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The Limits of Voluntary Conservation Programs

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Agricultural nonpoint source (NPS) is pollution that reaches receiving waters through diffuse and complex pathways. It has long been recognized as an important contributor to U.S. water quality impairments and the subject of an array of local, state, and federal initiatives to reduce it. A common feature of these initiatives is that they rely heavily on voluntary approaches that offer financial and technical assistance to farmers to encourage the adoption of conservation practices for reducing NPS pollution. The Clean Water Act exempts nonpoint source pollution from its regulatory permit programs, giving the United States Department of Agriculture (USDA) and state conservation programs the primary responsibility for reducing agricultural pollution of water resources.

Despite billions of dollars of investment in conservation measures over the past several decades agricultural NPS policies do not appear to be enough to address landscape-scale water quality problems. While some water quality metrics have improved in some agriculturally influenced watersheds, others have deteriorated and more generally, outcomes have remained short of established water quality goals (Diebel et al., 2008; Shortle et al., 2012; Arbuckle, 2012). Over 5,000 water bodies are on the United States Environmental Protection Agency's (EPA) impaired waters list due to nutrients, primarily from nonpoint sources (U.S. EPA, 2014). The voluntary approach has generally not led to an aggregation of conservation effort in impaired watersheds sufficient to produce measurable improvements in water quality. The Natural Resources Conservation Service (NRCS) assessment of conservation practices on cropland finds that while investments in conservation practices have produced an array of environmental services there is still much room for improvement, particularly in regards to nutrients (USDA, NRCS, 2011a, b, 2012a, b; Ribaudo et al., 2011). Agriculture's role is particularly important for some of the nation's most important water resources including the Chesapeake Bay, the Gulf of Mexico, the Florida Everglades, and the Great Lakes, where agricultural nutrients have damaged major fisheries and ecosystems, and threatened water supplies.

The lack of progress is leading to pressure on resource managing agencies to find ways of making programs more effective. In an unusual case that might be an example of what could drive future policy, the Des Moines Water Works plans to sue three neighbouring counties for high nitrate levels in the Raccoon and Des Moines Rivers (Meinch, 2015). The upstream counties manage tile drainage systems that keep the cropland productive, but also make it easier for nitrate to leave the fields and enter into rivers. The utility argues that it should not have to bear the cost of removing excess levels of nitrate from drinking water caused by artificial drainage of cropland upstream.

A long line of research has found that certain cropland—defined in terms of resource characteristics, farming practices, and geographic location—tend to contribute a disproportionate share of pollutants to the environment (Nowak, Bowen, and Cabot, 2006). For example, in the Chesapeake Bay watershed, 80% of cropland loses less than 40 lbs/acre of nitrogen (N) per year, while the remaining 20% loses up to 300 lbs/acre (USDA, NRCS, 2011a). In the Mississippi River Basin, 10% of cropland is estimated to contribute 30% of the entire nitrogen load from

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cultivated cropland to the Gulf of Mexico (White et al., 2014). The majority of soil erosion from cropland in the United States comes from only a small proportion of the total cropland (USDA, NRCS, 2003).

Disproportionality occurs as an outcome of the interaction of two distinct dimensions of farming: the biophysical and the social (Nowak, Bowen, and Cabot, 2006). The concept of disproportionality and its importance in policy has become a central focus of emerging conservation policies in agriculture.

Certain landscape and soil characteristics may increase susceptibility of pollutant loss from farming operations. For example, in the Chesapeake Bay watershed, there is a 25 lbs N/acre difference in nitrogen leaching potential between the high and low levels of conservation treatment on soils with a low leaching vulnerability (USDA, NRCS, 2011a). On highly vulnerable soils, the difference is 95 lbs N/acre. It is clear that engaging producers with vulnerable soils would provide the largest environmental gains.

Field drainage is a prime example of a vulnerable biophysical setting. Tile drainage lowers the water table, enabling fields that would otherwise be wet part of the year, to be intensively cropped. These drained soils tend to be highly productive. Tiles, however, provide a rapid conduit for soluble nitrate, effectively bypassing any attenuation that may occur in the soil (David, Drinkwater, and McIsaac, 2010; Petrolia and Gowda, 2006). Even what would normally be considered good management on "average" fields, could lead to excess nutrient losses on tiled fields (David, Drinkwater, and McIsaac, 2010). In 2006 about 26% of cropland receiving nitrogen was tiled, most of this in corn production—the field crop that uses the most nitrogen (Ribaudo et al., 2011). About 71% of tiled cropland acres did not meet the three nitrogen management criteria for increasing nitrogen-use efficiency (NUE) and reducing loss: rate, timing, and application method (Ribaudo et al., 2011). Much of the tile-drained cropland is located in the Mississippi River Basin. Nitrogen from this land is a major contributor to nutrient enrichment in the northern waters of the Gulf of Mexico, leading to a "dead" zone of de-oxygenated water. Nitrogen treatment, measures for tiled fields—such as water table management, bio-reactors, and artificial wetlands—can be costly and are not likely to be adopted voluntarily, especially without financial assistance.

Cost-effective pollution control depends on those farms that can provide the greatest reduction in pollutant loadings at lowest costs—generally those that have the fewest conservation measures on vulnerable fields—to implement effective practices. The question for policy makers is how to engage these farms in a voluntary setting.

Nonpoint source programs often try to address watershed-scale problems by targeting funds to impaired watersheds, such as USDA's Watershed Initiatives and the previous Hydrologic Unit Area (HUA) Projects. However, programs do not actively target high-priority farms and fields *within* targeted watersheds (Kalcic et al., 2014). Current conservation programs may fail to effectively reduce agricultural pollution as farmers operating on the most vulnerable or polluting cropland, may not be inclined to seek conservation assistance (Nowak, Bowen, and Cabot, 2006; Diebel et al., 2008). Considering site-specific factors of those farms that apply for assistance, might not be of much utility if the most important land from a watershed perspective is not enrolled in the program.

Social factors constitute the second factor in disproportionality. The voluntary approach results in water quality improvements that are supply driven rather than demand driven (Shortle et al., 2012). That is, farmers propose contracting for conservation practices based on their own self-interest, and not on society's demands for environmental quality. Understanding what motivates farmers to make changes to their operations is, therefore, critical when pollution abatement on highly vulnerable cropland depends on landowner voluntary decisions. At the risk of oversimplifying, motivations can be labeled as two types: conservationists and productivists.

Farmers tend to be well informed about agri-environmental problems, and most hold very favorable attitudes toward the environment, at least in a general sense (Kalcic et al., 2014; Baumgart-Getz, Prokopy, and Floress, 2012). "Conservationists" value stewardship highly enough, that they are willing to adopt conservation measures even if they harm their bottom line and the benefits fall mostly off the farm.

Farmers also value the ability to produce a crop. "Productivists" highly value measures such as yields, profits, and the appearance of the farm—straight rows, uniform crop height and color, "clean" fields (Burton, 2004; Arbuckle, 2013; Reimer, Thompson, and Prokapy, 2012; McGuire, Morton, and Cast, 2013). To a productivist such measures define what farming is, and are used to judge other farmers' skills. It's not that productivists do not care about the environment, but that productivist values tend to dominate management decisions (McGuire, Morton, and Cast, 2008). This means that farmers with strong productivist values are likely to voluntarily propose conservation practices that yield private benefits. They are therefore less likely to be using conservation measures that provide difficult-to-observe off-farm benefits, such as water quality (Arbuckle, 2013; Reimer, Thompson, and Prokapy, 2012). Evidence suggests that the productivist identity is widespread, which would help explain the apparent lack of success of the voluntary approach for addressing nutrient-related water quality problems (Burton and Wilson, 2006; Chouinard et al., 2008; National Research Council, 2010; Sulemana and James, 2014). The concern for resource managers is highly vulnerable soils that are operated by farmers with strong productivist values.

Addressing Disproportionality through Policy

Addressing the most important sources of pollutants from cropland will require engaging those farmers who manage the most vulnerable land. If these farmers also hold strong productivist values, alternative policy approaches to those commonly employed to address nonpoint source pollution may be required.

One option is compliance. Compliance mechanisms require a basic level of environmental performance as a condition of eligibility for other agriculture programs, usually defined in terms of a set of approved practices. Farmers who violate compliance provisions are at risk for losing all or part of their commodity, conservation, and disaster payments—subsidized crop insurance—access to USDA farm loan and loan guarantee programs; and other agriculture-related benefits. Compliance has been used to promote the usage of soil-erosion measures on cropland designated highly erodible and to discourage the draining of wetlands since 1985.

Nutrient compliance would add the adoption of nutrient management practices as a condition for eligibility for program benefits. An estimated 75% of cropland acres with medium, high, or very high potential for nitrogen leaching or runoff are located on farms that receive government payments (Claassen et al., 2004). In the case of corn, over 97% of acres, receive government payments (Ribaudo et al., 2011). In 2006, 88% of corn acres fertilized with nitrogen received payments in excess of $27 per acre per year, which was more than the average Environmental Quality Incentives Program (EQIP) payment rates for nutrient or manure related management practices. As long as productivists benefit from federal income support, loan, insurance, or conservation programs nutrient compliance would force them to consider nutrient best management practices. A drawback of compliance is that the strength of the incentive is dependent on the level of government payments.

Another approach would be to elevate conservationist values in the decision-making process. Traditional voluntary programs link financial assistance to the cost of implementing a supported practice. By linking payments to practice costs rather than the provision of environmental outcomes, voluntary financial assistance programs limit the ability of farmers to act entrepreneurially or to introduce innovative ideas into conservation management, things that may be highly valued by productivists (Burton, Kuczera, and Schwarz, 2008). There are no rewards for doing anything more than the minimum necessary to receive the payment, or for applying conservation measures on the most vulnerable land. (The same could be said for regulation). As a result there is no social or cultural advantage to be gained by productivist farmers. A simple cost-share does not compensate a productivist for the potential social cost of the practice. A pay-for-performance approach could change this. Conservation payments based on reductions in nutrient runoff and leaching would provide productivist farmers the opportunity to benefit financially from their skills in providing pollution abatement on the most vulnerable land. Environmental outcomes could therefore become a higher priority for productivist farmers, increasing the likelihood that meaningful changes in management will be attained. The Conservation Stewardship Program (CSP) currently bases part of its payments on the estimated amount of environmental services provided. However, the inability to observe improved water quality may make it difficult for a productivist to demonstrate managerial skill to other farmers and to increase their social capital. Reporting environmental outcomes via social networks or receiving recognition from a local watershed group may help to elevate conservationism in the farmer community. Pay-for-performance also requires a modeling tool to estimate the amount of abatement produced on a field. The transaction cost of employing such a tool could be high.

One of the difficulties of getting productivists to voluntarily adopt water quality practices is that the link between their actions and measurable outcomes are extremely difficult to see—if they can be seen at all. Education and extension activities that convince productivists that their actions have real impacts on water quality, coupled with an ability to demonstrate their managerial skills, might reduce their resistance to water quality practices that yield off-site benefits (Baumgart-Getz, Prokopy, and Floress, 2012).

Another approach would be to work directly on cultivating stewardship values in farmers through extension and outreach. What is called "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 conservation provision could increase conservation-oriented thinking on the part of those who held strong productivist values (Burton, Kuczera, and Schwarz, 2008). McGuire, Morton, and Cast (2013) found that ownership of the 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 was the most important source of information, rather than traditional extension.

Lessons for Future Policy Design

The cost-effectiveness of nonpoint source pollution abatement policies would be increased if the fields that contribute a disproportionate share of pollutant loadings could be treated with appropriate management practices. Considering the social and biophysical factors that contribute disproportionately to watershed impairments in policy design and implementation, could improve program performance. Using surveys or models to identify vulnerable crop acres and the level of management improvement needed, such as what NRCS is doing as part of the Conservation Effects Assessment Project, could provide the basis for actively targeting specific fields within impaired watersheds.

Conservation decisions are influenced by a more complex array of attitudes and factors than costs and returns. Understanding these factors is therefore critical to designing effective policies. If a productivist ethic prevails in areas of high pollution vulnerability, then traditional conservation programs aimed at subsidizing costs and addressing "average" conditions will not likely succeed, even if a majority of "average" landowners participate. Linking payment or recognition to the level of pollution abatement would likely appeal to productivists. Community conservation could increase the social capital of holding conservationist values, and make use of existing information networks to convey information about new practices (Reimer, Thompson, and Prokopy, 2012). Using education and outreach to clearly link the adoption of conservation practices on a particular field to water quality improvements could also help raise conservation-oriented actions in a community conservation setting by tapping into the stewardship values farmers already have.

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