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Conservation Programs Can Accomplish More with Less by Improving Cost-Effectiveness

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The U.S. Department of Agriculture (USDA) has a long history of supporting the adoption of conservation practices, mostly through conservation programs that provide both financial and technical assistance to farmers for addressing water quality and other resource-related issues on farms. After substantial increases in conservation funding under the 2002 and 2008 Farm Acts, funding held steady under the 2014 Farm Act, and increases are not anticipated in the near future.

Regardless of future conservation program budgets, cost-effectiveness is an important determinant of how much conservation programs actually accomplish in terms of environmental services. A program is cost-effective when payments go to farmers to support practices that deliver the largest environmental gain relative to adoption and maintenance cost. The more cost-effective a program is, the greater the benefits from a given budget. Research suggests that the cost-effectiveness of conservation programs can vary widely depending on how much is paid to which farmers for taking what actions (Shortle et al., 2012). Given that most USDA conservation programs are subject to budget constraints, the environmental gain that a program can leverage is maximized when payments are just large enough to encourage adoption by those farmers who can provide the greatest environmental benefits at least cost.

The challenge is to improve cost-effectiveness within the current structure of the USDA's suite of conservation programs, which includes the Environmental Quality Incentives Program (EQIP), Conservation Stewardship Program (CSP), Regional Conservation Partners Program (RCPP), Conservation Reserve Program (CRP), Agricultural Conservation Easement Program (ACEP), and Conservation Technical Assistance (CTA). These programs are voluntary, relying on farmers to approach the USDA to enroll and to choose which resource issues to address. Most of these programs employ a benefit-based ranking procedure based on some type of benefit-cost scoring. The Environmental Benefits Index (EBI) of the CRP is an example. However, the specifics vary by program and even within programs, as states or even counties can establish their own ranking procedures for addressing self-identified resource priorities. The U.S. General Accounting Office has recently concluded that EQIP funds are not being targeted to resource issues where they are needed most (U.S. Government Accountability Office, 2017).

We use water quality to frame the discussion of improving program cost-effectiveness. In general, water quality is still impaired in places where agricultural nonpoint pollution is the dominant source. While programs have helped many farmers adopt conservation measures that produce a variety of ecosystem services, the concentration of best practices necessary for improving water quality in impaired watersheds has generally not occurred through voluntary programs alone (Kling, 2011; Osmond et al., 2012; Shortle et al., 2012).

One of the challenges for improving cost-effectiveness is that the interface between agriculture and the environment is extensive and heterogeneous (Nowak, Bowen, and Cabot, 2006). Thousands of individual resources—including rivers and streams, wetlands, lakes, estuaries, and groundwater—can be affected by agricultural production. The benefits associated with increasing the supply of ecosystem services vary widely. The environmental effect of individual farms (even individual fields) may vary widely depending on the mix of crop and livestock commodities produced, topography, soils, landscape position, and the specific production and conservation practices already in use.

A number of policy design features could potentially be implemented with current conservation programs. Some have been used on a small scale or in a single program, and others have been proposed for past Farm Bills.

Targeting

Focusing conservation efforts to regions with high levels of impairments (potentially high benefits), fields within watersheds that contribute a disproportionate amount of pollutants, and practices that tend to be most cost-effective in reducing pollution would be a formula for increasing the overall cost-effectiveness of a program (Babcock et al., 1997). In many cases, the confluence of vulnerable resources and environmentally risky practices produces situations in which a large share of pollution originates on a relatively small number of farms and fields (Ribaudo, 1989; Nowak, Bowen, and Cabot, 2006; Diebel et al., 2008). In the Mississippi River Basin, for example, 10% of cropland is estimated to contribute 30% of the entire nitrogen load from cultivated cropland to the Gulf of Mexico (White et al., 2014). It would seem that targeting these settings would enhance program cost-effectiveness.

Geographic targeting of impaired watersheds to address water quality issues has been a staple of USDA conservation efforts for many years. The Rural Clean Waters Program (1980s) and the President's Water Quality Initiative (1990s) are two examples. Effective targeting requires that monitoring data, models, or other measurement tools identify those particular settings where large environmental gains can be attained at relatively low cost. From a cost-effectiveness standpoint, successful targeting also requires the most cost-effective practices to be employed on those farms that can reduce pollutants at the lowest cost. Achieving this is much more difficult when programs are voluntary, however. Farmers who can provide the most cost-effective control may not enroll in programs or may want to address other issues on their farms that more directly affect their net returns.

Collecting the information necessary to effectively target conservation entails costs for program agencies. Such costs are important to consider when evaluating the overall benefits of a targeting program.

Additionality

Improvements in environmental quality can be attributed to conservation payments only if farmers would not have adopted the practice without the payment. Such practices are said to be additional. Additionality depends on the characteristics of conservation practices. Practices with high adoption costs relative to private benefits (directly realized by the farmer) or those that are difficult to reverse are more likely to be additional (require conservation payment to be adopted) than practices with high private benefits relative to adoption costs (Claassen, Duquette, and Smith, 2017). Conservation tillage is an example of a practice with generally high private benefits that many farmers have adopted without any financial assistance from government programs. Providing financial assistance for conservation tillage when it would have been adopted anyway could reduce overall program efficiency. On the other hand, structural and off-field practices such as fencing, terraces, and vegetative buffers have high implementation costs and/or low private benefits. Such practices have been found to be mostly additional (Claassen, Duquette, and Smith, 2017).

The cost-effectiveness of existing conservation programs could be improved if information on additionality were considered in determining eligibility for financial support and support rates. Predicting which farmers need assistance to adopt a practice and which do not is difficult due to asymmetric information, differences in local resource conditions, and differences in farmer ability and attitude toward environmental protection. One approach could be to establish a practice baseline in a region that reflects local non-additional practices (practices farmers tend to adopt on their own). Practices eligible for financial assistance could be limited to those believed to be most additional.

Potential benefits of additional and non-additional practices could be considered along with the costs. It is possible that a practice that tends to be non-additional generates much higher environmental benefits than a practice that is clearly additional. Supporting a high-benefit non-additional practice with cost shares may actually be more cost-effective (Claassen, Duquette, and Smith, 2017).

Auctions

When farmers have more information about practice implementation costs than the buyers (asymmetric information), the potential exists for them to receive a payment in excess of what is actually needed when a single "price" is offered for the adoption of that practice. This reduces overall program cost-effectiveness. Auctions are a mechanism that can counter this behavior. When there is one buyer (USDA) and many sellers (farmers), auctions can facilitate competition between participants that can improve cost-effectiveness (Hellerstein, Higgins, and Roberts, 2015).

Specifically, farmers simultaneously offer (or "competitively bid") a level of performance (components in a contract) and their required level of compensation. The managing agency then selects the offers that provide the most environmental benefit at least cost until the budget or acreage goal is exhausted. Farmers who seek "excessive profit" from their offer risk being outcompeted by other bidders. Accordingly, farmers have an incentive to make an offer that is closer to their willingness to accept (generally an amount that just covers costs) than they might otherwise, thus increasing their chances of being awarded a contract. For auctions to be effective, costs and benefits of ecosystem services should vary across potential participants and there should be enough potential sellers to spur competition (increasing the likelihood that high bids will not be accepted).

Auctions have been successfully used in the general sign-up of the Conservation Reserve Program. In EQIP, bidding down (taking a lower cost-share) is forbidden by Congress, due to concerns that small or resource-limited farmers cannot compete with larger farms (based on experience when bidding down was allowed). The only option for competing would be in terms of the level of environmental services that could be provided. A bundle of practices with high environmental benefits would be accepted before a contract with the same cost but with lower environmental benefits. This type of bidding also increases cost-effectiveness, although maybe not to the degree it would if costs were also biddable.

Performance-Based Payments

Even with design features such as targeting and auctions to promote cost-effectiveness, there is still the issue of attracting into the program those farmers who can provide the most environmental gain at the least cost. For example, if farmers who can provide the most pollution reduction at the lowest cost do not apply for a contract in a program that uses an auction, then an opportunity for getting the most out of program resources is lost. Without adequate compensation, farmers motivated by profit likely have little incentive to voluntarily undertake actions that provide few benefits to them (Claassen, Cattaneo, and Johansson, 2008). One way to address this issue is to base financial assistance on performance rather than on a portion of implementation cost.

In general, paying for performance (e.g., amount of nutrient loss reduced) is more cost-effective than basing payments on practice costs (Ribaudo, Horan, and Smith, 1999; Ferraro and Simpson, 2002; Savage and Ribaudo, 2016). Importantly, those farmers who can provide the most abatement at the lowest cost have the largest economic incentive to act. This means that farmers who may not have traditionally participated in conservation programs might have a strong incentive to do so. In addition, performance-based payments could provide greater flexibility in how a particular environmental service is produced. Practice-based payments tend to limit choice to those practices that are cost-shared, while performance-based policies award innovations that lower costs. Savage and Ribaudo (2016) estimated that payments based on nutrient reductions in the Chesapeake Bay Watershed would achieve a water quality goal at a much lower cost than payments based on practice costs, even with targeting. Field-level measurement tools for estimating environmental performance are needed with performance-based policies. Such tools, including the NRCS's Nutrient Tracking Tool, are being developed and are currently being used in water quality trading (a pay-for-performance policy) and other programs.

Compliance Incentives

Another way to motivate farmers with the potential to provide high levels of pollutant reduction is to expand USDA compliance provisions to cover nutrient management. Compliance provisions require farmers to meet some minimum standard of environmental protection on environmentally sensitive land as a condition for eligibility for many federal farm program benefits, including conservation and commodity program payments, crop insurance subsidies, and disaster payments. Under current compliance requirements, farm program benefits could be denied to producers who fail to implement and maintain an approved soil conservation system on highly erodible land, convert highly erodible grasslands to crop production without applying an approved soil conservation system, or convert a wetland to crop production. Proposals have been made to require the development and implementation of a nutrient management plan to receive program benefits.

Compliance creates an incentive for farmers benefitting from USDA programs to take stock of their management choices and to make changes if the costs of implementing conservation systems are less than the potential loss of program benefits. An analysis of a hypothetical nutrient compliance policy found that farms that receive the most program benefits per acre also tend to have the highest excess nitrogen application rates (nitrogen supplied relative to crop need) (Ribaudo, Key, and Sneeringer, 2016). A nutrient compliance policy would therefore produce an incentive for farms with the greatest risk of nitrogen loss to at least consider developing a nutrient management plan and to possibly seek assistance from conservation programs or other service providers. A caveat is that the farmer must have an expectation that the provision will be enforced. The cost to the government of such a provision would likely be relatively small (primarily enforcement) and could have significant benefit.

Community Conservation

Another approach would be to work directly on strengthening stewardship values in farmers through extension and outreach. "Community conservation" engages all farmers in an impaired watershed to work on solutions in a group setting. Community recognition of environmental performance and the demonstration of innovativeness and entrepreneurship in managing a farm could increase conservation-oriented thinking on the part of those who were traditionally motivated primarily by profit (Burton, Kuczera, and Schwarz, 2008; Reimer, Thompson, and Prokopy, 2012). McGuire, Morton, and Cast (2013) found that ownership of the environmental impairment issue, collaborative development of mitigation efforts, and group celebration of project successes led to leadership development and increased commitment in environmental efforts in an Iowa watershed. Neighbor-to-neighbor exchange, rather than traditional extension, was the most important source of information. Peer pressure could become a strong incentive to adopt conservation measures consistent with the community's conservation goal.

Summary

Investments in targeting and measurement tools, technical assistance and outreach, and research on policy design may improve the cost-effectiveness of delivering improved environmental quality through conservation programs. Weighing the costs of such investments against the potential long-term economic gains of improved program cost-effectiveness can help chart a course of action.

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