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Adoption of Agricultural Conservation Practices: **Insights from Research and Practice**

Because agriculture dominates the midwestern landscape, it has a huge impact on environmental quality. Agricultural producers are often advised to adopt practices that help to reduce the impact of agriculture on the environment. However, like all humans, they are often reluctant to change, which makes the work of conservation professionals extremely challenging. In this publication, we explore the myths and realities around what motivates farmers to adopt conservation practices. We draw on the authors' combined research and applied practitioner experience with farmer adoption of conservation practices. Most evidence is based on studies and observations of traditional row-crop farmers in the midwestern United States.

We present much of this discussion as a dialogue between two authors, Linda, a Purdue researcher, and Dan, a conservation practitioner, and conclude with important

considerations and recommendations for conservation professionals in the field who are trying to encourage conservation practice adoption.

Analysis of Past Research

(Linda, a researcher's view)

When the Natural Resource Social Science (NRSS) lab at Purdue first looked at farmer adoption of conservation practices, we investigated the literature to see what was known. Specifically, we did a quantitative, statistical analysis of 55 studies done in the United States that focused on conservation practice adoption by farmers. These studies covered livestock operations, large cropping systems, and small cropping systems. They looked at operations from Louisiana to California and from the Midwest to the Northeast. Our goal was to find what motivates farmers to adopt conservation practices.



We found very few generalizable trends, because, it turns out, farmer behavior is very hard to predict. We also found that most identifiable factors that impact farmer willingness to adopt conservation practices are not very useful for initiating change. For example, we found that older farmers are less likely to change their behaviors and adopt new practices. For farmers near retirement, purchasing new equipment for conservation practice adoption or learning a new technology or management skill is a low priority. However, since we can't change age or other demographic characteristics, this information isn't very useful. Other findings from this study, however, were more salient and generated additional questions that we attempted to answer through our own research.

Surveys vs. Interviews *(Linda, a researcher's view)*

Most research findings in this publication are based on either surveys or interviews. Surveys tend to include random samples of populations, are typically quantitative, and produce statistically analyzable data. Conversely, interviews tend to be qualitative and to help answer "why" questions that cannot be answered with a quantitative approach. Often the goal of interviews is to identify the types of people in the population, but not the percentage of each type of person. Both surveys and interviews are complex tasks and involve careful design of questions and pre-testing with the target audience.

Farm Size and Type

(Linda, a researcher's view)

Our analysis of past research indicates that the larger the farm, the more likely farmers are to adopt conservation practices. We explored this a little more with our own surveys of farmers in the Little Calumet-Galien watershed in northwestern Indiana. We found that owners of smaller farms (5–50 acres of crops, pasture, and/or hay) in the Little Calumet-Galien watershed were indeed less likely to adopt conservation practices than farmers with greater acreage. However, paradoxically, small farmers generally felt more positive towards improving water quality and were more willing to try new practices than were producers on larger farms.

Why the disconnect? This is probably because small and non-traditional farmers are not connected with sources of conservation information. Small farmers in our study were less aware of both pollutants and the conservation practices that address them. They also were less familiar with common institutions that provide information about conservation practices, such as Soil and Water Conservation Districts (SWCDs), the Natural Resources

Conservation Service (NRCS), the local watershed groups, and the Cooperative Extension Service.

Our work with nontraditional farmers showed a similar lack of information. In the equine industry, for example, an analysis of print magazines found very little reference to conservation practices in equine magazines compared to traditional agriculture magazines. Our interviews with horse farmers in Central Indiana revealed that they are unaware of conservation practices that could improve the environmental integrity of their operations.

These findings suggest that smaller and non-traditional farmers might be a prime audience for increased outreach.

Specialized Equipment and Management Techniques

(Dan, a practitioner's view)

What I've learned over the years is that smaller farms may lack the specialized equipment, such as a no-till planter, that they need to adopt no-till. Many smaller farmers work part- or full-time off-farm, so they cannot attend field days and educational events often attended by full-time farmers. As a result, many times when smaller farmers try something new they are more likely to fail; they don't have the right equipment and/or management skills. Consistent with Linda's findings, time and again I've seen inadequate on-farm conservation measures on small farms caused by an overall lack of awareness that their current practices are damaging. When you see a horse pasture with bare soil and eroded slopes, you typically find a producer behind this operation who assumes that when you manage for horses, mud and erosion are unavoidable and do not cause major harm. The producer may have not been reached by conservation professionals. Without adequate outreach and information, these small farms may not get the tools or training necessary to adopt better practices.



Photo courtesy of USDA NRCS

Environmental Attitudes, Motives

(Linda, a researcher's view)

The literature we analyzed indicated that environmental attitudes make a difference; the more positive farmers' environmental attitudes are, the more likely they are to adopt conservation practices.

Because all the studies we analyzed used different measures of environmental attitudes, we explored this concept further with a qualitative study in the Eagle Creek watershed of Central Indiana. We interviewed farmers and identified three types of motivation. While all farmers interviewed were motivated by financial gain, one group was predominantly motivated to maximize profits on their investment. A second group of farmers was more motivated by land stewardship and wanted to improve the quality of their soil and ensure the future productivity of their property. A third group was motivated by off-farm environmental benefits and more likely to adopt actions on their property to improve the downstream environment.

By understanding farmers' different attitudes and motives, resource planners can better describe practices in ways that are meaningful to farmers.

Social Networks

(Linda, a researcher's view)

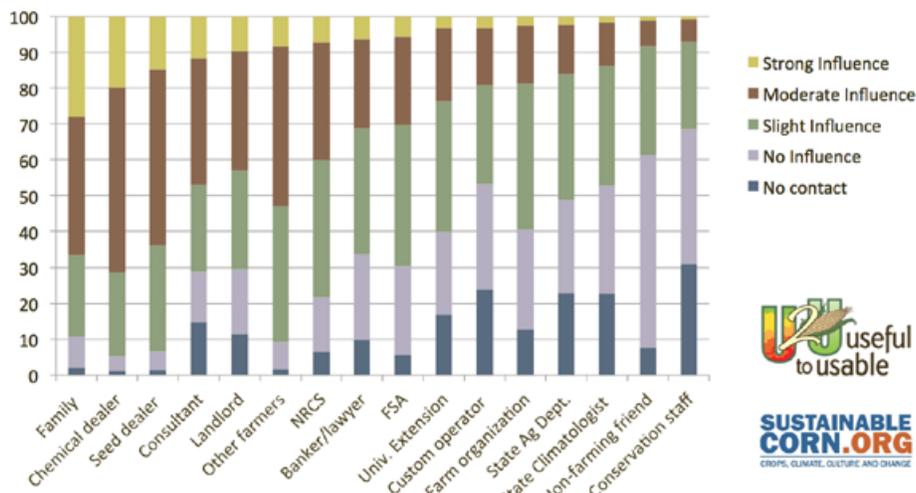
A final finding from the analysis of the literature is that farmers' social networks—the people farmers trust and talk to, as well as the message that they hear from those people—play key roles in the adoption process. In addition,



every study done by the NRSS lab since that analysis also found that social networks are a driving force that determines whether or not a farmer adopts a practice.

Our lab currently leads the Useful to Usable (U2U) project (www.AgClimate4U.org), a USDA-NIFA funded research and Extension grant focused on improving climate information to support more resilient Corn Belt agriculture. In 2012 we joined with another USDA-NIFA funded project, Sustainable Corn or CS-CAP, and surveyed 4,778 medium- to large-sized corn producers and found that agricultural practices and strategies are

Q: Please indicate how influential the following groups and individuals are when you make decisions about agricultural practices and strategies



Influence of groups and individuals on farmer decision making about agricultural practices and strategies. Results from a 2012 survey of Midwestern corn producers conducted by Useful to Usable (U2U) and SustainableCorn.org



most strongly influenced by family, farm chemical dealers, seed dealers, and crop consultants, respectively. Since conservation professionals cannot directly influence family, the conservation community clearly needs to work with chemical dealers, seed dealers, and crop consultants to make sure they understand what we are trying to promote. Then, when a farmer asks questions about a potential conservation practice, they are more likely to hear the same message from key nodes in their social network.

In summary, it is imperative to consider whom farmers talk to—and it is important to recognize, understand, and use social networks to improve the conservation practice adoption rate.

Ambassadors and Partnerships

(Dan, a practitioner's view)

One thing that really helped accelerate adoption of conservation cropping systems in Indiana is the well respected, successful, and innovative farmer who engages in a conservation practice and shares the knowledge. Farmers who try something new and different each year, but never stick with it for long, are poor ambassadors for a practice. However, if others see that a well-respected farmer in the community has success with a practice, then you often see rapid diffusion through the community. This is happening in Indiana with cover crops. Farmers see cover crops working for others, become curious, and ask for more information. Here support from agribusiness is also crucial. The Purdue research has shown that farm



Photo courtesy of USDA NRCS

chemical dealers, seed dealers, and crop consultants—three actors that farmers trust most—are the key people who need to be aware of conservation practice specifics. These three groups need information to respond to their customers, information they can get from us. It doesn't happen overnight, but when we train seed dealers and crop consultants whose customers are already asking them about cover crops, it becomes a win-win situation for both business and the environment. This united messaging leads to local coops and seed dealers working with local conservation professionals to put out cover crop demonstration plots and host field days to spread the word.

We know that farmers and consultants working together with a good facilitator can identify common production and conservation issues. The facilitators from Soil and Water Conservation Districts or watershed groups don't have to be experts to be successful, but they do need to be credible salespeople who know the terminology.

A successful organization often has at least one person on staff who has good people skills and strong technical skills and can put it all together to help people put conservation first.

Systems Thinking

(Dan, a practitioner's view)

If you look at traditional approaches to nutrient and pest management, it is not surprising that nitrates continue to cause hypoxia in the Gulf of Mexico or that we haven't achieved many of our water quality goals. One key thing that I have witnessed in my career is that you cannot have separate conservation and production plans; they need to be integrated into a full-systems approach. That way, whether a farmer is talking to the conservation folks, the chemical dealers, or the crop consultants, the language is the same. Systems thinking is as important on the agronomic side as networks are the social side.



Photo courtesy of USDA NRCS

Indiana farmers who saw cover crops like this working for others asked for more information.

Some good examples of systems-level conservation practices are adaptive nutrient and pest management, use of continuous no-till, and use of cover crops. Each of these practices influences the others.

You can see key systems-thinking development coming into play in nitrogen nutrient management. Traditional approaches to nitrogen nutrient management typically entail applying the amount recommended by university Extension in a region of the state. However, nitrogen management is very complex, and we know that there is huge variability within the field that is influenced by soil type, rainfall, and management history. By using adaptive nutrient management, farmers may utilize manure, cover crops, no-till, different forms of nitrogen, variable rate nitrogen application, multiple nitrogen applications, and nitrogen stabilizers to be as efficient as possible with their nitrogen management.

Practice Characteristics

(Linda, a researcher's view)

While individual farmer characteristics influence whether or not a farmer decides to adopt a conservation practice, our research also reveals that key characteristics of the practices themselves also affect farmer adoption. Identifying these key characteristics can help match a practice with a farmer and help determine how to best reach the farmer with information about that practice. Our research reveals that the on-farm, financial, and

environmental benefits of a practice, as well as the compatibility of the proposed practice with current farming systems, are key considerations.

It is important to meet and talk with people in a watershed to identify local concerns before promoting a conservation practice. If the messages you send don't address local concerns, your outreach campaign will have limited success.

According to Everett Rogers' famous theory on the "Diffusion of Innovations," for innovations like conservation practices to diffuse through a community, the potential adopters first have to be knowledgeable about the key characteristics of conservation practices. Then, they have to be persuaded that the practice is good for them and their farm operation. After deliberation, they decide to adopt the practice and then, some time later, actually implement it.

People can get stuck for a variety of reasons at the decision phase, and figuring out how to get them over their inertia is really important. For example, a farmer can be persuaded that no-till is a good idea and plan to adopt it, but remain in the decision phase until he or she actually gets the equipment, funds, or time to start using no-till. In this case, the need for specialized equipment may be the bottleneck that, once identified, can be targeted for outreach and support.

Innovation-decision process



Pathway of innovation adoption. From Rogers, 1995.

No-till: Risk vs. Reward *(Dan, a practitioner's view)*

Change is complicated. Take a second to reflect; why do you make the decisions that you do?

Farmers, when deciding to change their practices, are concerned with risks versus rewards. One of the difficult things about risks and rewards is the difference between actual versus perceived risk or reward. A good example is no-till corn. Currently, only about 22% of corn in Indiana is no-till, and one reason for this is the perception of reduced yield. No-till corn may be shorter in June than conventional corn, because the no-till environment is a bit cooler. Farmers may assume that shorter corn in June means reduced yields, when in fact, yields of no-till corn are consistently similar to, if not better than, yields of conventional corn—especially in dry years. However, eyeballing no-till corn from the road creates a perceived risk that is not borne out when the actual yield differences are compared.

On the other hand, if no-till corn is done incorrectly (for example, if a farmer uses the wrong planter setup or does not use starter fertilizer on the planter), corn yields—and profits—may be reduced. If this happens when a producer first switches to no-till that producer may be more likely to go back to previous methods (in this case, tillage). There is always a learning curve with something new. This makes some producers risk-adverse, because if they do something different they may miss important details and run the risk of reduced yield. Fear leads some farmers to strenuously avoid changing anything that could cause a perceived or actual yield decrease and keeps them from experimenting with new conservation practices. In the words of Rogers, while these farmers might be aware of the new practice, it may be very difficult to persuade them that adopting this practice will benefit their farm operation. They know there also are problems with the conventional system, but they know what those problems are and how to deal with them.

Keep in mind that an improved quality of life is another reward. In addition to producing comparable yields to conventional corn when done correctly, no-till corn cropping systems also require less of a producer's time at spring planting. Often, saved time is more important than improved yields in motivating farmers to make the switch. We have heard farmers say that before no-till they never had time to go to their kid's baseball games, because their tillage systems required more equipment passes in the field than no-till. This quality-of-life issue is important to many farmers.



Done correctly, no-till corn cropping systems require less of a producer's time at spring planting.

Photo courtesy of USDA NRCS



Photo courtesy of USDA NRCS

Severe hillside erosion without the use of no-till, cover crops or other conservation methods.

Maintenance*(Linda, a researcher's view)*

One neglected and underfunded area of research and outreach is the study of maintenance of conservation practices over time. Programs and funding tend to focus on the implementation of new practices. Still, we face important questions about conservation maintenance, for example:

- Are the people who adopt these practices motivated to maintain them over time?
- If not, when and why are practices abandoned after installation?
- What are the impacts on the environment when conservation practices are abandoned after installation?

A PhD dissertation done in the NRSS lab here at Purdue looked at EPA 319-funded projects across the state of Indiana. In that limited study, which is not generalizable outside of Indiana, we found that the more farmers and landowners were connected to community groups, the more likely they were to maintain conservation practices over time—perhaps because there is a social norm towards conservation practice maintenance in those groups. We also found that a sense of ownership is really important. That is, adopters who were more hesitant at first to participate in government programs were more likely to maintain those practices over time. This tells us that the persuasion stage of practice diffusion is important. In fact, the more effort it takes to persuade and convince a producer, the more likely that producer is to actually maintain a practice.

Where Programs Succeed—or Fail

(Linda, a researcher's view)

Where do watershed conservation approaches and practice adoption campaigns succeed? How should we focus our efforts?

Our lab set up discussions with government program administrators, university researchers, and professional resource managers to answer these questions. We found that, ideally, we should focus on watersheds that already have solid social support. These watersheds have paid watershed staff; active conservation groups; and trust and collaboration between the different, overlapping agencies and social networks working within the associated jurisdictions and communities. In addition, watersheds where farmers already recognize the problems of excess nutrients, inadequate soil health, etc., are more likely to succeed in farmer adoption.

Watersheds likely to succeed with more cutting-edge practices (e.g., two-stage ditches, bioreactors, and cover crops) are ones where basic conservation practices like grassed waterways have already been adopted and where there is buy-in and interest from local conservation staff around the proposed project. As we pointed out above, success is also more likely where well-respected farmer-conservationists help carry the message of the project.

Conversely, where do programs fail? Our research suggests that they fail when they focus on the individual farmer instead of the community and when they don't actively engage farmer networks to influence social norms regarding adoption and maintenance. Programs also fail when they focus solely on the short-term (spending grant dollars) rather than thinking about educating adopters and long-term maintenance. Finally, programs can fail when they don't incorporate landscape-level planning; when they do not strategically target specific land with the practices that will have the biggest impact. Since some land disproportionately contributes to water quality issues, we need to target our programs to those lands with the most degradation potential. Based on some qualitative work done at Purdue and some quantitative work in Iowa, we know that most producers do not oppose geographic targeting. They understand that not all land is created equal and that conservation practice money doesn't have to be spread around equally.

Conclusions

Below are some takeaway messages from our combined research and practitioner experience.

- Think about the characteristics of the conservation practices and what motivates adoption from the perspective of the farmer.
- Some watersheds have inherently greater capacity to support conservation practice adoption. In the context of limited funds and limited resources, think carefully about where you work.
- It is becoming increasingly evident that we need to move the focus beyond initial adoption to include who will maintain practices over time.
- Having the “right” innovators is critical; the well-respected farmers who are willing to get up in front of their peers and share their successes and challenges are key actors in a successful outreach campaign.
- Undergirding all of this is the notion that networks are extremely important. Understanding existing farmer networks is important. New farmer/agribusiness/conservationist networks can be cultivated and leveraged for success when facilitated by persons with both social and technical farming skills.
- Systems-thinking and adaptive management are essential in the design, outreach, and implementation of agricultural conservation practices.

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Linda Prokopy is an Associate Professor in the Department of Forestry and Natural Resources at Purdue University. For the past 10 years her Natural Resource Social Science lab has used a number of different methods to collect information about agricultural producers and people who work with producers, including surveys, interviews, literature reviews, focus groups, and facilitated meetings with experts in the field.

Dan Towery worked for the Natural Resources Conservation Service (NRCS) for 26 years, including a ten-year stint with the Conservation Technology Information Center at Purdue. He also worked as the NRCS State Agronomist in Illinois as a NRCS District Conservationist (12 years) and as a NRCS soil scientist (2 years). He operated a retail fertilizer outlet for one year. He started his own company in 2005, Ag Conservation Solutions, and is currently a Conservation Educator. He is currently President of the International Soil & Water Conservation Society.

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May 2014

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