Figure 1) decide to undertake these actions. These actions lead to water quality outcomes which do not directly relate back to the recipient of government cost share or technical assistance.

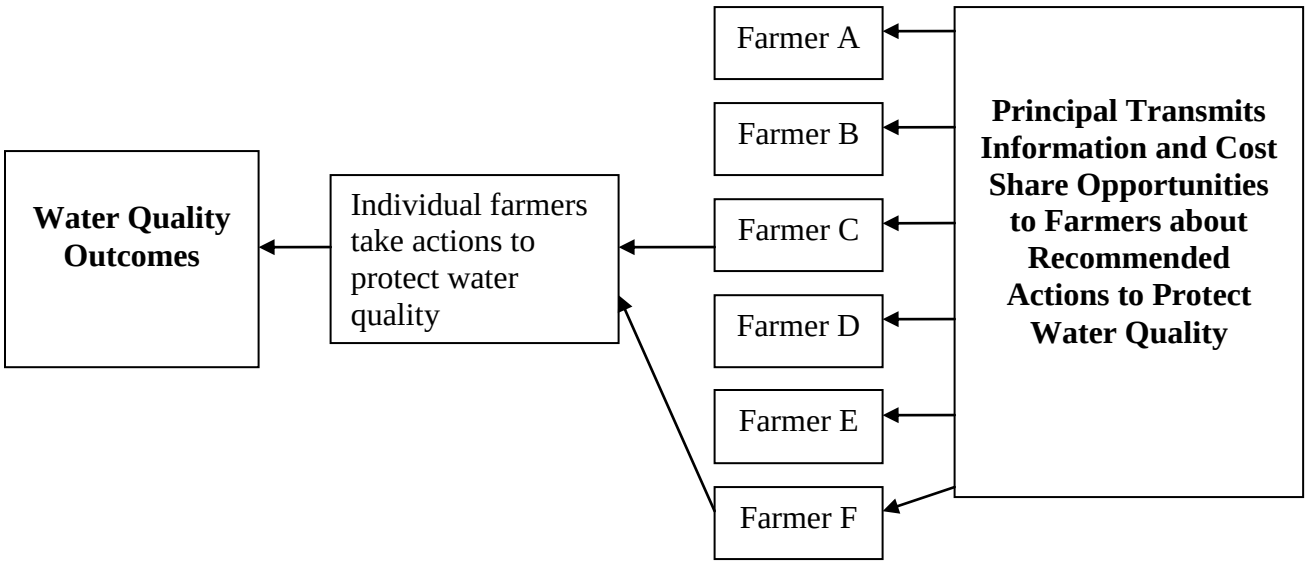

Figure 1. Cost share approach to water quality protection.

There are motivations, however, for both the principal and for farmers to engage in a team approach. From the perspective of the principal acting for society as a whole, there are four main motivations: (1) non-point pollution is difficult and costly to identify from individual sources so it is more feasible from an informational perspective to measure pollution at a watershed basis; (2) farmers have information about their own and/or their neighbors' pollution contributions that regulators would have difficulty obtaining; (3) a potential for dealing with fewer entities; and (4) teams allow for farmers to influence the water quality protection behavior of other farmers through the use of moral suasion. From a farmer perspective, watershed level decision-making is a reasonable approach to problem solve if farmers perceive a water quality problem from ANP pollution. Romstad (2003) describes motives for farmers to join a team approach under the threat of more costly individual regulation.

The economic incentives provided for team participation can be either negative (threat of individual regulation) or positive (provide a subsidy to participate). Threats imply that society operates from a polluter pays principle and/or that citizens have a right to clean water. Subsidies imply the property right to clean water lies with the agricultural landowner. A combination of negative and positive incentives can be used when water quality standards are implemented with penalties for pollution in excess and subsidies provided when pollution levels are less than the standard. In our field experiment, positive economic incentives were used.

Figure 2 depicts the principal's role under a team approach using positive economic incentives. Here the principal interacts with farmers as a team, thereby recognizing that interconnections exist between farmers in how they impact water quality. The team decides which actions to take regarding water quality and then the water quality outcomes are reflected in the watershed level payments made to participating farmers. As shown in Figure 2, farmers can be interconnected in terms of their water quality protection actions as Farmer C impacts Farmer B and D's water quality protection actions.

The farmer interactions presented in Figure 2 occur in the Cullers Run watershed in terms of poultry litter used for fertilizer. In this example, assume Farmer C is a poultry grower without sufficient land base to utilize the nutrients in litter. To dispose of litter, Farmer C transfers litter to Farmers B and D (with or without cash compensation) to apply on their agricultural land. In this case, team decision making at a watershed level has the potential to improve the prospects of individual level decisions that protect water quality. Since our field experiment involves nitrate-N pollution impacting a watershed level payment distributed to farmers (Maille and Collins 2007), under a team approach Farmer C has an incentive to encourage Farmers B and D to determine if the litter applied contains nutrients in excess of crop needs. If excess nitrate is being land applied, this could reduce the watershed level payment to all participating farmers. Thus under excess land application, Farmer C would be better off to sell a portion of his litter out of the watershed rather than only transferring it to Farmers B and D. In our field experiment, Cullers Run farmers are presented with such an opportunity to work within a team approach to investigate issues related to land application of litter.

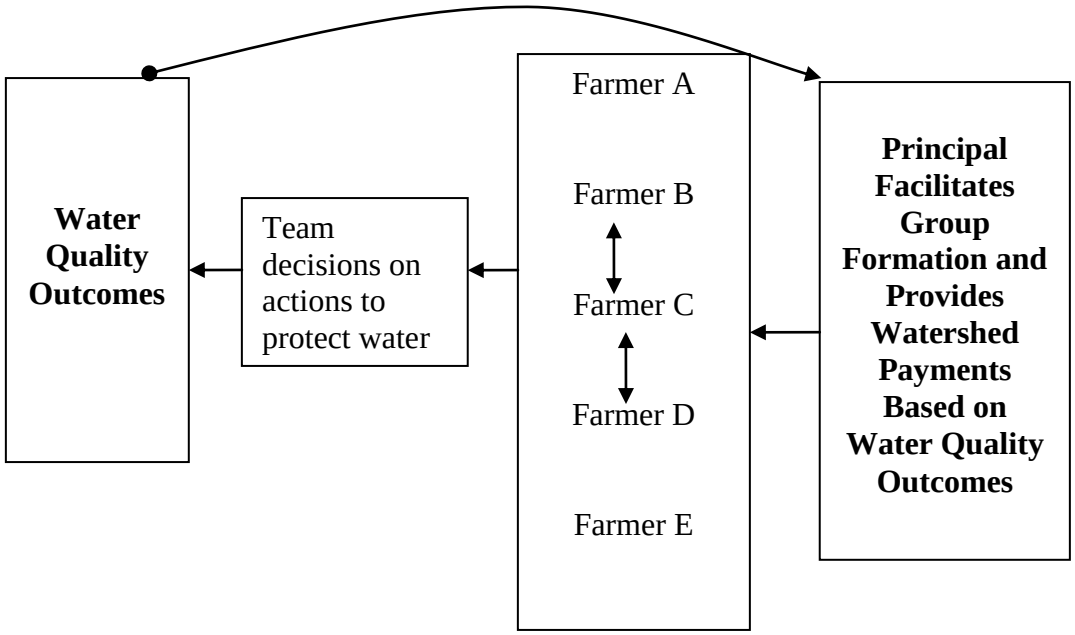

Figure 2. Team approach to water quality protection.

METHODS

In December 2006, we began to advertise and inform local farmers about this field experiment project. These efforts included: a presentation at the Mathias Ruritan Club (many of the watershed residents are members of this community service organization), articles to in community newspaper about the project, and a letter sent to all agricultural landowners in the experimental watershed inviting them to an introductory meeting.

During winter of 2007, an introductory meeting (February 5th) and three additional meetings (February 19, March 5th and March 26th) were organized by project researchers. From the beginning, it was important to engage local community resources in these meetings and to

provide inducements for attendance. We utilized a community center operated by the Mathias Ruritan Club to hold all the meetings (a monetary donation was made to the club). At each meeting, a dinner was provided for the attendees. We hired a local Future Farmers of America organization to prepare these dinners. Aerial photo maps of the watershed were prepared by the Natural Resource Analysis Center at West Virginia University. These maps were displayed and copies were given out to all attendees. These maps proved to be very popular among attendees.

Each of these meetings was attended by twenty to thirty people. Overall, a substantial portion of farmer households in the watershed attended at least one meeting. We also made efforts to involve community elites in the project. The county extension agent attended a meeting and a county commissioner was recruited to lead one of the meetings. State and federal government conservation agency personnel attended meetings and assisted with presentations.

During these meetings, the project was described as a unique field experiment involving economic incentives to abate ANP. These incentives would take the form of monthly payments over a period of two years based on the quantity and quality of water flowing from the watershed to farmers who chose to participate. The introductory meeting included a presentation about water quality as an issue in Cullers Run and the Lost River watershed in general. This presentation was made by this paper's co-author from Cacapon Institute who has extensive experience with water quality issues in the region.

There were two important outcomes from these meetings: (1) a written contract was created with the input of farmers; and (2) a farmer advisory committee was established to determine how to allocate the watershed payments among participants.

The contract was discussed and revised a number of times during the meetings. It served to clarify the institutional framework of the experiment and outlined the roles and responsibilities of both farmers and researchers. Comments and suggestions about this contract were obtained from a lawyer on the Agricultural and Resource Economics faculty at West Virginia University. Key stipulations for farmers in this contract included:

- Participation in this project is voluntary and is initiated by signing a contract.
- A participant who has signed a contract can choose to leave the project at any time with no penalty or further obligation.
- Payments will be made monthly to 'The Group'. The initial participants will determine how these monthly payments are allocated among the participants. The resulting allocation rules will be presented to the project investigators, who will use these rules to distribute the monthly payments and be responsible for disbursements.
- Participants are allowed to be enrolled in state or federal cost-share programs.
- A participant is able to select which best management practice (BMP) or other management change to implement in order to impact water quality.
- Signing a contract does not obligate a participant to implement any BMP.

Farmers, along with researchers, have difficulty projecting the amount and timing of pollution reductions resulting from BMP implementation (Park *et al.* 1994; Bracmort *et al.* 2006). Thus, risk reduction aspects of this contract include the voluntary aspects of participation, BMP selection, and BMP implementation. The two year time frame of the experiment may limit

farmer interest in BMP implementation so cost share participation is encouraged. In addition, participants have the ability to control for risk by allocating more of the monthly payments to those farmers that implement BMPs.

Key stipulations for project researchers included:

- Responsibility for determining if a potential participant qualifies for participation in the project based solely on the boundary of Cullers Run watershed.
- Participation is not voluntary. There are no provisions that permit withdrawal of project funds.
- Calculation of the amount of each monthly payment to 'The Group' and distribute this payment among participants based on written allocation rules provided by 'The Group'. The amount of the payment will be computed by project researchers based on a payment formula and prices presented to the farmers.
- Setting up a water quality and quantity sampling, monitoring, and testing plan. Participants will be allowed to observe any sampling, monitoring, and testing being conducted under this plan.

Creation of an advisory committee emerged as a suggestion by farmer attendees during the March 5th meeting that was led by a county commissioner. The purpose of this meeting was to assist farmers in determining how they would organize themselves as a group in this project. This advisory committee consisted of five farmers from the watershed, each who had attended most of the meetings. The committee met only once on March 12th. This committee made recommendations that were then presented at the March 26th meeting and formally approved at the first meeting of project participants on April 16th.

RESULTS

Farmers were able to sign a written contract to participate in the project beginning April 1, 2007. To date, a total of fifteen farm households have signed a contract. This sign-up represents about one-half of the farmers who attended the series of meetings introducing the project to farmers. Using farmer reported agricultural use information as well as aerial photo data, we computed that participating farm households own or operate approximately 41% of the agricultural land in the watershed.

Participation is not evenly distributed throughout the watershed. Cullers Run watershed can be divided into two main sections. The lower section is where most of the row cropping takes place. In this section, about 10% of agricultural land is farmed by a project participant. In the upper section, hay fields and pasture predominate. Participating farmers operate 49% of the agricultural land in this section. Based on participating hectares, a simple Chi-squared test of independence indicates that the likelihood of a given hectare of land being included in the project is not independent of location ($p<0.01$). Our interpretation is that farmland in the lower section is significantly less likely to be enrolled in the project than farmland in the upper section. Maille and Collins (forthcoming) surmise that lower participation rates for farmers in the lower section is the result of the greater risk to agricultural production that they face when participating in the project because they fertilize at higher rates with poultry litter than do farmers in the upper section.

As a group, participating farmers have made two important decisions: (1) allocation of watershed payments; and (2) a request for a watershed-wide sampling to verify source areas of nitrate-N. As suggested by the advisory committee, their innovative payment allocation involved: (a) a $50 signing bonus to each participant who signed up prior to June 1st, 2007, (b) 10% of each monthly payment is to be distributed equally among all participants, (c) the remaining 90% is reserved to financially assist farmers who engage in N-nitrate abatement, and (d) any remaining funds at the end of the year are to be paid out as a bonus to all participants. This allocation provides early participants with immediate rewards and addresses issues of risk from BMP implementation by individual farmers and provides immediate rewards for participation. The results of the watershed-wide nitrate-N sampling were presented to farmers at a June 2007 meeting. These results agreed with prior water quality data that showed the majority of nitrate-N originated from the lower section of the watershed. Dry conditions on the watershed prevented further watershed-wide sampling, but more are planned for the future.

CONCLUSIONS AND FUTURE DIRECTIONS

We are encouraged with the sign-up results to date. About one-half of the agricultural land in the watershed and about one half of farmers attending the meetings are participating in the experiment. Payments for water quantity and quality are being made to farmers based on a payment allocation scheme that they developed and approved. At the farmers' request, detailed water quality sampling of the watershed has taken place. To facilitate information sharing between researchers and farmers, we have an established a project website (http://www.cacaponinstitute.org/wvunri.htm). To date, no group decision has occurred with respect to cost sharing from project funds for ANP abatement.

Given their low participation rate, a practical research question involves how to bring farmers in the lower section into the field experiment. This may provide a rationale for allocating a greater share of the payments to farmers in the lower section. We can also investigate the role that information on soil nutrients may play in determining farmer response. For example, Feather and Amacher (1994) find that information can increase farmer willingness to adopt BMPs. A potentially relevant example is presented by Fuglie and Bosch (1995). They determined that corn farmers decreased fertilization rates when provided with information from soil tests indicating that they could fertilize less without introducing additional production risk. To address these issues, participating farmers have discussed reviewing existing or creating new nutrient management plans for all farms throughout the watershed. Currently, participating farmers are seeking to persuade lower section farmers to participate in the project.

ACKNOWLEDGEMENTS

Support for this research comes from National Research Initiative Grant USDA/CSREES # 2006-35102-17261. Assistance for this project was provided by Tom Basden (Nutrient Management Specialist, WVU Cooperative Extension Service), Gretchen Cremann (Conservation Specialist, WV Conservation Agency), Ed Kesecker (NRCS District Conservationist), the Mathias Ruritan Club, Stanly Moyer (Hardy County Commissioner), and David Workman (Hardy County Extension Agent).

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