Iowa Nutrient Research Center

WATERSHED STUDY FINAL REPORT

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CONSERVATION LEARNING GROUP:
A collaborative team to advance training, outreach, and research across land uses and production systems to increase overall sustainability of agricultural and natural systems for multiple generations to come

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Iowa Nutrient Research Center Watershed Study Executive Summary

The Iowa Nutrient Research Center (INRC) Watershed Study was designed to gather and report information that could be utilized by farmers, landowners, stakeholders, policymakers, and support agencies to better understand the short- and long-term impacts watershed improvement projects have had on improving water quality and reducing nonpoint source pollution.

To better understand motivations and propensities of all stakeholders with regards to watershed improvement projects, the researchers employed three primary research methodologies to assess and understand how watershed projects have been organized and pursued, what measured outcomes resulted, and how the outcomes are perceived by those involved in and/or living in the subject watersheds. Methodologies utilized included historical documentation review, stakeholder surveys and listening sessions, and comparison of standardized data within each comparison set.

Three sets of comparison watersheds were selected for this project. Each set was comprised of a HUC12 (hydrologic unit code, 12-digit) watershed with organized improvements and a similar non-contiguous but nearby HUC12 watershed.

Utilizing quantitative and qualitative assessment methods, the study focused on the following key questions:

1. What happens when the funding or paid project coordinator is gone?
    a. Are practices continued at the same or higher rates?
    b. Do farmers maintain, grow or abandon practices?
    c. Does public awareness and support continue?

2. How do managed watersheds compare with non-intervention watersheds that function under normal motivations, such as federal Environmental Quality Incentive Program (EQIP) funding or private investment?
    a. Are practice adoption rates similar over time?
    b. What attitudes and opinions about conservation are held and expressed by local stakeholders within intervention and non-intervention watersheds?

3. How do activities and maintenance of watersheds contribute to reduction goals established in Iowa's Nutrient Reduction Strategy (NRS)?

The analyses conducted in the study yielded limited differentiation in outcomes and performance within comparison sets. These results are at odds with the perceptions of participants who are likely influenced by the short-term successes which were publicly recognized in and beyond the local communities. Such recognition contributed to a "halo effect" which can skew the perceived value of watershed improvement projects.

Owing to the current patchwork of programs, funding and incentives for water quality improvement and conservation program implementation, the researchers found little to no long-term advantage in organized projects, which drew significant public and private investment and accolades, over ad hoc or individual efforts utilizing public and private funding.

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Purpose

This study was designed to gather and report information that could be utilized by farmers, landowners, stakeholders, policymakers, and support agencies to better understand the short- and long-term impacts watershed improvement projects have had on improving water quality and reducing nonpoint source pollution. With the understanding that across Iowa there are different environmental and cultural factors as well as differing perceptions of the importance and value of implementing conservation practices within watersheds, the study incorporates both quantitative analysis of practice implementation and results as well as qualitative analysis of stakeholder opinions, impressions and propensities regarding the value of pursuing conservation strategies in the short- and long-terms.

Situation Analysis

As the predominant industry in Iowa, agricultural production drives the state's economic health, but is also a major contributor to elevated levels of sediment, nitrate, phosphorus and other pollutants which compromise water quality in watersheds across the state. Pollutants are not deliberately released to waterways, but typically migrate from farm fields through the flow of water across and throughout a watershed. This broad-based migration of chemicals is considered nonpoint source pollution.

Addressing the negative water quality effects of nonpoint source pollution has proven to be a tricky enterprise. There is no spigot to turn off, but rather there are many different small contributors across a range of landscapes, land uses, cropping systems, and farming techniques which must be considered in mitigating loss of nutrients to waterways. Of these factors, farming practices and propensities have the most potential to affect change across the ecosystem.

The predominant approach to changing farming practices has not been through regulation, but rather through an intricate system of incentives to encourage voluntary adoption of best management practices. Education and outreach programs and centers of knowledge such as the Iowa Nutrient Research Center (INRC), statewide Iowa State University Extension and Outreach programs, USDA Natural Resources Conservation Service (NRCS) centers, and independent farming and conservation organizations, work consistently to provide farmers with information and advice on best practices to reduce nutrient loss, manage water flow, and navigate incentive and support programs.

The breadth and variety of programs and messages from different governmental organizations can also cause some confusion and have contributed to a patchwork of organized and coincidental watershed improvements across the state. While federal agriculture agencies have promoted incentive programs, the U.S. Environmental Protection Agency (EPA) has approved the devolution of authority in addressing nonpoint source pollution by promoting a local-level approach through voluntary watershed management.

Voluntary watershed management seeks to combine agency expertise, citizen knowledge and place-based interests to address water quality issues. Across Iowa and over time, we have utilized variable approaches to the engagement, adoption and sustainability of voluntary water quality and conservation practices through watershed management. These approaches are usually assessed at the time of implementation, but there has been little to no evaluation of their long-term effectiveness to motivate sustainable change.

Understanding the motivations of farmers to participate in various federal, state, and privately funded programs for conservation practice adoption and the ability to measure success of these activities with respect to the dollars invested and the long-term effects on water quality within and downstream from the local watershed, is critical to planning and the potential improvement of funding programs and structures. In addition, gaining a clearer understanding of local norms and beliefs can help inform policy decisions intended to increase participation in pursuit of achieving goals established in the Iowa Nutrient Reduction Strategy.

Goals/Objectives

This study was designed to help understand how watershed projects have been organized and pursued, what measured outcomes resulted in both the short-term and long-term, and how the outcomes are perceived by those involved in and/or living in the subject watersheds. Utilizing quantitative and qualitative assessment methods, the study focused on the following key questions:

1. What happens when the funding or paid project coordinator is gone?
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3. How do activities and maintenance of watersheds contribute to reduction goals established in Iowa's Nutrient Reduction Strategy (NRS)?

Three sets of comparison watersheds were selected for this project. Each set was comprised of a HUC12 (hydrologic unit code, 12-digit) watershed with organized improvements and a non-contiguous but nearby HUC12 watershed. Three study watersheds were selected based on the interventionist watershed projects funded over the last couple of decades and the short-term successes that have been documented in each. The other three watersheds were chosen because of their proximity and similarity to the first three watersheds in terms of access to general technical and financial assistance, but for these there has not been any focused intervention beyond normal state and federal programs.

Data Collection Methodology

Data collection strategies consisted of three research and direct interaction processes detailed below.

Historical Documentation

A review of the history of the three subject watersheds since the early 1980s was conducted, including cultural and economic issues that have influenced conservation and water quality attitudes and adoption over the review period.

The three intervention watersheds selected had all been recognized beyond the local community as examples of successful conservation projects which incorporated private investment and agency resources to directly affect the health of the local watershed. Each project was researched through extensive archival searches for coverage in periodicals, online reports, research studies and mainstream media features.

A listing of identified sources is included in *Appendix A: Historical Research Reference Table.*

Surveys and Listening Sessions

A written survey was distributed to all known addresses within and near the subject watersheds to gather data regarding watershed improvement activities, knowledge about the watershed itself, and motivations behind the implementation of watershed improvement and conservation practices that have been implemented. The survey was conducted concurrently with the Iowa Learning Farms (ILF) 15-Year Farmer Survey that included all participants in ILF field days in the preceding 15 years. The same survey questions were used in the project surveys and the ILF 15-Year Farmer Survey, facilitating comparison of data between the two instruments. The surveys were conducted following best practices in the survey design literature (Dillman et al., 2009). A sample survey is included in *Appendix B: Sample Survey.*

Researchers also facilitated listening sessions with farmers who own or manage farms within the three subject watersheds or who participated in some manner with the organized watershed intervention projects. These listening sessions were conducted by Jacqueline Comito in July 2018. The purpose of the listening sessions was to gather data regarding local norms, attitudes and propensities influencing historical, ongoing and potential conservation practice implementation. Participants were also asked to offer insights and recommendations on methods for funding watershed improvements, assessments of the success of their watershed projects, opinions regarding the viability of the current voluntary system, and suggestions for increasing and maintaining participation among farmers in independent or organized watershed improvement efforts.

In addition, a listening session was facilitated with 25 watershed coordinators from across Iowa to gather data regarding the management of organized and independent watershed improvement activities in different counties and regions of the state. The session was conducted by Jacqueline Comito in October 2018, and was focused on identifying the challenges facing watershed coordinators, methods of engagement with farmers, and insights regarding the measurement or determination of watershed improvement project successes.

Evaluation of Standardized Data between Comparison Watersheds

Comparative analysis of best management practice (BMP) implementation between the comparison watersheds was conducted utilizing data from the BMP Mapping Project (https://www.gis.iastate.edu/gisf/projects/conservation-practices) conducted by Iowa State University researchers. The BMP database includes a complete baseline set of BMPs dating from the 1980s-present timeframe for use in watershed modeling, historic occurrence, and practice tracking. The BMPs mapped include terraces, contour buffer strips, stripcropping, grassed waterways, farm ponds and water and sediment control basins (WASCOBs). Detailed comparison data are included in *Appendix C: BMP Results.*

Expected Outcomes

Expected outcomes of the research would include 1) increased understanding of long-term sustainability of alternative voluntary watershed improvement project strategies, 2) input to policymakers on successful strategies for the Nutrient Reduction Strategy adoption and 3) clearer assessment rubrics for evaluating success and impacts of watershed intervention project practices and management structures and 4) determination of differences between quantitative water quality improvements and perceived improvements which may be influenced by the attitudes and social factors related to project advocates and participants.

Key Questions

1. What are short-term success metrics?
2. What are long-term success metrics?
3. Is there a Halo Effect associated with organized watershed improvement projects?
4. How do interventionist project outcomes compare with non-organized watersheds?

SHORT-TERM SUCCESS

Characteristics related to short-term success include:

- High farmer participation and ownership of the problem
- Distribution of financial and technical assistance to implement practices where they will best impact water quality
- Committed coordinator (formal or informal)
- Motivation to solve problems that allows diverse group of stakeholders to stay engaged throughout the project
- Activities in the watershed including field days and other high profile means of communication

LONG-TERM SUCCESS

Characteristics related to long-term success include:

- Continued water quality improvement over time
- Conservation and water quality practices become the norm in the same fashion as nutrient management and pesticide application
- Stakeholders accept environmental responsibility
- Improved social conditions in watershed—more awareness, trust and social capital—improve ability to identify and respond to emerging problems faster

HALO EFFECT

Halo Effect: The tendency for an impression created in one area to influence opinion in another area. In terms of watershed projects, the level of effort and involvement of stakeholders has a tendency to inflate the perceived project impacts. Early successes and measurable improvements are well-remembered and can carry forward an unrealistic influence on the perceptions of participants even if conditions and outcomes level off or move backward. This effect can also be impacted by outside influences such as awards, public recognition and press coverage, which can elevate the perceived value and success of the program or project.

Subject and Comparison Watershed Selection

For each of the three watershed project areas, a nearby, noncontiguous HUC12 watershed that was not associated with a formal watershed project or program was selected as a comparison control watershed. Watersheds were selected which had as many biophysical and social factor similarities as possible. Attention was also paid to administrative consistency, including access to agency programs and resources, as well as conservation and agricultural leadership and other public and private conservation services available across the two watersheds.

Subject Watershed Project Funding Summary

The three subject watersheds received significant funding and support from various grant and sponsorship sources:

Farmers Creek (2006–2009)

- Agency-led with a watershed coordinator and farmer advisory group
- Focus on sediment reduction
- $61,843 (WIRB and Iowa DNR REAP)
- $200,000 (Farmer investment)
- $285,000 (IDALS)
- $362,000 (USDA EQIP technical and financial assistance)

Hewitt Creek (2004–2015)

- Farmer-led with ISU Extension facilitation
- Focus on nutrient reduction
- $755,000 (WIRB, Farm Bureau, Iowa Corn Growers Association)
- $80,937 (Estimated cooperator in-kind contribution to the project)
- $5,400,000 (2010 USDA MRBI—a portion of this grant was available to the watershed)

Middle West Fork of Crooked Creek (2009–present)

- Hybrid farmer-led, ISU Extension facilitation and NRCS/SWCD leadership
- Focus on nutrient reduction
- $484,000 (2013 WQI demonstration project award)
- $779,500 (2016 WQI project renewed)
- $2,093,000 (WQI total—a portion of this grant was available to the watershed)

Comparison Selection Criteria

Project and control watersheds were selected based on considerations of multiple characteristics, including:

- Cost-share opportunities
- Location within same county to assure comparable availability of NRCS and Soil and Water Conservation District (SWCD) practice implementation assistance as well as similar public and private conservation and agricultural leadership
- Total watershed area
- Proportion of row crop acres to total watershed area
- Percentage of Highly Erodible Land (HEL): row crop land that is classified as having a representative slope gradient value greater than 5%

Data resources accessed to determine applicability for the study included:

- Soil Survey Staff, United States Department of Agriculture-Natural Resources Conservation Service. Web Soil Survey. Available online at https://websoilsurvey.nrcs.usda.gov/. Accessed 01/03/2019.
- GIS Facility, Iowa State University. BMP Mapping Project. Available online at https://www.gis.iastate.edu/gisf/projects/conservation-practices. Accessed 06/20/2019.

Figure 4. Location of Project and Control Watersheds

Table 1. Comparative Characteristics of Project and Control Watersheds

Study Watersheds					
HUC12 Name	**Study Status**	**Total Watershed Acres**	**Year**	**Annual Row Crops (Acres)**	**Highly Erodible Land Row Crop Acres (as Percent of Total Row Crop Acres)**
Comparison Set 1					
Farmers Creek	Project Area	30,579	2008	12,199	88
			2012	13,873	89
			2017	15,527	89
Hainer Creek	Control	21,657	2008	4,305	77
			2012	5,509	84
			2017	6,735	84
Comparison Set 2					
Hewitt Creek	Project Area	22,836	2008	14,466	56
			2012	15,217	58
			2017	16,074	59
Johns Creek	Control	21,745	2008	12,884	58
			2012	12,862	60
			2017	13,604	60
Comparison Set 3					
Middle West Fork of Crooked Creek	Project Area	33,520	2008	21,358	22
			2012	21,410	22
			2017	22,105	23
North Fork Long Fork Creek	Control	21,469	2008	16,347	24
			2012	16,177	25
			2017	16,640	25

Comparison Data Sources and Methods

Three major data sources were accessed to gather data for comparison across the study period:

- Iowa Best Management Practices (BMP) Mapping Project: a public/private collaboration involving ISU and other organizations to identify and track BMP implementations from 1980 through present.
- Iowa Department of Agriculture and Land Stewardship (IDALS) and USDA-NRCS cost share data regarding cover crop utilization.
- USDA Cropland Data Layer
    - Extended rotations
    - Pasture, hay and other perennials

BMP Data Analysis

Seven in-field, edge-of-field and land use change BMPs were evaluated as indicators of conservation behavior in the project and comparison watersheds. Study BMPs were terraces, contour buffer strips, stripcropping, grassed waterways, farm ponds and water and sediment control basins (WASCOB) adoption during three time periods—the 1980s, 2007-10, and 2016-17—utilizing publicly-reported data through the Iowa BMP Mapping Project.

Cover Crop Adoption Data

Cover crop adoption data were gathered through a database of state public conservation program (i.e., state cost-share) and federal EQIP contracts. These databases allowed tracking of cover crop acres that were partially funded by public programs, but do not capture the use of cover crops outside of these programs. This represents an underreporting of total utilization, but self-funded cover crop deployments are a relatively new development and can be assumed to be statistically insignificant and relatively evenly distributed across each comparison set due to the close proximity between the project and control watersheds. Cover crop data are shown in *Appendix D: Cover Crop Results.*

History of Watershed Projects

All three project watersheds had been recognized by the general public and organizations outside the core participating group.

Farmers Creek

The period of the Farmers Creek watershed improvement project was 2006-2009.

The Farmers Creek Watershed Project was undertaken to address the listing of the waterway on Iowa's 303(d) List of Impaired Waters in 2002. The listing was attributed to unacceptable levels of nutrient loading and sedimentation. The project was awarded a three-year grant in 2005 to reduce nutrient and sediment loading by 40%, concentrating on critical areas along the stream corridor. The grant was extended through June 2009 after delays in structure design certifications and approvals.

The project was named the Conservation Districts of Iowa (CDI) Outstanding Watershed Project in 2006. The project was also recognized by conservation groups and planners across the state as a successful model of voluntary watershed improvement.

In the Farmers Creek Watershed Project Final Report published in 2009, positive outcomes included broad participation and improved water quality. The report also highlighted the social benefits of the project, noting there was a change in human behavior related to livestock watering systems. As a result of the Alternative Watering Field Day, one landowner decided to install cattle approaches and another implemented rotational grazing with a solar pump as the water source.

CONSERVATION Showcase

NRCS

Small Waterway Offers Big Challenges

Farmers Creek is a small waterway with big problems. It twists and turns for 17 miles through Jackson County in northeast Iowa before draining into the North Fork of the Maquoketa River. On the state's 303(d) List of Impaired Waters, the Iowa Department of Natural Resources (IDNR) says Farmers Creek suffers from excessive sediment, nutrient loading, and fecal contamination. The watershed is home to about 6,000 cattle with about 86 percent of the 30,590 watershed acres classified as highly erodible.

While Farmers Creek has its water quality and erosion problems, it also has farmers and conservationists working together to fix them; people like Bob and Judy Kremer, Ernie and Janice Felderman, John Deppe, and watershed coordinator Michelle Turner.

Work to improve the watershed began January 2005 with special funding from IDNR, the Iowa Department of Agricul-

Bob and Judy Kremer

(NRCS) with project management provided by the Jackson Soil and Water Conservation

Figure 5. Conservation Districts of Iowa (CDI) named the Farmers Creek Watershed Project winner of their 2006 Outstanding Watershed Project Award.

Hewitt Creek and The Hewitt Creek Model

The period of the Hewitt Creek watershed improvement project was 2004-2015.

In local news coverage, the Hewitt Creek Watershed project was lauded as a farmer-led effort to clean up Hewitt and Hickory Creeks, billing itself as "a model for Iowa and the Midwest." The project was launched in response to the creek being declared impaired due to elevated levels of sediment, nitrate and phosphorus, by state and federal officials.

Researchers at ISU have also memorialized the Hewitt Creek Model as a guide for groups seeking to implement watershed improvement projects. One example is "Performance-based Environmental Management - The Hewitt Creek Model," published May 2018, and available from the ISU Extension Store.

In the Hewitt Creek Watershed Project Final Report published in 2009, noted accomplishments included improved macroinvertebrate and fish populations, widespread watershed resident participation and development of a watershed community, and significant reductions in sediment and nutrient delivery. In 2015, the Hewitt Creek Watershed Improvement Association reported that project participation in the watershed had reached 85% among local farmers.

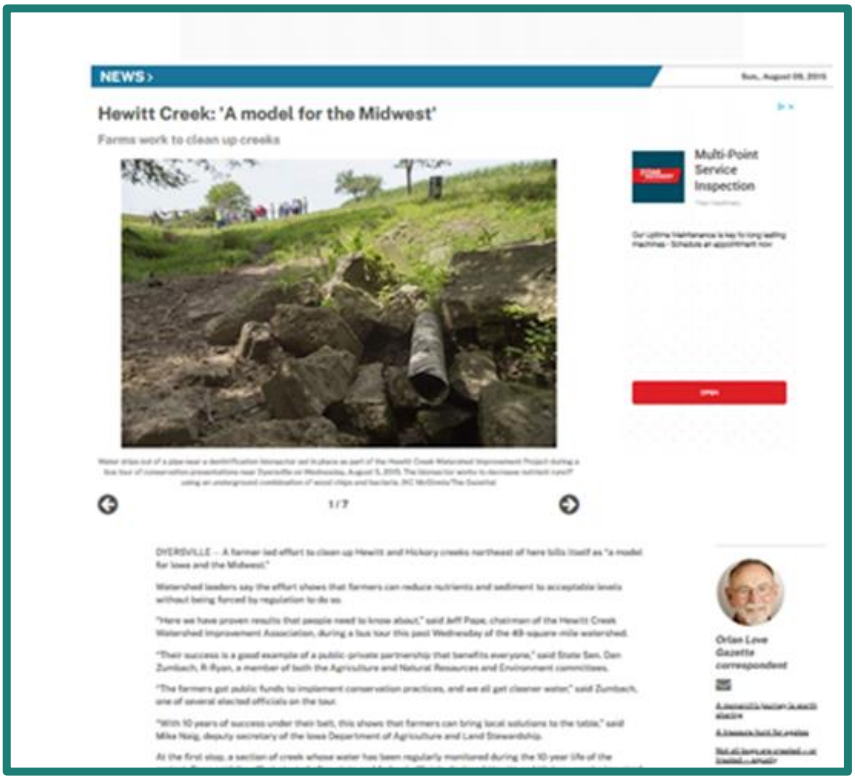


Figure 6. Hewitt Creek: "A Model for the Midwest" news coverage

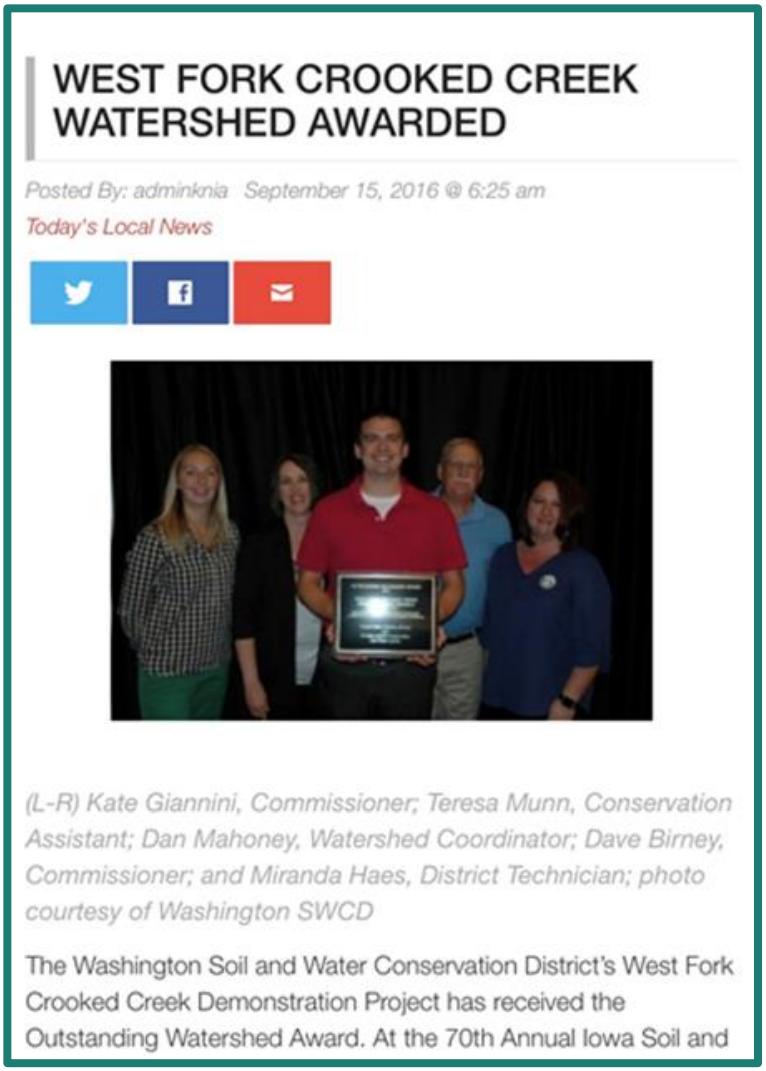
Middle West Fork of Crooked Creek

The period of the Middle West Fork of Crooked Creek watershed improvement project was 2009–present (2021). The project began with an ISU Extension-facilitated leadership training and engagement in cornstalk nitrate and soil metric evaluation by watershed farmers. The project later expanded to include the Upper and Lower West Fork Crooked Creek HUC12 watersheds to form the West Fork Crooked Creek Water Quality and Soil Health Initiative to support the Iowa Nutrient Reduction Strategy and the Iowa Water Quality Initiative by working with producers within the watershed in Washington and Keokuk counties.

Participating farmers have access to funding to support implementation of cover crops, bioreactors, wetlands, and grassed waterways within the watershed. The primary focus of this project is reduction of nitrate and phosphorus levels in the waterways. Of the study watersheds, this is the only project in progress at the time of this study. https://www.cleanwateriowa.org/west-fork-crooked-creek-water-quality-and-soil-health-initiative

Named the winner of the CDI 2016 Outstanding Watershed Award, the West Fork Crooked Creek watershed project has been recognized as a success throughout Iowa and is considered a model for watershed improvement activities. The project is also featured as a success story on Clean Water Iowa. In addition, this watershed project was subject of a 2008 case study by ISU's Lois W. Morton highlighting how civic structure and social connections among farmers in a common watershed provide an effective strategy for creating performance-based goals that can lead to better water outcomes (Morton, 2008).

The West Fork Crooked Creek Water Quality and Soil Health Initiative was expanded to incorporate the Long Creek watershed in early 2020. https://www.kciiradio.com/2020/01/13/long-creek-added-to-west-fork-watershed-project/



WEST FORK CROOKED CREEK WATERSHED AWARDED

Posted By: adminknia September 15, 2016 @ 6:25 am

Today's Local News

(L-R) Kate Giannini, Commissioner; Teresa Munn, Conservation Assistant; Dan Mahoney, Watershed Coordinator; Dave Birney, Commissioner; and Miranda Haes, District Technician; photo courtesy of Washington SWCD

The Washington Soil and Water Conservation District's West Fork Crooked Creek Demonstration Project has received the Outstanding Watershed Award. At the 70th Annual Iowa Soil and

Figure 7. News coverage of West Fork Crooked Creek Watershed receiving award.

Survey Data Summaries

For each watershed, mailing lists were compiled from plat maps, allowing for a wide margin beyond the watershed boundaries to ensure all those living within were included. Responses were only included in the analysis set if the respondent self-identified as being within the watershed.

The surveys used the same questions as the ILF 15-Year Farmer Survey that was conducted contemporaneously.

Questions were designed to elicit quantitative data regarding practice implementation as well as quantitative information regarding networking and information sharing, community influences, and perceptions and attitudes toward conservation.

Table 2. Survey Data Comparison: Conservation Practice Adoption

	Hewitt Creek n=67	**Farmers Creek n=59**	**MWF Crooked Creek n=122**	**ILF 15-Year n= 904**
Average acres farmed	321	313	413	704
Total acres of no-till/strip-till implemented by respondent	5,917 (28% of acres)	5,508 (39% of acres)	21,144 (56% of acres)	254,516 (42% of acres)
Total acres of cover crops planted by respondent	2,007 (10% of acres)	3,014 (22% of acres)	7,985 (21% of acres)	132,695 (22% of acres)
Cost share used for cover crops	50%	62%	79%	67%
Average years planted cover crops	1	3	7	7

Table 3. Building Social Capital: Farmer-to-Farmer Connections

	Hewitt Creek n=67	**Farmers Creek n=59**	**MWF Crooked Creek n=122**	**ILF 15-Year n= 904**
I discussed +/- of using no-till/strip-till/cover crops/prairie strips with my landowners/tenants	36%	41%	42%	66%
I networked conservation ideas with other farmers	30%	34%	35%	61%
# of field days attended in last year	0 = 79% 1+ = 21%	0 = 71% 1+ = 29%	0 = 74% 1+ = 26%	0 = 27% 1+ = 73%

Survey Data Observations

The data reported by respondents do not necessarily agree with the data from other sources with respect to the size and makeup of the watershed and implementation of practices within its boundaries. Through review of the survey responses and the listening sessions it is evident that most of the farmers do not relate to being in a watershed, but rather identify with being in a certain county.

Looking at no-till/strip-till, Middle West Fork of Crooked Creek (56%) was significantly higher than the level reported by ILF respondents (42%), Farmers Creek (39%) was a similar rate and Hewitt Creek (28%) was substantially lower. Some of these may be related to different land types within the watersheds.

Cover crop implementation reporting was similar between ILF (22%), Middle West Fork of Crooked Creek (21%) and Farmers Creek (21%), while Hewitt Creek (10%) was significantly lower. In addition, Hewitt Creek respondents reported an average of one year for cover crop planting, indicating that use of cover crops was a relatively new concept in the area. Farmers Creek respondents reported an average of three years of cover crop planting, and those in Middle West Fork of Crooked Creek reported seven years, which was on par with the ILF responses.

When reporting cost-share, Middle West Fork of Crooked Creek farmers appear to be utilizing cost-share at the highest rate (79%) versus 67% for ILF, 62% in Farmers Creek and 50% in Hewitt Creek. When combined with the seven-year average for cover crop planting, this indicates many farmers are continuing to rely on cost-share as a normal long-term practice.

The survey questions regarding social capital and building farmer-to-farmer connections showed a significant difference between the subject watersheds and the ILF responses. A review of the survey data alone shows lower rates of tenant-landowner conversations about conservation practices ranging from 36-42% in the project areas compared to 66% by ILF respondents. Networking with other farmers about conservation ideas in the watershed project areas was also approximately half of what was reported by ILF respondents.

The most significant difference between the ILF survey and the project watershed responses was related to field day attendance. Watershed project area farmer participation was nearly an inverse of that reported by ILF farmers, with attendance at one or more field days at 21% in Hewitt Creek, 29% in Farmers Creek, 26% in Middle West Fork of Crooked Creek and 73% for ILF respondents.

These differences were further explored in the listening sessions.

Listening Sessions

The goal of the listening sessions was to stimulate conversation with and between participants in an effort to explore and expose ideas, opinions and attitudes about conservation efforts and the current voluntary, funding program-based approach to incentivizing farmers to participate in improving water quality in their local watersheds. In addition, broader adoption of BMPs in pursuit of meeting the Iowa Nutrient Reduction Strategy goals was discussed.

Other key topics raised in the listening sessions included:

- Motivations for Adoption
- Farmer-to-Farmer Connections and Education
- Perceptions on Partnerships
- Expanding Participation and Deployments
- Priorities for Future Funding
- Compliance and Measurement
- Needs Going Forward

Listening session invitations were issued to farmers in each watershed area who were directly involved in the watershed project or whose land was impacted by some part of each project.

Listening sessions were conducted in July 2018, as follows:

Table 4. Farmer Listening Sessions

Watershed	Number of Participants	Gender	Age Range
Farmers Creek	8	7 men 1 woman	50-85
Hewitt Creek	9	9 men	50-80
Middle West Fork of Crooked Creek	11	10 men 1 woman	50-80

A separate listening session was conducted with 25 watershed coordinators from across Iowa to gain perspective on watershed improvement project implementation and farmer BMP adoption.

Key Feedback or Discussion Points—Farmers

MOTIVATIONS FOR ADOPTION

Respondent (R): We're the cover crop capital of Iowa. This last year we had more acres than any other county, and I would give that probably to the watershed group.
(Middle West Fork of Crooked Creek [MWFCC] 1807)

R: I think the reason that cover crops have done as well as they have as far as adoption is because there appeared to be an economic return to having done it. No matter what other incentive you apply to any program, tax incentive or just plain help in one shape or another. The thing that makes it work the best or to be adopted is if it works and it produces an economic return, because long term unless there's an economic return, I don't think anything will survive.
(Farmers Creek [FC] 1807)

Moderator (M): So, no-till makes a lot of sense in these scenarios. Is that something that happened as a result of the watershed [project], or is this a trend that just was happening up here?

R: I like to think both. I'm not sure which happened first, but again I think it's something—your neighbor practices and you see it, and it looks to be successful, so why don't you try it. You know, you try it yourself. Or you read about it enough in enough articles. Why do I want to do all of that extra tillage? Am I really helping myself or am I hurting myself?
(FC 1807)

R: Well, I think it started with the watershed. People started understanding what you can do and how you can do the cover crops and make it work. And as people did more, other people got comfortable. So besides that, the NRCS is offering funding for it. Because for most of the guys, the only benefit is saving their soil, and some of them are still looking for financial benefit.
(Hewitt Creek [HC] 1807)

R: We have quite a few people that don't till, you know, a lot of cover crops in this county, too, and that's all stuff that started after watershed was more… People putting cover crops in and watched them. People knew it.
(HC 1807)

R: Well, I got involved in this because it drives me nuts to watch my ground wash away when we had those four- and five-inch rains and it would come running out of the field and make erosion in the fields and whatnot, wash out ditches. That's just unacceptable for me.
(HC 1807)

FARMER-TO-FARMER CONNECTIONS AND EDUCATION

R: Well, people that are reluctant to try and if they have cost share and if they know they can break even on it at least, they're more willing to give it a try. And if they try it, and there's enough people that were doing it in the county, at field days you can learn a lot how people were being successful at it. So, you change your management to make it work.
(MWFCC 1807)

R: Well, education, I think. This group by far would probably say the education they got is what set them on their way as far as doing something. It was in a smaller group setting at our watershed meeting and the education came through C and J (ISU Specialists). And they brought information from Iowa, ISU and brought it to us.

R: A lot of it was farmer to farmer, too.

R: Yeah. Guys would say, "Do this. Don't do that." And "I tried this."
(HC 1807)

M: Could education improve in the area? You think that better outreach, more field days? Do field days matter?

R: Not a lot.

R: If you have time. (FC 1807)

R: I think part of it is where the field day is. If it's in your neighborhood and that's what J (name omitted) used to do—he had several of them—and, you know, if you go to your neighbor and it's only a mile away and he's making it work, then you can talk to him one-on-one and say—how do you do this and so on. So I think it's maybe more location and proximity than it is the number of them you go to.
(MWFCC 1807)

R: The NRCS has pushed it really hard, and I think we've got one of the best NRCS offices in the state probably as far as conservation goes.

M: ...It can't just be the NRCS office, because we have good NRCS offices [in other counties].

R: Progressive farmers, I think...I think we've got really progressive farmers in Washington County that are willing to try things.
(MWFCC 1807)

R: Well, as the discussions happened in the meetings, they started, you know, well, waterways don't work. Well, they do if they're wide enough. But as M (name omitted) said earlier, if it's not wide enough and the water goes down both sides, you got two ditches instead of one. And once they understood that you've got to have some dip and it's got to be wide enough to handle the water, I think that was part of the conversation at the meetings, too. Then they started understanding it.
(HC 1807)

R: Yeah, there's got to be an economic benefit to it.

R: And you have to be able to make people aware that there is. Everybody comes in a little skeptical about cover crops because there's a cost associated with it. You know, people look across the fence and see that maybe there isn't a penalty, you know, in the spring planting into a cover crop, and that does a lot more good. If you see your neighbor doing it and it's working, that's probably a lot better than a third party telling you.
(HC 1807)

R: I think that's good, but it all comes back to—and I say this all the time, and these guys are probably tired of hearing me say it all the time—but education is… I think we've got to look at some true funding to educate the people of how their nutrients move. We as farmers assume we understand crop cycle, growing, and nutrients and all that pretty well. I don't think there's a whole lot of them that went to these meetings who can't say that they didn't learn something about nutrient moving and how it moves, that made changes in their operation because of it.
(HC 1807)

R: Got to see it in the field. Talk to who's doing it.
(MWFCC 1807)

PERCEPTIONS ON PARTNERSHIPS

R: We went through the NRCS office, and they come out and they had their certain rules and regulations that they have to abide by... and I think they should have listened to a farmer on that, and listened to some of your contractors…'Cus them guys, they do that all the time. They know how to do that. The cost to have a contractor come in and make that facility, that structure, versus the cost of having it done according to standards of the NRCS are significantly different. … And I'm not saying that NRCS is completely wrong. They're building the thing to last, pretty much forever, which is the right idea. But I think most of these contractors have done enough of it that they can come in and do that just as well with a lot less money.
(HC 1807)

M: Do you feel like you have the local support here to help you if you want to try to do new practices there?

R: I think we've got a good local staff, and I think they're limited to what they can do with what's the programs, what they have to work with. We've got knowledgeable people in the office.

M: … but do they have time?

R: You mean hold hands for everybody?

M: Not to hold your hand but I've heard in other watersheds that having somebody come out and actually help them do a water test changed how they saw things when they saw what the quality was coming off of their land.

R: Well, anybody can grab a jug of water when water is running off their land.

M: But not everybody is.

R: I know, but if you want to know, you'll go out and get it. I don't think we need to require or hire a person to come out and grab a jug of water.
(FC 1807)

R: Yeah, they [watershed coordinators and agency staff] don't need to waste time with most of us in this room but they need to go find the places that need some help and get them assistance and do what it takes.
(MWFCC 1807)

R: The other thing is we had control over what we spent and how we spent the money. I mean, we kind of decided what we were going to prioritize every year, and at the end of the year the funds were just kind of divided up. The first year for sure it'd be like—well, maybe we can pay you this, maybe we could pay you that; it depends on how many acres we get.

R: Exactly, and having the control again by the watershed group instead of having someone on the other end of the county telling you what to do. It's like everybody kind of knows what needs to be done—most everybody can see that. (HC 1807)

EXPANDING PARTICIPATION AND DEPLOYMENTS

R: It goes back to probably a tax incentive. I'm in favor of compliance to participate in farm programs, but they need to be policed, and that then steps over the toes of our independent desire to run our business. So it's a tough situation… it's education and an incentive. And, but at the same time they can be… Self-compliance can be a tough one to police. So within the confines of education that you talked about, put the media out, I think we need to… Incentive in terms of tax incentives or… Doling out cash seems to be kind of a bad omen, although we all take it and we all appreciate it, I'm sure. But that gives us a black eye in agriculture, but other incentives are there. (FC 1807)

R: Well, people that are reluctant to try and if they have cost share and if they know they can break even on it at least, they're more willing to give it a try. And if they try it, and there's enough people that were doing it in the county, at field days you can learn a lot how people were being successful at it. So, you change your management to make it work. We also had no-till probably started in this county 40 years ago or so. And we're probably one of the leading counties in no-till I would guess too, so the farmers are willing to look at things that have to do with conservation, I guess. (MWFCC 1807)

R: It's just how do you get people to try something new, different. That's the issue, young or old. We have young people that don't want to try something new and not only older people. They say the older people are set in their ways. That's not true. Older people will change. I see younger people that don't want to change, and we have to all change. (HC 1807)

R: As far as people not getting in, I agree with whatever you said, you know, they're afraid of it. They're afraid of change. The other side of that is, though, there are some people that didn't get into it that I've seen switch their ways because everybody around them was doing it.
(HC 1807)

PRIORITIES FOR FUTURE FUNDING

R: I'm going to go strong on the cover crops. I'm a big believer in that. I know they're not an every year thing, but without them we're not trying though either—we're doing nothing. So I'm going to be very supportive of that.
(FC 1807)

R: I think establishing and maintaining the waterways is the biggest and also your buffer strips.
(FC 1807)

R: As much as I appreciate the cost-share that we're getting on cover crops, I guess I would be willing to take a little bit less cost-share, since I've done it for a while, and make more money available for people to try it the first time and help them have a little bit more on their first attempt at it.

M: So it's almost like a tier—it's like if you're doing it for the first… If this is your first shot, you're going to maybe get this. To help you sustain, you're going to get this. That sort of tiered. Is that what you're thinking?

R: That's what I'm saying

R: And, yeah, it needs to be like a multi-year commitment to cover crops for that individual farmer, not just a one-year thing.
(MWFCC 1807)

COMPLIANCE AND MEASUREMENT

R: I don't know which watershed in Iowa is the worst, but pick one, and maybe there needs to be a moratorium on tiling projects in that area unless certain steps are followed, that waterways are present and maintained correctly, and that you have this bioreactor in place to stop the nitrogen runoff. I don't think any of us want more rules. Don't leave here and say I told you, you need to go and do this, but to see that there is an interaction between all these programs seems to be something that we aren't looking at, at all, either.
(FC 1807)

R: Yeah, and nobody does anything anymore with our watershed. There's no water sampling. Nobody comes to my bioreactor anymore. I mean, there's nothing, nothing going on.
(HC 1807)

NEEDS GOING FORWARD

R: Don't disband the watershed groups.

R: Yeah.

M: So how do you not do that? That's a great thing. How do we…

R: It was a dumb thing that they quit funding us. It's like really?! We've got all the structure and the people involved.

R: If you talk to farmers, the thing they dread is EPA regulation, so maybe say that you've got to come participate in a watershed group. You know, we all live in the watershed, so that'd be a natural progression to say, "Well, you live in a watershed. This is your responsibility. At least come listen."

R: I think if there would be money… I mean, having those meetings, there were a lot of ideas that were just being tossed around.
(HC 1807)

Key Feedback or Discussion Points—Watershed Coordinators

TIME IN THE JOB AND TIME ON TASK

R: I did not have a plan at all. We just finished actually our watershed management plan in June.

M: And how many years into your job did you plan?

R: November will be two years.

M: OK.

R: So when I started, I'm the third coordinator since its inception in 2015.

R: That's just it, yes, yeah, and because they only fund us every three years. I don't know about anybody else, but I have to write an extension every three years to fund the position, there's no permanency. But yet they want us there. There has to be trust. There's not a lot of trust with me being the third coordinator, her being the fourth. And that kind of stuff all comes into play, and I don't think they look at that.

R: So what I think I need is that we talked about the longevity, but I need transparency. So with Water Quality Initiative funding and doing extensions every three years, the lack of transparency of how things are actually going to work, and if you're meeting their expectations, last-minute telling you that your career might be in jeopardy is not a good way of doing it.

R: All right, so if the Nutrient Reduction Strategy is going to be successful, the one place this thing is lacking in every district is they don't have time to knock on doors.

CONSISTENCY AND TRANSITION

R: When I first started, I had one project where I was a district employee that I did the assessment and got it going, you know, with the office. And the other project I got thrown into, and that project we got thrown into is actually a nightmare. And if you have no background on it, it's frightening. You don't know who to call. You don't know anything.

R: The trouble with being the project coordinator, you have a lot of duties. There is a huge learning curve to it, it takes three, four or five years to really get…

R: I think a lot of that kind of sink or swim really depends on the field office that you're in… or if you're in a field office, some of those sitting around are not in a field office. But on the local level if they've got a history of watershed projects and they kind of can guide you through that, that makes a lot of difference. Whereas maybe they haven't had many watershed projects or you're the first project in that county or area, and they may not know what's the best way to facilitate that.

COMMUNICATION AND BEST PRACTICES

R: … and to build the relationships you need, like she was saying for trust—you have to build relationships with those people.

M: Build relationships with who?

R: With the producers, with the landowners, the stakeholders, yeah.

R: You have to also build partnership relationships, too.

R: Yeah, right, that too.

R: And I feel like that's been focused on a little more lately, but when you first start the job and you're literally just thrown in, and nobody knows what you're supposed to do, they just say, "Good luck." You don't even know that these partners exist, so how are you supposed to go to them for help?

R: My most difficult thing is getting people to change their ways. I think that's my…, and getting the thinking to change.

R: The narrative, too, is that—even though if you have research and data, those are city people. They've never farmed. They don't know how to farm, and they don't know how to farm up here, because we're further north. It's totally different. It's like a whole different, planet, apparently, so…

R: I have seen progress and I have seen lightbulbs, and I have seen people come to their own conclusions, just by giving them the information, the fact that their actual land use has an impact on the drinking water of their community. And they're like—"What?! That makes sense."

Best Management Practices Utilization

For the three sets of watersheds, comparisons of BMPs were standardized as the number of acres as a percent of the watershed's highly erodible land (HEL) row crop acres. Cover crop data collected annually or biannually were used for comparison. All other BMPs were compared using data from the BMP Mapping Project available for three distinct periods of time—1980s, 2010 and 2016.

Comparison Set 1: Farmers Creek (project) and Hainer Creek (control)

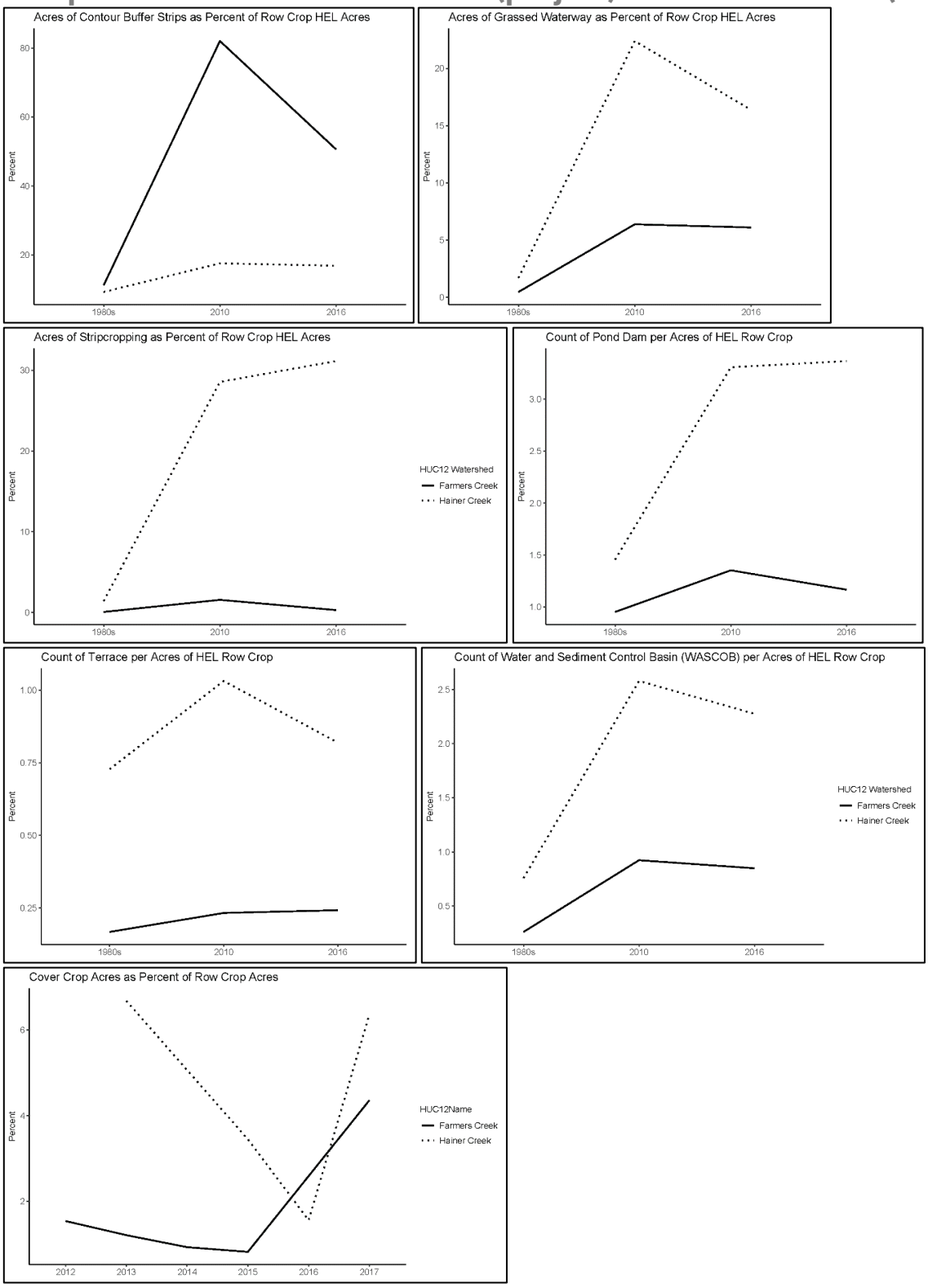


Figure 8. The extent of selected soil erosion BMPs and cover crops in the Farmers Creek HUC12 watershed (a watershed project area) and the Hainer Creek HUC12 watershed (the corresponding control watershed).

Contour buffer strip use was similar between the pair in the 1980s. Farmers Creek increased to treat approximately 80% of the HEL row crop acres in 2010 and then fell to approximately 50% in 2016. Hainer Creek increased to approximately 18% in 2010 and remained steady in 2016.

Farmers Creek adoption of grassed waterways increased from approximately 2% of the HEL row crop acres to approximately 5% in 2010 and remained constant through 2016. Hainer Creek started in a similar range in the 1980s, increasing to over 20% through 2010, then moved downward to near 15% in 2016.

Farmers Creek implementation of stripcropping remained close to zero throughout the study period. Hainer Creek exhibited growth from near zero in the 1980s to approximately 30% in 2010 and continued slow growth through 2016.

The quantity of ponds remained steady between 1-1.5% of the HEL acres in Farmers Creek across all three sample points. Hainer Creek saw an increase to more than 3% in 2010, continuing with slight growth through 2016.

Terrace implementation in the two watersheds remained below 1% throughout the study period.

WASCOBs saw similar percentages and trends as grassed waterways.

Cover crop adoption at Farmers Creek stayed in the 1-2% range until 2016, then increased to 4% of row crop acres in 2017. Hainer Creek started out higher than Farmers Creek, topping 6% in 2013. Hainer Creek trended downward to about 2% in 2016 and then went back up again to approximately 6% in 2017.

Comparison Set 2: Hewitt Creek (project) and Johns Creek (control)

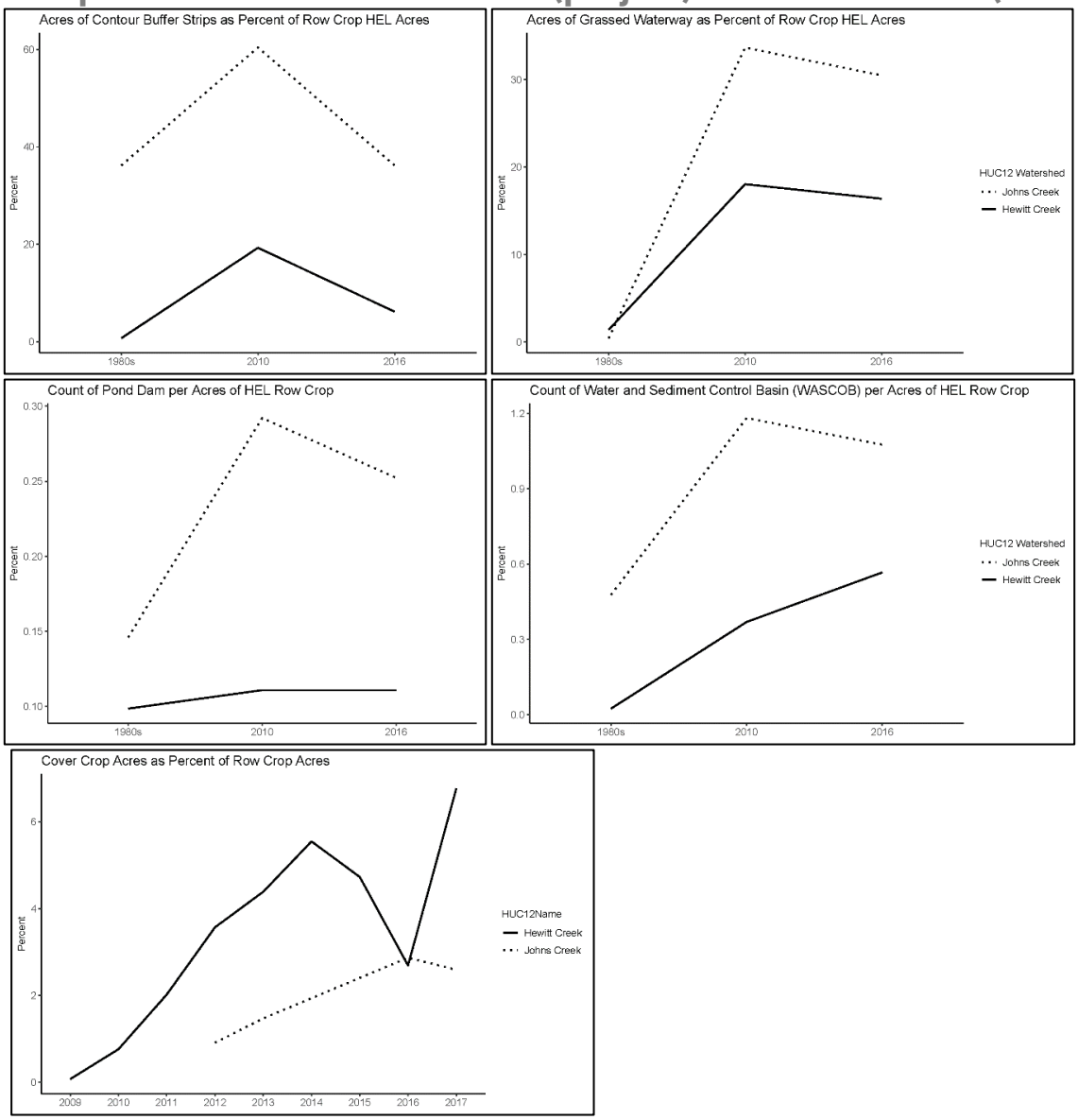


Figure 9. The extent of selected soil erosion BMPs and cover crops in the Hewitt Creek HUC12 watershed (a watershed project area) and the Johns Creek HUC12 watershed (the corresponding control watershed).

Contour buffer strip trends were similar between the pair. Hewitt Creek increased to approximately 18% of HEL acres in 2010 and remained steady in 2016. Johns Creek increased from approximately 38% to nearly 60% in 2010 and then fell back to approximately 38% in 2016.

Grassed waterways showed similar trends between the two watersheds. However, Hewitt Creek contained substantially fewer acres of grassed waterways than Johns Creek throughout the study period. In 2010, Johns Creek topped 30% of HEL acres compared to 15% in Hewitt Creek. In 2016, both decreased slightly.

The quantity of ponds was not significant, remaining at approximately 0.1% in Hewitt Creek and 0.3% in Johns Creek throughout the study period.

WASCOBs in Hewitt Creek were at near zero in the 1980s, growing to 0.3% of HEL acres in 2010 and nearly 0.6% in 2016. Johns Creek WASCOBs grew from 0.5% in the 1980s to approximately 1.2% in 2010 before falling back to around 1% in 2016.

Cover crops in Hewitt Creek rose to just over 5% of row crop acres in 2014, reflected a dip to nearly 2% in 2016, and then returned to over 6% in 2017. Cover crops in Johns Creek gained ground from 2012 through 2016, when they were roughly equivalent to Hewitt Creek. In 2017, Johns Creek saw a slight reduction in cover crop acres.

Comparison Set 3: Middle West Fork of Crooked Creek (project) and North Fork Long Fork Creek (control)

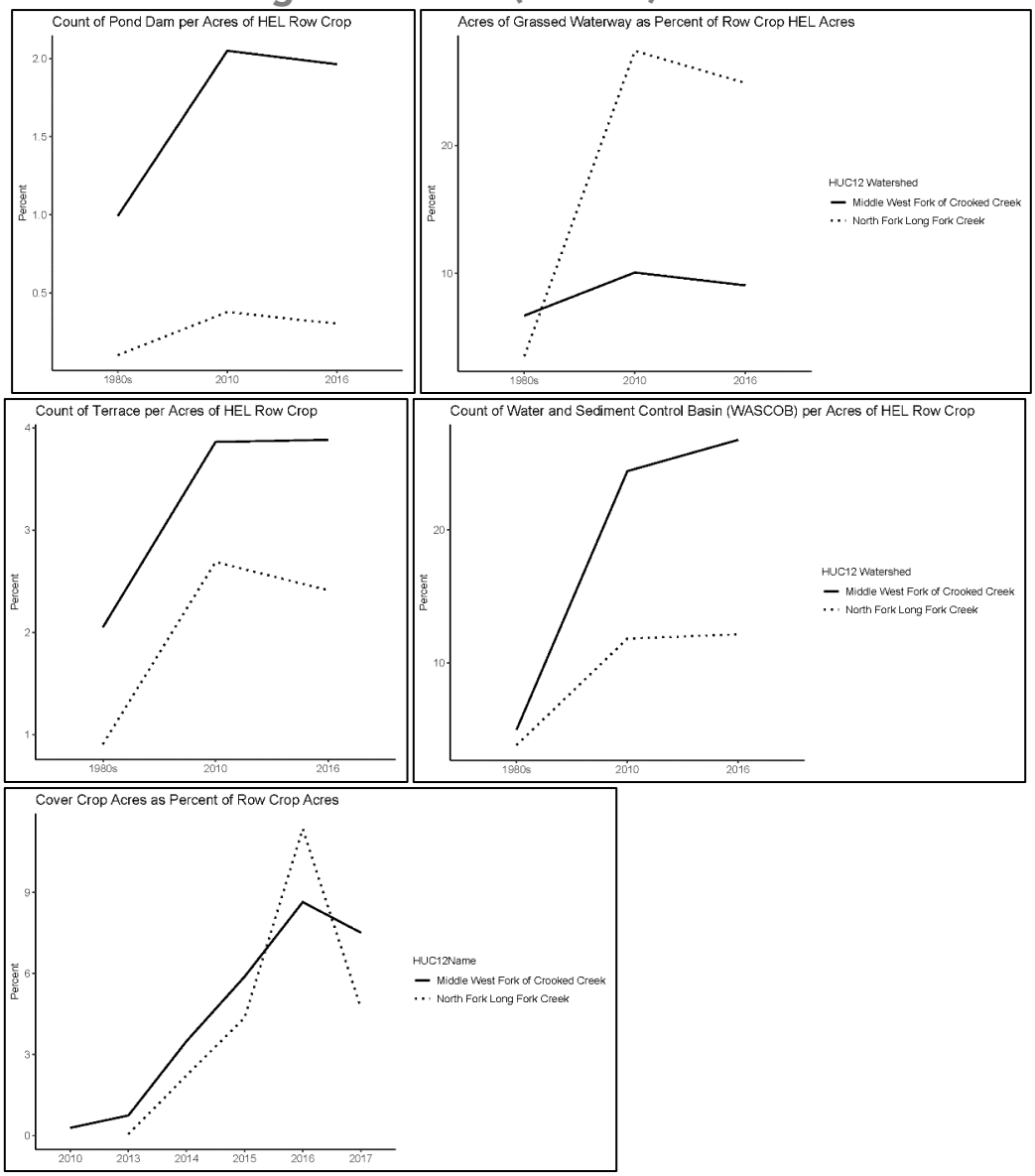


Figure 10. The extent of selected soil erosion BMPs and cover crops in the Middle West Fork of Crooked Creek HUC12 watershed (a watershed project area) and the North Fork Long Fork Creek HUC12 watershed (the corresponding control watershed).

The quantity of ponds in Middle West Fork of Crooked Creek doubled between the 1980s and 2010, falling slightly in 2016. Ponds in North Fork Long Fork Creek followed a similar trend at a lower level.

Grassed waterways in Middle West Fork of Crooked Creek increased from 5% of HEL acres to nearly 10% in 2010. In North Fork Long Fork Creek, grassed waterways grew to more than 20% in 2010. Percentages in both watersheds fell slightly in 2016.

Terrace implementation in Middle West Fork of Crooked Creek increased from 2% of HEL acres to nearly 4% in 2010 and remained steady through 2016. Terraces in North Fork Long Fork Creek exhibited a similar slope, peaking at approximately 2.5% in 2010.

WASCOBs in both watersheds showed similar growth trends. Middle West Fork of Crooked Creek increased to more than 20% of HEL acres in 2010 and continued growth through 2016. North Fork Long Fork Creek grew to around 10% in 2010 and remained steady through 2016.

Cover crops trended similarly in both watersheds. Implementation grew steadily up to 9-10% of row crop acres in 2016 and then back downward to approximately 5-6% in 2017.

BMP Observations

There were some key differences between the project watersheds and their comparison watersheds, but not all the results were expected. Based on the available data sources, in Comparison Set 1, Farmers Creek demonstrated lower use of soil and water BMPs over time than Hainer Creek. When standardized as the numbers of acres as a percent of the watershed's highly erodible row crop acres, Farmers Creek showed lower rates of grassed waterways, stripcropping, ponds, terraces, and WASCOBs (Figure *8*). Comparison Set 2 showed similar results. Hewitt Creek exhibited lower use of BMPs than Johns Creek (Figure *9*). However, at 6.8% of annual row crop acres, Hewitt Creek demonstrated higher use of cover crops in 2017, compared to Johns Creek's 2.6%.

Generally, Comparison Set 3 showed results that align with the hypothesis that watershed project areas exhibit higher rates of BMP use. The Middle West Fork of Crooked Creek watershed had higher rates of ponds, terraces and WASCOBs than the comparison, the North Fork Long Fork Creek (Figure *10*). Neither watershed had any measurable stripcropping in any of the three time periods. Both watersheds exhibited similar rates of cover crop use.

The implementation trends of BMPs across all three comparison sets were generally similar over time. This indicates that localized awareness and access to information and support for these practices is roughly equivalent across the project and control watershed areas.

Two anomalies were noted. In Comparison Set 2, Hewitt Creek saw a reduction in cover crops in 2015 and 2016, but returned to a continuation of the upward trend seen across the study period in 2017. In Comparison Set 3, North Fork Long Fork Creek saw a spike in cover crops in 2016, but returned to the expected upward trend in 2017. In both cases, these short-term differences could be attributed to factors outside the scope of this study such as weather, timing of funding support requests, or individual farmer propensities and actions.

Analysis of Data

Considering the key questions defined at the start of this research project, the quantitative and qualitative inputs gathered support generally positive outcomes related to short-term success, but offer less-conclusive guidance regarding long-term success. The key questions are:

1. What are short-term success metrics?
2. What are long-term success metrics?
3. Is there a Halo Effect associated with organized watershed improvement projects?
4. How do interventionist project outcomes compare with non-organized watersheds?

Short-term Success

Taking each project as a whole, they all can be deemed successful in the short-term based on increasing conservation trends, tactical engagement and stakeholder feedback.

Characteristics related to short-term success include:

1. High Farmer Participation and Ownership of the Problem
2. Distribution of All Cost-Share to Implement Practices Where They Will Best Impact Water Quality
3. Committed Coordinator (Formal or Informal)
4. Motivation to Solve Problems that Allows Diverse Group of Stakeholders to Stay Engaged Throughout the Project
5. Activities in the Watershed Including Field Days and Other High Profile Means of Communication

HIGH FARMER PARTICIPATION AND OWNERSHIP OF THE PROBLEM

All three subject watershed projects appeared to have high farmer participation during the active years of the projects. However, it appears that as time passes beyond the conclusion of the formal project, participation and engagement trails off.

The Farmers Creek project ended in 2009. Participants in the Listening Session did not express a strong connection with the original project, but were able to cite BMPs that were implemented during the project and after the project concluded. Individual voluntary conservation activities have been maintained and implemented, but there is no formal communication or watershed-wide coordination or activities.

The Hewitt Creek project ended in 2015. Participants in the Listening Session expressed satisfaction and pride in the accomplishments of the project and those implemented since the project concluded. There is a high degree of interest in continued conservation activity, but limited centralized communication and organization.

The Middle West Fork of Crooked Creek project was still active at the time of this report. The participants in the Listening Session made it clear that ongoing project activities are vital and engaging many farmers within the watershed.

DISTRIBUTION OF ALL COST-SHARE TO IMPLEMENT PRACTICES WHERE THEY WILL BEST IMPACT WATER QUALITY

All three project watersheds utilized cost-share funding to successfully accomplish the stated project goals with respect to BMP implementation and water quality improvement. However, it is debatable whether the exact implementation of cost-share dollars was in areas that strategically affected watershed health. The decision process appeared to be driven by economic and experimental priorities of individual farmers rather than an overarching goal of specifically improving water quality in the most cost-effective and efficient manner.

COMMITTED COORDINATOR (FORMAL OR INFORMAL)

While all three watershed projects had a committed coordinator, the efforts of the Farmers Creek coordinator stood out. The coordinator was very effective at motivating participants to engage and implement practices through strong communication and advisory approaches. Hewitt Creek and Middle West Fork of Crooked Creek coordinators were effective, but both projects saw multiple coordinators which may have impeded the full potential of the projects. Once the projects were no longer funded, in the cases of Farmers Creek and Hewitt Creek, there was no longer a watershed coordinator or facilitator and it became harder to keep farmers engaged in watershed improvements. In the case of Middle West Fork of Crooked Creek's continued funding but multiple coordinators, farmers have turned to the local Natural Resources Conservation Service for continuity and stability and have connected with ISU Extension and Outreach for ongoing outreach and education.

MOTIVATION TO SOLVE PROBLEMS THAT ALLOWS DIVERSE GROUP OF STAKEHOLDERS TO STAY ENGAGED THROUGHOUT THE PROJECT

Motivation to solve problems that allow a diverse group of stakeholders to stay engaged throughout the project is unclear for all three watershed projects. While there was strong participation from farmers, other stakeholders from the community were not clearly engaged.

ACTIVITIES IN THE WATERSHED INCLUDING FIELD DAYS AND OTHER HIGH PROFILE MEANS OF COMMUNICATION

All three had many community and stakeholder engagement activities and events during the active years of the projects.

Long-term Success

This is the forward-looking part of the study which takes into account farmers, other stakeholders, and community members living in each watershed. The long-term success of the three watershed projects is less clear than short-term success. Each project is at a different stage since initiation, yet all display some roots of being a good long-term success. However, it is unclear if improvements will continue.

Characteristics related to long-term success include:

1. Continued Water Quality Improvement Over Time
2. Conservation and Water Quality Practices Become the Norm in the Same Fashion as Nutrient Management and Pesticide Application
3. Stakeholders Accept Environmental Responsibility
4. Improved Social Conditions in Watershed—More Awareness, Trust and Social Capital—Improve Ability to Identify and Respond to Problems Faster

CONTINUED WATER QUALITY IMPROVEMENT OVER TIME

It is difficult to measure continuous water quality improvement without methodical and stringent monitoring protocols in place. Considering the relationship of the timing and placement of BMPs, some conclusions can be drawn about overall water quality improvement based on anticipated benefits delivered by each practice implementation. It can take years to affect change in water quality, and reductions in BMPs or lack of maintenance can impact the net change throughout the watershed. Watershed modeling or use of nutrient and sediment change estimator tools can be beneficial in tracking practice impacts when monitoring data are unavailable or at a larger scale where it is difficult to detect short-term change.

CONSERVATION AND WATER QUALITY PRACTICES BECOME THE NORM IN THE SAME FASHION AS NUTRIENT MANAGEMENT AND PESTICIDE APPLICATION

Conservation and water quality practices are clearly not the norm in these watershed communities. Decision-making is still driven by financial incentive offerings and fear of regulatory oversight and intervention.

STAKEHOLDERS ACCEPT ENVIRONMENTAL RESPONSIBILITY

The core groups in each watershed project clearly accepted environmental responsibility and were motivated to take action during the projects. However, many other farmers in each area are along for the ride. In the Farmers Creek Listening Session, participants did not speak about environmental responsibility, but that may be related to the time gap since the formal project concluded.

IMPROVED SOCIAL CONDITIONS IN WATERSHED–MORE AWARENESS, TRUST AND SOCIAL CAPITAL–IMPROVE ABILITY TO IDENTIFY AND RESPOND TO PROBLEMS FASTER

Social capital is defined as the extent to which groups in a community, in this case a watershed, have shared norms, values and understanding that can facilitate cooperation within or among the group. While tactical social engagement activities such as field days and public information meetings are useful in educating peers and stakeholders, they tend to address short-term goals and don't necessarily build the social capital needed to implement conservation and environmental practices that are maintained through the years. Because of the nature of watersheds, it is important to remember that these are highly complex biological systems and changes in one area can lead to challenges in other areas. Environmental issues are going to happen and all stakeholders should be prepared to respond to them. If sufficient social capital and environmental responsibility are not in place, effective and timely responses are more difficult.

Halo Effect

Halo Effect: The tendency for an impression created in one area to influence opinion in another area.

When considering watershed projects, the Halo Effect is often demonstrated as a degree of short-term success (and social capital) inflating stakeholders' perceptions of the project's impact on long-term continued water quality improvement (Leach and Sabatier, 2005).

The perceived value of all three watershed projects was inflated by awards and recognition focused on the demonstrated short-term advances, particularly the level of farmer participation in meetings and activities. The impression of this high level of trust among farmers generated (and continues to generate) a Halo Effect on local and state level stakeholders' perceptions about the watershed projects' collective impact on watershed conditions, making the projects seem more successful than they actually were. The extension of the benefits to long-term effects is not clearly borne out by the adoption of water quality improvement practices as a normal course of business.

Conclusions

Can we build a better watershed project?

We started off by asking how we build a better watershed project. As we looked at the data, we started wondering if watershed projects are the best means for improving water quality in Iowa. As watershed projects are currently delivered, are they built for long-term successes? They are often short-term, underfunded, and they lack widespread stakeholder support that would lead to long-term successes. The assumption seems to be that if we provide adequate incentives, then farmers will adopt the appropriate water quality improvement practices and maintain them long after the incentives are gone. More research is needed to understand if that assumption is true.

Until farmers, landowners, and other agricultural decision makers buy into the urgency of the water quality challenges in the Midwest and the need to make changes on their land to improve water quality in Iowa and beyond, watershed improvement projects (as they are currently structured) are destined to fail. Money and science alone won't solve the problem. We need to change the norms, values and belief systems of our society. Incentives are built on the idea that if you change a person's behavior, you will change their values and beliefs. That idea isn't wrong. However, the current incentive system doesn't fully invest in the cohesive strategies needed to push a shift in our norms toward conservation.

Can we build a better watershed project? Maybe the question should instead be: Can we improve water quality in Iowa? The answer rests in understanding that the current system doesn't value water quality. Only until we prioritize water quality and conservation as integral to long-term agricultural (and environmental) resiliency, will we be able to put the system in place to improve water quality that will lead to long-term success. Success depends on statewide awareness, acceptance and action. Do we have the ability to conduct a state and local visioning process that will help us imagine a different future for Iowa?

Ideas for prioritizing water quality and conservation in Iowa:

1) Perhaps policies that support and motivate water quality improvements.
2) Perhaps a statewide marketing campaign that informs people about water quality issues, motivates them to get involved in water quality improvement work and to change their behavior. Such a campaign could help gain support for policy changes. This statewide campaign could help normalize water quality practice implementation and conservation adoption as a necessary part of agricultural production as well as key to any urban development.
3) Perhaps more educational boots on the ground. The role for extension as a facilitator, education leader and stable constant in the watershed community can be critical. Watershed coordinators "wear many hats" and strong partnerships with local extension specialists and county extension program leaders can leverage access to quality education resources and outreach support. The opportunity to impact change, build relationships, and protect natural resources makes watershed coordinator jobs attractive to early career conservation professionals. Short-term funding terms and lack of benefits in many cases make it difficult to keep qualified coordinators long-term. Investment in watershed coordinators' salaries, benefits, career development and skill building support can increase longevity in this role and increase long-term success.
4) Perhaps better long-term visioning at the state, local and watershed levels. Where do communities want to see themselves in 25 years? Perhaps access to watershed planning

funds could include assessments for targeting watershed resources where investment will result in the highest water quality or soil improvement outcomes. The Agricultural Conservation Planning Framework is a tool that could assist watershed coordinators and farmer-leaders in focusing time and financial incentives in the most critical areas of the watershed.

Creating an infrastructure of support and a critical mass of well-informed citizenry is a necessary step in improving and restoring water quality and our natural resources both in the short- and long-term. Good water quality should be a priority to all of us.

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APPENDICES

Appendix A: Historical Research Reference Table

Watershed abbreviations are as follows:

FC	Farmers Creek
HC	Hewitt Creek
MWFCC	Middle West Fork of Crooked Creek

Watershed	Type of material	Date published	Article Title	Article Author	Where published	Overview of material
FC	blog article	12/26/16 and 1/13/17	Driftless area stream stocked mussels appear to be doing well	Nathan Eckert	Friends of the Upper Mississippi Blog	Farmers Creek is a small stream in eastern Iowa. It flows into the Makoqueta system that ultimately reaches the Mississippi River. Years ago the mussel population there was decimated by the breech of a manure holding pond during a rain event.
FC	newsletter article	11/2016	Driftless area stream stocked mussels appear to be doing well	Genoa National Fish Hatchery	GNFC News and Notes	Since 2007 Genoa NFH has been routinely stocking fatmucket and a few other assorted species in Farmers Creek.
FC	newspaper article	1/24/2005	Farmers Creek focus of conservation - Grant money targets tributary of North Fork Maquoketa river	John Everly	Telegraph Herald - Dubuque	A local effort is under way to rescue endangered Farmers Creek, a tributary of the North Fork Maquoketa River that meanders for 17 miles through central Jackson County.
FC	departmental report	2/21/2007	Farmers Creek: Our stream needs your help	Margaret Barr	Iowa DNR	
FC	web page		Getting Farmers Creek off the list	Bill Northey	IDALS	Almost 90 percent of the land in the Farmers Creek drainage area is classified as highly erodible.
FC	newspaper article	4/20/2013	Invest in proven water initiatives	Chuck Isenhart	The Gazette - Cedar Rapids	Conservation efforts along the 17-mile Farmer's Creek in Jackson County have reduced sediment and nutrients by 40 percent
FC	newspaper article	3/27/2016	Iowa district court rules against DNR in water anti-degradation case	Orlan Love	The Gazette - Cedar Rapids	An Iowa District Court earlier this month found the Department of Natural Resources failed to appropriately enforce the state's clean water anti-degradation standards when it approved a wastewater treatment project that would increase pollution in the Des Moines River watershed.

Watershed	Type of material	Date published	Article Title	Article Author	Where published	Overview of material
FC	newspaper article	7/4/2016	Iowa panel weighs changes to clean-water rules	Orlan Love	The Gazette - Cedar Rapids	The Iowa Department of Natural Resources' Environmental Protection Commission is considering proposed changes to rules that govern anti-degradation standards included in the state's clean-water regulations.
FC	newspaper article	11/5/2015	Iowa senators Ernst, Grassley expect Waters of the U.S. rule-making issue heading to court	James Lynch	The Gazette - Cedar Rapids	Sen. Joni Ernst expects the U.S. House to follow the Senate's lead in approving her resolution that would void new environmental rules known as the Waters of the U.S. – WOTUS – that the EPA says would protect waterways from pollution, but are opposed by farm and business groups as overly restrictive and costly to follow.
FC	project report	10/2009	Iowa Watershed Project Status: One Paragraph Summaries	IDALS	iowaagriculture.gov	
FC	newspaper article	1/3/2006	Legislature's program works to clean up waterways	AP	The Gazette - Cedar Rapids	A new program will allocate $5 million for water quality projects statewide.
FC	newspaper article	3/12/2005	Local Briefs: Meeting to center on watershed concerns	Telegraph Herald	Telegraph Herald - Dubuque	The public is invited to a meeting regarding the Farmers Creek Watershed at 9 a.m. Tuesday at the Circle C in La Motte.
FC	blog article	1/29/2013	MIND AND MUSSELS CLEAN AN IOWA WATERWAY	Julianne Couch	The Daily Yonder - Center for Rural Strategies	How do you restore an impaired stream? In Eastern Iowa, conservationists and farmers are enlisting the appetites of thousands of local mollusks.
FC	USFWS Field Notes	7/13/2007	Mussel Restoration Begins in Iowa's Driftless Area	Larry Dean	US Fish & Wildlife Service Field Notes	Farmer's Creek suffered a manure spill approximately 10 years ago that killed over 133,000 fish and the entire native mussel community. Genoa National Fish Hatchery first became involved with Farmer's Creek in 2003 by providing smallmouth bass to repopulate the impacted streams.
FC	newspaper article	3/9/2014	Nutrient levels falling in some Iowa rivers - An 'impetus to keep doing what we've been doing'	Orlan Love	The Gazette - Cedar Rapids	Watercress growing in Farmer's Creek in Jackson County are an indicator of a healthy creek.
FC	newspaper article	6/3/2007	Pasture walks focus on alternative water systems	The Gazette	The Gazette - Cedar Rapids	Three pasture walks are being held in Eastern Iowa this summer with a focus on alternative water systems. The walks are sponsored by Iowa State University Extension.
FC	departmental report	2/2008	Small Waterway Offers Big Challenges	Dick Tremain	USDA-NRCS	

Watershed	Type of material	Date published	Article Title	Article Author	Where published	Overview of material
FC	newspaper article	12/4/2012	WATERSHED PROJECT BENEFITS TROUT IN TETE DES MORTS CREEK	States News Service	States News Service	The Tete Des Morts Creek watershed project was instantly popular with local landowners, due in part to the success of the nearby Farmers Creek watershed project.
FC	annual report		WIRB 2008 Annual Report			page 17
FC	newspaper article	5/1/2005	Work continues on water quality - Area landowners and farmers try to improve streams	John Everly	Telegraph Herald - Dubuque	Watershed residents had their first meeting in February to review the Iowa Department of Natural Resources stream assessment that placed Hickory Creek on the department's list of more than 200 impaired water bodies in Iowa.
HC	newspaper article	12/24/2005	$4.7 million allocated for Iowa watershed program	Tom McMahon	Daily Nonpareil - Council Bluffs	Ag Secretary Patty Judge announced Wednesday that the Watershed Improvement Review Board approved 17 projects, which will fund water quality improvements affecting 24 counties.
HC	newspaper article	8/9/2015	'A model for the Midwest' - Farmers work to clean up creeks in northeast Iowa	Orlan Love	The Gazette - Cedar Rapids	A farmer-led effort to clean up Hewitt and Hickory creeks northeast of here bills itself as "a model for Iowa and the Midwest."
HC	web article	3/10/2016	5 fresh stats prove Iowa's water quality progress	Zach Bader	Iowa Farm Bureau	Iowa's water is like a college basketball team that's elevating its play heading into the tournament. It's not perfect, but there's no doubt that the team working to improve Iowa's rivers and streams is gelling and each victory along the way is elevating its standing. As more farmers become familiar with Iowa's EPA-endorsed Nutrient Reduction Strategy, new and varied conservation practices are being used to improve Iowa's water.
HC	newspaper article	12/1/2017	A fast track is the wrong track for water quality	The Gazette	The Gazette - Cedar Rapids	We read news this week that water quality legislation may be placed on a fast track when lawmakers return to the Statehouse in January.
HC	newspaper article	8/6/2015	A watershed moment near Dyersville	Craig Reber	Telegraph Herald - Dubuque	Aaron Pape drove more than two hours from Wis. to attend a bus tour of a voluntary, farmer-led watershed improvement project. He learned of the tour after performing an online search for the Hewitt Creek Watershed.
HC	newspaper article	8/2/2015	Agriculture Briefs: Bus tour of area watershed offered	Telegraph Herald	Telegraph Herald - Dubuque	A bus tour of the Hewitt Creek watershed this week will show what made the voluntary, farmer-led improvement project a model for the Midwest, according to a press release.

Watershed	Type of material	Date published	Article Title	Article Author	Where published	Overview of material
HC	newspaper article	2/26/2008	Bill to help coordinate watershed cleanup	Dick Dearden	Des Moines Register	The Legislature has taken several steps in recent years to improve Iowa's water quality through increased funding and expanded access to soil conservation programs.
HC	report		Cost-effective water quality protection in the Midwest	Charles Wortmann et. Al.	extensionpublications.unl.edu	This publication is a resource that watershed planners can use to understand opportunities to improve the cost-effectiveness of BMPs for water quality protection. It is targeted to the states of Iowa, Kansas, Missouri, and Nebraska.
HC	article	5/13/2016	Des Moines Water Works' great idea to reduce nitrates in water		Iowa Farm Bureau	Des Moines Water Works is creating a one-acre wetland test site to help remove nitrates from the Raccoon River (which provides drinking water for central Iowans).
HC	radio article	10/11/2017	DNR Investigating Fish Kill Near Dyersville	Janelle Tucker	KMCH.com	The DNR is investigating a fish kill on Hickory and Hewitt Creeks near Dyersville. The fish kill was reported Monday, but the caller noticed dead fish on Sunday after the weekend's rainfall.
HC	newspaper article	10/12/2017	DNR Investigates Fish Kill Near Dyersville	States News Service	States News Service	DNR staff from the Manchester field office looked for the source of a fish kill on Hickory and Hewitt Creeks in Dubuque County. The likely source of the fish kill is manure washed into the stream from an animal feeding operation in the upper part of the watershed.
HC	radio article	10/31/2017	DNR says New Vienna dairy manure spill killed thousands of fish	Dar Danielson	radio Iowa	The Iowa Department of Natural Resources has identified the source of a fish kill in Dubuque County. Lab tests confirm that ammonia in runoff from a manure storage basin at the John Hoefler Dairy in New Viennaa was responsible for the October 9th fish kill. The DNR counted 60,278 dead fish along seven miles of waterway that included Hickory Creek and Hewitt Creek and an unnamed tributary of Hickory Creek.
HC	article	12/11/2017	Education will drive adoption of conservation practices	Dirck Steimel	Iowa Farm Bureau	Building momentum for farmer adoption of conservation practices, such as cover crops, waterways and bioreactors, will require additional field days, more educational seminars and simply more time, three Iowa conservation leaders said last week.
HC	blog article	8/25/2010	End of season nitrate test examines nitrogen use in corn crop		iowariversheds.wordpress.com	Producers in the North Fork Maquoketa and Hewitt Creek watersheds near Dyersville have the chance to get cornstalk nitrate sampling done through the watersheds' incentive programs.

Watershed	Type of material	Date published	Article Title	Article Author	Where published	Overview of material
HC	newspaper article	1/11/2006	Environmentally friendly farming gets boost - Hewitt Creek Watershed group receives nearly $160,000 in grant	Emily Klein	Telegraph Herald - Dubuque	There are about 80 farm operations in the 23,000-acre watershed, which encompasses parts of Dyersville, Holy Cross, Bankston, Farley and New Vienna. According to the association, 92 percent of the land is used for crop and livestock production, while woodland accounts for only 7 percent.
HC	newspaper article	6/4/2012	Event showcases way to cut nitrates in farm fields' runoff	Telegraph Herald	Telegraph Herald - Dubuque	A look at how one northwest Dubuque County farmer is protecting the environment will be detailed as part of an education event that's open to the public. Featuring Matt Helmers and Matt Welsh.
HC	article	4/22/2011	Every Day is Earth Day for Iowa Farmers	Laurie Johns	Iowa Farm Bureau	With Earth Day upon us, it's easy to see why the Environmental Working Group (EWG) report on erosion has turned a few heads. The EWG claims farmers are solely to blame for collapsed creek beds, erosion in waterways, even statewide flooding. But, there are plenty of level-headed folks who put the blame on the temperamental muse of Mother Nature, instead.
HC	press release	4/23/2012	Extension Watershed Specialist Participates in White House Roundtable	Chad Ingels and Willy Klein	ISU Extension	Today, Hewitt Creek has 80 percent of the operators in the watershed as members and the results on the land and water are measurable. Ingels gives credit for the association's good participation rate to extension's inclusion of local data in education and scientific-based practices.
HC	dissertation		Farmer Participation in Farmer-Led Watershed Groups: A Case Study in the Western Lake Erie Basin	Shayna Marlene Petit	Michigan State University	To work toward improved water quality, community-led groups have been formed as a way for farmers to engage with each other on pertinent issues. In addition, the groups serve as a forum for agricultural community members to discuss current technologies, learn about new research and network with their neighbors.
HC	web article	12/23/2014	Farmer-led watershed groups offer water quality collaboration	Susan Winsor	Corn and Soybean Digest	For 10 years, 75% of Hewitt Creek Watershed farmers have voluntarily collaborated to solve water-quality issues locally before regulators step in.
HC	video		Farmers use bioreactors and other technology to protect water	Farmers in Action webpage	Iowa Farm Bureau: Iowa Minute	Bioreactors are being used by farmers all over Iowa as a way of filtering water and holding in nutrients. But what exactly is a bioreactor?
HC	web article	4/30/2016	Grants help farmers improve watershed	Jeff Pape	Iowa Farmer Today	I'm asked many questions about The Hewitt Creek Watershed's success: How did your watershed start? How does the watershed know when they have succeeded? How do you interest people to become involved?

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HC	newspaper article	3/11/2006	Help farmers overcome cost barriers to conservation	Rob Sand	Des Moines Register	Including farmers' views while creating conservation policy doesn't just make effective policy; it also makes efficient policy.
HC	blog	2011-2012	Hewitt Creek Watershed			Farmers working together to improve the water quality of our stream.
HC	press release	5/31/2012	Hewitt Creek Watershed Field Day June 8 near New Vienna	Carol Brown and Chad Ingels	ISU Extension	Iowa Learning Farms and the Hewitt Creek Watershed Improvement Association are hosting a field day at the Al Wente denitrifying bioreactor site in Farley
HC	project report	12/2014	Hewitt Creek Watershed Improvement Project	HC Watershed Improvement Association	publications.iowa.gov	Final Project Report: January 2010 - December 2014
HC	project report		Hewitt Creek Watershed Project	Chad Ingels and Jeff Pape	US EPA archived document	All about Hewitt Creek Watershed.
HC	project report		Hewitt Creek Watershed Project - Final Report		publications.iowa.gov	Hewitt Creek Watershed project accomplishments include improved animal populations, widespread resident participation and significant reductions in nutrient delivery.
HC	newspaper article	11/5/2014	Improving water takes education - GUEST COLUMN	Jeff Pape	The Gazette - Cedar Rapids	I have witnessed that voluntary watersheds can, and do, work to our benefit. The Hewitt Creek Watershed in northeastern Iowa has proved in the last nine or more years that water quality improvements can be made.
HC	article	12/9/2013	Innovative conservation practices improve Iowa soil, water	Tom Block	Iowa Farm Bureau	Critics who claim voluntary, farmer-led efforts to reduce nitrogen and phosphorus runoff won't work need to see what's actually happening on farms around the state, Iowa Secretary of Agriculture Bill Northey said last week at the Iowa Farm Bureau annual meeting. One shining example is the Hewitt Creek watershed project in northeast Iowa.
HC	newspaper article	1/23/2016	Iowa cities share $97M grant	Donnelle Eller	Des Moines Register	Dubuque, Coralville and Storm Lake will receive $40 million with the remainder used to target watersheds across the state.
HC	newspaper article	10/30/2017	Iowa DNR cites New Vienna dairy for fish kill	Erin Jordan	The Gazette - Cedar Rapids	The fish kill was reported Oct. 9 on Hickory and Hewitt Creeks in Dubuque County. Department of Natural Resources staff started at the Highway 136 bridge in Dyersville and followed dead fish upstream for about five miles to an unnamed tributary of the Hickory Creek, where they believe the leak occurred.

Watershed	Type of material	Date published	Article Title	Article Author	Where published	Overview of material
HC	article	12/8/2013	Iowa Faces A Problem With Anti-Ag Attitude Of More Residents	Rod Swoboda	Wallaces Farmer	An increasing number of people don't fully support the farming industry, a well-known farm advocate tells Iowa Farm Bureau annual meeting.
HC	newspaper article	11/27/2012	IOWA FARM BUREAU MEMBERS GATHER TO CELEBRATE "INNOVATIONS IN CONSERVATION" DURING 95TH ANNUAL MEETING	States News Service	States News Service	Jeff Pape, chairman of the Hewitt Creek Watershed Council; and Doug Adams, president of Humboldt County Farm Bureau, will lead the conservation-themed seminar
HC	newspaper article	10/6/2016	Iowa has little idea of cost for flood protection	Donnelle Eller	Des Moines Register	In the Turkey River watershed, farmers allow their fields to flood and provide land for ponds and water detention, while county crews design roads that can double as flood-retention walls.
HC	newspaper article	4/20/2014	Iowa site filmmakers left behind has drawn fans, stirred controversy since	Kyle Munson	Des Moines Register	An Illinois couple has pushed a plan to develop the farm around the field into a massive, $74 million baseball and softball complex for traveling youth tournament teams. The proposed All-Star Ballpark Heaven has sparked feuds and lawsuits between neighbors and against the city of Dyersville.
HC	newspaper article	4/17/2013	Iowa View: All stakeholders must be in the boat to clean up Iowa's water	Chuck Isenhart	Des Moines Register	According to the Iowa Department of Natural Resources, Iowa has 628 impaired waterways (more than half of all those assessed), making them suspect for activities such as drinking, swimming and fishing
HC	newspaper article	12/30/2012	Iowa View: More regulations not the answer to soil conservation	Craig Hill	Des Moines Register	Iowa Farm Bureau has worked hard to encourage all farmers to embrace voluntary conservation measures, because science shows us that there is no "one size fits all" approach that brings real results in water quality.
HC	newspaper article	1/3/2006	Legislature's program works to clean up waterways	AP	The Gazette - Cedar Rapids	A new program will allocate $5 million for water quality projects statewide.
HC	newspaper article	5/28/2017	Letter: Education is key to water quality success	Jeffrey Pape	The Gazette - Cedar Rapids	Letter to the Editor: Hewitt Creek Watershed started in 2005 with help of baseline funding from Iowa Farm Bureau, and it took seven years to see consistent results from the conservation efforts farmers put in place.
HC	meeting minutes	4/17/2015	Minutes of the Apr 17, 2015 WIRB Meeting		iowaagriculture.gov	
HC	meeting minutes	2/19/2010	Minutes of the Feb 19, 2010 Meeting of the WIRB		iowaagriculture.gov	

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HC	meeting minutes	6/18/2015	Minutes of the June 18, 2015 WIRB Meeting Teleconference		iowaagriculture.gov	
HC	meeting minutes	9/9/2011	Minutes of the Sep 9 Teleconference Meeting of the WIRB		iowaagriculture.gov	
HC	newspaper article	2/27/2015	Most support water lawsuit	Donnelle Eller	Des Moines Register	A whopping 63 percent of Iowans believe Des Moines Water Works should pursue a lawsuit against drainage districts in three northwest Iowa counties after testing showed record nitrate levels in streams feeding a river supplying much of central Iowa's drinking water
HC	article	2/14/2012	Nature reserves as catalysts for landscape change	James Miller, Lois Wright Morton, David Engle, Diane Debinski, Ryan Harr	Frontiers in Ecology and the Environment	Scientists have called repeatedly for a broader conservation agenda that emphasizes not only protected areas but also the landscapes in which those areas are embedded. We describe key advances in the science and practice of engaging private landowners in biodiversity conservation and propose a conceptual model for integrating conservation management on reserves and privately owned lands. The overall goal of our model is to blur the distinction between land management on reserves and the surrounding landscapes in a way that fosters widespread implementation of conservation practices. Reserves assume a new role as natural laboratories where alternative land-use practices, designed to achieve conservation objectives, can be explored. We articulate the details of the model using a case study from the North American tallgrass prairie ecoregion.
HC	article	11/1/2010	New information sheets from ILF	Carol Brown	Wallaces Farmer	The Iowa Learning Farm has recently created a series of information sheets addressing soil and water quality topics.
HC	newspaper article	6/15/2014	Nitrate reduction starts with farm practices	Jason Clayworth	Des Moines Register	Pape helped launched efforts about eight years ago using an initial $90,000 Farm Bureau grant to leverage science and advance farm practices to help clear waters of excess nitrates, phosphorus or other undesired water elements often associated with agriculture runoff.
HC	video		Northwest Iowa farmers take conservation to the next level	Farmers in Action webpage	Iowa Farm Bureau: Conservation Counts	As part of the Iowa Nutrient Reduction Strategy, farmers are using a number of different conservation strategies to continue to care for the land on which they live and work. Many of those take foresight and careful planning.

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HC	newspaper article	6/22/2002	Officials look into fish kill	Clark Kauffman	Des Moines Register	The Iowa Department of Natural Resources is investigating a manure spill that created a fish kill in the White Pine Hollow watershed in Dubuque County.
HC	blog article	11/3/2017	One Dairy Farm's Manure Runoff Just Wiped Out 60,278 Fish	Michelle Kretzer	PETA blog	Iowa residents can thank a single dairy farm in New Vienna for spoiling miles of their waterways and killing more than 60,000 fish.
HC	letter to the editor	4/2/2006	Organic worse than Round-up	Jerry Crew	Des Moines Register	Editorial in response to article 19HC stating that organic farming encourages tillage which increases soil loss and therefore pollution
HC	newspaper article	1/2/2006	Panel OKs $5 million in water projects	Perry Beeman	Des Moines Register	A new state panel recently approved $5 million in water-quality projects as part of a new statewide program.
HC	book	1/1/2011	Pathways for Getting to Better Water Quality: The Citizen Effect	Lois Wright Morton, Susan Brown	SpringerLink Books	Ultimately change on the land is managed and accomplished by the people that live on land within each watershed.
HC	academic article	5/16/2011	Pay-for-results concept tested: pilot programs give farmers incentive payments based on the environmental benefits they achieve	Jacqui Fatka	Feedstuffs	MOST farmers consider themselves stewards of their land for a short time and aim to leave it in better condition than it was initially. Small payments provide farmers with an incentive to try something new, and oftentimes, the measure pays for itself.
HC	report		Performance-based Environmental Management: The Hewitt Creek Model	Lois Wright Morton, John Rodecap, Susan Brown, Gerald Miller	ISU Extension	The Hewitt Creek Model uses a performance- based management process to set goals that are environmentally sound and economically practical for the watershed. Citizens together decide on incentives for management practices and evaluation of soil condition, nitrogen and phosphorus levels.

Watershed	Type of material	Date published	Article Title	Article Author	Where published	Overview of material
HC	report	1/12/2009	Providing service and support to watershed improvement projects across Iowa	Jamie Benning, Chad Ingels	PROCEEDINGS OF THE 21ST ANNUAL INTEGRATED CROP MANAGEMENT CONFERENCE	Nonpoint source nutrient pollution from agriculture entering Iowa's surface water bodies is a problem for impaired local watersheds throughout the Corn Belt, and as far away as the Gulf of Mexico. The Mississippi River drains 40 percent of the continental US and carries almost 140 cubic miles of water yearly (Libra 1998). The U.S. Geological Survey estimated an average of 1.65 million tons/year of nitrogen (N) were exported into the Gulf of Mexico from 1987-1996 causing a condition called hypoxia (Libra 1998). Hypoxia, also known as a dead zone, is an area where water has no or very little oxygen necessary for fish and other marine life. Nitrogen accelerates the production of marine phytoplankton whose life cycle consumes oxygen previously available for fish and shrimp (Libra 1998). Estimates in 1996 suggested that Iowa supplied on average almost 25 percent of the nitrate-N to the Gulf of Mexico via the Mississippi River; much of it from agricultural land-use practices (Libra 1998).
HC	article	3/2013	Reconstructing the good farmer identity: shifts in farmer identities and farm management practices to improve water quality	Jean McGuire, Lois Wright Morton, Alicia Cast	Agriculture and Human Values	
HC	article	8/27/2015	Record number of farmers receive environmental leader awards	Andrew Wheeler	Iowa Farm Bureau	A record number of Iowa farmers were recognized at the Iowa State Fair this year for their exceptional leadership as stewards of the land and watershed. Of the 95 Iowa farm families honored this year with the 2015 Iowa Farm Environmental Leader award, nearly three-quarters are Iowa Farm Bureau Federation (IFBF) members.
HC	newsletter article	7/2011	Side dressing dry urea works for Dubuque County corn grower	Jason Johnson	nrcs.usda.gov	Daly farms in the Hewitt Creek Watershed, a sub- watershed of the Maquoketa River Watershed. This is a focus area of the Mississippi River Basin Healthy Watershed Initiative (MRBI). Farmers there can receive higher payment rates on conservation practices that avoid, control, and trap nutrient runoff; improve wildlife habitat; and maintain agricultural productivity. Side dressing N is one of the practices available in the MRBI.

Watershed	Type of material	Date published	Article Title	Article Author	Where published	Overview of material
HC	newspaper article	2/18/2014	Speakers set for Red Cedar Watershed Conference March 13	University of Wisconsin-Stout	The Dunn County News - Wisconsin	Keynote speakers (including Chad Ingels and Jeff Pape) will address land, water and people, the three main focus areas of the Red Cedar Watershed Conference at University of Wisconsin-Stout.
HC	article	10/8/2009	State Watershed Review Board Approves Funds for 13 Iowa Projects		Wallaces Farmer	More than $5.1 million in grant money is approved to support 13 projects that will improve water quality in Iowa.
HC	newspaper article	1/17/2016	Stowe needs to get his story straight	Don Kass	Des Moines Register	According to CEO Bill Stowe, it is the job of the Des Moines Water Works to "protect the surface waters of our state from unfettered degradation."
HC	web article	10/1/2007	Stream of Dreams	Susan Winsor	Corn and Soybean Digest	Located a stone's throw from where the movie "Field of Dreams" was filmed, his Hewitt Creek, IA, watershed is cleaner than it's been in a long time. Farmers, not government regulators, are cleaning up their watersheds.
HC	graduate thesis	1/1/2010	The Hewitt Creek Watershed Group: A study of mechanisms that led to the adoption of farm management practices to improve water quality	Jean Marie McGuire	ISU Digital Repository	farmers in northeast Iowa have demonstrated that it is possible for farmers to come together within a watershed to address water and soil quality issues, while maintaining farm operation profitability
HC	newspaper article	4/22/2014	The land dispute	Kyle Munson	Des Moines Register	Opposition to the sports complex has run the gamut from fears over heavy traffic to concern for how water runoff from the ball fields and parking lots will affect Hewitt Creek Watershed.
HC	article	1/15/2009	The role of civic structure in achieving performance-based watershed management	Lois Wright Morton	Society and Natural Resources	Traditional solutions to solving the problem of non-point source pollution from agricultural sources have been to write and enforce regulatory rules and create top-down financial incentives to shift land use practices. What has been overlooked are the roles that social pressure and internal beliefs and knowledge play in achieving sustainable practices. In this research, a model for achieving and sustaining targeted water quality outcomes is developed. A case study is used to illustrate how the civic structure and social connections among farmers in a common watershed provide an effective strategy for creating performance-based goals that can lead to better water outcomes.

Watershed	Type of material	Date published	Article Title	Article Author	Where published	Overview of material
HC	web article	6/20/2017	Then versus now	Laurie Johns	Iowa Farm Bureau	I first saw a finished bioreactor in the Hewitt Creek watershed, a 23,000-acre watershed located northeast of Dyersville, where dozens of area farmers have banded together to add new conservation practices to reduce nitrates and phosphorus in the watershed.
HC	report	6/1/2013	Toward Strategic Watershed Management: Lessons from the Boone River Watershed Program Evaluation	Stephanie Enloe, Lisa Schulte, John Tyndall	Landscape Ecology and Sustainable Ecosystem Management Lab	Water quality is a growing problem throughout the world. There are over 400 aquatic ecosystems worldwide that have recently recorded hypoxic conditions. Although eutrophication is a natural process in many systems, anthropogenic forces contribute heavily to many of the world's "dead zones." The hypoxic zone in the Gulf of Mexico is an example of a system negatively affected by human land use, particularly agriculture in Midwestern states such as Iowa. There are a number of groups throughout the country and the world working to address water quality issues on a landscape level. These groups are contributing to broader understanding of how to conduct watershed management on private and working lands.
HC	newspaper article	1/14/2007	Tri-State Briefs: Meetings on watersheds to be held this week	Telegraph Herald	Telegraph Herald - Dubuque	Residents of Coffee Creek and Hewitt Creek watersheds will hold meetings this week at the New Vienna Mutual Insurance meeting room in New Vienna.
HC	newspaper article	5/14/2015	UPDATE: Iowa's impaired waters list grows 15% in 2 years	Craig Reber	Telegraph Herald - Dubuque	A new state report says the number of lakes, rivers and streams in Iowa impaired due to some level of pollution has climbed 15 percent in two years, prompting environmental groups to say Iowa's voluntary farm nutrient reduction strategy isn't working.
HC	report		Water quality targeting success stories	Michelle Perez	World Resources Institute	This report shows how projects in agricultural watersheds encouraged farmers to voluntarily adopt conservation practices and documented the resulting improvements in water quality. It features six successful projects. The report details how the projects achieved their results and explores how federal conservation programs can be improved to replicate this success.
HC	web article	2/9/2006	Watershed farmers develop own incentives for conservation	Tim Hoskins	Iowa Farmer Today	While driving in his pickup truck around the Hewitt Creek watershed in Dubuque County recently, Jeff Pape proudly pointed out the conservation practices he and his neighbors have completed over the past year. Some of the practices include planting cover crops, converting to no-till, applying less manure and making waterways.

Watershed	Type of material	Date published	Article Title	Article Author	Where published	Overview of material
HC	web article	4/27/2010	Where Earth Day is everyday	Dirck Steimel	Iowa Farm Bureau	There are many examples of farmers working every day to improve the environment in their communities. One is the Hewitt Creek watershed, which is in northeast Iowa and encompasses the famous Field of Dreams near Dyersville.
HC	annual report		WIRB 2008 Annual Report			page 19
HC	annual report		WIRB 2010 Annual Report			page 26
HC	annual report		WIRB 2011 Annual Report			page 20
HC	report		WIRB awarded projects 2009			Description of funded projects
HC	newspaper article	5/1/2005	Work continues on water quality - Area landowners and farmers try to improve streams	John Everly	Telegraph Herald - Dubuque	Watershed residents had their first meeting in February to review the Iowa Department of Natural Resources stream assessment that placed Hickory Creek on the department's list of more than 200 impaired water bodies in Iowa.
MWFCC	online article	1/13/2020	LONG CREEK ADDED TO WEST FORK WATERSHED PROJECT	Tyler Brunner		https://www.kciiradio.com/2020/01/13/long-creek-added-to-west-fork-watershed-project/
MWFCC	project description page		WEST FORK CROOKED CREEK WATER QUALITY AND SOIL HEALTH INITIATIVE	IDALS		https://www.cleanwateriowa.org/west-fork-crooked-creek-water-quality-and-soil-health-initiative
MWFCC	project description page		WEST FORK CROOKED CREEK WATERSHED PROJECT	Washington County SWCD		http://washingtoniaswcd.weebly.com/projects.html
MWFCC	project fact sheet	2019	Mississippi River Basin Healthy Watersheds Initiative (MRBI)	Iowa NRCS		https://www.nrcs.usda.gov/wps/cmis_proxy/https/ecm.nrcs.usda.gov%3a443/fncmis/resources/WEBP/ContentStream/idd_B0238266-0000-CE1E-848C-7706A34F990D/0/WestForkCrookedCreek_2019.pdf
MWFCC	online article	7/26/2016	IIHR, RAGBRAI in Washington	Iowa Now (U of I)		https://now.uiowa.edu/2016/07/iihr-ragbrai-washington

Watershed	Type of material	Date published	Article Title	Article Author	Where published	Overview of material
MWFCC	online article	12/20/2016	Iowa's state level water-quality funds announced, refunding current projects	Cedar Rapids Gazette		https://www.thegazette.com/subject/news/government/iowas-state-level-water-quality-funds-announced-refunding-current-projects-20161220?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%3A%20GazetteOnlineLocalNews%20(TheGazette.com%20Local%20News)&fbclid=IwAR3Bq6OXWbKE0UlER7skcOEZbet36wTrust0YxEoDFGpzoYePWJveMEMKE0
MWFCC	online article	3/1/2020	Eastern Iowa Water Quality Improvement Projects expanded	High Plains Journal		https://www.hpj.com/ag_news/eastern-iowa-water-quality-improvement-projects-expanded/article_aa7f0e00-5a72-11ea-b5a5-3bf17523375a.html?utm_medium=social&utm_source=facebook&utm_campaign=user-share&fbclid=IwAR2nPSys5-9Z_q3Am6T9KsbNsUz7-x_lGyDrRUYmfDN5z8YbK_BuDpVrgB8
MWFCC	online article	10/22/2018	New Mississippi River Basin Projects in Iowa	Wallaces Farmer		https://www.farmprogress.com/conservation/new-mississippi-river-basin-projects-iowa
MWFCC	report	2019	Iowa Water Quality Initiative Legislative Report	Clean Water Iowa		https://www.farmprogress.com/conservation/new-mississippi-river-basin-projects-iowa
MWFCC	online article	12/21/2016	Iowa's watershed projects to receive second round of funding	Iowa Environmental Focus		https://iowaenvironmentalfocus.org/2016/12/21/iowas-water-quality-projects-to-receive-second-round-of-funding/
MWFCC	website		ADVANCING IOWA'S WATERSHED EFFORTS	Conservation Infrastructure Initiative		https://www.iowaci.org/project/the-watershed-approach---amplifying-efforts
MWFCC	online article	10/6/2017	Meet a good farm neighbor: Rob Stout	Wallaces Farmer		https://www.farmprogress.com/conservation/meet-good-farm-neighbor-rob-stout
MWFCC	online article	10/13/2017	Continuum Ag. LLC, Partners with West Fork Crooked Creek Watershed Project: Mitchell Hora - Washington County, Iowa			https://www.cleanwateriowa.org/success-stories/2017/10/13/uaezf7ckqwhcile8oa0epuh0hw6erv
MWFCC	report	3/21/2017	IIHR 2016 Water Monitoring Report	IIHR (U of I)		https://iwqis.iowawis.org/assets/monitoring-report-2016.pdf

Watershed	Type of material	Date published	Article Title	Article Author	Where published	Overview of material
MWFCC	online article	2/17/2020	Iowa Department of Agriculture and Land Stewardship Awards $4.1 Million to Expand Eastern Iowa Water Quality Improvement Projects	IDALS		https://iowaagriculture.gov/news/awards-41-million-expand-eastern-iowa-water

Appendix B: Sample Survey

Farmers Creek Watershed Survey

Which describes you? (check all that apply)

☐ Farmer/operator ☐ Landowner ☐ Rural resident

How many acres do you farm? _____

List the total number of field days/workshops you attended in 2018 _____

Is there an active watershed project in your area? ☐ Yes ☐ No ☐ Don't know

Do you live and/or farm in the Farmers Creek watershed? ☐ Yes ☐ No

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Please describe the ways you have integrated what you learned from this field day or workshop into your farming operation:

I fall-seeded cover crops on some (or more) of my acres in fall 2018. ☐ Yes ☐ No

- List number of total acres with cover crops_____ • New cover crop acres in 2018_____
- Type(s) of cover crop planted_____
- List the year you first planted cover crops_____
- Was cost share used? ☐ Yes ☐ No

I increased use of surface residue (no-till or strip-till) management on some of my acres in 2018.

☐ Yes ☐ No • List number of total acres_____ • New acres in 2018_____

I used prairie strips in my row crop fields to reduce erosion and create pollinator habitat.

☐ Yes ☐ No • List number of total acres_____ • New acres in 2018_____

☐ I'm considering it ☐ Too expensive ☐ Never heard of it

I discussed benefits and challenges of cover crops/no-till/strip-till/prairie strips with my landowners/tenants.

☐ Yes ☐ No

I networked conservation ideas with other farmers or my farmer clients. ☐ Yes ☐ No

If yes, how successful were you?

☐ I influenced one other farmer ☐ I influenced two or more farmers ☐ I influenced no others

I did not make any conservation changes to my farming operation in 2018. ☐

What additional practice(s) are you currently using? (check all that apply)

☐ Nutrient removal wetland ☐ Extended rotations ☐ Saturated buffer

☐ Rotational grazing ☐ Bioreactor ☐ Soil testing every 3 years

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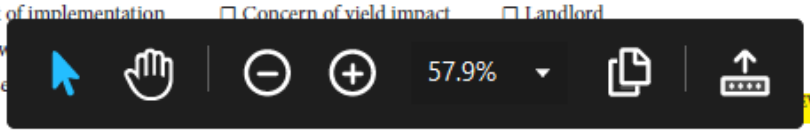
What are the biggest barriers to implementing additional conservation practices? (check all that apply)

☐ Cost of implementation ☐ Concern of yield impact ☐ Landlord

☐ Know

☐ No se



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Appendix C: BMP Results

Practice	Time Period	Farmers Creek (Project Area) Area (Acres/100 ac HEL)	Farmers Creek (Project Area) Length (m/100 ac HEL)	Farmers Creek (Project Area) Count (no/100 ac HEL)	Hainer Creek (Control) Area (Acres/100 ac HEL)	Hainer Creek (Control) Length (m/100 ac HEL)	Hainer Creek (Control) Count (no/100 ac HEL)
Contour Buffer Strips	1980s	11.2	336	0.2	9.2	657	0.3
	2010	82.1	1,027	0.6	17.5	1,525	0.8
	2016	50.6	631	0.4	16.8	1,317	0.7
Grassed Waterway	1980s	0.5	796	4.3	1.7	1,161	6.1
	2010	6.4	4,380	21.5	22.4	8,292	47.4
	2016	6.1	5,289	24.5	16.4	6,935	34.7
Pond Dam	1980s		54	1.0		67	1.5
	2010	*N/A*	79	1.4	*N/A*	159	3.3
	2016		73	1.2		174	3.4
Stripcropping	1980s	0.1	8	0.0	1.4	206	0.1
	2010	1.6	56	0.1	28.6	765	0.3
	2016	0.3	17	0.0	31.2	994	0.4
Terrace	1980s		39	0.2		132	0.7
	2010	*N/A*	50	0.2	*N/A*	178	1.0
	2016		51	0.2		153	0.8
Water and Sediment Control Basin (WASCOB)	1980s	*N/A*	11	0.3	*N/A*	27	0.8
	2010		39	0.9		92	2.6
	2016		37	0.9		85	2.3

Practice	Time Period	Hewitt Creek (Project Area) Area (Acres/100 ac HEL)	Hewitt Creek (Project Area) Length (m/100 ac HEL)	Hewitt Creek (Project Area) Count (no/100 ac HEL)	Johns Creek (Control) Area (Acres/100 ac HEL)	Johns Creek (Control) Length (m/100 ac HEL)	Johns Creek (Control) Count (no/100 ac HEL)
Contour Buffer Strips	1980s	0.7	35	0.0	36.2	727	0.3
	2010	19.3	485	0.3	60.4	1,064	0.5
	2016	6.2	302	0.2	36.2	719	0.3
Grassed Waterway	1980s	1.4	232	0.5	0.5	664	1.9
	2010	18.1	4,960	15.4	33.7	3,434	11.1
	2016	16.4	5,007	14.0	30.5	3,367	10.0
Pond Dam	1980s		5	0.1		8	0.2
	2010	*N/A*	6	0.1	*N/A*	16	0.3
	2016		6	0.1		13	0.3
Stripcropping	1980s	0.0	0	0.0	3.0	109	0.0
	2010	0.0	0	0.0	3.0	109	0.0
	2016	0.0	0	0.0	3.0	109	0.0
Terrace	1980s		0	0.0		110	0.5
	2010	*N/A*	0	0.0	*N/A*	294	1.3
	2016		0	0.0		302	1.4
Water and Sediment Control Basin (WASCOB)	1980s	*N/A*	1	0.0	*N/A*	23	0.5
	2010		14	0.4		58	1.2
	2016		20	0.6		54	1.1

Practice	Time Period	Middle West Fork Crooked Creek (Project Area) Area (Acres/100 ac HEL)	Length (m/100 ac HEL)	Count (no/100 ac HEL)	North Fork Long Fork Creek (Control) Area (Acres/100 ac HEL)	Length (m/100 ac HEL)	Count (no/100 ac HEL)
Contour Buffer Strips	1980s	0.0	0	0.0	0.2	32	0.1
	2010	0.0	0	0.0	1.8	477	0.5
	2016	0.0	0	0.0	1.4	389	0.4
Grassed Waterway	1980s	6.7	2,448	6.3	3.5	2,941	7.8
	2010	10.1	7,125	21.0	27.4	8,992	26.5
	2016	9.1	6,664	18.9	24.9	8,428	24.1
Pond Dam	1980s		72	1.0		5	0.1
	2010	*N/A*	145	2.1	*N/A*	28	0.4
	2016		141	2.0		24	0.3
Stripcropping	1980s	0.0	0	0.0	0.0	0	0.0
	2010	0.0	0	0.0	0.0	0	0.0
	2016	0.0	0	0.0	0.0	0	0.0
Terrace	1980s		476	2.1		171	0.9
	2010	*N/A*	885	3.9	*N/A*	564	2.7
	2016		887	3.9		521	2.4
Water and Sediment Control Basin (WASCOB)	1980s	*N/A*	330	5.0	*N/A*	306	3.8
	2010		1,516	24.4		922	11.8
	2016		1,697	26.8		948	12.1

Appendix D: Cover Crop Results

	Farmers Creek (Project Area)				Hainer Creek (Control)			
Year	Applied Acres - State	Applied Acres - EQIP	Total Acres	Percent of Row Crop Acres	Applied Acres - State	Applied Acres - EQIP	Total Acres	Percent of Row Crop Acres
2012	188	0	188	1.5	0	0	0	0.0
2013	148	0	148	1.2	288	0	288	6.7
2014	114	0	114	0.9	0	0	0	0.0
2015	100	0	100	0.8	60	89	149	3.5
2016	0	0	0	0.0	67	0	67	1.6
2017	532	0	532	4.4	274	0	274	6.4

	Hewitt Creek (Project Area)				Johns Creek (Control)			
Year	Applied Acres - State	Applied Acres - EQIP	Total Acres	Percent of Row Crop Acres	Applied Acres - State	Applied Acres - EQIP	Total Acres	Percent of Row Crop Acres
2009	0	10	10	0.1	0	0	0	0.0
2010	0	110	110	0.8	0	0	0	0.0
2011	0	292	292	2.0	0	0	0	0.0
2012	56	460	516	3.6	117	0	117	0.9
2013	83	552	635	4.4	190	0	190	1.5
2014	148	655	804	5.6	0	0	0	0.0
2015	0	685	685	4.7	0	0	0	0.0
2016	318	71	389	2.7	370	0	370	2.9
2017	970	10	980	6.8	312	22	334	2.6

	Middle West Fork Crooked Creek (Project Area)				North Fork Long Fork Creek (Control)			
Year	Applied Acres - State	Applied Acres - EQIP	Total Acres	Percent of Row Crop Acres	Applied Acres - State	Applied Acres - EQIP	Total Acres	Percent of Row Crop Acres
2010	0	63	63	0.3	0	0	0	0.0
2011	0	0	0	0.0	0	0	0	0.0
2012	0	0	0	0.0	0	0	0	0.0
2013	160	0	160	0.8	10	0	10	0.1
2014	747	0	747	3.5	365	0	365	2.2
2015	1,257	0	1,257	5.9	714	0	714	4.4
2016	1,847	0	1,847	8.7	1,858	0	1,858	11.4
2017	1,606	0	1,606	7.5	774	0	774	4.7