



# The Adoption of Conservation Practices in Agriculture

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## Introduction

Growing crops and raising animals can impact the environment both on the farm and off. For example, soil loss and erosion can reduce crop yields and impair natural and manmade water systems while runoff of nutrients applied to farm fields can contaminate groundwater and surface waters. Although farmers can reduce these impacts by using conservation practices or best management practices (BMPs), many impacts occur off-site (or downstream) and their impacts on crop yields may not be significant enough for farmers to take action. However, BMPs that help absorb nutrients or retard run-off can provide additional benefits for the environment by creating wildlife habitat, improving soil health, improving air quality or sequestering carbon so USDA strongly promotes their use (Schnepp and Cox 2006; Shortle 2010).

To participate in Water Quality Trading markets, producers implement BMPs that reduce the run-off of nutrients from their fields and point sources purchase the resulting nutrient offsets or credits. Understanding how BMPs are adopted and implemented by producers can help markets, programs and projects focus on BMPs that farmers are receptive to implementing and better understand the degree of technical assistance that might be needed.

## Producers go through a logical sequence of stages before adopting a BMP

In general, the voluntary adoption of BMPs occurs slowly and much of the BMP adoption is self-funded (Lichtenberg et al. 2010). Producers adopt practices that protect the environment more slowly than technologies and practices that increase crop yields and productivity and respond to market demands (Nowak et al. 1997; Marsh 1998). Numerous studies have looked at how and why conservation practices are adopted, what some of the barriers are and how we can overcome them.

In 2006, the USDA NRCS Social Sciences Team analyzed over 2,500 research reports on how farmers adopt BMPs or conservation practices (USDA NRCS 2005). Rogers' Adoption-Diffusion model remains the most commonly used process for "getting conservation on the ground." Rogers laid out six stages that producers commonly go through in adopting a practice: 1) Awareness of the problem; 2) Interest in more information; 3) Evaluation—how the technology can be applied to the producer's operation; 4) Trial—testing the applicability at a specific site; 5) Adoption—full use of the technology; and 6) Adaptation—producer customizes the practice or technique to fit his or her needs. Producers get their information from different sources as they progress through each stage (USDA NRCS 2005). In Stages 1 and 2 (Awareness and Interest), producers turn to mass media, government agencies, friends and neighbors, dealers and salespeople (in that order). In Stages 3 through 5 (Evaluation, Trial and Adoption), farmers rely on friends, neighbors and family, government agencies, mass media, dealers and salespeople. And in Stage 6 (Adaptation), farmers use their own personal experience. In addition, producers are increasingly turning to the Internet and certified crop consultants as sources of information.

The adoption blueprint was refined in 2006 to acknowledge that adoption may be based more on subjective perception than on objective truth and that producers expect BMPs

to help them better achieve their goals (Pannell et al. 2006). In this slightly modified version, the stages of adoption become:

1. Awareness of a relevant opportunity on one's own farm.
2. A process of data collection of positive perceptions of a practice.
3. Their own cautious trial evaluation. Without a small evaluation, chances are greatly diminished for adoption.
4. Scaling up the innovative practice, a continuous process that sometimes is only a partial or modified adoption.
5. A continuous process of review and modification.
6. Dis-adoption when not sufficiently encouraging or goals are not advanced. This could lead to abandonment or a scaling down of the practice.

### **Producers adopt new practices at different rates**

Rogers also recognized that farmers adopt new practices at different rates and he characterized these groups as: innovators, early adopters, early majority, late majority and laggards, each with their own value systems, personal characteristics, communication sources and social relationships (USDA NRCS 2005). Of these groups, the early adopters rather than the innovators tend to be the most respected “opinion leaders” in the agricultural community because they are more cautious in their approach and tend to gather information on the reliability of a technology before they proceed. These producers can help others adapt to change.

### **Reaching conservation “late adopters” to get more practices on “critically undertreated” acres is becoming more urgent**

More recently, the “laggards” or “late adopters” have come under greater scrutiny. For example, recent USDA Conservation Effects Assessment Project analyses show that 15 percent (8.5 million acres) in the Upper Mississippi River Basin and 19 percent (0.8 million acres) in the Chesapeake remain critically undertreated with highly erodible soils and soils prone to leaching, requiring treatment for multiple natural resource problems (USDA NRCS 2010 and 2011). These acres can contribute disproportionately to water quality problems. For example, eight of 61 farms in the Pleasant Valley watershed in Wisconsin occupy only 12 percent of the area but are responsible for 73 percent of the estimated runoff of phosphorus. Avoiding the “late adopter” and “bad actor” terminology, Nowak instead characterizes these eight farms as opportunities and potential collaborators (Nowak 2010). Although they are engaging in inappropriate behaviors in vulnerable times or places, he urges that it is up to us to listen to them and mutually develop solutions that work (Nowak 2010).

### **Targeting “critically undertreated acres” is effective but not always easy**

Ideally, the most effective way to protect water quality is to implement BMPs on watershed areas that contribute the most to water quality impairment—instead of relying on voluntary implementation of BMPs randomly scattered throughout the watershed (Tuppad et al. 2010). By targeting the placement of BMPs, watersheds can reduce annual average pollutant loads by 10 percent using less than half the land area that random placement of BMPs requires. The benefits of targeting are greater for the initial increments of BMP adoption and decrease as the proportion of BMP adoption on

targeted land areas increases. However, even though targeting increases effectiveness, it may take more money and effort than random implementation since landowners must be identified, located, approached and sold on implementation. The most cost-effective strategy may be to transition from targeting during the early phase of implementation efforts when returns (pollutant-yield reductions per dollar invested in implementation) are still high, to random (first come, first served) implementation when returns are lower.

In most watersheds, reaching the producers on critically undertreated acres and getting conservation practices on their land will be a challenge and projects will have to figure out the best approach for that particular watershed. For example, the IPM Institute of North America, American Farmland Trust and other groups convened listening sessions with conservation professionals, agricultural retailers and producers in the Sandusky River watershed in Ohio (AFT 2010b; 2010c; Green 2012). By reaching out to key stakeholders, we were able to determine that fertilizer dealerships and their affiliated certified crop advisers are in the best position in this watershed to identify and work with farmers who are engaged in inappropriate behaviors.

**Barriers to the adoption of BMPs range from lack of awareness and worries about crop yields and management skills to community constraints and landlord-tenant relationships**

Along with understanding the process farmers typically go through on the way to implementing a BMP, it is also helpful to identify and address the obstacles in their way. AFT typically holds listening sessions with producers and conservation professionals in a watershed to determine these barriers but surveys can be equally effective. The USDA NRCS Social Science Team highlight many of the common obstacles to adoption (USDA NRCS 2005):

- Farmers may not be aware of or understand the on-site and off-site causes and consequences of their farming practices, the short- and long-term benefits of conservation and the types and sources of available assistance.
- Farmers may worry that the adoption of practices may reduce crop yields or they may lack appropriate management skills.
- Community constraints may include the absence of support from leaders, family, friends and neighbors and the absence of active community support structures such as conservation districts, salespeople or local USDA offices.
- Organizational barriers may include conflicting messages from different sources, confusion over the roles and responsibilities among the various agencies, and lack of coordination between and among agencies.
- Economic obstacles may include lack of cash or credit for producers share of cost and limited cash flow while waiting for government reimbursement.
- Landlord-tenant relationship issues may include short-term leases that may discourage installation and maintenance of practices/systems and program sign-ups that may require long-term commitments.

And once projects understand these obstacles, they can ask farmers the best ways to

overcome them. For example, the USDA NRCS Social Science Team (USDA NRCS 2005) particularly recommends:

- Use local information sources to promote conservation;
- Seek out and work with early adopters and use them to demonstrate BMPs to the rest of the community;
- Use demonstrations, pilot projects and field tours to showcase BMPs;
- Use community support structures such as environmental education programs and centers (*AFT Note: this could be very effective for reaching out to absentee landowners who live in the watershed*);
- Use “Conservationist of the Year” programs, active watershed coalitions and “Ag Days” to help reinforce and shape the diffusion of a technology.

Nowak also suggests paying land users in small watershed a proportionate incentive for working together to solve local conservation problems. He points to the tillage clubs in the 1970s and pasture walks in the 1980s that involved groups of neighbors who came together to successfully promote BMP adoption (Nowak 2009).

**Out of 170 variables, only education, farm size, income, rainfall, technical assistance, program participation and awareness of environmental threats correlate positively with BMP adoption**

Hundreds of studies both in the United States and other countries have looked at the adoption of BMPs by farmers and tried to use the information gathered to improve adoption rates (Makuch et al. 2004). A research analysis of international literature extracted nearly 170 variables that can influence farmers' adoption of BMPs but none are universally significant (Knowler and Bradshaw 2006). Of the variables identified, education, farm size, income, rainfall, extension/technical assistance, program participation and awareness of environmental threats show mostly positive correlations.

A similar review in the United States of 55 studies over 25 years also finds that none of the adoption variables are consistently positive or stand out (Prokopy 2011) and that:

- Capacity measures can be easily surveyed and include acres, education, farming experience, income capital and land tenure:
  - Education is more likely to have a positive impact.
  - Capital and income are mostly positive (but capital is often insignificant).
  - Income is never significant for landscape management and water management BMPs.
  - Mixed evidence about the role of farmer experience.
  - Mixed evidence about the role of land tenure.
- Proximity to rivers does not lead to higher rates of adoption.
- Social networks appear to be important.
- Increased awareness and increased information are important.
- Farmers who perceive a practice will be profitable are more likely to adopt (but if they have used cost share dollars to adopt one practice, they will not necessarily continue to use cost share programs to adopt subsequent practices).

- Farmers who are more likely to adopt BMPs are younger, have larger acreages, higher education levels, more income and capital, more diverse operations and more access to labor.

**BMPs that are more challenging to manage, take time and cost money are less likely to be adopted**

Reading through the studies, it becomes apparent that management complexities (time commitment and expense) and profitability are key factors impeding further adoption of many BMPs. Farms of all sizes tend to adopt management practices that are profitable and provide environmental benefits without large conversion costs (e.g., conservation tillage, crop rotation and the use of insect-resistant or herbicide-resistant plants) and do so largely without direct financial assistance (Lambert et al. 2006; Marsh 1998). However, small farms that rely on off-farm income are less likely to adopt practices requiring extra time or expense than operators of large enterprises who farm for a living.

**Higher education, outside expertise, a conservation plan and incentive payments help overcome the barriers for the adoption of more complex BMPs**

Higher education, the use of outside expertise, farm household reliance on farm income and receipt of commodity program payments all affect the likelihood of farms adopting practices requiring extra time or expense (such as variable rate application of inputs or integrated pest management). For example, information-intensive technologies such as nitrogen testing fare significantly better with highly educated farmers. Overcoming these educational barriers may require technical assistance, demonstration or consulting services (Caswell et al. 2001).

A survey by the Fertilizer Institute and the Conservation Technology Information Center of 2,000 U.S. farmers managing 2.5 million acres (Fertilizer Institute 2008) shows:

- Having a conservation plan is a key predictor that farmers will adopt additional BMPs.
- Producers prefer financial assistance over education and technical assistance for the adoption of conservation buffers, GPS yield monitors, irrigation water management, precision agriculture, terraces, and water and sediment control basins.
- The most respected information sources are Cooperative Extension, certified crop advisers, agribusiness and USDA NRCS.
- Economic concerns and time are the primary obstacles to soil testing and about half do not do any testing.

**There are no silver bullets for BMP adoption so it is important to survey farmers beforehand to find out more about what might work**

In summary, when working with groups of farmers to hasten adoption of BMPs, researchers conclude that:

- Most adoption behavior is linked to consideration of relative profitability.
- Attitudes and perceptions are influenced by demographic factors such as age, ethnicity, gender, wealth, experience, education, family size, etc. The producers who are more likely to adopt BMPs have: above average income, greater number of years of formal education; high number of agency contacts; high participation rates

in agricultural organizations; greater reliance on mass media; high awareness of conservation problems (e.g., FI/CTIC survey showing that conservation plans were a key predictor); willingness to take risks; are full-time operators; and want to pass their farm/ranch on to children. Larger farms, high gross sales and owner operations are also more likely to adopt BMPs (USDA NRCS 2005).

- Both the actions of leading farmers (= early adopters) and Extension can positively affect the awareness and perceptions of other farmers.
- Peer/community pressure is a potential conflicting objective to be traded off.
- The quality and quantity of farm resources affect perceptions and attitudes, as well as true relative profitability of the innovation to the individual.
- Environmental considerations may fit directly as an element of profit, or may be a conflicting objective to be traded off.
- A farmer's attitude to risk affects perceptions of profitability and riskiness. For example, farmers over-apply nutrients in a rational economic decision process, to address risk of spring field entry, risk of wet conditions precluding side-dress, time utilization of fall field time availability, and variable uptake of nutrient based on year-to-year changes (Sherriff 2005). In these cases, AFT's BMP Challenge may hasten the adoption process by providing a yield guarantee to cover on-farm testing of reduced fertilizer rates (Brandt and Baird 2008).

**Land ownership adds a new layer of complexity to BMP adoption because landowners and tenants may be motivated by different objectives**

Absentee landowners comprise more than 40 percent of people who own agricultural land in the United States and in states with the most fertile lands, between 53 percent to 63 percent of the farmland is leased to tenants. Since landowners and tenants are motivated by different objectives, this could impact the use of some BMPs on leased lands (Cox 2011). Year-to-year renewable leases are the norm although most yearly leases are renewed, on average, for 11.3 years. However, the yearly risk of losing a lease can dissuade the tenant from using some of the longer-term conservation practices on their leased land. Anecdotal information from AFT's listening sessions with producers indicate that year-to-year leases inhibit the adoption of some conservation practices on leased land (AFT 2009; AFT 2010a; 2010b; 2010c; 2010d; J. Fox 2010a, 2010b; 2011).

**Research shows fewer conservation practices are generally used on leased land**

Early research analyses concluded that cash renters (but not share-renters) were less likely than owner operators to use conservation tillage. Both cash-renters and share-renters were less likely than owner operators to adopt practices that greatly reduced nutrient and soil sediment runoff over the longer term (like grassed waterways, strip cropping and contour farming) (Soule et al 1999; Soule et al. 2000; Magleby 2003;).

More recent USDA ERS surveys confirm that fewer conservation practices are generally used on rented land (Nickerson and Borchers 2011). For example, in wheat, 45 percent of owned acres receive cost share to install terraces versus only 23 percent of rented acres, 81 percent of owned acres receive cost share for filter strips versus 37 percent for rented acres and 73 percent of owned acres receive cost share for riparian buffers

versus 13 percent for rented acres. Fifty percent of corn acres are rented and while surveys find no difference in the use of conservation buffers on leased or owned land, significantly fewer stormwater runoff controls and soil erosion controls are used on leased land. With soybeans, 60 percent of the crop is grown on leased land and surveys find significantly fewer conservation buffers, stormwater runoff controls and soil erosion controls are used on the leased land.

### **Reaching out to non-operating landowners could help accelerate the use of conservation practices on leased land**

Currently, producers are competing for limited farmland acres to lease. This means that landowners could require their tenants to use conservation practices and an untapped segment of absentee landowners might be willing to do just that. A survey of non-operating landowners finds that conservation is very important to them and could influence their decisions about land use (Agren 2007; Agren et al. 2010; Petrzelka and Marquart-Pyatt 2011). Most have above average levels of education and income and average 60 years in age. They tend to value conservation, wildlife, aesthetics and recreation more than income and tradition. However, most depend heavily on their tenants or renters to make managerial decisions and nearly 75 percent have never enrolled their farms in a state or federal conservation program. Many were unaware of various conservation agencies as a source of information although more than 70 percent had ready access to the Internet and most had high-speed Internet service. Agren and its partners have now incorporated this information into innovative outreach campaigns to market conservation to absentee landowners. In 2011, Drake University Agricultural Law Center and the Leopold center released a guide to sustainable farm leases (Cox 2011) and established a website for absentee landowners. Depending on the number of leased acres in a watershed, reaching out to enlist absentee landowners could be an effective approach to getting more conservation practices on the ground.

### **Using marketing techniques to reach producers can help improve BMP adoption rates**

Virginia's Department of Conservation and Recreation recently re-examined its approach to marketing water quality BMPs using focus groups, telephone surveys and phone interviews with other states (Virginia Conservation Marketing Warehouse). Farmers identify with conservation and stewardship, are tired of being overlooked and even blamed for water pollution, may not be aware of cost-share programs and don't understand how some BMPs work. The most effective message is that conservation methods can be compatible with production and a uniform brand or logo that conveys the essence of a campaign can be effective since visual repetition builds awareness. In this case, the most effective message for Virginia was "you have to produce, you want to conserve... learn how you can do both at your local SWCD." They placed adds in rural newspapers, on rural radio stations and on outdoor billboards. They also found that research helped gain buy-in and is the best basis for effective communication. Producers also responded to face-to-face communications with trusted sources, field signs and partnership events with their producer associations.

### **The language you use may send mixed messages so focus groups can help**

The AFT listening sessions with conservation professionals and producers have reinforced the importance of the language used in messaging. For example, for producers in the Sandusky River watershed, the term “conservation” implies taking land out of production or using no-till. The conservation professionals we talked with recommending using the term ‘resource management’ rather than ‘conservation practices’. The presumption is that “conservation” implies that ‘they don’t want me to do anything with the ground,’ is associated with the term ‘environmental’ and also implies ‘government.’ At the same time, communicating effectively to build public support for conservation within a watershed also requires strategic use of language, avoiding terms like “landscape” and “ecosystem services”(Metz and Wiegel 2009).

### **WORKING IN WATERSHEDS**

#### **Producers need to be aware of and believe there is a problem**

From 1981 to 1995, USDA’s Rural Clean Water Program (RCWP) invested in projects with the goal of enlisting 75 percent of producers in targeted watersheds. Afterwards, they surveyed 21 of the RCWP projects to determine how to recruit and retain participants in voluntary NPS pollution control projects. Their results are still highly relevant (Osmond and Gale, 1995; USDA Water Quality Program 1997).

Producers who are more aware of water pollution (and receive most of their water quality and conservation information from government agencies and farm magazines) participate in greater numbers than farmers who are less well informed. Producers are also most likely to participate when they understand that their own agricultural practices affect the water quality of a local water resource. For the most part, producers who did not participate in the RCWP projects did not believe that water pollution was a problem. Conversely, twice as many RCWP participants as non-participants state that they believe water quality is a problem. Producer participation also depends on farmers valuing the impaired water resource. For example, because Iowa RCWP project participants valued a recreational lake that was threatened by sediments eroding from the surrounding cropland, they were willing to adopt new agricultural practices. In addition, if farmers perceive a need to alter production practices for reasons other than enhanced profit, they are willing to adopt practices that increase their risk or decrease their profits as long as it benefits the local environment and their farms remain financially viable.

#### **Determine who is in the best position to provide education and technical assistance**

There are a number of technical service providers in agriculture including Soil and Water Conservation District staff, USDA NRCS staff, agricultural crop consultants, university extension agents and agricultural retailers. Knowing who is providing technical support to the farmers and what the motivations are for that sector improves the chances for successful implementation. For example, the Sandusky River watershed is in the western Lake Erie basin and producers are dealing with the need to reduce dissolved phosphorus (P) run-off. With funding from the Great Lakes Protection Fund and Ohio NRCS, the IPM Institute along with AFT, the Sandusky River Watershed

Coalition and Heidelberg University held a series of listening sessions for 50 producers, agricultural professionals and agricultural retailers, beginning each session with science-based and data-intensive presentations from local experts on the nutrient loss issue, followed by discussion (AFT 2010b; 2010c). From these sessions, the IPM Institute was able to identify BMPs to help reduce the run-off of dissolved P and concluded that the agricultural retailers were in the best position to help producers.

### **Provide education, flexible financial assistance and technical assistance to help them address the problem**

Other recommendations from successful water quality projects (USDA Water Quality Program 1997) include: for long-term success of the program, emphasize practices that generate higher returns like conservation tillage, nutrient management, irrigation water management and integrated pest management; offer flexible financial assistance (with varying incentives levels and a collection of practices eligible for assistance); offer education, technical and financial assistance in a coordinated fashion; provide field testing and demonstrations of new practices which do not have a local history of use; involve local stakeholders early in project planning; pay attention to water quality monitoring and project evaluation and establish an effective mechanism for tracking changes in crop management in the project area (including management changes on fields not receiving assistance); and make sure the project allows adequate time to set results (the Water Quality Program projects were set up as five year projects).

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