REPORT: STUDY ON THE ADOPTION OF EDGE OF FIELD PRACTICES

Prepared for Iowa Department of Agriculture and Land Stewardship
by Resolve and Soil and Water Conservation Society

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RESOLVE

SOIL AND WATER CONSERVATION SOCIETY

INTRODUCTION AND PURPOSE

Substantial progress has been made through Iowa's Water Quality Initiative (WQI) and other programs in the adoption of conservation practices that help further the goals of the Iowa Nutrient Reduction Strategy (NRS). Results are demonstrating that, when energy and resources are focused on addressing a resource concern and a concerted effort is made to facilitate practice adoption, genuine improvements are achieved. For example, through the efforts of WQI and other programs the number of acres of cover crops in Iowa has increased from less than 400,000 acres in 2012 to more than 750,000 acres today. Even with the noteworthy increases in cover crop adoption, a great deal of additional work remains to meet the NRS goal of reducing the nitrogen and phosphorus loads to Iowa's waterbodies by 41% and 29%, respectively.

Even if targets for in-field practices are met, there will still be a need for significant adoption of edge of field practices to achieve water quality goals.

The same is true for adoption of edge of field practices. According to the 2017 Annual Report for NRS, the state of Iowa has 85 nitrogen-removing wetlands and 82 Conservation Reserve Enhancement Program (CREP) wetlands that cumulatively treat 203,000 acres. The most conservative scenario for wetlands in the NRS Science Assessment recommends 7.7 million acres treated by wetlands. At the time this report was being developed, there were 20 known bioreactors in the state, and an unknown amount of saturated buffers due to their recent inclusion as an NRS approved practice. One scenario in the NRS Science Assessment requires 138,000 bioreactors (or equivalent edge of field practice, such as a saturated buffer) to reach the 41% nitrogen reduction. In order to scale up to statewide goals, a substantial increase in best management practice adoption is necessary.

An assumption of the NRS Science Assessment, which was confirmed by this study's interviews, is that even if targets for in-field practices are met there will still be a need for significant adoption of edge of field practices to achieve water quality goals. For that reason, this study was initiated to support WQI efforts to expand the extent and increase the effectiveness of edge of field practices through WQI efforts in Phase II projects. This study focuses on determining the current state of knowledge, training, and technical assistance (TA) available to provide guidance that supports expanded adoption of edge of field practices.

It is important to note that there are other efforts and collaborations at work to address edge of field issues related to scaling up and removing barriers, such as the Conservation Infrastructure Initiative, which has provided recommendations on a wide range of near and long-term strategies and policies. While those efforts address a number of the same issues raised here, this report focuses on collecting information on the process by which adoption of edge of field practices may be effectively increased. In that sense, the report is intended to complement other efforts and provide additional insights on edge of field practice adoption that are of value to WQI.

The following report includes a brief description of the methods used in carrying out the study, a summary of results from key informant interviews and site visits, a set of key observations and recommendations, and a set of selected references that provide an overview of the information available on edge of field practices in Iowa.

METHODS

The project relied on a qualitative approach that provided the flexibility necessary to learn as the study progressed and allowed the opportunity to use that learning in subsequent discussions and interviews. This sort of research would generally be termed a "grounded theory" approach, where gathered contextual and specific data guide the investigation, allowing for the development of observations rather than empirical conclusions. Using a basic set of questions as prompts to ensure that the interviews covered the important issues, the process provided for open-ended discussions.

Key informant interviews were conducted with a cross section of state and federal staff, including the Iowa Department of Agriculture and Land Stewardship (IDALS), Soil and Water Conservation Districts, the Natural Resources Conservation Service (NRCS), the Environmental Protection Agency (EPA), and Iowa State University (ISU) Extension and Outreach, as well as private engineers and contractors, farmers, and agribusiness. Each of the interviews began with a brief description of the purpose of the interview and assurance that comments would not be attributed to individuals. Twenty-one phone and in-person interviews were conducted over a five-month period. While the number of interviews was greater than originally planned, the discussions typically led to suggestions of other potential interviewees with useful observations to include in the study. The results of each of the interviews were summarized, reviewed, and compiled.

In addition to the interviews, field meetings were conducted with farmers who had installed bioreactors, saturated buffers, and constructed wetlands. The site meetings provided an opportunity to see the practices in action and to hear the farmers' experiences, their insights into the installation process, and their level of satisfaction with the results. Notes were compiled from those meetings, and results are included in the summary of key informant interviews.

BASIC KEY INFORMANT INTERVIEW QUESTIONS

Where are we? What is your sense of edge of field practices' accessibility, viability, effectiveness, and level of adoption?

- What holds the most promise for increased adoption?
- Are they the same as the practices that offer the greatest reduction?

How readily can growers adopt these practices, how inclined are they to do so, and what are the challenges? And solutions?

What is your sense of the decision support and technical implementation information available to growers and practitioners?

- What is the level of confidence people have in the practices?
- What is working, what isn't, what do we need, and how can we fill those needs?
- What will it take to scale up adoption?

What things would best further use of edge of field practices, and how can we make them happen?

- Are there outstanding implementation and/or maintenance issues that need to be resolved?
- Are there policy or program issues that need to be resolved?

Whom should we contact to get a field level perspective: district, NRCS, crop advisor, Extension, project or IDALS coordinator?

SUMMARY OF FINDINGS

CURRENT SITUATION

In an effort to accurately capture interview responses, the “Summary of Findings” section is an unfiltered reporting of the primary and overlapping sentiments expressed by interviewees. There is a diversity of opinions surrounding the barriers to edge of field adoption, and in some cases contradictory opinions. Those responses are reported here, and then clarified and analyzed in the “Key Observations” section.

The initial questions were about the interviewees’ experience with edge of field practices and their sense of the current state of play. Responses consistently pointed out that although there have been annual increases in practice adoption, current rates are a tiny percentage of necessary adoption. There was agreement that even with no up-front cost to growers the current audience is limited to producers who are conservation leaders, early adopters, or “water quality conscious” farmers. While cost share that covers a high percentage of the expenses for wetlands, bioreactors, and saturated buffers is available, wetlands are viewed by some landowners as cost-prohibitive. The WQI began in 2013 and in recent years has increased their focus on edge of field practices; there is hope among interviewees that the groundwork is being laid for wider adoption.

Floodplain site in Hardin County, Iowa. SWCS.

The most widely cited reason for the current limited state of adoption is that farmers do not see a bottom line or productivity benefit from edge of field practices. Several interviewees attributed low adoption, even where cost share is available, to problems with site design and the number of delays from the time the farmer expresses interest to the time a practice is installed. These delays often result because many field offices do not have the ability to design practices and all work is delegated to the NRCS area engineer's office. Even if there are design capabilities at the county-level office through technicians, the process is still slowed by the requirement of engineering approval from the area office.

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In spite of some of the challenges, there is a general sense that edge of field practices are supported by adequate science and that they are compatible with production structure even if they offer no direct economic benefit to producers. This is referred to as "stackability" or "the suitability to stack or be layered with other practices" (Christianson et al. 2018). From this perspective, an interviewee noted that we need to look at the practices as part of an overall farming system and watershed approach. A common sentiment was that practice adoption would benefit from greater public and private investment to increase the availability of TA and funding sources. One interviewee summed up the current situation for edge of field practices by saying, "We just need to get out of our own way, take a step back, create a more streamlined process, address the real capacity issues, and rely on effective public-private partnerships."

Other thoughts included the general agreement that saturated buffers and bioreactors are still considered "new" practices to many and that project coordinators and NRCS staff need further training and assistance to raise the profile and encourage adoption of these practices. Interviewees noted that there is currently less interest than there seemed to be around the time of the Des Moines Waterworks lawsuit or when there were higher commodity prices. In addition, the amount of rented land that is farmed and the attitudes of landowners affect the likelihood of edge of field practice adoption.

"We just need to get out of our own way, take a step back, create a more streamlined process, address the real capacity issues, and rely on effective public-private partnerships." – KEY INFORMANT

PHOTO BY LYNN BETTS

Saturated buffer installation in Story County, Iowa. NRCS/SWCS.

KNOWLEDGE, AWARENESS, OUTREACH, AND TRAINING

When asked about the current state of knowledge on edge of field practices, respondents stated that science has matured in the last five years with more research on bioreactors and wetlands, and additional emerging research on saturated buffers. Even with what several interviewees referred to as "adequate and compelling science," there is a real need among farmers and crop advisors for a better understanding of the basics that empowers rather than discourages them. A limiting factor is farmer knowledge. Many do not understand the problem and therefore do not see a need for conservation practice adoption. One interviewee noted, "Many farmers do not believe they are losing nitrogen, they do not believe they are part of the problem. Models are needed to show them where loss is and what practices can reduce it." Some success has occurred with the use of retaiN test kits to help farmers see the composition of their tile water. However, even where there may be general awareness about nitrate loss reduction, some interviewees felt it is not a priority or motivator for greater practice adoption.

In addition to the issues of fundamental awareness about water quality problems, interviewees pointed out some deficiencies in the current outreach process. Conservation staff have difficulty encouraging adoption because they cannot deliver in a timely manner and they themselves sometimes lack practice knowledge. One respondent noted, "I see a lack of knowledge of the practices and the programs that can fund them as a problem outside of watershed demo areas, and even within some. The overall practices and the work needed to get them on the ground can be daunting to coordinators who already have a lot on their plates." Participants indicated the need for more formal monitoring data to support the efficacy of the practices. Interviewees also indicated that there is a need to provide more tools and support that can be used in understanding the situation and implementing practices at the field level.

A critical step is helping field staff—conservation districts, IDALS, NRCS, Extension, and private sector—become more familiar and better versed in the practices in order to expand implementation. Staff also need to be more aware of programs to help pay for practices and should be prepared to

facilitate the entire implementation process. Some respondents observed that NRCS staff are still learning about site selection and other technical issues associated with edge of field practices. Staff need to be more adequately aware of the practices so that they are not solely relying on producers to raise the idea. It should be noted that many federal and state staff are already overburdened with duties, and additional staff in the public and private sector are needed to increase capacity and scale up edge of field adoption.

Several suggestions were offered to increase the level of knowledge and support among field staff. Training opportunities that focus on in-the-field troubleshooting, siting, maintenance, and agronomic knowledge surrounding these practices, like the Watershed Academy, should continue to be offered. One watershed coordinator also noted the value of area meetings with a small group of project coordinators. Coordinators felt more comfortable sharing their struggles and recommendations in a small group, and it was a valuable opportunity to learn from their peers. Another recommendation was incorporating information on edge of field practices into the ISU Extension and Outreach Integrated Crop Management and Crop Advantage Training for farmers and agriculture retailers. In general, an effort should be made to offer inclusive trainings that clarify the design and timeline for edge of field practices to conservation staff including contractors, members of the Land Improvement Contractors of America, and drainage district staff.

Further communication and coordination with the private sector is also needed. Engaging retailers, co-ops, and private contractors in trainings and feedback sessions would help increase the level of knowledge, awareness, and capacity to implement practices. Many engineering companies and private contractors are interested in engaging in the process. Their role, however, needs to be better communicated and streamlined for ease of access. One interviewee noted, “Contractors are beginning to see [edge of field practices] work and, particularly younger contractors, are seeing how they can fit in as off-season projects.” Another echoed that sentiment saying, “There is interest in the practices from contractors who see them as ideal for summer construction (their slow periods).” Contractors and other technical service providers (TSPs) need to be included in the conversation about these practices in order to better engage them in their implementation and troubleshoot any barriers.

PRACTICES

The key informant interviews included extensive discussions with individuals who had significant experience with the unique issues associated with constructed wetlands. They indicated that, as with saturated buffers and bioreactors, there had been good but relatively limited success. Farmers who have installed edge of field practices have done so in the interest of water quality in the watersheds and have generally been pleased with the results and maintenance. That said, interviewees noted some trepidation about the maintenance of newer practices, such as bioreactors and saturated buffers. While maintenance was not cited as an issue with any farmer interviewees, other conservation professionals noted the need for a more long-term understanding of maintenance during the practice lifecycle.

Constructed, denitrifying wetlands are working well, but the capital-intensive nature, more complicated planning process, implementation challenges, and fact that multiple agencies are involved in the process have hampered progress. These more complicated projects require specific topography and site conditions in order to work. As larger projects, they typically take more time and substantially more money. While neither bioreactors nor saturated buffers are perceived as providing economic value to the production system, the adoption of those practices is seen as being more readily implemented than wetlands. Interviewees cited the increased maintenance, the stigma or cost of taking land out of production, the higher price tag for implementation, and the long timeline as possible reasons for this perspective. However, the importance of wetlands are proven in that they

offer longer-term benefits for larger areas of land as compared to other conservation practices. There are several federal programs, such as CP39 Farmable Wetlands Constructed Wetland, with the ability to install constructed wetlands, but they have been under-prescribed for many of the same reasons described in this report.

There is also a huge learning curve at all levels, especially concerning wetlands. There is a need for clear and appropriate design standards, especially because several different wetland programs are delivered by the NRCS and Farm Service Agency (FSA). Noting that wetlands require more money, one interviewee suggested that the process could benefit from engagement of the drainage districts similar to projects undertaken in the past through CREP, the Iowa Wetland Landscape Systems Initiative, etc. However, although promising, significant barriers still exist with these types of initiatives.

Those that have implemented edge of field practices on their farms were typically conservation minded, and even for them, as one farmer put it, it was "a leap of faith." Given the unfamiliarity and complexity of the project and the process, the availability of someone to serve as a coordinator or "quarterback" to facilitate the work and paperwork was seen as critical to the success of all edge of field projects. While some farmers wanted to be actively involved in the design and implementation, others wanted a trusted "quarterback" to handle all logistics and simply report back when the process was completed. Each farmer had different expectations of involvement, yet they all stressed the importance of the "quarterback" to lead the process and coordinate all parties. In addition, the availability of maintenance money through easement programs is important to the longer-term viability of the practice.

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SITING

Many of the interviewees raised issues related to the siting of edge of field practices. While the utility of the Agricultural Conservation Planning Framework (ACPF) tool is recognized, additional precision, information, field validation, and judgment are needed for siting decisions. For example, additional ground-truthing and local knowledge are often necessary. A major barrier with the siting tools is their incompatibility with NRCS specifications. Several issues relating to NRCS specifications were brought up in interviews and are fully reported here although a number of these issues have already been resolved by the NRCS. Further detail into these changes is included in the next section. At the time of interviews one respondent noted, "ACPF tool and ISU tools will site practices, but then the site won't work with NRCS specs. The 5% of flow NRCS standard rule disqualifies sites." There is a great need to coordinate siting tools with NRCS specifications in order to access cost-share. Interviewees noted the NRCS requirement of 5% peak flow as being an obstacle because robust tile records are needed to meet this specification, and such records often do not exist. In general, locating tile lines was noted as a significant time burden and an area where private companies may be able to offer services. There was a clear sense in the interviews that better tools are needed for decision-making in addition to ACPF.

NATURAL RESOURCES CONSERVATION SERVICE AND FARM SERVICE AGENCY

Interviewees were consistent in acknowledging that financial resources that NRCS provides are of significant value and have played a critical role in edge of field practice implementation. However, as with any new practices, process and technical issues have arisen in the design, siting, and implementation process. Were demand for edge of field practices to increase, generating even 25 to 30 projects statewide, it would outstrip NRCS capacity given the current process and resources. In general, interviewees felt there was a need to make the process simpler and more consistent, and ensure that tools and technology for siting are well understood and available. They noted that there are opportunities for the NRCS to provide clarity and consistency on tools, funding, and practice standards. The current process can result in delays that, given the limited window for practice installation, can push projects back six months or more. The limitations are substantial—the process can be long and drawn out, reducing the ability to implement practices efficiently and discouraging adoption.

Interviewees listed the following specific concerns:

- ***Listing of saturated buffer (604) as Engineering Practices requiring Professional Engineering approval is limiting.*** It can take 30 to 40 hours to complete one design, and a shortage of engineering capacity is a limiting factor even at current levels of adoption.

- ***NRCS specifications require a maximum eight-foot bank height that is difficult to meet in drainage district areas where all the ditches are excessively deep.*** This barrier has been resolved by the NRCS in that banks can be over eight-feet in height, but require additional investigation to minimize risk of adverse impacts to streambanks. Questions remain as to the level of additional investigation required or if expertise is available to conduct these assessments.

- ***ACPF and ISU recommendations are often incompatible with NRCS specs (5% peak flow).*** Like the eight-foot rule, this has also been addressed and is discussed below.

- ***There is a short window of implementation on Conservation Reserve Program (CRP) land outside of nesting season.*** It would be helpful to not require taking acreage out of CRP in order to install practices. This has also been addressed in regards to saturated buffers and bioreactors and is discussed below.

- ***NRCS standards require an engineering review of practice designs, streambank stability assessments, flow capacity at maximum levels, and grade verification.*** Even where there is NRCS or other engineering capacity at the county level, all designs are required to pass through the area engineer. Interviewees also noted that they had encountered inconsistencies among engineering reviews within the states and with other states.

As issues have emerged, NRCS has worked to resolve them. In July of 2017, greater clarification was added to the Clean Lakes, Estuaries, and Rivers (CLEAR) announcement leading to greater flexibility in establishing bioreactors and saturated buffers in CRP enrolled land. Greater flexibility for saturated buffer design and implementation was established with a new federal conservation practice standard (code 604) being added to the federal register in May of 2016. Now the distribution pipe for saturated buffers can be located along a channel that is more deeply incised than eight feet as long as "a slope stability analysis shows an acceptable level of safety against saturated streambank failure." Slope stability can be assessed through local knowledge and field observations. The NRCS has also responded to concerns about the 5% peak flow by adding language to the practice standard stating a "minimum saturated buffer design flow is 5% or drainage system capacity *or as much as practical* [emphasis added] based on the available length of the vegetated buffer." Changes to the Iowa conservation practice standard, however, are still in the NRCS state technical committee awaiting final approval.

Interviewees also mentioned further improvements and noted that it would be far more efficient to establish a recognized standard and ensure quality assurance through spot inspections. Additionally, they suggested that that the tools and technology for siting should be well understood and available in order to cut through red tape and increase awareness of the practices at multiple levels. Current interagency and stakeholder efforts to improve and streamline processes were deemed critical and, if anything, could be expanded and intensified. Interviewees also noted that the NRCS is still learning and becoming familiar with saturated buffers and bioreactors, and that more training is needed on design so that practices can be completed at the county level.

CREP site construction in Wright County, Iowa.

TECHNICAL ASSISTANCE

Respondents noted that the situation for TA is something of a good news/bad news situation. The good news is that, given current demand for edge of field practices, existing resources and capacity are close to sufficient. The bad news is, of course, that if demand were to increase as is hoped, there is insufficient capacity and funding for TA, and in fact, concerns were raised about having already reached this point. It is assumed that NRCS will find it difficult to add additional staff, so suggestions to increase capacity included having another person with engineering expertise (possibly through IDALS), in addition to NRCS staff, to work on edge of field practices and help move projects along. Adequate engineering expertise was seen as important for designing and planning purposes, as well as for installation when questions regularly arise. However, the greatest bottleneck of the edge of field practice implementation process is waiting for approval from the area engineer for practices using federal funding. While it would be valuable to add engineering expertise at the county level, all designs still have to be funneled through the area engineer, and there is a significant need to speed up the approval process or increase the capacity of IDALS or private contractors to approve designs.

It was also recognized that there is a need to incentivize private companies and organizations to become more involved and show them the path to participate. Part of that process would include work by NRCS to streamline and clarify the TSP process so that more private companies become involved in conservation. The work done by the Iowa Soybean Association is an important example of how a private organization has been actively engaged in leading producers through the process of edge of field practice installation. Further engaging the private sector in best management practices could make adoption much more efficient and effective. Doing so would require an effective review and approval process, more expedited certainty, and adequate TA dollars. Increasing private sector opportunities could also be beneficial to young contractors as they consider edge of field practice installations as off-season projects.

FINANCIAL ASSISTANCE

As with TA, financial assistance (FA) is relatively sufficient to meet current demand for edge of field practices. Cost share has been relatively high: 50% to 75% regularly, with special projects involving other sources of FA receiving 90% or more. However, given the overall substantial cost of these practices, interviewees noted that current federal and state sources of funding would not be adequate to achieve WQI adoption goals. A suggested larger solution is to leverage private capital and apply lessons learned in water management.

A case can be made for community engagement with edge of field practices through the State Revolving Loan Fund's capacity for special projects. Special projects allow communities to leverage the interest from infrastructure loans to fund water quality projects and have been utilized effectively by several large and small communities. In areas with higher population centers and stronger urban infrastructure, there are often more funding options. Polk County SWCD, for example, has been able to acquire grants from nonprofits such as Prairie Meadows and the Nature Conservancy to fund wetland projects with a strong wildlife or community benefit. Higher population centers in Iowa, such as Ames, Des Moines, Sioux Center and Dubuque, use stormwater utility fees to fund conservation projects; however the projects must often have a flood mitigation component. This requirement can limit the suitability of bioreactors; saturated buffers; and, in many cases, wetlands. The same can be said for funding from Iowa's Watershed Management Authorities, which require practices to have a flood mitigation component.

Interview respondents stated that we cannot cost share our way into sufficient adoption—we need to look at new revenue streams such as tax credits, offsets by water utilities, commodity premium payments, and/or involvement of other stakeholders. Some respondents advocated re-engaging the Iowa Wetland Landscape Initiative or "Iowa Plan" for edge of field practices. It could also provide a path for going from the current 20 bioreactors to the 138,000 that are necessary and provide sustainable FA and TA funding. Lastly, project coordinators are still in need of a greater understanding of the range of programs for FA across the state.

KEY OBSERVATIONS

It was noted in a number of the interviews that adoption of edge of field practices has taken place primarily among conservation leaders, innovators, or early adopters. This situation is typical for the introduction of new practices and has been the case for other practices important to WQI, such as cover crops. As with cover crops, achieving adoption goals will require working with more than just the few innovative farmers and engaging the larger majority. However, as interviewees stated, several capacity issues need to be addressed before a statewide scale-up can be accomplished. In addition, there is still an untapped pool of innovative farmers who could very well become edge of field practice adopters. For that reason, these recommendations suggest a sequential approach that would (1) focus on increasing adoption among conservation-minded farmers and, in the process, (2) establish the knowledge foundation and capacity for expanding adoption beyond innovative farmers that, in turn, (3) creates demand and the rationale for increasing the level of investment to support edge field practices from additional sources.

Capitalizing on the potential for adoption among conservation-minded farmers would include several interrelated measures:

- ***Establish a systematic process to identify and recruit likely adopters that focuses on conservation-minded producers.*** The process would select operations for FA and TA based on ACPF, a targeted sociological profile of potential adopters, watershed priorities, and other appropriate assessments. It would be helpful to have a dedicated set of FA resources for this effort in order to ensure a sufficient number of projects and to aid in setting priorities. This would require creating better tools that comply with NRCS specifications to site edge of field practices and having a set of informed field staff to facilitate the identification process.

- ***Create a set of skilled field staff who can serve as the facilitators or "quarterbacks" for edge of field projects and document results.*** They would be based locally in the watersheds and include staff already engaged in this work with additional individuals added from the private and public sectors. These facilitators will fill the critical role of one-on-one interface with the farmer to walk them through the process and be on site during practice installation. In addition to their field roles, the facilitators would document, process results, and be a key resource for developing information and training to build capacity among public and private practitioners. In this way, they would serve both as facilitators for specific projects and as active participants in using their experience to create a greater knowledge base and capacity for subsequent adoption.

- ***Support increased capacity through a dedicated state edge of field coordinator.*** With the need for "quarterbacks" to facilitate the field-level adoption and implementation of edge of field practices, there is also a need to have a dedicated coordinator who can serve as the "coach". The coordinator would coordinate engagement with other agencies, companies, and organizations; guide outreach; facilitate field staff training and resources; serve as a hub of technical information; and coordinate the other various external stakeholders who will play a role in edge of field practice adoption.

- ***Develop a program of project-focused field days and in-service training to increase awareness and knowledge.*** Farmer leaders would be provided a comprehensive set of resources created by the edge of field coordinator and be guided through the resources by the local field staff. Farmers could then contact neighbors and convene local field meetings. Farmer interviewees indicated that they had led these kinds of meetings to demonstrate the practices and provide a chance for farmers to also interact with the technical support staff associated with planning, design, and

implementation. Singh et al. (2018) recently noted the importance of field days stating, "[l]earning from others who know about the practice, who are outside their usual networks, and who know the conditions in which they farm, help agricultural producers take a new idea and apply it to their operation." The program would also include field level in-service training provided for the private and public sector. The training sessions would be locally based, using project sites, and convened by the facilitators/quarterbacks in coordination with the edge of field coordinator. Training would be based on input from the facilitators, build on existing training and education tools, and would be conducted by ISU or other professionals. Training development and implementation would benefit from coordination with NRCS and contractor staff. In fact, respondents mentioned the need for increased availability of ISU training for field conservation staff and the value of including private sector staff in NRCS training. The field training could be a pivotal step in expanding the knowledge base for edge of field practice adoption and would increase the familiarity of conservation staff. Watershed coordinators would also benefit from having small area meetings annually to share feedback with IDALS and each other. The farmer meetings would help increase awareness and familiarity with edge of field practices among farmers in a hands-on setting. The in-service trainings would provide the means to increase edge of field awareness and knowledge among conservation and contractor staff that is necessary for successful outreach to farmers.

This approach synthesizes key ideas that were raised in the course of the interviews: the need to increase adoption, the need for greater awareness and understanding among farmers, and the need for greater knowledge and capacity among technical staff. A particularly important part of the approach is building a set of people who can be "quarterbacks" for developing and implementing edge of field projects. As noted in the interviews and farm meetings, having a quarterback who is knowledgeable to work with the farmer and coordinate work and interagency interaction is critical to efficient and effective design and installation. A further purpose of the facilitators is to document how to best carry out edge of field work and to assist in the design and ground-truthing of education and training efforts materials. A useful companion product from this effort could be a field guide to help staff in navigating the planning, design, and implementation of edge of field practices.

The advantage of this approach is that it makes it possible to expeditiously install additional practices with the most appropriate segment of producers. The approach is scale neutral and can be designed to fit the available resources; it could be organized on a regional basis in the state if that turned out to be more manageable. The approach also creates dedicated capacity for facilitating and documenting successful implementation efforts and offers a systematic, field validated approach for expanding awareness and knowledge. By creating that capacity and awareness, the approach also provides the experience and tools for expanding efforts beyond the initial set of early adopters.

The following three other measures mentioned in the interview process would be useful to carry out in parallel with the implementation work or on their own:

- ***A number of interviewees noted that engineering capacity is a serious limiting factor in increasing adoption.*** The option of adding edge of field practice engineering and design approval capacity at NRCS and IDALS was mentioned several times as the most promising option to increasing and expediting adoption. Additionally, there needs to be a revamped process for reviewing and including TSPs in conservation implementation.

- ***A continuing and effective process for identifying and resolving technical and policy issues that can slow or impede practice implementation will continue to be important.*** There was wide agreement that a process led by IDALS in collaboration with other agencies and engaged private partners would be an important component of progress on edge of field practice implementation.

PHOTO BY JAMES VEVERKA

CREP site in Dallas County, Iowa.

- ***To implement this suggested approach, an adequate source of funding for TA and FA must be made available.*** In this regard, respondents consistently acknowledged the necessity of additional sources of funding from private and public sources.

It is widely recognized that edge of field practices are important, if not essential, to achieving Iowa's water quality goals. While these practices are generally seen as effective and technically sound, implementation is still at initial levels. In addition to being relatively new, edge of field practices are relatively expensive to install and provide no real return to the productivity or net revenue of the farming operation. Increased adoption will depend on securing adequate financial support for implementation, increasing awareness and knowledge, providing further training and capacity, and overcoming institutional hurdles. Given the importance of the task and the early foundation that has been laid, a systematic approach to addressing those issues, along with adequate resources, is likely to draw substantial support in the agricultural and conservation communities and provide measurable progress in improving Iowa's water quality.

CURRENT RELEVANT INFORMATION AND SOURCES

FACTSHEETS AND WEBPAGES

1. ***Ten Ways to Reduce Nitrogen Loads from Drained Cropland in the Midwest.*** A publication by Illinois Drainage Research and Outreach Program that highlights practices designed to reduce nitrogen loads from cropland. Saturated buffers, drainage water management, bioreactors, and wetlands. http://draindrop.cropsci.illinois.edu/index.php/i-drop-impact/ten-ways-to-reduce-nitrogen-loads-from-drained-cropland-in-the-midwest/
2. ***Transforming Drainage.*** A project team of leading drainage researchers and extension specialists focused on addressing important drainage management questions. https://transformingdrainage.org/
3. ***Talking with Your Tenant About: Denitrifying Practices.*** A two-page overview of wetlands, bioreactors, and saturated buffers from Iowa Learning Farms. https://www.iowalearningfarms.org/files/page/files/TWYT%20%28denitrifying%20practices%29_web.pdf
4. ***Woodchip Bioreactors for Nitrate in Agricultural Drainage.*** A four-page overview of bioreactors from ISU Extension and Outreach. https://www.iowalearningfarms.org/files/page/files/PMR1008_bioreactor.pdf
5. ***Cleaning Iowa's Waters with Saturated Buffers in Iowa Watersheds.*** A two-page overview of saturated buffers from ISU Extension and Outreach. https://store.extension.iastate.edu/product/14441
6. ***Wetlands Implementation.*** A four-page overview of wetlands from Iowa Learning Farms. https://www.iowalearningfarms.org/files/page/files/Wetlands_think-piece_revised_4-9.pdf
7. ***Questions and Answers about Drainage Water Management for the Midwest.*** An eight-page overview by Purdue University Cooperative Extension Service. http://www.extension.purdue.edu/extmedia/WQ/WQ-44.pdg
8. ***The Iowa Watershed Approach – Wetlands.*** A two-page overview of wetlands from ISU Extension and Outreach. https://store.extension.iastate.edu/product/The-Iowa-Watershed-Approach-Wetlands
9. An informational webpage on ***CREP wetlands*** from IDALS' Water Resources Bureau. https://www.iowaagriculture.gov/waterresources/CREP.asp
10. Information on ***saturated buffers, bioreactors, drainage water management, and wetlands*** from the Iowa Agriculture Water Alliance. http://www.iowaagwateralliance.com/saturated-buffers/
11. ***ACPF Tool.*** http://www.nrrig.mwa.ars.usda.gov/st40_huc/satBuff.html
12. Iowa Nutrient Reduction Strategy ***Cost Tool Overview for Denitrifying Bioreactor***. https://www.nrem.iastate.edu/bmpcosttools/files/page/files/2016%20Cost%20Sheet%20for%20Denitrifying%20Bioreactors.pdf
13. Iowa Nutrient Reduction Strategy ***Cost Tool Overview for Wetlands***. https://www.nrem.iastate.edu/bmpcosttools/files/page/files/2016%20Cost%20Sheet%20for%20Constructed%20Wetlands.pdf
14. Iowa Nutrient Reduction Strategy ***Cost Tool Overview for Saturated buffers.*** https://www.nrem.iastate.edu/bmpcosttools/files/page/files/2016%20Cost%20Sheet%20for%20Riparian%20Buffer%20or%20Filter%20Strip.pdf
15. NRCS tool for ***saturated buffer design specifications***. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/il/technical/engineering/?cid=nrcs141p2_030572

VIDEOS

1. The Leopold Center for Sustainable Agriculture, “On the Ground” series that covers bioreactors and “Nabbing Nitrates: Before Water Leaves the Farm” series that includes wetlands, bioreactors, and conservation drainage. http://www.leopold.iastate.edu/news/other-videos
2. ISU Extension and Outreach video on bioreactors. https://www.youtube.com/watch?v=pQKtbDFd4A0
3. Iowa Farm Bureau, “Conservation Q&A: Saturated Buffer.” https://www.youtube.com/watch?v=pRB-CmLYQxyk
4. Iowa Farm Bureau, “Conservation Q&A: Wetlands.” https://www.youtube.com/watch?v=Wi-unOOoFwTE

WEBINARS

1. Iowa Learning Farms webinars on saturated buffers, bioreactors, wetlands, and edge of field practices generally. https://www.iowalearningfarms.org/page/webinars
2. The Ag Water Management Research Group at ISU webinars on controlled drainage, bioreactors, saturated buffers, and wetlands. http://agwatermgmt.ae.iastate.edu/
3. North Central Region Water Network webinar series on managing agricultural drainage. https://www.youtube.com/watch?v=VxDTd3bC8Vs&feature=youtu.be

PHOTO BY LYNN BETTS

Completed saturated buffer in Story County, Iowa. NRCS/SWCS.

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