CONSERVATION TECHNOLOGY INFORMATION CENTER

Indian Creek Watershed Project Final Report

A draft report to Illinois EPA August 15, 2016

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SUMMARY

Over the course of six years—two funding cycles—the Indian Creek Watershed Project proved to be a significant model for voluntary water quality improvement efforts, not just in Livingston County, Illinois, where the watershed is located, but across the country. Many farmers, conservation districts and other conservation personnel, NGO and government agency representatives looked to Indian Creek for ideas and inspiration on watershed-wide adoption of best management practices (BMPs). By the end of the project, conservation systems and BMPs were in place on at least 57% of the area of the watershed.

Several key concepts were at the heart of the Indian Creek Watershed Project, including:

- The importance of locally led conservation efforts
- The power of including stakeholders in the watershed from on and off the farm
- Cooperation among conservation entities within the watershed
- Demonstrations of key conservation practices under local conditions
- The impact of applying priority conservation practices by at least 50% of the producers in a small watershed to improve water quality in the receiving surface waters

CTIC and local organizers in the watershed also aimed to develop a "recipe" that could be exported to watershed groups in other areas of the country.

The Livingston County Soil and Water Conservation District (SWCD) was the local lead for the project, which began in 2010. The District worked closely with the local USDA Natural Resources Conservation Service (NRCS) office to organize the project and secure early funding through the NRCS'S Mississippi River Basin Healthy Watersheds Initiative (MRBI) and a pollution abatement grant through the Illinois Environmental Protection Agency, funded through Section 319 of the Clean Water Act.

CTIC joined the effort in 2010 to help with communications, organizing demonstration plots and securing additional funding through partnerships with CTIC members and other interested companies and entities.

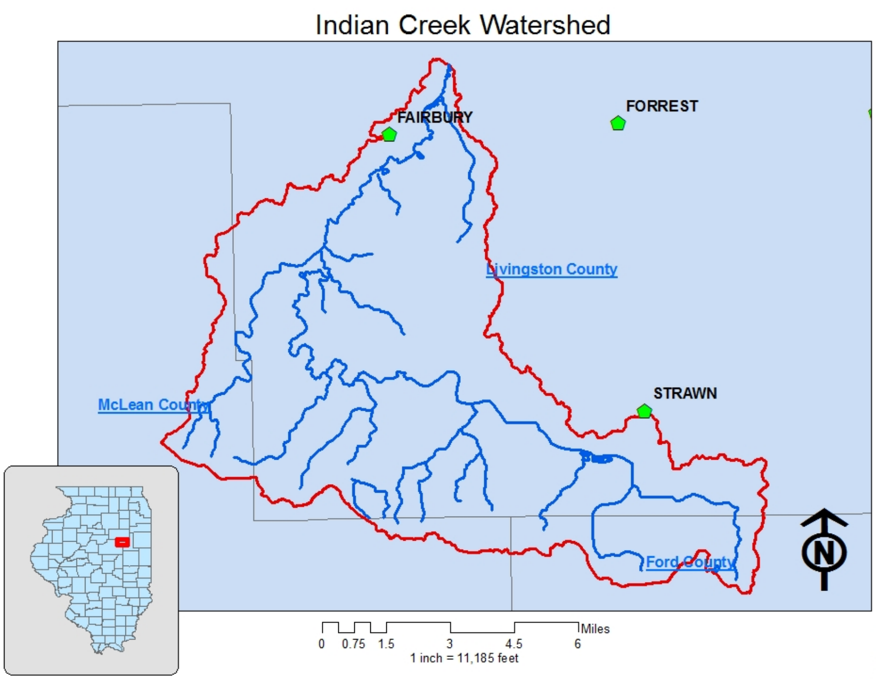
Quarterly meetings of the project's steering committee emphasized the importance of every perspective in the room. They also set the direction for demonstration plots to be conducted each year of the program, which harnessed not only local knowledge but also expertise from national partners. University research into water quality and the social/organizational phenomena within the watershed added depth to the insight emerging from the program.

This report will include summaries of the demonstrations, meetings, presentations, research, activities and outreach that resulted from the Indian Creek Watershed Program, as well as detailed discussion of the findings and lessons other watershed organizers can draw from the experience of the committed local leaders in Livingston County, Illinois.

INTRODUCTION

The Indian Creek System

The Indian Creek watershed covers 51,243 acres in north-central Illinois and encompasses part of southern Livingston County and portions of Ford and northern McLean counties (see map). Indian Creek empties into the South Fork Vermilion River near Fairbury, Illinois at the northern tip of the watershed.



The Indian Creek watershed represents approximately 6% of the Vermilion River watershed, which in turn supplies drinking water to the communities of Streator and Pontiac.

Portions of the Vermilion were listed in the 2012 Section 303(d) list of impaired waters in Illinois. Impairments listed for reaches of the river included nitrates, total nitrogen, sediment and total suspended solids (TSS). Those pollutants are often linked by the public to agricultural activities, and may be positively influenced by the adoption of agricultural conservation systems and best management practices (BMPs) on farmland.

Project Partners and Roles

Funding and expertise for the Indian Creek Watershed Project comes from a wide range of sources and reflects the comprehensiveness of the program.

The **Conservation Technology Information Center** (CTIC) participated in the project beginning in the effort's first year, bringing organizational, educational and outreach expertise to the program. The Section 319 funding that CTIC received from Illinois EPA is focused on helping organize the locally led effort and leading the education and outreach elements, providing social and educational support for producers implementing new conservation systems on their farms.

CTIC also recruited partners among its member organizations and contacts, which contributed technical expertise in conservation systems, technical support for producers and leadership in developing demonstration plots on farms throughout the watershed. Industry partners introduced new technologies and practices—as well as protocols to effectively test them—to help improve nutrient use efficiency. Last, many partners contributed matching dollars to the project.

The **Livingston County Soil and Water Conservation District** (SWCD) was the principal local technical assistance agency for the Indian Creek Watershed Project and the prime engine behind producer contacts. The district's long ties with the community and relationships with producers in the watershed are built on years of helping farmers implement conservation systems on their farms. As the main local agency responsible for protecting the county's soil and water resources, the district worked closely with state and federal agencies to initiate, promote and fund programs that lead to the adoption of conservation systems and BMPs on private farmland. Much of the SWCD's work in the past was quite technical, but the staff built on that experience and the relationships established through it to play a more organizational role in the project.

The USDA **Natural Resources Conservation Service** (NRCS) in Illinois is deeply engaged in Livingston County and highly respected for its technical assistance. With decades of history helping landowners address technical and funding needs to adopt conservation practices, NRCS worked hand in hand with the SWCD to promote the adoption of conservation practices and recruit local leaders to form the Indian Creek Watershed Program Steering Committee. In addition to technical expertise and energy, NRCS brought to the Mississippi River Basin Healthy Watersheds Initiative (MRBI) funding to the watershed. MRBI funds are targeted to assist watersheds like Indian Creek in the Mississippi River watershed to protect water quality using targeted USDA conservation program funds to provide technical and financial assistance to farmers to help them utilize practices and conservation systems on their farms.

Formed of farmers, agribusiness, local political leaders and other stakeholders in urban and rural communities within the watershed, the Indian Creek Watershed Program Steering Committee heard a suggestion from SWCD staff to pursue MRBI funding for its project. The funding—channeled through the Illinois NRCS office—encourages conservation practice adoption and water quality improvements in select watersheds. Upon approval by the steering committee, the SWCD applied for and received implementation funding through MRBI for the Indian Creek Watershed Project.

The **Illinois Environmental Protection Agency** (IL EPA) directed Section 319 funds to strengthen the project's organizational, educational and outreach elements. Working with the **U.S. Geological Survey** (USGS), which operates water monitoring stations in the watershed, and with CTIC, IL EPA provided water quality data that was integral to the effort to measure the impacts of conservation system adoptions on a range of parameters in Indian Creek. IL EPA also provided leadership in the development of the Illinois Nutrient Loss Reduction Strategy, a coordinated effort to help Illinois farmers reduce nutrient losses from their farms and work to curb the impacts of agriculture on hypoxia in the Gulf of Mexico.

Project Objectives

The objectives of the Indian Creek Watershed Project were to engage local residents to initiate a locally led, comprehensive watershed project that would result in the adoption of conservation systems or best management practices on at least 50% of the watershed's cropland areas. Partners would provide educational and technical assistance to identify, promote and aid in the successful adoption of priority conservation practices.

CTIC also wanted to create a long-lasting, local leadership structure to help advise and guide the project. A local steering committee was formed to help provide grassroots leadership and give area farmers, agribusiness and conservationists a way to contribute to the project.

Careful monitoring of water quality and university analysis of the data over a three-year period would help ascertain the impact of adopting conservation practices and BMPs on a majority of the watershed's acreage.

Among the priority practices were improved nutrient management techniques built on the 4R framework established by The Fertilizer Institute (TFI) and the International Plant Nutrition Institute (IPNI). Other nutrient use efficiency improvements—through technology, timing or BMPs such as planting cover crops, changes in tillage operations, or drainage water management—were demonstrated and promoted for use in local conditions.

Expected Results

Because the water quality parameters of concern in the 303(d)-listed reaches of the Vermilion River can be associated with agricultural activity, CTIC believed that working with producers in a small watershed could illustrate that widespread, voluntary adoption of conservation systems and BMPs at a sufficient scale can have a measurable impact on those water quality variables.

The project was also expected to yield a model for other watershed efforts. Contacting 100% of the farmers in the watershed to promote conservation practices and connect the producers with funding sources was expected to yield a high rate of participation.

Given the effectiveness of conservation systems such as cover crops and buffer strips, practices such as switching from fall nitrogen application to spring timing or split applications, and technologies such as nutrient injection rigs and enhanced-efficiency nitrogen formulations, CTIC expected to see measurable decreases in the release of nitrates and sediment into Indian Creek after the adoption of conservation practices on more than 50% of the watershed's acreage.

Methods and Timeframes

Beginning in 2010, SWCD staff personally contacted the operators on each of the 104 farms in the Indian Creek watershed to educate them about conservation systems and technologies, and inform them of the programs and funding available to them through MRBI for implementing priority practices.

At the same time, SWCD, the local NRCS office, and CTIC identified producers and other stakeholders from the watershed to invite them to join the project's steering committee. The committee was developed to provide advice and feedback on the project's direction, review and approve strategic actions, help with outreach and serve as spokespeople for the project. Quarterly meetings, each with some sort of talk or presentation included to pique interest, kept the project focused and maintained its momentum. Attendance ranged from 15 to 30 participants, on average, throughout the 6-year project. Meetings were conducted to encourage constructive dialogue and direction from the members rather than from "top-down" communications.

In 2011, CTIC and several partners established an education network within the watershed and began establishing demonstration plots to highlight preferred technology and conservation systems on local farms, with the farmers' own equipment, under real-world conditions. Protocols were developed and overseen by Dr. Harold Reetz of Reetz Agronomics and Tim Smith of Cropsmith, subcontractors to CTIC, and included:

- Comparisons of nitrogen application timing (fall, spring, sidedress)
- Split applications of nitrogen vs. single, full-rate application
- Comparisons of broadcast vs. strip applications of anhydrous ammonia
- Variable rate vs. uniform rate for nitrogen applications
- Rate and timing trials of enhanced-efficiency nitrogen formulations
- Enhanced phosphorus fertilizer
- Nitrogen testing regimens, including stalk and pre-sidedress tests
- Manure management
- Cover crops

The demonstration plot program launched in 2011 with 6 plots. In 2012, 10 demonstration and Nutrient Use Efficiency (NUE) plots were conducted; the next year, 13 demonstrations were organized for the watershed. Ten demonstrations in 2014, 8 in 2015 and 5 in 2016 contributed to the exposure of area producers to a wide range of tactics and technologies.

Reetz and Smith assisted demonstration plot hosts with plot design and implementation, and advised them on proper rates and applications. They also tracked and managed data on inputs and harvest and analyzed the results of each season's plots in a year-end report.

In many cases, analysis of data from the demonstration plots included the use of IPNI's Crop Nutrient Response Tool (CNRT) to calculate the Maximum Economic Rate of Nitrogen (MERN). In turn, that illustrated Nutrient Use Efficiency (NUE) on many of the farms. Excluding drought years with little or no nitrogen response, improving NUE through timing and enhanced-efficiency N formulations significantly reduced nitrogen applications; extrapolated across the entire watershed, the figures rocketed into the millions of pounds.

Dan Shafer of the Illinois Fertilizer and Chemical Association (IFCA) demonstrated a nutrient toolbar and discussed nitrogen testing. Shafer also provided additional insight into recommendations for on-farm demonstrations and worked with project agronomists to help make recommendations for demonstrations. He worked with many farmers in the watershed to help fine-tune their nitrogen application strategies by adopting technology—including optical sensor technology, which he demonstrated to illustrate how it can help refine late-season nitrogen applications based on the color and nitrogen needs of the corn—and by better understanding nitrogen movement on their farms. The program that Dan is working with, called N-Watch, has helped many ag retailers in the area become more aware of nitrogen movement in soil and water, and has helped them refine their nitrogen recommendations to farmers.

Results and experiences were shared with hundreds of farmers, crop advisors, researchers, district and agency staff, and other visitors at annual summer field tours and winter meetings. With first-person insight from the host farmers, backed by context from CTIC and industry and university experts, participants in and out of the watershed received strong promotion of conservation messages as well as practical advice from farmers on implementing the practices locally.

Each of the practices demonstrated in the plot program could be implemented and incentivized through the MRBI program. Expectations were high that the plots—backed by other education and outreach elements of the program—would motivate and teach producers in the watershed to successfully adopt the practices, technologies and systems. The result would be increased participation in MRBI, more efficient use of inputs in the watershed, and improved water quality in Indian Creek and the Vermilion River.

Education and Outreach

The education and outreach components of the Indian Creek Watershed Project were designed to engage producers and other stakeholders on a range of levels through a variety of contacts—in person around the watershed, in print and online.

Annual summer field tours were headline attractions from 2011 through 2016. As many as 150 farmers, neighboring stakeholders, agribusiness leaders and government agency personnel attended each field day, where they heard host farmers, university researchers, industry leaders, and local and state conservation experts describe the plots and talk frankly about the lessons learned about each practice or technology.

Winter meetings were also held every year to publicize and discuss the results from each year's demonstration and NUE plots. Discussions also delved into lessons learned, challenges faced and issues impacting conservation systems during the previous growing season. Growers, researchers and agribusiness experts also presented the latest research and technology in nutrient use efficiency, nutrient management and conservation systems.

Technical sheets highlighted key lessons from the project's demonstration plot program. Themes included:

- Creating your own demonstration plots
- Establishing and managing cover crops
- Understanding MERN
- Using enhanced-efficiency nitrogen sources

The sheets are being distributed by CTIC and the SWCD as ongoing technical resources.

A 7-page **Leadership Lessons** booklet details the development and management of the Indian Creek Watershed Project and its steering committee. The booklet, available in PDF form online, is designed to share the organizational principles that led to Indian Creek's success with other conservation-oriented organizers anywhere in the world.

Sarah P. Church and Linda Stalker Prokopy of Purdue University studied the leadership techniques and analyzed the organizational elements in an **academic paper,** **extension bulletin** and a pair of **leadership videos** available online on YouTube. Such analysis and outreach allows the Indian Creek model to inspire organizers in other watersheds, no matter how distant. Interviewees included 12 producers, 7 steering committee members (agronomists, ag retailers and crop advisors), 6 key project and agency staffers and 10 sources external to the project (including county NRCS office staff, Illinois American Water Company, engineers and conservation NGO staff). The Purdue team also observed two steering committee meetings, a winter meeting and a summer tour to observe function, content and management styles.

Producer vignettes produced by CTIC subcontractor Motion Source and uploaded to the CTIC website provide powerful testimonials on the benefits of getting involved in the project, how it worked, and why conservation is important to the farmers in a watershed.

Inclusion in CTIC outreach materials such as **Conservation in Action Partners** (including the December 2015 issue, which focused exclusively on Indian Creek) and **CTIC Member Mail**. Both electronic media are emailed directly to hundreds of CTIC members, partners, friends, media gatekeepers and contacts across the conservation agriculture world.

Results of water quality research conducted by Ursula Mahl in Dr. Jennifer Tank's lab at the University of Notre Dame were publicized through a **press release** in the spring of 2016, and again in CTIC Member Mail.

Ongoing **media outreach** efforts throughout the project resulted in excellent coverage of the project's progress in the agricultural press. Media relations efforts included invitations to summer field days and winter meetings, press releases, and engagement at key ag media events such as the Agricultural Media Summit and Commodity Classic.

Farmer Focus Group

CTIC and partners gathered together a focus group of key farmers in the watershed to learn from them the ways that the project was doing good things and to gain input on those things that could be done better or more effectively. In all, 13 farmers, agronomists and conservationists gathered on March 18, 2015 for an open and honest discussion. A detailed write-up on the farmer focus group can be found in the appendices at the end of this document.

Other Related Projects

The Indian Creek watershed has attracted several projects that complement the Indian Creek Watershed Project's conservation goals and tap into the community's strong local engagement.

A special NUE plot on the farm of Jack and Mike Trainor in Wing, Illinois—active cooperators in the Indian Creek Watershed Project—combined NUE rate/timing/application protocols with a rigorous edge-of-field monitoring program of carefully isolated tile lines to characterize the nitrogen reaching the drainage system after storm events. A 2011 partnership between USDA NRCS in Illinois and the USDA-ARS National Laboratory for Agriculture and the Environment (NLAE) in Iowa, funding was provided through a USDA-NRCS Conservation Innovation Grant (CIG) and water analysis was conducted by NLAE. Crop and harvest data was collected by Reetz and Smith as part of the Indian Creek Watershed Project demonstration program.

A biomass crop project sponsored by the Department of Energy's Argonne National Laboratory from 2012 through 2016 employed willows and switchgrass on less-productive areas of farm fields to remove nutrients from groundwater while producing fuel. The project combined conservation and nutrient reduction goals with the additional benefit of studying the production of biomass in commercial agricultural systems.

Funding from the National Wildlife Federation (NWF) in 2013 supported cover crop plots and evaluation in the Indian Creek watershed. Working with at least three farmers, CTIC and partners would sample and evaluate soil quality on cover crop plots as well as on nearby farms with similar management but without cover crops.

In 2014, a grant from the U.S. Fish and Wildlife Service's Fishers and Farmers program designed to connect farmers with water quality helped augment the year's summer field tour and focus a stop highlighting the biological communities within Indian Creek.

Indian Creek producers also participated in the National Soybean Sustainability Survey, working in conjunction with the Illinois Soybean Association. This survey was aimed at assessing producers' use of conservation practices.

Indian Creek is widely seen as the model for watershed projects being conducted in the Upper Vermilion watershed of Illinois and the Big Pine watershed of Indiana, both of which are following the same outline for selecting a steering committee, contacting all farmers in the watershed, and engaging farmers to encourage the adoption of best practices and priority conservation systems. Organizers from Indian Creek helped Vermillion Headwaters Project leaders work with sponsors to manage expectations of results on a watershed scale. Staff from The Nature Conservancy also met several times with Indian Creek steering committee members, CTIC and partners for guidance to use in developing their Mackinaw River project.

At least 30 producers in Indian Creek and Big Pine Creek are linked through an additional project coordinated by CTIC and funded by the United Soybean Board (USB). Each participating grower completes the Field to Market Fieldprint Calculator, an online assessment of sustainability indicators. The producers then discuss the results one-on-one with a farm advisor and create a plan to improve scores for each indicator. Cycles of improvement and assessment will result in continual improvement in conservation practice adoption and other sustainability factors. This project will carry on beyond the scope of the original 319-funded Indian Creek project and help further engage the SWCD in addressing conservation needs in the watershed by working with farmers to direct them to financial and technical assistance.

DISCUSSION

Watershed Selection

Upon receiving Section 319 funding, CTIC convened a meeting with representatives of Illinois EPA, NRCS, the Illinois State Department of Agriculture and the Illinois Department of Natural Resources to select a suitable watershed for the project.

The Indian Creek watershed (HUC Town of Fairbury—HUC #071300020205, Belle Prairie—Indian Creek—#071300020204, Indian Creek—#71300020203) in Livingston, Ford and McLean counties was selected for its size, strong local SWCD and connection to the Mississippi River Basin Healthy Watersheds Initiative (MRBI). Indian Creek is also connected to the impaired Vermilion River watershed (Illinois River Tributary—HUC #07130002), various reaches of which had been listed under Section 303(d) of the Clean Water Act for nitrates, total nitrogen, sediment and total suspended solids (TSS). The Vermilion is also the source of drinking water for over 25,000 residents in the cities of Streator and Pontiac, amplifying the need for water quality improvement. Those parameters can be associated with agricultural activity, which could make a watershed-wide conservation effort impactful.

In all, CTIC’s 319 funding could be applied in Indian Creek efficiently to conduct the technical support, education and outreach that would complement MRBI projects geared toward encouraging the adoption of conservation systems and BMPs.

Implementing Best Management Practices (BMPs)

Rather than emphasizing structural changes—for instance, terraces or vegetated buffers—to protect water quality in the Indian Creek watershed, the project organizers set out to encourage changes in management and the adoption of conservation systems across the landscape. Structural conservation measures are effective at reducing sediment and overland flow of stormwater, but the Indian Creek Watershed Project was developed to focus on improving nutrient use efficiency and reducing nutrient loading in the creek. Organizers also believed that changes in management and behavior would extend beyond the program's funding period to represent long-term improvements in farm management over greater acreage within the watershed.

Changing behavior and management based on technical assistance, education and outreach would also reflect active participation in the program, emerging from greater understanding of the farm, watershed and ecosystem.

BMP Implementation Strategy

In the Indian Creek project, CTIC directed all its 319 funds to technical, educational and social support to augment implementation support from MRBI.

The emphasis on management systems, not structural measures, in the Indian Creek Watershed Project represented a departure from many previous conservation efforts in the state. As a result, the BMP implementation strategy in Indian Creek introduced new strategies and elements that could inform other such projects around the country.

Technical Assistance

The Livingston County SWCD and the county NRCS team, aided by CTIC subcontractors Harold Reetz and Tim Smith, provided all technical assistance under the Indian Creek Watershed Project. Unlike other programs in which technical assistance consists largely of engineering help, this project's assistance phase was more like creating conservation plans. Technical assistance required extensive contact and dialogue to ascertain current management practices on each farm and discuss conservation objectives. With objectives identified, staff suggested conservation systems, practices and technologies that would help landowners achieve their goals, suit their crops and equipment, maintain economic sustainability and fit their management capabilities.

Growers who were working with the SWCD and NRCS were encouraged to also meet with their retailers or an agronomist to help them fill in some of the gaps in their conservation plans by including specific nutrient recommendations for their farms. This not only engaged conservationists, but also brought ag retailers into the effort to protect water quality and improve nutrient use efficiency in Indian Creek.

Extensive follow-up and coaching was also extremely important for successful adoption and maintenance of the practices. Any structural measures incorporated into the new conservation system would also be inspected to ensure that the project met engineering and construction standards detailed in MRBI documentation. Retailers and agronomists also followed up with their clients to make sure that the nutrient programs were producing the right results and that no changes were warranted.

Pre-Construction Review

Reducing nitrogen loading in Indian Creek—thus influencing the Vermilion River downstream that supplies drinking water to Streator and Pontiac—was less a product of construction projects than of management changes. Instead of pre-construction meetings and plan drawings, the Indian Creek Watershed Project emphasized the mental work of adopting the 4Rs of Nutrient Stewardship, created by The Fertilizer Institute (TFI) and the International Plant Nutrition Institute (IPNI)—The right nutrient rate, at the right time, from the right source in the right place.

Decades of previous construction efforts resulted the installation of tile drainage in much of the Indian Creek watershed. That conduit between the upper feet of soil and surface waters emphasized the need for more efficent nutrient application, improved timing of fertilizer application to better match crop uptake, nutrient sequestration between cash crops, and improved nutrient use efficiency (NUE) overall.

Some structural improvements could be integrated into conservation systems during the project (exclusive of 319 funding), but most of the emphasis was on management. As a result, most of the "pre-construction review" was really training on how to implement new systems.

Implementing BMPs

All conservation implementation in the project was conducted using existing USDA and local conservation programs, in accordance with their protocols. All documentation reflected those programs and adhered to their deadlines.

In conjunction with the Indian Creek Watershed Project Steering Committee, the Livingston County SWCD received MRBI funding, as well as $900,000 in Conservation Stewardship Program (CSP) funds from NRCS to fund new CSP program acres and $210,000 from the Environmental Quality Incentives Program (EQIP) between to promote best management practices and conservation systems.

As a result of the Indian Creek Watershed Project's emphasis on using 319 funds to encourage management and system changes rather than structural ones, the "BMP Implementation" task in the 319 agreement was not completed. However, efforts to inspire and guide management changes and practice adoption were highly successful, as illustrated below.

Nutrient Management Plans

The original 2010 project agreement included funds from Illinois EPA to help fund nutrient management plans on farmland in the Indian Creek watershed. However, those monies were reallocated to other areas of the state or otherwise unavailable for the project. Section 319 resources within the project that would have augmented the absent funding were instead allocated to help farmers make more efficient use of their applied nutrients. However, nutrient management planning was a part of both the CSP and EQIP programs funded under the MRBI watershed project. Through MRBI, growers were able to apply for funding to help incentivize the use of some of the principles being shown in the on-farm demonstrations.

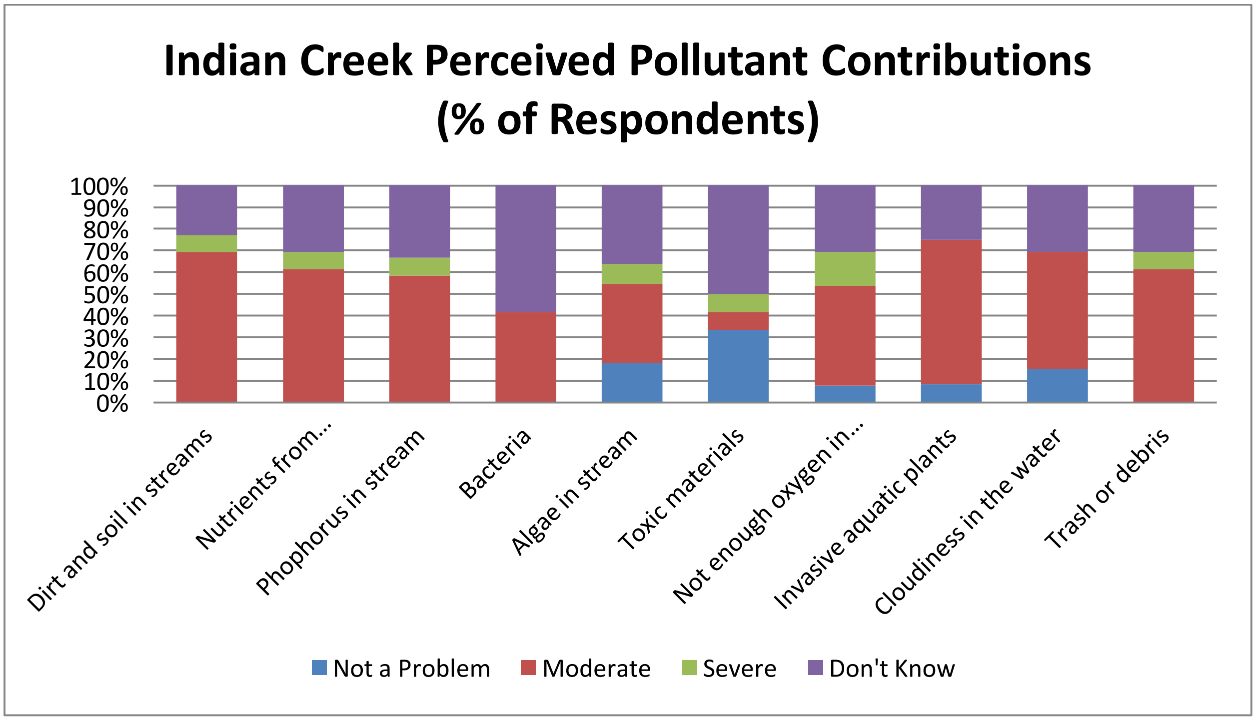
Watershed Education and Outreach: Education Work Strategy

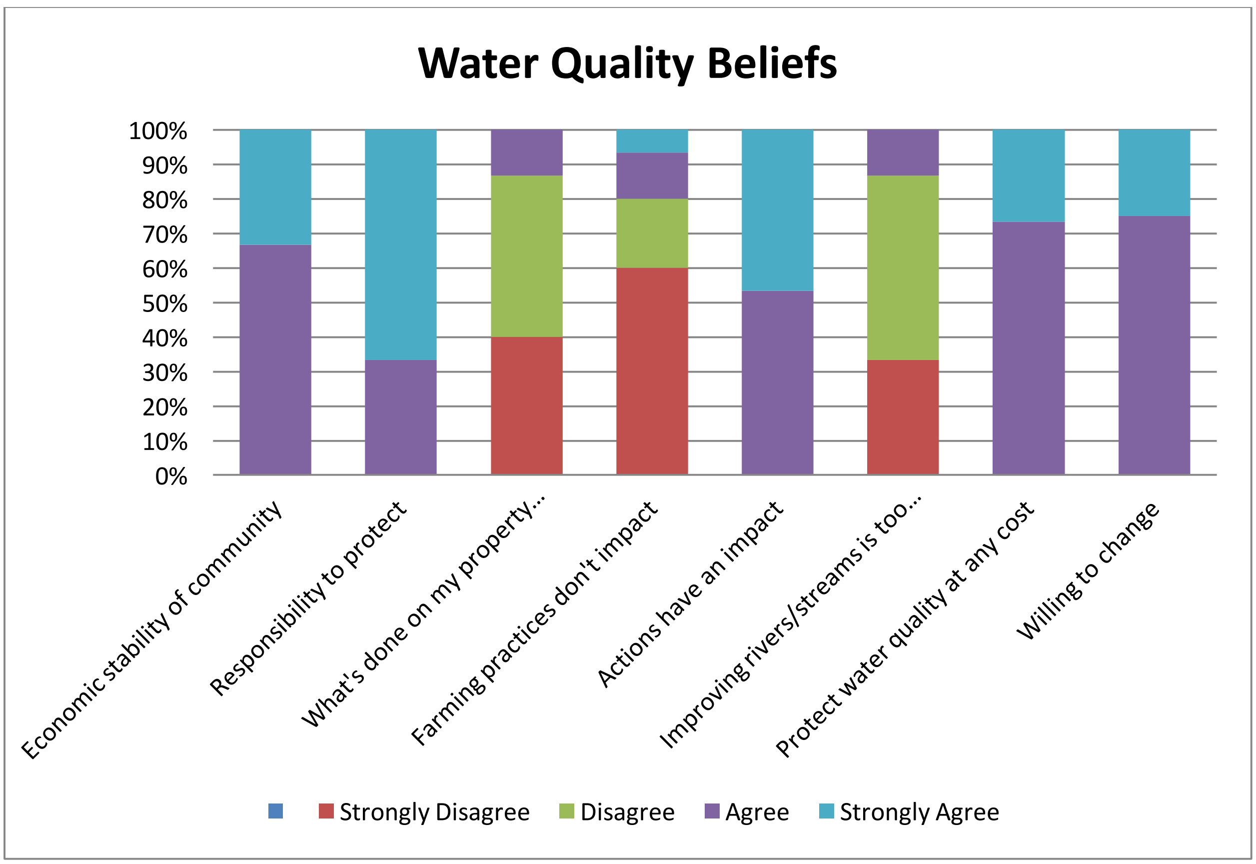
An Education Work Strategy (EWS) developed at the start of the project and updated each year guided outreach efforts. Recording producers' impressions and attitudes around water quality in Indian Creek, the EWS provided direction for raising awareness and educating growers about water quality and conservation issues in the watershed. The plan laid out in the EWS set the groundwork for using community's peer social network to encourage farmer-to-farmer promotion of conservation systems that work in the area. Presentations at field days and meetings were identified as key forums for conservation messages and testimonials for key systems and technologies.

Demonstration plots, which provided the information as well as proof on the ground of the systems' suitability in local conditions, were outlined in the document.

The elements of the public outreach campaign—including technical sheets on key elements of the project, presentations about the project at the SWCD's annual meeting, online resources and recruiting non-farmer stakeholders to the steering committee—were also identified in the EWS.

A follow-up survey conducted in 2012 and again in 2013 showed that subsurface drainage from fields was the highest concern both years, reflecting an increase in the level of concern in 2013. Similarly, the second-place concern, surface drainage from fields, also received a rating of greater concern in 2013 than in 2012, as did scenic beauty/enjoyment. Fish habitat/fishing and canoeing were the lowest priorities, and their scores reflected less concern in 2013 than in 2012.





Focus groups with producers and sponsors in 2014 and 2015 helped guide the project into its second phase.

RESULTS

Goal: Determine Impact On Water Quality of Adoption of Conservation Practices/Systems On 50% of Watershed Acreage

By the end of the Indian Creek Watershed Project, the key metric was achieved: BMPs were adopted on 57% of the watershed's total acreage, up from 7% at the start of the project. Most of those BMPs—70%—were located in the most upstream sub-watershed. The BMPs included on-farm nitrogen management on up to 50% of the total watershed area. In addition, 5% of the watershed acreage was planted to cover crops as a result of the project.

Among the practices adopted through the project and MRBI applications were:

- Cover crops
- Adoption of the 4Rs of Nutrient Stewardship
- Corn stalk tissue testing for nitrate
- Pre-sidedress nitrate testing
- Changing from fall nitrogen applications to spring or sidedress applications
- Split (spring and fall) applications of N
- Manure application
- Use of enhanced-efficiency nitrogen formulations

Using water quality data collected by the U.S. Geological Survey (USGS) and Illinois EPA (IL EPA), Ursula Mahl and Dr. Jennifer Tank at the University of Notre Dame analyzed the impact of conservation practices in the watershed on water quality in Indian Creek.

Water quality readings were collected four times monthly at five sites located at the top and bottom of each of the sub-watersheds beginning in May 2010. These collections continued throughout the project. Continuous nitrate monitoring devices were installed in the watershed in July 2011 as part of a USGS gauge station that also captured other physical water parameters. Flow data was also periodically collected at the outlets of the sub-watersheds by IL EPA. The research to correlate the application of conservation systems in the watershed with water quality results was funded in 2015 by the Nutrient Research and Education Council (NREC) grant to the SWCD and Notre Dame. The Illinois EPA provided a match towards the USGS monitoring probe for the first 5 years of the project, and the Illinois Corn Marketing Board funded the match towards the probe after the IL EPA match funding expired. Illinois Corn Marketing Board also sponsored a tile water sampling/nitrate testing program as an engagement tool with growers in the region to help them better understand the movement of nitrogen on their farms and through their tile systems.

Mahl presented her water quality findings at the 2016 Indian Creek Watershed Project Winter Meeting. Among her conclusions:

- Because flow increased with drainage area, nitrate export increased from upstream to downstream. However, there was NOT a downstream increase in nitrate concentration and yields.
- The majority of the annual nitrate export occurred during large storms (pointing to the importance of conservation practices that reduce runoff).
- Despite high annual variation in flow and nitrate, including a drought in 2012, the researchers detected a trend of decreasing nitrate export over time (2013-2015) and saw less nitrate runoff during storms in 2015 than in 2013 (for events of similar size).
- The results suggest that increasing BMPs, particularly those that decrease runoff during storms, reduced nitrogen loss from the watershed. Given that estimated yields ranged from roughly 35 to 100 pounds of nitrogen per acre per year, BMPs that increase nitrate retention are important for both water quality and crops.

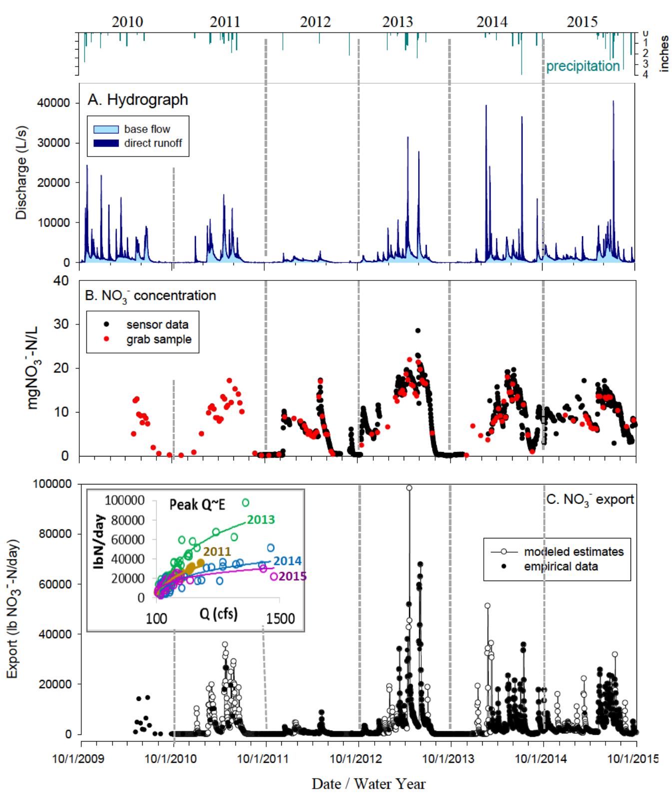


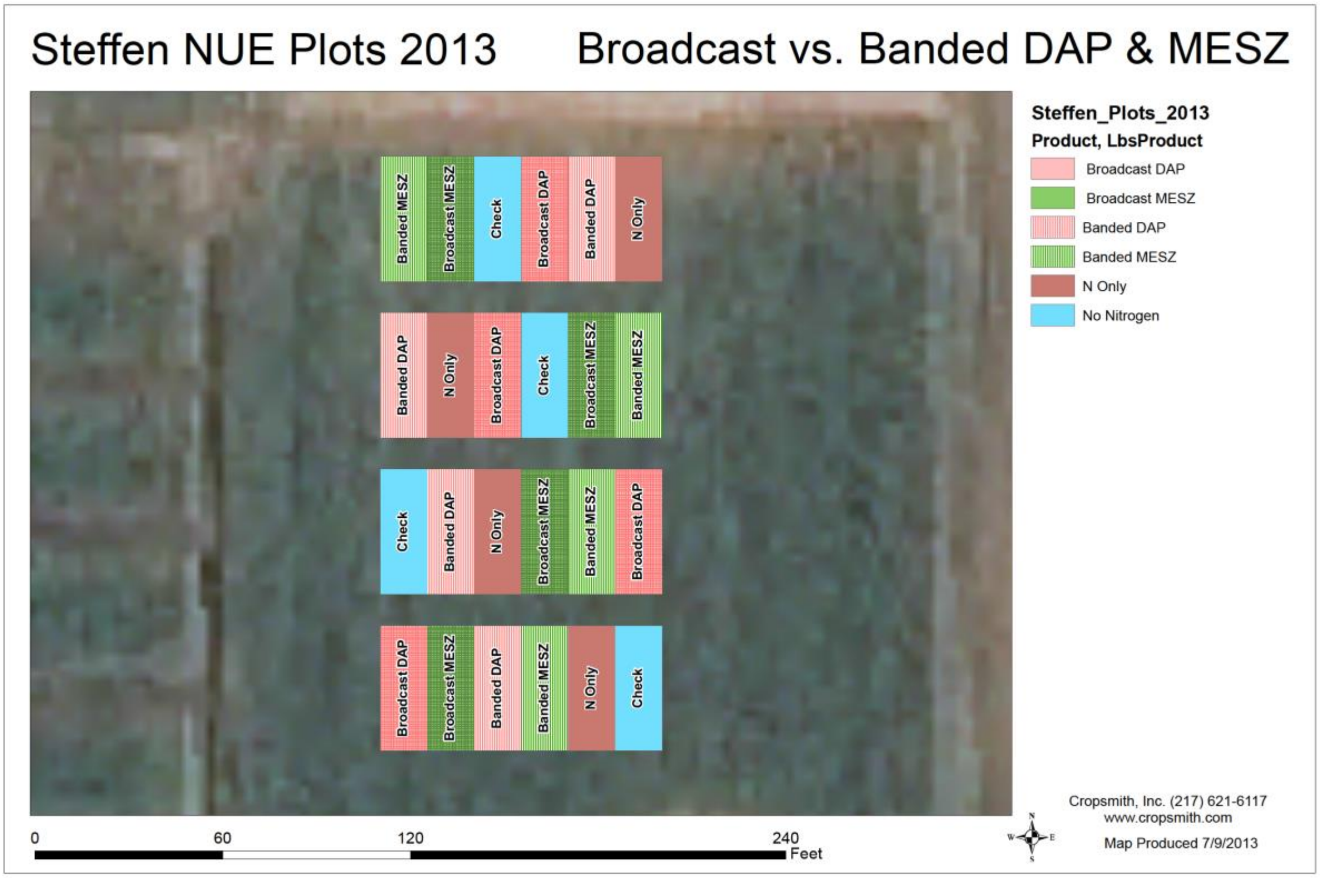
Figure 8. Daily time series showed that timing for (top) **precipitation during large storms** (when Q was 95% > Qb) coincided with peaks in the **(A) hydrograph** (Q = base flow (Qb) + direct run off), **(B) NO_3^- concentrations** (grab samples *vs.* sensor), and **(C) NO_3^- export** (empirical measurements and estimates from the Loadflex composite model). Export was lowest during a drought in 2012 and highest during the year following the drought (2013). For other years, the magnitude of NO_3^- export in response to Q during large storms appeared to decline somewhat over time (C, inset panel).

Goal: Demonstrate BMPs, Technologies and Conservation Systems That Can Help Improve Water Quality In The Watershed

Dozens of demonstration plots, on more than 20 farms, illustrated the benefits and challenges of adopting key practices, technologies and conservation systems in the Indian Creek watershed. Field-scale demonstrations, using farmers' own equipment on their own land, underscored the applicability of the practices in the watershed in commercial conditions. These were not theoretical, and they were not small, academic plots—they were real-world demonstrations, open to inspection by neighbors all season long and thoroughly examined during summer field tours.

Among the demonstrations conducted during the course of the project were:

- Comparisons of nitrogen application timing (fall, spring, sidedress)
- Split applications of nitrogen vs. single, full-rate application
- Comparisons of broadcast vs. strip applications of anhydrous ammonia
- Variable rate vs. uniform rate for nitrogen applications
- Comparisons of slow-release nitrogen sources (Agrotain®, ESN® SmartNitrogen®, Super U® and LIMUS) with conventional N
- Commercial fertilizer and manure with and without Instinct® nitrogen stabilizer
- Rate and timing trials of enhanced-efficiency nitrogen formulations
- Enhanced phosphorus fertilizer (MicroEssentials® SZ): comparisons with MAP
- Nitrogen testing regimens, including stalk and pre-sidedress tests
- Nutrient application timing on wheat
- Comparing cover crops, conservation tillage and manure application with a standard UAN program
- Cover crop management
- Comparing conservation indicators on fields with and without drainage water management structures
- Using climate prediction software (ClimatePro®) to improve crop management decisions
- Using a crop canopy sensor to apply late-season nitrogen



Demonstration plots did not always go smoothly. Challenges ranging from inclement weather and drought to a host farmer's broken leg interfered with the smooth operation of some of the plots. However, the six-year project and multi-site demonstration plot model provided dozens of excellent models and a great forum for conversation about conservation systems, practices and technologies.

Throughout the demonstration plot program and grower meetings (summer and winter), the 4Rs of Nutrient Management were emphasized. In addition to specific tools and technologies that enhance conservation, the philosophy of applying the right fertilizer source at the right rate at the right time in the right place is fundamental to good nutrient management and should be an enduring legacy of the conservation gains enjoyed well beyond the term of the project.

Because Illinois EPA funding was scheduled to end in the middle of the 2016 growing season, CTIC extended the project with IL EPA to extend the program through December 2016 to include the harvest. With that added time in the project, CTIC could capture yield data from the demonstrations and include it as a part of this project report.

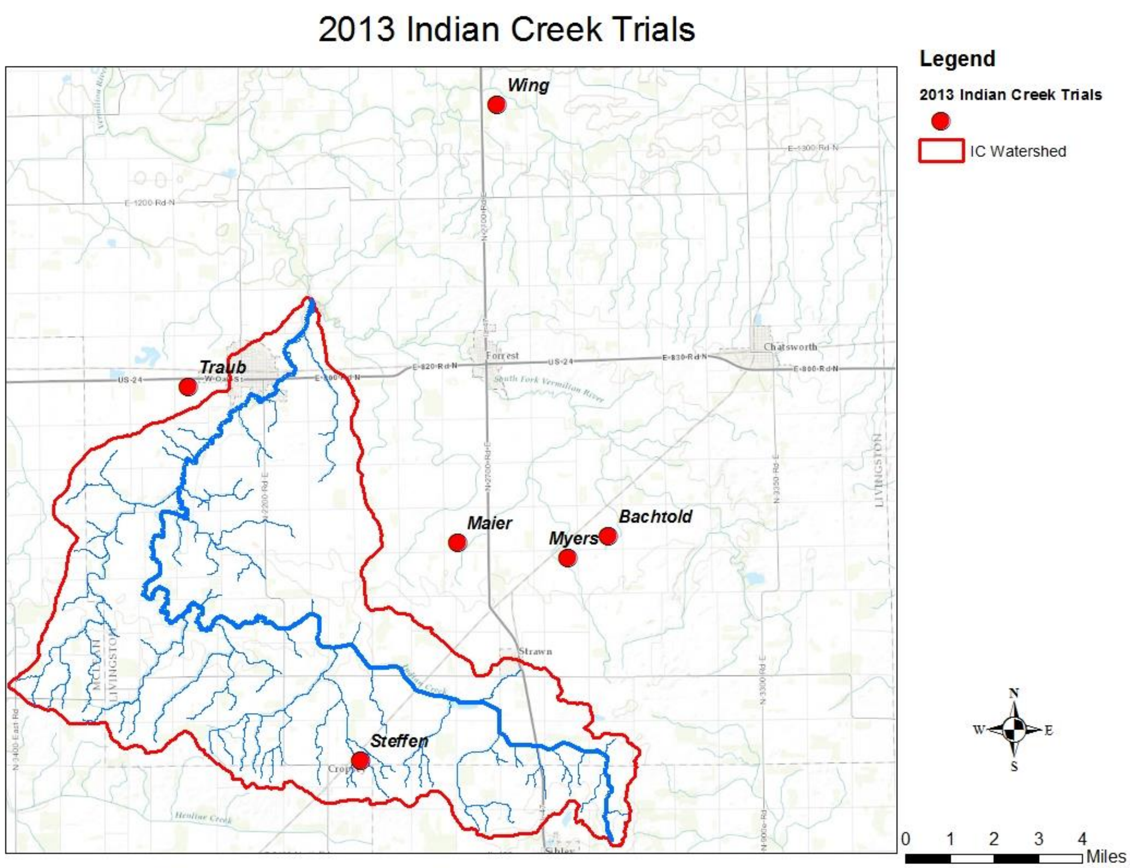
Goal: Implementing The Work Strategy

Putting the Education Work Strategy (EWS) developed under the Illinois EPA framework into practice was a vital step in ensuring positive and effective outreach and promotion of conservation systems within the Indian Creek watershed and well beyond its borders.

Outreach To Indian Creek Producers

Between 2010 and 2012, the Livingston County SWCD—primarily Ag Resources Coordinator Terry Bachtold, who is also a local producer—met one-on-one with each of the 104 producers in the watershed. Bachtold discussed priority conservation systems, described the Indian Creek project, and introduced each producer to funding opportunities designed to encourage adoption of the practices and systems.

Initial USDA-Farm Service Agency (FSA) records calculated 160 farming entities in the



watershed. However, many were actually identified as single farming entities—for instance, farms owned separately by a father and a son but operated together. Five producers from the original list were no longer farming at the time of contact; 10 wished to have no part in a government program. More than half of the 104 farmers contacted had CSP plans.

Following the initial meetings with every producer in the watershed, Bachtold and the SWCD staff maintained a busy schedule of personal contacts throughout the course of the project, meeting with scores of producers every year to maintain contact and keep producers apprised of new opportunities and technologies.

Direct mailings to producers in the watershed detailing the aims of the program and funding available were sent in May, September and November 2011; and January, May and June 2012. Advertisements for annual summer field days and winter meetings were also sent to the entire grower list to make sure that everybody in the watershed was apprised of the educational opportunities.

Meetings with ag retail dealership staffs were conducted throughout the project. Flyers, posters and brochures were distributed to the dealerships for dissemination to producers in June, July and November 2011 and June 2012. Fact sheets highlighting some of the most effective practices from the on-farm demonstrations are also being disseminated at meetings, from the SWCD office and at retail locations throughout the watershed area.

In addition to conventional means, CTIC aggressively pursued a social media program to promote Indian Creek activities inside and outside the watershed, using websites, Facebook and tweets to reach a wide audience with timely messages. The steering committee also reached out to ag retailers for help in reaching their customer bases.

Many other groups also helped spread the word about Indian Creek. Livingston County Farm Bureau, the SWCD and other local agricultural and farmer-based groups helped to spread the word about field days and events and encouraged their members to attend.

Conservation Field Tours

Summer field tours were a highly effective tool for highlighting conservation systems, technologies, practices and products that could benefit the watershed. Centered around visiting demonstration sites, the annual tours grew in popularity from year to year, drawing busloads of farmers, landowners, crop advisors, agribusiness leaders, neighboring stakeholders and government agency personnel to fields around the watershed.

Host farmers, neighboring producers, agronomists, soil scientists, district staff and industry experts provided insight at each tour stop on the practices, science and funding possibilities behind each practice.

In 2013, the Indian Creek Watershed Project summer tour was combined with CTIC’s annual Conservation in Action Tour. In all, 271 people registered for the tour, filling four buses (including one specifically for local farmers and neighbors) as well as a parade of cars that followed the four tour buses to their tour stops.

Prior to the Conservation in Action Tour in Livingston County, CTIC project director Chad Watts and local agronomist and retired extension agent Marion Shier participated in a panel answering questions about the Indian Creek project, part of a Solutions from the Land (SFL) dialogue held the day before the tour for a group of 50 to 60 people.

In 2015, the annual summer tour was preceded by a roundtable discussion. Ben Wicker of Indiana Pork Producers Association, Matt Lechtenburg of the Iowa Department of Agriculture and Land Stewardship, Don Guinnip of the Illinois Soybean Association and Dan Shafer of the Illinois Fertilizer and Chemical Association spoke about nutrient management issues, regulations and nutrient reduction strategies from various states. Timely discussions of major pollution issues, including the Des Moines (Iowa) lawsuit and water quality regulations in the Chesapeake Bay watershed, made the discussion especially relevant to producers engaged in voluntary conservation measures. Information was also presented on the Illinois Nutrient Loss Reduction Strategy, a plan developed by a diverse group of stakeholders in Illinois to reduce nutrient runoff from Illinois farms into waters of the Mississippi River.

Tours included:

- July 7, 2011—120 attendees
- July 10, 2012—150 attendees
- June 2012—Illinois Soybean Association promotional tour in watershed
- July 2012—Illinois Corn Marketing Board tour for legislators on BMPs in watershed
- October 2012—SWCD/NRCS cover crop tour
- July 10, 2013—271 attendees (in conjunction with CTIC Conservation in Action Tour)
- July, 2013—Fishers and Farmers Steering Committee Tour
- May 2014—Legislative visit from staff of Sen. Mark Kirk to Kilgus Dairy
- 2014—USFWS Fishers and Farmers tour of the watershed
- August 2014—120 attendees
- July 16, 2015—130 attendees
- March 2016—4Rs meeting co-hosted with IPNI
- July 13, 2016—80 attendees

Winter Meetings In The Watershed

Each winter, CTIC and the steering committee conducted an informal meeting in Fairbury, Illinois, to discuss challenges and results from the previous growing season; federal, state and local programs used for funding the system; products and practices used in the demonstration plots; and emerging technologies that could augment conservation efforts in the watershed. Each meeting drew 60 to 100 participants.

Meetings included:

- December 2010
- November 2011
- January 2012
- December 2013
- February 2014
- February 2015
- February 2016

Just prior to the meetings in 2014, 2015 and 2016, CTIC held sponsor and partner focus groups. During this time, sponsors and partners were given an advance look at the results from the on-farm demonstrations from that crop year, as well as the chance to ask questions of project agronomists. The focus groups also provided CTIC with a chance to talk to partners and sponsors about the future of demonstrations to help set priorities for the following year. Typically, 5 to 12 partners attended these informational gatherings.

Presentations On Indian Creek

In keeping with the EWS, CTIC and its partners delivered many presentations on the Indian Creek project over the course of the program, including:

- Steering Committee Presentation to CPS Banquet (3/8/11)
- Makinaw Watershed Tour (5/2/11)
- Agricultural Media Summit, New Orleans (7/25-7/26/11)
- Meeting with Soybean Challenge Team (3/28/12)
- Illinois Farm Bureau Young Leaders Conference (3/12), Springfield, IL
- Bureau Creek Watershed Project Meeting (3/12)
- Illinois Non-Point Source Pollution Workshop (11/14/12), Bloomington, IL
- Watershed Innovation and Implementation Network (WIIN) Webinar (12/3/12)
- EPA Webinar on Implementation of the 4Rs (12/10/12)
- Commodity Classic Learning Center Session Featuring Indian Creek Farmer John Traub (3/1/13), Kissimmee, FL
- Ag Connect Expo Display (1/29-1/31/13), Kansas City, MO
- AGREE Meeting (3/21/13), Washington, DC
- Southern Illinois Fertilizer Association Dealers Meeting (11/13), Mt. Vernon, IL
- TFI Fertilizer Roundtable (11/19-11/21/13), Tampa, FL
- Florida Fertilizer and Agrichemical Association (1/14)
- CropLife Webinar (3/14)
- Commodity Classic (2/27-3/1/14), San Antonio, TX
- National Association of Conservation Districts Annual Meeting (1/14), Anaheim, CA

- Soil and Water Conservation Society Annual Meeting (7/28-7/29/14), Lombard, IL
- Agricultural Media Summit (7/14), Indianapolis, IN
- Argonne National Laboratory Bioenergy Meeting (6/14)
- USFWS Fishers and Farmers Steering Committee Meeting (7/14), Bloomington, IL
- National Corn Growers Association Production & Stewardship Action Team Meeting (8/14), Washington, DC
- Illinois Society of Farm Managers and Rural Appraisers (8/29/14)
- Soil Health Partnership Field Day (11/14/14), Forrest, IL
- Lake Springfield Meeting (4 /15), Lake Springfield, IL
- Soil Health Partnership Conservations Systems Workshop (8/5/15), Forrest, IL
- St. Joseph River Basin Commission Meeting (5/20/2016), Niles, MI
- National Association of Conservation Districts Annual Meeting (2/1/16), Reno, NV
- Hypoxia Task Force Meeting (4/25/16), St. Louis, MO
- [Scheduled] Illinois Water Conference (10/16), Champaign, IL

Outreach Via Media and Materials

Media relations, press releases and literature helped spread messages and key lessons from the project throughout its 6-year history. The project, its field days and meetings, and key messages about conservation emanating from the Indian Creek watershed were covered extensively in the farm media serving central Illinois, including FarmWeek, Illinois Agri-News, Indiana Agri-News, Fairbury Blade, Pontiac Daily Leader, Dwight Paper, Central Illinois Farm News, Central Illinois Farm Network, WJEZ Radio and Livingston County SWCD newsletter.

Statewide coverage appeared in Prairie Farmer and Field and Bean (Illinois Soybean Association). Regional/national media contacts amplified the message further through Corn and Soybean Digest, Successful Farming, Farm Futures, AgProfessional, the Penton/Farm Progress media, Progressive Farmer, AgriPulse, Meister Media, the Brownfield Network and AgWired.

Sample placements include:

http://cornandsoybeandigest.com/conservation/cover-crop-challenges-realistic-approach-can-improve-results

http://agrinews-pubs.com/Content/News/MoneyNews/Article/Initiative-shows-ag-can-make-difference-/8/27/9920

http://agrinews-pubs.com/Content/News/Latest-News/Article/Group-looks-to-patch-leaky-nutrient-system/8/6/10102

http://farmfutures.com/story-researchers-integrate-biofuels-food-farms-0-129678 http://agwired.com/2011/07/10/illinois-epa-working-with-farmers-in-indian-creek-watershed/

https://corncorps.com/2011/08/17/water-quality-wednesday-indian-creek-watershed-project/

http://www.agri-pulse.com/Unique-partnership-for-conservation-grows-in-central-Illinois-07123013.asp

http://environmentalchange.nd.edu/news-events/news/67750-study-links-best-management-practices-to-cleaner-watershed/

http://agrinews-pubs.com/Content/Default/Illinois-News/Article/Data-shows-improved-water-quality/-3/78/14591

In addition to media relations, CTIC created a series of fact sheets based on the demonstration projects within the project, which were distributed not only in the Indian Creek watershed, but also in the Vermillion River Headwaters project and at the 4Rs meeting co-hosted in Fairbury with IPNI. A CTIC-published PDF booklet on leadership lessons, as well as PDF sheets on key leadership learnings from Purdue University, augmented the media efforts. So did a series of video vignettes on individual farmers involved with the project, an inspiration to other farmers and an explanation of the importance of voluntary conservation efforts to non-farm audiences.

Indian Creek Watershed Project Sponsors

Tier 1:
Agrium
The Fertilizer Institute
GROWMARK
Illinois Soybean Association
Monsanto
The Mosaic Company
New Leader
Tier 2:
BASF
Case IH
Dow AgroSciences
John Deere
Illinois American Water
Illinois Corn Marketing Board
Tier 3:
Cropsmith
Koch Agronomic Services

Syngenta
Tour:
Brandt

Thanks to our partners: Illinois Environmental Protection Agency, Livingston County Soil and Water Conservation District, USDA Natural Resources Conservation Service, U.S. Geological Survey, Illinois Fertilizer and Chemical Association, Crop Production Services, Fishers and Farmers Partnership for the Upper Mississippi River Basin, Illinois Council on Best Management Practices, The A.J. Sackett and Sons Company and Altorfer, Inc.

CONCLUSION

The six-year Indian Creek Watershed Project was a model program in many ways. A shining example of organization and leadership; a paragon of public-private partnerships; a case study in demonstration plots and outreach; a watershed studied for both its water chemistry and its social sciences; and a case study for organizers in watersheds across the nation, Indian Creek's impacts will be felt well beyond its banks.

The project undoubtedly benefitted from its unique place on the map and in history. The early years of the project's sign-ups coincided with record-high commodity prices, making it less financially risky to try new practices or invest in upgrades and machinery. That said, it is important to note that Indian Creek producers' commitment to risk some yield in the transition to new systems ran counter to the instincts of many growers across the country, who abandoned conservation tillage in an effort to maximize yields during the period of high prices. Those Indian Creek growers should be saluted for their commitment.

In addition to occurring at the right time, the Indian Creek Watershed Project was also conducted in the right place. Choosing a small, largely agricultural watershed for the project was a calculated, smart move. But no one could have predicted how a tight-knit community—joined by family and church ties—would come together around the project, how committed the steering committee would be to staying the course over six years, nor how Terry Bachtold would take on the massive task of meeting with every farmer in the watershed, often several times during the project.

The payoffs became apparent during the second phase of the project, when commodity prices crashed. The demonstrations continued, the steering committee held together, improvements in water quality were documented and acreage under conservation practices held above the targeted 50% mark in spite of the challenges facing the producers in the watershed. Born in good times and maintained through tough ones, the conservation lessons of Indian Creek will echo through the years and across the country.

APPENDICES

USDA United States Department of Agriculture Natural Resources Conservation Service — IDEA Integrated Data for Enterprise Analysis

HUC12 Practice Summary (Applied Practices that were reported to PRS)

Report Parameter	Parameter Value
Report View	HUC12
State	Illinois
Locations	07130002 (Vermilion)
Sub-Locations	Belle Prairie-Indian Creek (071300020204), Indian Creek (071300020203), Town of Fairbury (071300020205)
Programs	All
Practices	All
Applied Years	2010, 2011, 2012, 2013, 2014, 2015
Land Uses	All
Report Last Updated	Feb 13 2016 7:22AM
Total Record Count	80

HUC 8	HUC 12	Pr. Code	Practice Name	Pr. Unit	Program	Applied Year	Land Use	Land Unit Acres	Applied Amount	Applied Count
Vermilion	Belle Prairie-Indian Creek	102	Comprehensive Nutrient Management Plan - Written	no	EQIP	2012	Farmstead	1.80	1.00	1
Vermilion	Belle Prairie-Indian Creek	328	Conservation Crop Rotation	ac	CTA-GENRL	2011	Crop	223.00	223.00	3
Vermilion	Belle Prairie-Indian Creek	328	Conservation Crop Rotation	ac	CTA-GENRL	2012	Crop	313.00	313.00	2
Vermilion	Belle Prairie-Indian Creek	340	Cover Crop	ac	EQIP	2014	Crop	86.50	40.00	1
Vermilion	Belle Prairie-Indian Creek	340	Cover Crop	ac	EQIP	2015	Crop	86.50	40.00	1
Vermilion	Belle Prairie-Indian Creek	345	Residue and Tillage Management, Reduced Till	ac	CTA-GENRL	2012	Crop	313.00	313.00	2
Vermilion	Belle Prairie-Indian Creek	412	Grassed Waterway	ac	EQIP	2013	Crop	4.10	4.10	1
Vermilion	Belle Prairie-Indian Creek	590	Nutrient Management	ac	CTA-GENRL	2013	Crop	225.90	107.40	2
Vermilion	Belle Prairie-Indian Creek	633	Waste Recycling	ac	EQIP	2010	Crop	169.60	76.70	3
Vermilion	Belle Prairie-Indian Creek	633	Waste Recycling	ac	EQIP	2011	Crop	77.00	64.00	1
Vermilion	Belle Prairie-Indian Creek	633	Waste Recycling	ac	EQIP	2012	Crop	173.20	163.70	6
Vermilion	Belle Prairie-Indian Creek	633	Waste Recycling	ac	EQIP	2013	Crop	149.50	110.60	1
Vermilion	Belle Prairie-Indian Creek	798	Seasonal High Tunnel System for Crops	sq ft	EQIP	2010	Crop	9.60	2,000.00	1
Vermilion	Indian Creek	102	Comprehensive Nutrient Management Plan - Written	no	EQIP	2010	Farmstead	5.10	1.00	1
Vermilion	Indian Creek	102	Comprehensive Nutrient Management Plan - Written	no	EQIP	2011	Farmstead	13.00	3.00	3
Vermilion	Indian Creek	313	Waste Storage Facility	no	EQIP	2011	Farmstead	5.00	1.00	1
Vermilion	Indian Creek	313	Waste Storage Facility	no	EQIP	2014	Farmstead	2.10	1.00	1
Vermilion	Indian Creek	317	Composting Facility	no	EQIP	2010	Farmstead	11.30	1.00	1
Vermilion	Indian Creek	317	Composting Facility	no	EQIP	2011	Farmstead	5.00	1.00	1
Vermilion	Indian Creek	317	Composting Facility	no	EQIP	2012	Crop	5.90	1.00	1
Vermilion	Indian Creek	327	Conservation Cover	ac	CRP	2010	Crop	4.10	4.10	1
Vermilion	Indian Creek	328	Conservation Crop Rotation	ac	CTA-GENRL	2010	Crop	388.80	388.80	2
Vermilion	Indian Creek	328	Conservation Crop Rotation	ac	CTA-GENRL	2011	Crop	408.50	438.90	7
Vermilion	Indian Creek	328	Conservation Crop Rotation	ac	CTA-GENRL	2013	Crop	76.50	76.50	2
Vermilion	Indian Creek	340	Cover Crop	ac	EQIP	2013	Crop	40.10	37.60	1
Vermilion	Indian Creek	340	Cover Crop	ac	EQIP	2014	Crop	124.30	20.00	1
Vermilion	Indian Creek	340	Cover Crop	ac	EQIP	2015	Crop	349.00	348.30	5
Vermilion	Indian Creek	342	Critical Area Planting	ac	EQIP	2014	Other Rural Land	4.30	0.90	1
Vermilion	Indian Creek	342	Critical Area Planting	ac	EQIP	2015	Associated Ag Land	2.80	2.40	1
Vermilion	Indian Creek	345	Residue and Tillage Management, Reduced Till	ac	CTA-GENRL	2010	Crop	388.80	388.80	2
Vermilion	Indian Creek	360	Waste Facility Closure	no	EQIP	2011	Farmstead	5.00	1.00	1
Vermilion	Indian Creek	380	Windbreak/Shelterbelt Establishment	ft	EQIP	2010	Farmstead	11.30	140.00	1
Vermilion	Indian Creek	393	Filter Strip	ac	CRP	2010	Crop	4.10	4.10	1
Vermilion	Indian Creek	412	Grassed Waterway	ac	CRP	2010	Crop	1.40	1.40	1
Vermilion	Indian Creek	412	Grassed Waterway	ac	EQIP	2011	Crop	4.80	5.10	4
Vermilion	Indian Creek	412	Grassed Waterway	ac	EQIP	2012	Crop	11.80	11.20	5
Vermilion	Indian Creek	412	Grassed Waterway	ac	EQIP	2014	Other Rural Land	4.30	0.90	1
Vermilion	Indian Creek	412	Grassed Waterway	ac	EQIP	2015	Associated Ag Land	2.80	2.40	1
Vermilion	Indian Creek	560	Access Road	ft	EQIP	2011	Farmstead	5.00	400.00	1
Vermilion	Indian Creek	560	Access Road	ft	EQIP	2012	Farmstead	4.00	300.00	1
Vermilion	Indian Creek	560	Access Road	ft	EQIP	2015	Farmstead	2.10	307.00	1
Vermilion	Indian Creek	590	Nutrient Management	ac	CTA-GENRL	2013	Crop	239.40	151.50	4
Vermilion	Indian Creek	606	Subsurface Drain	ft	EQIP	2011	Farmstead	5.00	1,341.00	1
Vermilion	Indian Creek	606	Subsurface Drain	ft	EQIP	2012	Crop	4.30	2,750.00	2
Vermilion	Indian Creek	606	Subsurface Drain	ft	EQIP	2014	Farmstead	2.10	800.00	1

Vermilion	Indian Creek	606	Subsurface Drain	ft	EQIP	2014	Other Rural Land	4.30	521.00	1
Vermilion	Indian Creek	606	Subsurface Drain	ft	EQIP	2015	Associated Ag Land	2.80	2,000.00	1
Vermilion	Indian Creek	633	Waste Recycling	ac	EQIP	2010	Crop	119.10	118.00	1
Vermilion	Indian Creek	633	Waste Recycling	ac	EQIP	2011	Crop	238.20	236.00	2
Vermilion	Indian Creek	633	Waste Recycling	ac	EQIP	2013	Crop	239.40	151.50	4
Vermilion	Indian Creek	634	Waste Transfer	no	EQIP	2011	Farmstead	5.00	1.00	1
Vermilion	Indian Creek	634	Waste Transfer	no	EQIP	2015	Farmstead	2.10	1.00	1
Vermilion	Indian Creek	645	Upland Wildlife Habitat Management	ac	CRP	2010	Crop	4.10	4.10	1
Vermilion	Indian Creek	645	Upland Wildlife Habitat Management	ac	CRP	2011	Crop	4.10	4.10	1
Vermilion	Indian Creek	ENR01	Fuel use reduction for field operations	ac	CStwP	2015	Crop	334.20	261.40	2
Vermilion	Indian Creek	SQL05	Use deep rooted crops to breakup soil compaction	ac	CStwP	2015	Crop	167.10	36.40	1
Vermilion	Indian Creek	WQL04	Plant Tissue Testsing and Analysis to Improve Nitrogen Management	ac	CStwP	2015	Crop	425.40	425.40	2
Vermilion	Town of Fairbury	122	Agricultural Energy Management Plan, Headquarters - Written	no	EQIP	2014	Farmstead	3.50	1.00	1
Vermilion	Town of Fairbury	313	Waste Storage Facility	no	EQIP	2013	Crop	154.80	1.00	1
Vermilion	Town of Fairbury	317	Composting Facility	no	EQIP	2014	Farmstead	2.10	1.00	1
Vermilion	Town of Fairbury	328	Conservation Crop Rotation	ac	CTA-GENRL	2011	Crop	226.00	226.00	3
Vermilion	Town of Fairbury	328	Conservation Crop Rotation	ac	CTA-GENRL	2011	Farmstead	7.80	7.80	1
Vermilion	Town of Fairbury	328	Conservation Crop Rotation	ac	CTA-GENRL	2012	Crop	825.60	825.60	12
Vermilion	Town of Fairbury	340	Cover Crop	ac	EQIP	2014	Crop	38.10	38.10	1
Vermilion	Town of Fairbury	345	Residue and Tillage Management, Reduced Till	ac	CTA-GENRL	2012	Crop	825.60	825.60	12
Vermilion	Town of Fairbury	367	Roofs and Covers	no	EQIP	2014	Farmstead	2.10	1.00	1
Vermilion	Town of Fairbury	380	Windbreak/Shelterbelt Establishment	ft	EQIP	2014	Crop	154.80	300.00	1
Vermilion	Town of Fairbury	533	Pumping Plant	no	EQIP	2014	Farmstead	2.10	1.00	1
Vermilion	Town of Fairbury	560	Access Road	ft	EQIP	2013	Crop	154.80	250.00	1
Vermilion	Town of Fairbury	606	Subsurface Drain	ft	EQIP	2013	Crop	154.80	685.00	1
Vermilion	Town of Fairbury	633	Waste Recycling	ac	EQIP	2010	Crop	305.00	549.00	3
Vermilion	Town of Fairbury	633	Waste Recycling	ac	EQIP	2011	Crop	226.00	171.00	3
Vermilion	Town of Fairbury	633	Waste Recycling	ac	EQIP	2012	Crop	275.00	190.80	5
Vermilion	Town of Fairbury	633	Waste Recycling	ac	EQIP	2015	Crop	114.30	58.60	1
Vermilion	Town of Fairbury	634	Waste Transfer	no	EQIP	2013	Crop	154.80	1.00	1
Vermilion	Town of Fairbury	798	Seasonal High Tunnel System for Crops	sq ft	EQIP	2014	Crop	5.00	2,000.00	1
Vermilion	Town of Fairbury	AIR07	GPS, targeted spray application (SmartSprayer), or other chemical application electronic control tec	ac	CStwP	2015	Crop	18.00	758.50	1
Vermilion	Town of Fairbury	AIR08	Nitrification inhibitors or urease inhibitors	ac	CStwP	2015	Crop	18.00	158.50	1
Vermilion	Town of Fairbury	PLT19	Herbicide resistant weed management	ac	CStwP	2015	Crop	18.00	320.00	1
Vermilion	Town of Fairbury	WQL14	Land application of only treated manure	ac	CStwP	2015	Crop	18.00	280.00	1

USDA United States Department of Agriculture Natural Resources Conservation Service

IDEA Integrated Data for Enterprise Analysis

HUC12 Practice Summary (Planned Practices that have Not Been Applied, Planning was reported to PRS)

Report Criteria:

Report Parameter	Parameter Value
Report View	HUC12
State	Illinois
Locations	07130002 (Vermilion)
Sub-Locations	Belle Prairie-Indian Creek (071300020204), Indian Creek (071300020203), Town of Fairbury (071300020205)
Programs	All
Practices	All
Planned Years	2010, 2011, 2012, 2013, 2014, 2015
Land Uses	All
Report Last Updated	Feb 13 2016 7:22AM
Total Record Count	319

HUC 8	HUC 12	Pr. Code	Practice Name	Pr. Unit	Program	Planned Year	Land Use	Land Unit Acres	Planned Amount	Planned Count
Vermilion	Belle Prairie-Indian Creek	327	Conservation Cover	ac	CRP	2012	Crop	4.00	2.40	1
Vermilion	Belle Prairie-Indian Creek	327	Conservation Cover	ac	CRP	2015	Associated Ag Land	7.20	4.80	3
Vermilion	Belle Prairie-Indian Creek	327	Conservation Cover	ac	CRP	2015	Crop	2.50	2.50	1
Vermilion	Belle Prairie-Indian Creek	328	Conservation Crop Rotation	ac	CTA-GENRL	2010	Crop	100.00	100.00	1
Vermilion	Belle Prairie-Indian Creek	338	Prescribed Burning	ac	CRP	2010	Crop	14.50	14.50	3
Vermilion	Belle Prairie-Indian Creek	338	Prescribed Burning	ac	CRP	2012	Associated Ag Land	18.90	18.90	3
Vermilion	Belle Prairie-Indian Creek	338	Prescribed Burning	ac	CRP	2013	Crop	13.80	13.80	1
Vermilion	Belle Prairie-Indian Creek	338	Prescribed Burning	ac	CRP	2015	Crop	4.00	2.40	1
Vermilion	Belle Prairie-Indian Creek	342	Critical Area Planting	ac	CRP	2012	Crop	4.00	0.60	1
Vermilion	Belle Prairie-Indian Creek	342	Critical Area Planting	ac	CTA-GENRL	2015	Crop	339.00	0.80	2
Vermilion	Belle Prairie-Indian Creek	345	Residue and Tillage Management, Reduced Till	ac	CTA-GENRL	2010	Crop	100.00	100.00	1
Vermilion	Belle Prairie-Indian Creek	386	Field Border	ac	CRP	2010	Crop	13.80	13.80	1
Vermilion	Belle Prairie-Indian Creek	386	Field Border	ac	CRP	2012	Crop	6.50	6.50	2
Vermilion	Belle Prairie-Indian Creek	391	Riparian Forest Buffer	ac	CRP	2014	Crop	5.80	5.80	1
Vermilion	Belle Prairie-Indian Creek	393	Filter Strip	ac	CRP	2010	Crop	3.70	3.70	2
Vermilion	Belle Prairie-Indian Creek	393	Filter Strip	ac	CRP	2012	Crop	3.90	3.90	2
Vermilion	Belle Prairie-Indian Creek	393	Filter Strip	ac	CRP	2013	Crop	4.10	4.20	2
Vermilion	Belle Prairie-Indian Creek	393	Filter Strip	ac	CRP	2015	Associated Ag Land	4.80	4.80	2
Vermilion	Belle Prairie-Indian Creek	410	Grade Stabilization Structure	no	CTA-GENRL	2015	Crop	154.50	1.00	1
Vermilion	Belle Prairie-Indian Creek	412	Grassed Waterway	ac	CRP	2010	Crop	1.40	1.40	1
Vermilion	Belle Prairie-Indian Creek	412	Grassed Waterway	ac	CRP	2012	Crop	3.30	3.60	2
Vermilion	Belle Prairie-Indian Creek	412	Grassed Waterway	ac	CRP	2013	Crop	2.00	2.00	1
Vermilion	Belle Prairie-Indian Creek	412	Grassed Waterway	ac	CRP	2014	Crop	1.00	1.00	1
Vermilion	Belle Prairie-Indian Creek	412	Grassed Waterway	ac	CRP	2015	Crop	1.20	1.20	1
Vermilion	Belle Prairie-Indian Creek	412	Grassed Waterway	ac	CTA-GENRL	2015	Crop	184.50	0.60	1
Vermilion	Belle Prairie-Indian Creek	472	Access Control	ac	CRP	2010	Crop	18.90	18.90	4
Vermilion	Belle Prairie-Indian Creek	472	Access Control	ac	CRP	2012	Crop	17.70	18.00	7
Vermilion	Belle Prairie-Indian Creek	472	Access Control	ac	CRP	2013	Crop	6.10	6.20	3
Vermilion	Belle Prairie-Indian Creek	472	Access Control	ac	CRP	2014	Crop	6.80	6.80	2
Vermilion	Belle Prairie-Indian Creek	472	Access Control	ac	CRP	2015	Associated Ag Land	4.80	4.80	2
Vermilion	Belle Prairie-Indian Creek	472	Access Control	ac	CRP	2015	Crop	3.70	3.70	2
Vermilion	Belle Prairie-Indian Creek	606	Subsurface Drain	ft	CRP	2010	Crop	1.40	1,600.00	1
Vermilion	Belle Prairie-Indian Creek	606	Subsurface Drain	ft	CRP	2012	Crop	3.30	2,540.00	2
Vermilion	Belle Prairie-Indian Creek	606	Subsurface Drain	ft	CRP	2013	Crop	2.00	1,400.00	1
Vermilion	Belle Prairie-Indian Creek	606	Subsurface Drain	ft	CTA-GENRL	2012	Crop	4.10	3,000.00	1
Vermilion	Belle Prairie-Indian Creek	606	Subsurface Drain	ft	CTA-GENRL	2015	Crop	184.50	400.00	1
Vermilion	Belle Prairie-Indian Creek	633	Waste Recycling	ac	CTA-GENRL	2011	Crop	101.70	47.70	2
Vermilion	Belle Prairie-Indian Creek	633	Waste Recycling	ac	CTA-GENRL	2013	Crop	313.00	146.00	2
Vermilion	Belle Prairie-Indian Creek	644	Wetland Wildlife Habitat Management	ac	CRP	2012	Crop	4.00	4.00	1
Vermilion	Belle Prairie-Indian Creek	645	Upland Wildlife Habitat Management	ac	CRP	2010	Crop	17.50	17.50	3
Vermilion	Belle Prairie-Indian Creek	645	Upland Wildlife Habitat Management	ac	CRP	2012	Crop	10.40	10.40	4
Vermilion	Belle Prairie-Indian Creek	645	Upland Wildlife Habitat Management	ac	CRP	2013	Crop	4.10	4.20	2
Vermilion	Belle Prairie-Indian Creek	645	Upland Wildlife Habitat Management	ac	CRP	2014	Crop	5.80	5.80	1

Vermilion	Belle Prairie-Indian Creek	646	Shallow Water Development and Management	ac	CRP	2012	Crop	4.00	1.00	1
Vermilion	Belle Prairie-Indian Creek	647	Early Successional Habitat Development/Management	ac	CRP	2010	Crop	73.60	77.30	15
Vermilion	Belle Prairie-Indian Creek	647	Early Successional Habitat Development/Management	ac	CRP	2011	Crop	9.30	9.50	3
Vermilion	Belle Prairie-Indian Creek	647	Early Successional Habitat Development/Management	ac	CRP	2012	Associated Ag Land	18.90	18.90	3
Vermilion	Belle Prairie-Indian Creek	647	Early Successional Habitat Development/Management	ac	CRP	2012	Crop	1.90	1.90	1
Vermilion	Belle Prairie-Indian Creek	647	Early Successional Habitat Development/Management	ac	CRP	2013	Crop	13.80	13.80	1
Vermilion	Belle Prairie-Indian Creek	647	Early Successional Habitat Development/Management	ac	CRP	2014	Crop	4.10	4.20	2
Vermilion	Belle Prairie-Indian Creek	647	Early Successional Habitat Development/Management	ac	CRP	2015	Crop	10.50	8.90	3
Vermilion	Belle Prairie-Indian Creek	AIR02	Nitrogen stabilizers for air emissions control	ac	CStwP	2011	Crop	694.80	200.00	1
Vermilion	Belle Prairie-Indian Creek	AIR02	Nitrogen stabilizers for air emissions control	ac	CStwP	2013	Crop	694.80	200.00	1
Vermilion	Belle Prairie-Indian Creek	AIR02	Nitrogen stabilizers for air emissions control	ac	CStwP	2014	Crop	694.80	200.00	1
Vermilion	Belle Prairie-Indian Creek	AIR02	Nitrogen stabilizers for air emissions control	ac	CStwP	2015	Crop	694.80	200.00	1
Vermilion	Belle Prairie-Indian Creek	AIR08	Nitrification inhibitors or urease inhibitors	ac	CStwP	2015	Crop	184.50	2,346.30	1
Vermilion	Belle Prairie-Indian Creek	ANM03	Incorporate native grasses and/or legumes into 15% or more of the forage base	ac	CStwP	2012	Pasture	66.40	12.00	1
Vermilion	Belle Prairie-Indian Creek	ENR05	Locally grown and marketed farm products	ac	CStwP	2010	Pasture	15.00	15.00	1
Vermilion	Belle Prairie-Indian Creek	ENR05	Locally grown and marketed farm products	ac	CStwP	2013	Pasture	15.00	15.00	1
Vermilion	Belle Prairie-Indian Creek	ENR05	Locally grown and marketed farm products	ac	CStwP	2014	Pasture	15.00	15.00	1
Vermilion	Belle Prairie-Indian Creek	PLT02	Monitor key grazing areas to improve grazing management	ac	CStwP	2011	Pasture	15.00	15.00	1
Vermilion	Belle Prairie-Indian Creek	PLT02	Monitor key grazing areas to improve grazing management	ac	CStwP	2013	Pasture	15.00	15.00	1
Vermilion	Belle Prairie-Indian Creek	PLT02	Monitor key grazing areas to improve grazing management	ac	CStwP	2014	Pasture	15.00	15.00	1
Vermilion	Belle Prairie-Indian Creek	WQL04	Plant Tissue Testsing and Analysis to Improve Nitrogen Management	ac	CStwP	2011	Crop	996.70	600.00	2
Vermilion	Belle Prairie-Indian Creek	WQL04	Plant Tissue Testsing and Analysis to Improve Nitrogen Management	ac	CStwP	2012	Crop	741.20	741.20	1
Vermilion	Belle Prairie-Indian Creek	WQL04	Plant Tissue Testsing and Analysis to Improve Nitrogen Management	ac	CStwP	2013	Crop	1,737.90	1,341.20	3
Vermilion	Belle Prairie-Indian Creek	WQL04	Plant Tissue Testsing and Analysis to Improve Nitrogen Management	ac	CStwP	2014	Crop	1,737.90	1,341.20	3
Vermilion	Belle Prairie-Indian Creek	WQL04	Plant Tissue Testsing and Analysis to Improve Nitrogen Management	ac	CStwP	2015	Crop	1,737.90	1,341.20	3
Vermilion	Belle Prairie-Indian Creek	WQL05	Apply nutrients no more than 30 days prior to planned planting date	ac	CStwP	2015	Crop	184.50	1,600.00	1
Vermilion	Belle Prairie-Indian Creek	WQL06	Apply controlled release nitrogen fertilizer	ac	CStwP	2011	Pasture	15.00	15.00	1
Vermilion	Belle Prairie-Indian Creek	WQL06	Apply controlled release nitrogen fertilizer	ac	CStwP	2013	Pasture	15.00	15.00	1
Vermilion	Belle Prairie-Indian Creek	WQL06	Apply controlled release nitrogen fertilizer	ac	CStwP	2014	Pasture	15.00	15.00	1
Vermilion	Belle Prairie-Indian Creek	WQL08	Apply split applications of nitrogen based on a pre-sidedress nitrogen test on cropland	ac	CStwP	2011	Crop	996.70	600.00	2
Vermilion	Belle Prairie-Indian Creek	WQL08	Apply split applications of nitrogen based on a pre-sidedress nitrogen test on cropland	ac	CStwP	2013	Crop	996.70	600.00	2
Vermilion	Belle Prairie-Indian Creek	WQL08	Apply split applications of nitrogen based on a pre-sidedress nitrogen test on cropland	ac	CStwP	2014	Crop	996.70	600.00	2
Vermilion	Belle Prairie-Indian Creek	WQL08	Apply split applications of nitrogen based on a pre-sidedress nitrogen test on cropland	ac	CStwP	2015	Crop	996.70	600.00	2

Vermilion	Belle Prairie-Indian Creek	WQL10	Plant an annual grass-type cover crop that will scavenge residual nitrogen	ac	CStwP	2015	Crop	77.40	150.00	1
Vermilion	Belle Prairie-Indian Creek	WQL15	Reduce the concentration of nutrients on livestock farms	ac	CStwP	2010	Pasture	15.00	15.00	1
Vermilion	Belle Prairie-Indian Creek	WQL15	Reduce the concentration of nutrients on livestock farms	ac	CStwP	2013	Pasture	15.00	15.00	1
Vermilion	Belle Prairie-Indian Creek	WQL15	Reduce the concentration of nutrients on livestock farms	ac	CStwP	2014	Pasture	15.00	15.00	1
Vermilion	Belle Prairie-Indian Creek	WQL24	Apply enhanced efficiency fertilizer products	ac	CStwP	2015	Pasture	15.00	15.00	1
Vermilion	Belle Prairie-Indian Creek	WQL25	Split applications of nitrogen based on a PSNT	ac	CStwP	2013	Crop	741.20	264.10	1
Vermilion	Belle Prairie-Indian Creek	WQL25	Split applications of nitrogen based on a PSNT	ac	CStwP	2014	Crop	741.20	264.10	1
Vermilion	Belle Prairie-Indian Creek	WQL25	Split applications of nitrogen based on a PSNT	ac	CStwP	2015	Crop	818.60	384.10	2
Vermilion	Indian Creek	100	Comprehensive Nutrient Management Plan	no	CTA-GENRL	2010	Farmstead	4.00	1.00	1
Vermilion	Indian Creek	313	Waste Storage Facility	no	CTA-GENRL	2011	Farmstead	5.00	1.00	1
Vermilion	Indian Creek	316	Animal Mortality Facility	no	EQIP	2015	Farmstead	2.10	1.00	1
Vermilion	Indian Creek	327	Conservation Cover	ac	CRP	2011	Crop	3.30	3.30	1
Vermilion	Indian Creek	327	Conservation Cover	ac	CRP	2014	Crop	3.30	2.20	1
Vermilion	Indian Creek	327	Conservation Cover	ac	CRP	2015	Crop	12.80	12.10	6
Vermilion	Indian Creek	328	Conservation Crop Rotation	ac	CTA-GENRL	2010	Crop	74.10	74.10	3
Vermilion	Indian Creek	329	Residue and Tillage Management, No-Till	ac	CTA-GENRL	2010	Crop	74.10	74.10	3
Vermilion	Indian Creek	338	Prescribed Burning	ac	CRP	2015	Crop	0.20	0.20	1
Vermilion	Indian Creek	342	Critical Area Planting	ac	CTA-GENRL	2015	Crop	34.70	0.30	1
Vermilion	Indian Creek	345	Residue and Tillage Management, Reduced Till	ac	CTA-GENRL	2011	Crop	152.10	152.10	3
Vermilion	Indian Creek	367	Roofs and Covers	no	EQIP	2015	Farmstead	2.10	1.00	1
Vermilion	Indian Creek	386	Field Border	ac	CRP	2012	Crop	0.20	0.20	1
Vermilion	Indian Creek	386	Field Border	ac	CTA-GENRL	2010	Crop	161.10	6.70	2
Vermilion	Indian Creek	393	Filter Strip	ac	CRP	2010	Crop	2.30	2.30	1
Vermilion	Indian Creek	393	Filter Strip	ac	CRP	2011	Crop	6.60	5.50	2
Vermilion	Indian Creek	393	Filter Strip	ac	CRP	2013	Crop	13.70	6.00	3
Vermilion	Indian Creek	393	Filter Strip	ac	CRP	2014	Crop	5.70	5.70	4
Vermilion	Indian Creek	393	Filter Strip	ac	CRP	2015	Crop	16.30	16.30	8
Vermilion	Indian Creek	412	Grassed Waterway	ac	CRP	2010	Crop	147.80	6.40	3
Vermilion	Indian Creek	412	Grassed Waterway	ac	CRP	2011	Associated Ag Land	9.10	5.70	6
Vermilion	Indian Creek	412	Grassed Waterway	ac	CRP	2011	Crop	185.50	4.30	2
Vermilion	Indian Creek	412	Grassed Waterway	ac	CRP	2012	Crop	10.30	10.30	3
Vermilion	Indian Creek	412	Grassed Waterway	ac	CRP	2014	Associated Ag Land	2.10	2.10	1
Vermilion	Indian Creek	412	Grassed Waterway	ac	CRP	2015	Crop	0.90	0.90	1
Vermilion	Indian Creek	412	Grassed Waterway	ac	CTA-GENRL	2010	Crop	2.10	3.60	1
Vermilion	Indian Creek	412	Grassed Waterway	ac	CTA-GENRL	2011	Crop	5.30	5.70	5
Vermilion	Indian Creek	412	Grassed Waterway	ac	CTA-GENRL	2012	Crop	1.50	1.40	1
Vermilion	Indian Creek	412	Grassed Waterway	ac	CTA-GENRL	2013	Crop	312.70	4.00	1
Vermilion	Indian Creek	412	Grassed Waterway	ac	CTA-GENRL	2015	Crop	34.70	0.30	1
Vermilion	Indian Creek	472	Access Control	ac	CRP	2010	Crop	147.80	6.40	3
Vermilion	Indian Creek	472	Access Control	ac	CRP	2011	Associated Ag Land	9.10	5.70	6
Vermilion	Indian Creek	472	Access Control	ac	CRP	2011	Crop	102.80	5.30	2
Vermilion	Indian Creek	472	Access Control	ac	CRP	2012	Crop	3.10	3.10	2
Vermilion	Indian Creek	472	Access Control	ac	CRP	2013	Crop	13.70	6.00	3
Vermilion	Indian Creek	472	Access Control	ac	CRP	2014	Associated Ag Land	2.10	2.10	1
Vermilion	Indian Creek	472	Access Control	ac	CRP	2014	Crop	5.70	5.70	4
Vermilion	Indian Creek	472	Access Control	ac	CRP	2015	Crop	16.30	16.30	8
Vermilion	Indian Creek	533	Pumping Plant	no	CTA-GENRL	2013	Farmstead	4.40	1.00	1
Vermilion	Indian Creek	533	Pumping Plant	no	EQIP	2014	Farmstead	2.10	1.00	1
Vermilion	Indian Creek	590	Nutrient Management	ac	CTA-GENRL	2011	Crop	152.10	152.10	3
Vermilion	Indian Creek	606	Subsurface Drain	ft	CRP	2010	Crop	4.10	3,330.00	1
Vermilion	Indian Creek	606	Subsurface Drain	ft	CRP	2011	Associated Ag Land	6.50	3,150.00	4
Vermilion	Indian Creek	606	Subsurface Drain	ft	CRP	2011	Crop	86.00	1,360.00	1
Vermilion	Indian Creek	606	Subsurface Drain	ft	CRP	2012	Crop	3.70	4,225.00	1

Vermilion	Indian Creek	606	Subsurface Drain	ft	CTA-GENRL	2011	Crop	0.70	800.00	1
Vermilion	Indian Creek	606	Subsurface Drain	ft	CTA-GENRL	2012	Crop	1.50	1,100.00	1
Vermilion	Indian Creek	606	Subsurface Drain	ft	CTA-GENRL	2013	Crop	312.70	5,250.00	1
Vermilion	Indian Creek	606	Subsurface Drain	ft	CTA-GENRL	2015	Crop	34.70	339.90	1
Vermilion	Indian Creek	606	Subsurface Drain	ft	CTA-GENRL	2015	Farmstead	2.10	1,000.00	1
Vermilion	Indian Creek	633	Waste Recycling	ac	CRP	2010	Crop	49.80	49.80	1
Vermilion	Indian Creek	633	Waste Recycling	ac	CTA-GENRL	2013	Crop	1,241.20	1,241.20	23
Vermilion	Indian Creek	634	Waste Transfer	no	CTA-GENRL	2013	Farmstead	4.40	1.00	1
Vermilion	Indian Creek	634	Waste Transfer	no	EQIP	2014	Farmstead	2.10	1.00	1
Vermilion	Indian Creek	634	Waste Transfer	no	EQIP	2015	Farmstead	4.20	2.00	2
Vermilion	Indian Creek	645	Upland Wildlife Habitat Management	ac	CRP	2010	Crop	2.30	2.30	1
Vermilion	Indian Creek	645	Upland Wildlife Habitat Management	ac	CRP	2011	Crop	3.30	3.30	1
Vermilion	Indian Creek	645	Upland Wildlife Habitat Management	ac	CRP	2012	Crop	0.20	0.20	1
Vermilion	Indian Creek	645	Upland Wildlife Habitat Management	ac	CRP	2013	Crop	13.70	6.00	3
Vermilion	Indian Creek	645	Upland Wildlife Habitat Management	ac	CRP	2014	Crop	5.70	5.70	4
Vermilion	Indian Creek	645	Upland Wildlife Habitat Management	ac	CRP	2015	Crop	6.80	6.80	3
Vermilion	Indian Creek	645	Upland Wildlife Habitat Management	ac	CTA-GENRL	2010	Crop	161.10	5.00	2
Vermilion	Indian Creek	645	Upland Wildlife Habitat Management	ac	CTA-GENRL	2011	Crop	152.10	152.10	3
Vermilion	Indian Creek	647	Early Successional Habitat Development/Management	ac	CRP	2010	Associated Ag Land	7.40	5.50	1
Vermilion	Indian Creek	647	Early Successional Habitat Development/Management	ac	CRP	2010	Crop	3.70	3.70	1
Vermilion	Indian Creek	647	Early Successional Habitat Development/Management	ac	CRP	2011	Crop	38.90	38.90	9
Vermilion	Indian Creek	647	Early Successional Habitat Development/Management	ac	CRP	2014	Crop	2.50	2.50	1
Vermilion	Indian Creek	647	Early Successional Habitat Development/Management	ac	CRP	2015	Crop	2.50	2.50	2
Vermilion	Indian Creek	AIR04	Use drift reducing nozzles, low pressures, lower boom height and adjuvants to reduce pesticide drift	ac	CStwP	2011	Crop	1,354.60	1,354.60	1
Vermilion	Indian Creek	AIR04	Use drift reducing nozzles, low pressures, lower boom height and adjuvants to reduce pesticide drift	ac	CStwP	2012	Crop	117.90	117.90	1
Vermilion	Indian Creek	AIR04	Use drift reducing nozzles, low pressures, lower boom height and adjuvants to reduce pesticide drift	ac	CStwP	2013	Crop	1,472.50	1,472.50	2
Vermilion	Indian Creek	AIR04	Use drift reducing nozzles, low pressures, lower boom height and adjuvants to reduce pesticide drift	ac	CStwP	2014	Crop	2,638.40	2,638.40	3
Vermilion	Indian Creek	AIR04	Use drift reducing nozzles, low pressures, lower boom height and adjuvants to reduce pesticide drift	ac	CStwP	2015	Crop	2,638.40	2,638.40	3
Vermilion	Indian Creek	AIR07	GPS, targeted spray application (SmartSprayer), or other chemical application electronic control tec	ac	CStwP	2013	Crop	158.60	158.60	1
Vermilion	Indian Creek	AIR07	GPS, targeted spray application (SmartSprayer), or other chemical application electronic control tec	ac	CStwP	2014	Crop	1,324.50	1,324.50	2
Vermilion	Indian Creek	AIR07	GPS, targeted spray application (SmartSprayer), or other chemical application electronic control tec	ac	CStwP	2015	Crop	1,346.00	1,564.50	3
Vermilion	Indian Creek	AIR08	Nitrification inhibitors or urease inhibitors	ac	CStwP	2012	Crop	312.10	312.10	1
Vermilion	Indian Creek	AIR08	Nitrification inhibitors or urease inhibitors	ac	CStwP	2013	Crop	430.00	357.10	2
Vermilion	Indian Creek	AIR08	Nitrification inhibitors or urease inhibitors	ac	CStwP	2014	Crop	430.00	357.10	2
Vermilion	Indian Creek	AIR08	Nitrification inhibitors or urease inhibitors	ac	CStwP	2015	Crop	430.00	357.10	2
Vermilion	Indian Creek	EEM	Enhancement - Energy Management	ac	CSP	2010	Crop	1,326.80	1,326.80	2

Vermilion	Indian Creek	EEM	Enhancement - Energy Management	ac	CSP	2011	Crop	1,326.80	1,326.80	2
Vermilion	Indian Creek	EEM	Enhancement - Energy Management	ac	CSP	2012	Crop	663.40	663.40	1
Vermilion	Indian Creek	EEM	Enhancement - Energy Management	ac	CSP	2013	Crop	663.40	663.40	1
Vermilion	Indian Creek	EEM	Enhancement - Energy Management	ac	CSP	2014	Crop	663.40	663.40	1
Vermilion	Indian Creek	EEM	Enhancement - Energy Management	ac	CSP	2015	Crop	663.40	663.40	1
Vermilion	Indian Creek	EHM	Enhancement - Habitat Management	ac	CSP	2010	Crop	663.40	663.40	1
Vermilion	Indian Creek	EHM	Enhancement - Habitat Management	ac	CSP	2011	Crop	663.40	663.40	1
Vermilion	Indian Creek	ENM	Enhancement - Nutrient Management	ac	CSP	2010	Crop	1,326.80	1,326.80	2
Vermilion	Indian Creek	ENM	Enhancement - Nutrient Management	ac	CSP	2011	Crop	1,326.80	1,326.80	2
Vermilion	Indian Creek	ENM	Enhancement - Nutrient Management	ac	CSP	2012	Crop	663.40	663.40	1
Vermilion	Indian Creek	ENM	Enhancement - Nutrient Management	ac	CSP	2013	Crop	663.40	663.40	1
Vermilion	Indian Creek	ENM	Enhancement - Nutrient Management	ac	CSP	2014	Crop	663.40	663.40	1
Vermilion	Indian Creek	ENM	Enhancement - Nutrient Management	ac	CSP	2015	Crop	663.40	663.40	1
Vermilion	Indian Creek	EPM	Enhancement - Pest Management	ac	CSP	2010	Crop	1,326.80	1,326.80	2
Vermilion	Indian Creek	EPM	Enhancement - Pest Management	ac	CSP	2011	Crop	1,326.80	1,326.80	2
Vermilion	Indian Creek	EPM	Enhancement - Pest Management	ac	CSP	2012	Crop	663.40	663.40	1
Vermilion	Indian Creek	EPM	Enhancement - Pest Management	ac	CSP	2013	Crop	663.40	663.40	1
Vermilion	Indian Creek	EPM	Enhancement - Pest Management	ac	CSP	2014	Crop	663.40	663.40	1
Vermilion	Indian Creek	EPM	Enhancement - Pest Management	ac	CSP	2015	Crop	663.40	663.40	1
Vermilion	Indian Creek	ESM	Enhancement - Soil Management	ac	CSP	2010	Crop	663.40	663.40	1
Vermilion	Indian Creek	ESM	Enhancement - Soil Management	ac	CSP	2011	Crop	663.40	663.40	1
Vermilion	Indian Creek	PLT19	Herbicide resistant weed management	ac	CStwP	2014	Crop	1,165.90	1,165.90	1
Vermilion	Indian Creek	PLT19	Herbicide resistant weed management	ac	CStwP	2015	Crop	1,165.90	1,165.90	1
Vermilion	Indian Creek	SQL04	Use of Cover Crop Mixes	ac	CStwP	2010	Crop	750.80	80.00	1
Vermilion	Indian Creek	SQL04	Use of Cover Crop Mixes	ac	CStwP	2013	Crop	750.80	80.00	1
Vermilion	Indian Creek	SQL04	Use of Cover Crop Mixes	ac	CStwP	2014	Crop	750.80	80.00	1
Vermilion	Indian Creek	SQL05	Use deep rooted crops to breakup soil compaction	ac	CStwP	2013	Crop	1,333.00	536.40	2
Vermilion	Indian Creek	SQL05	Use deep rooted crops to breakup soil compaction	ac	CStwP	2014	Crop	1,333.00	536.40	2
Vermilion	Indian Creek	SQL05	Use deep rooted crops to breakup soil compaction	ac	CStwP	2015	Crop	1,316.60	700.00	2
Vermilion	Indian Creek	WQL04	Plant Tissue Testsing and Analysis to Improve Nitrogen Management	ac	CStwP	2011	Crop	7,952.50	6,455.50	9
Vermilion	Indian Creek	WQL04	Plant Tissue Testsing and Analysis to Improve Nitrogen Management	ac	CStwP	2012	Crop	634.70	634.70	2
Vermilion	Indian Creek	WQL04	Plant Tissue Testsing and Analysis to Improve Nitrogen Management	ac	CStwP	2013	Crop	12,046.00	9,423.20	15
Vermilion	Indian Creek	WQL04	Plant Tissue Testsing and Analysis to Improve Nitrogen Management	ac	CStwP	2014	Crop	12,046.00	9,423.20	15
Vermilion	Indian Creek	WQL04	Plant Tissue Testsing and Analysis to Improve Nitrogen Management	ac	CStwP	2015	Crop	9,363.20	7,186.60	14
Vermilion	Indian Creek	WQL05	Apply nutrients no more than 30 days prior to planned planting date	ac	CStwP	2011	Crop	393.10	393.10	1
Vermilion	Indian Creek	WQL05	Apply nutrients no more than 30 days prior to planned planting date	ac	CStwP	2013	Crop	705.20	705.20	2
Vermilion	Indian Creek	WQL05	Apply nutrients no more than 30 days prior to planned planting date	ac	CStwP	2014	Crop	1,871.10	1,871.10	3
Vermilion	Indian Creek	WQL05	Apply nutrients no more than 30 days prior to planned planting date	ac	CStwP	2015	Crop	1,871.10	1,871.10	3
Vermilion	Indian Creek	WQL06	Apply controlled release nitrogen fertilizer	ac	CStwP	2011	Crop	3,723.50	1,933.90	3

Vermilion	Indian Creek	WQL06	Apply controlled release nitrogen fertilizer	ac	CStwP	2013	Crop	3,723.50	1,933.90	3
Vermilion	Indian Creek	WQL06	Apply controlled release nitrogen fertilizer	ac	CStwP	2014	Crop	3,723.50	1,933.90	3
Vermilion	Indian Creek	WQL06	Apply controlled release nitrogen fertilizer	ac	CStwP	2015	Crop	1,293.90	1,293.90	2
Vermilion	Indian Creek	WQL07	Split nitrogen applications 50% after crop/pasture emergence/green up	ac	CStwP	2011	Crop	3,769.60	2,300.00	4
Vermilion	Indian Creek	WQL07	Split nitrogen applications 50% after crop/pasture emergence/green up	ac	CStwP	2012	Crop	772.80	771.10	1
Vermilion	Indian Creek	WQL07	Split nitrogen applications 50% after crop/pasture emergence/green up	ac	CStwP	2013	Crop	4,542.40	3,071.10	5
Vermilion	Indian Creek	WQL07	Split nitrogen applications 50% after crop/pasture emergence/green up	ac	CStwP	2014	Crop	7,834.10	5,082.00	8
Vermilion	Indian Creek	WQL07	Split nitrogen applications 50% after crop/pasture emergence/green up	ac	CStwP	2015	Crop	5,555.20	4,965.10	8
Vermilion	Indian Creek	WQL08	Apply split applications of nitrogen based on a pre-sidedress nitrogen test on cropland	ac	CStwP	2011	Crop	5,308.30	3,136.20	4
Vermilion	Indian Creek	WQL08	Apply split applications of nitrogen based on a pre-sidedress nitrogen test on cropland	ac	CStwP	2013	Crop	5,308.30	3,136.20	4
Vermilion	Indian Creek	WQL08	Apply split applications of nitrogen based on a pre-sidedress nitrogen test on cropland	ac	CStwP	2014	Crop	5,308.30	3,136.20	4
Vermilion	Indian Creek	WQL08	Apply split applications of nitrogen based on a pre-sidedress nitrogen test on cropland	ac	CStwP	2015	Crop	2,878.70	2,176.20	3
Vermilion	Indian Creek	WQL10	Plant an annual grass-type cover crop that will scavenge residual nitrogen	ac	CStwP	2010	Crop	2,429.60	200.00	1
Vermilion	Indian Creek	WQL10	Plant an annual grass-type cover crop that will scavenge residual nitrogen	ac	CStwP	2011	Crop	788.30	200.00	1
Vermilion	Indian Creek	WQL10	Plant an annual grass-type cover crop that will scavenge residual nitrogen	ac	CStwP	2013	Crop	3,217.90	400.00	2
Vermilion	Indian Creek	WQL10	Plant an annual grass-type cover crop that will scavenge residual nitrogen	ac	CStwP	2014	Crop	3,217.90	400.00	2
Vermilion	Indian Creek	WQL10	Plant an annual grass-type cover crop that will scavenge residual nitrogen	ac	CStwP	2015	Crop	939.00	400.00	2
Vermilion	Indian Creek	WQL11	Precision application technology to apply nutrients	ac	CStwP	2012	Crop	772.80	771.10	1
Vermilion	Indian Creek	WQL11	Precision application technology to apply nutrients	ac	CStwP	2013	Crop	772.80	771.10	1
Vermilion	Indian Creek	WQL11	Precision application technology to apply nutrients	ac	CStwP	2014	Crop	772.80	771.10	1
Vermilion	Indian Creek	WQL11	Precision application technology to apply nutrients	ac	CStwP	2015	Crop	772.80	771.10	1
Vermilion	Indian Creek	WQL17	Use of non-chemical methods to kill cover crops	ac	CStwP	2014	Crop	1,165.90	1,165.90	1
Vermilion	Indian Creek	WQL17	Use of non-chemical methods to kill cover crops	ac	CStwP	2015	Crop	1,316.60	1,365.90	2
Vermilion	Indian Creek	WQL25	Split applications of nitrogen based on a PSNT	ac	CStwP	2014	Crop	2,326.70	1,265.90	2
Vermilion	Indian Creek	WQL25	Split applications of nitrogen based on a PSNT	ac	CStwP	2015	Crop	2,477.40	2,109.00	3
Vermilion	Town of Fairbury	100	Comprehensive Nutrient Management Plan	no	CTA-GENRL	2010	Crop	156.00	1.00	1
Vermilion	Town of Fairbury	102	Comprehensive Nutrient Management Plan - Written	no	CTA-GENRL	2012	Farmstead	4.50	1.00	1
Vermilion	Town of Fairbury	313	Waste Storage Facility	no	CTA-GENRL	2010	Farmstead	6.60	1.00	1
Vermilion	Town of Fairbury	313	Waste Storage Facility	no	CTA-GENRL	2013	Farmstead	15.60	2.00	2
Vermilion	Town of Fairbury	327	Conservation Cover	ac	CRP	2014	Associated Ag Land	7.20	7.30	2
Vermilion	Town of Fairbury	328	Conservation Crop Rotation	ac	CRP	2011	Crop	231.90	231.90	3
Vermilion	Town of Fairbury	328	Conservation Crop Rotation	ac	CTA-GENRL	2011	Crop	43.30	43.30	1
Vermilion	Town of Fairbury	328	Conservation Crop Rotation	ac	CTA-GENRL	2014	Crop	77.00	75.10	1
Vermilion	Town of Fairbury	328	Conservation Crop Rotation	ac	CTA-GENRL	2015	Crop	63.30	57.20	2

Vermilion	Town of Fairbury	340	Cover Crop	ac	CTA-GENRL	2015	Crop	77.00	38.00	1
Vermilion	Town of Fairbury	345	Residue and Tillage Management, Reduced Till	ac	CRP	2011	Crop	231.90	231.90	3
Vermilion	Town of Fairbury	345	Residue and Tillage Management, Reduced Till	ac	CTA-GENRL	2011	Crop	43.30	43.30	1
Vermilion	Town of Fairbury	345	Residue and Tillage Management, Reduced Till	ac	CTA-GENRL	2014	Crop	108.50	104.10	2
Vermilion	Town of Fairbury	345	Residue and Tillage Management, Reduced Till	ac	CTA-GENRL	2015	Crop	31.80	28.20	1
Vermilion	Town of Fairbury	386	Field Border	ac	CRP	2015	Crop	63.30	6.10	2
Vermilion	Town of Fairbury	393	Filter Strip	ac	CRP	2012	Crop	1.50	1.50	1
Vermilion	Town of Fairbury	393	Filter Strip	ac	CRP	2014	Associated Ag Land	7.20	7.30	2
Vermilion	Town of Fairbury	393	Filter Strip	ac	CRP	2014	Crop	8.30	8.30	3
Vermilion	Town of Fairbury	412	Grassed Waterway	ac	CRP	2011	Crop	8.00	8.00	3
Vermilion	Town of Fairbury	412	Grassed Waterway	ac	CRP	2013	Crop	5.90	5.90	3
Vermilion	Town of Fairbury	412	Grassed Waterway	ac	CRP	2014	Crop	6.80	6.80	2
Vermilion	Town of Fairbury	468	Lined Waterway or Outlet	ft	CRP	2014	Crop	3.10	30.00	1
Vermilion	Town of Fairbury	472	Access Control	ac	CRP	2012	Crop	1.50	1.50	1
Vermilion	Town of Fairbury	472	Access Control	ac	CRP	2013	Crop	5.90	5.90	3
Vermilion	Town of Fairbury	472	Access Control	ac	CRP	2014	Associated Ag Land	7.20	7.30	2
Vermilion	Town of Fairbury	472	Access Control	ac	CRP	2014	Crop	8.30	8.30	3
Vermilion	Town of Fairbury	533	Pumping Plant	no	CTA-GENRL	2013	Farmstead	2.10	1.00	1
Vermilion	Town of Fairbury	533	Pumping Plant	no	CTA-GENRL	2014	Farmstead	7.80	1.00	1
Vermilion	Town of Fairbury	590	Nutrient Management	ac	CTA-GENRL	2015	Crop	63.30	57.20	2
Vermilion	Town of Fairbury	606	Subsurface Drain	ft	CRP	2014	Crop	3.10	1,925.00	1
Vermilion	Town of Fairbury	606	Subsurface Drain	ft	CTA-GENRL	2013	Farmstead	7.80	621.00	1
Vermilion	Town of Fairbury	633	Waste Recycling	ac	CTA-GENRL	2010	Crop	258.30	258.30	6
Vermilion	Town of Fairbury	633	Waste Recycling	ac	CTA-GENRL	2012	Crop	17.80	17.80	1
Vermilion	Town of Fairbury	633	Waste Recycling	ac	CTA-GENRL	2013	Crop	149.50	61.30	1
Vermilion	Town of Fairbury	633	Waste Recycling	ac	CTA-GENRL	2014	Crop	271.80	266.60	3
Vermilion	Town of Fairbury	634	Waste Transfer	no	CTA-GENRL	2013	Farmstead	9.90	6.00	2
Vermilion	Town of Fairbury	634	Waste Transfer	no	CTA-GENRL	2014	Farmstead	7.80	1.00	1
Vermilion	Town of Fairbury	645	Upland Wildlife Habitat Management	ac	CRP	2012	Crop	1.50	1.50	1
Vermilion	Town of Fairbury	645	Upland Wildlife Habitat Management	ac	CRP	2014	Associated Ag Land	7.20	7.30	2
Vermilion	Town of Fairbury	645	Upland Wildlife Habitat Management	ac	CRP	2014	Crop	8.30	8.30	3
Vermilion	Town of Fairbury	647	Early Successional Habitat Development/Management	ac	CRP	2010	Crop	34.90	34.90	7
Vermilion	Town of Fairbury	647	Early Successional Habitat Development/Management	ac	CRP	2012	Crop	4.60	4.60	3
Vermilion	Town of Fairbury	AIR02	Nitrogen stabilizers for air emissions control	ac	CStwP	2010	Crop	218.70	218.70	1
Vermilion	Town of Fairbury	AIR02	Nitrogen stabilizers for air emissions control	ac	CStwP	2013	Crop	218.70	218.70	1
Vermilion	Town of Fairbury	AIR02	Nitrogen stabilizers for air emissions control	ac	CStwP	2014	Crop	218.70	218.70	1
Vermilion	Town of Fairbury	AIR04	Use drift reducing nozzles, low pressures, lower boom height and adjuvants to reduce pesticide drift	ac	CStwP	2010	Crop	693.90	693.90	1
Vermilion	Town of Fairbury	AIR04	Use drift reducing nozzles, low pressures, lower boom height and adjuvants to reduce pesticide drift	ac	CStwP	2011	Crop	39.60	39.60	1
Vermilion	Town of Fairbury	AIR04	Use drift reducing nozzles, low pressures, lower boom height and adjuvants to reduce pesticide drift	ac	CStwP	2012	Crop	925.10	925.10	2
Vermilion	Town of Fairbury	AIR04	Use drift reducing nozzles, low pressures, lower boom height and adjuvants to reduce pesticide drift	ac	CStwP	2013	Crop	1,658.60	1,658.60	4
Vermilion	Town of Fairbury	AIR04	Use drift reducing nozzles, low pressures, lower boom height and adjuvants to reduce pesticide drift	ac	CStwP	2014	Crop	1,658.60	1,658.60	4

Vermilion	Town of Fairbury	AIR04	Use drift reducing nozzles, low pressures, lower boom height and adjuvants to reduce pesticide drift	ac	CStwP	2015	Crop	1,015.70	1,255.00	5
Vermilion	Town of Fairbury	AIR07	GPS, targeted spray application (SmartSprayer), or other chemical application electronic control tec	ac	CStwP	2011	Crop	39.60	39.60	1
Vermilion	Town of Fairbury	AIR07	GPS, targeted spray application (SmartSprayer), or other chemical application electronic control tec	ac	CStwP	2013	Crop	39.60	39.60	1
Vermilion	Town of Fairbury	AIR07	GPS, targeted spray application (SmartSprayer), or other chemical application electronic control tec	ac	CStwP	2014	Crop	39.60	39.60	1
Vermilion	Town of Fairbury	AIR07	GPS, targeted spray application (SmartSprayer), or other chemical application electronic control tec	ac	CStwP	2015	Crop	75.10	111.80	2
Vermilion	Town of Fairbury	AIR08	Nitrification inhibitors or urease inhibitors	ac	CStwP	2012	Crop	765.90	765.90	1
Vermilion	Town of Fairbury	AIR08	Nitrification inhibitors or urease inhibitors	ac	CStwP	2013	Crop	765.90	765.90	1
Vermilion	Town of Fairbury	AIR08	Nitrification inhibitors or urease inhibitors	ac	CStwP	2014	Crop	765.90	765.90	1
Vermilion	Town of Fairbury	AIR08	Nitrification inhibitors or urease inhibitors	ac	CStwP	2015	Crop	765.90	765.90	1
Vermilion	Town of Fairbury	ANM18	Retrofit watering facility for wildlife escape	no	CStwP	2011	Pasture	58.30	10.00	1
Vermilion	Town of Fairbury	ENR04	Recycle 100% of farm lubricants	no	CStwP	2010	Crop	218.70	1.00	1
Vermilion	Town of Fairbury	ENR04	Recycle 100% of farm lubricants	no	CStwP	2013	Crop	218.70	1.00	1
Vermilion	Town of Fairbury	ENR04	Recycle 100% of farm lubricants	no	CStwP	2014	Crop	218.70	1.00	1
Vermilion	Town of Fairbury	ENR05	Locally grown and marketed farm products	ac	CStwP	2010	Crop	693.90	350.00	1
Vermilion	Town of Fairbury	ENR05	Locally grown and marketed farm products	ac	CStwP	2013	Crop	693.90	350.00	1
Vermilion	Town of Fairbury	ENR05	Locally grown and marketed farm products	ac	CStwP	2014	Crop	693.90	350.00	1
Vermilion	Town of Fairbury	SQL15	Utilize the soil health nutrient tool to assess soil nutrient pools	ac	CStwP	2015	Crop	39.50	307.60	1
Vermilion	Town of Fairbury	WQL04	Plant Tissue Testsing and Analysis to Improve Nitrogen Management	ac	CStwP	2010	Crop	1,387.80	1,043.90	2
Vermilion	Town of Fairbury	WQL04	Plant Tissue Testsing and Analysis to Improve Nitrogen Management	ac	CStwP	2011	Crop	1,021.20	688.10	4
Vermilion	Town of Fairbury	WQL04	Plant Tissue Testsing and Analysis to Improve Nitrogen Management	ac	CStwP	2012	Crop	925.10	925.10	2
Vermilion	Town of Fairbury	WQL04	Plant Tissue Testsing and Analysis to Improve Nitrogen Management	ac	CStwP	2013	Crop	3,334.10	2,657.10	8
Vermilion	Town of Fairbury	WQL04	Plant Tissue Testsing and Analysis to Improve Nitrogen Management	ac	CStwP	2014	Crop	3,369.60	2,729.30	9
Vermilion	Town of Fairbury	WQL04	Plant Tissue Testsing and Analysis to Improve Nitrogen Management	ac	CStwP	2015	Crop	2,076.60	2,291.10	10
Vermilion	Town of Fairbury	WQL07	Split nitrogen applications 50% after crop/pasture emergence/green up	ac	CStwP	2010	Crop	128.50	128.50	1
Vermilion	Town of Fairbury	WQL07	Split nitrogen applications 50% after crop/pasture emergence/green up	ac	CStwP	2012	Crop	765.90	765.90	1
Vermilion	Town of Fairbury	WQL07	Split nitrogen applications 50% after crop/pasture emergence/green up	ac	CStwP	2013	Crop	894.40	894.40	2
Vermilion	Town of Fairbury	WQL07	Split nitrogen applications 50% after crop/pasture emergence/green up	ac	CStwP	2014	Crop	894.40	894.40	2
Vermilion	Town of Fairbury	WQL07	Split nitrogen applications 50% after crop/pasture emergence/green up	ac	CStwP	2015	Crop	929.90	966.60	3
Vermilion	Town of Fairbury	WQL10	Plant an annual grass-type cover crop that will scavenge residual nitrogen	ac	CStwP	2011	Crop	462.60	440.00	1
Vermilion	Town of Fairbury	WQL10	Plant an annual grass-type cover crop that will scavenge residual nitrogen	ac	CStwP	2013	Crop	462.60	440.00	1

Vermilion	Town of Fairbury	WQL10	Plant an annual grass-type cover crop that will scavenge residual nitrogen	ac	CStwP	2014	Crop	462.60	440.00	1
Vermilion	Town of Fairbury	WQL10	Plant an annual grass-type cover crop that will scavenge residual nitrogen	ac	CStwP	2015	Crop	502.10	747.60	2
Vermilion	Town of Fairbury	WQL11	Precision application technology to apply nutrients	ac	CStwP	2012	Crop	765.90	765.90	1
Vermilion	Town of Fairbury	WQL11	Precision application technology to apply nutrients	ac	CStwP	2013	Crop	765.90	765.90	1
Vermilion	Town of Fairbury	WQL11	Precision application technology to apply nutrients	ac	CStwP	2014	Crop	801.40	838.10	2
Vermilion	Town of Fairbury	WQL11	Precision application technology to apply nutrients	ac	CStwP	2015	Crop	816.90	1,056.20	3
Vermilion	Town of Fairbury	WQL15	Reduce the concentration of nutrients on livestock farms	ac	CStwP	2010	Crop	693.90	693.90	1
Vermilion	Town of Fairbury	WQL15	Reduce the concentration of nutrients on livestock farms	ac	CStwP	2013	Crop	693.90	693.90	1
Vermilion	Town of Fairbury	WQL15	Reduce the concentration of nutrients on livestock farms	ac	CStwP	2014	Crop	693.90	693.90	1
Vermilion	Town of Fairbury	WQL25	Split applications of nitrogen based on a PSNT	ac	CStwP	2015	Crop	51.00	290.30	2

June 30, 2016

NREC FINAL REPORT

Project Title: Linking voluntary conservation effort to water quality improvement in the Indian Creek Watershed

University of Notre Dame

Investigators: Ursula Mahl, Jennifer Tank, Steve Powers

OBJECTIVE: *To use existing data from the Indian Creek Watershed Project to determine how adoption of comprehensive agriculture conservation systems by >50% of producers and acres in a small watershed affected water quality over a six year period (2010-2015).*

JUSTIFICATION: *There is a critical need for an improved, data-driven understanding of water quality responses to conservation enrollment, to inform future decisions by farmers and land owners that sustain crop yields and water quality.*

BACKGROUND

The Indian Creek Watershed Project is an example of how conservation organizations and agencies can work together with industry leaders and private citizens to encourage conservation adoption at a watershed level. Our aim is to explain the water quality responses that can be achieved when priority conservation systems are applied at a sufficient scale within a small watershed. ***We hypothesize that when more than 50% of the producers in a given watershed have implemented priority conservation systems, this will result in a measurable improvement in water quality of the receiving surface waters.*** This idea is connected to a more general hypothesis that tipping points for conservation enrollment exist, above which detectable and quantifiable water quality improvements may be achieved, with further improvements under increasing enrollment, perhaps up to some upper limit.

Indian Creek, a tributary to the Vermilion River (Illinois River Basin) is a high priority target watershed of the Mississippi River Basin Healthy Watersheds Initiative (MRBI). For several years, and through MRBI, the Livingston County Soil and Water Conservation District (SWCD) has been working in concert with landowners and the Natural Resources Conservation Service (NRCS) to implement conservation systems and best practices on cropland. Through MRBI, Indian Creek is part of a larger, basin-wide effort involving multiple states and major investments to promote adoption of land conservation practices, with the intention of protecting agricultural production, water quality, and wildlife (Campbell et al. 2009, Sprague and Gronberg 2010). Federal support of agricultural conservation is implemented through the USDA via funding from the US Farm Bill, and at the national level, annual subsidies targeted for land conservation practices at the national level total in billions $US (Pavelis et al. 2011). As a result of the excellent coordination in the Indian Creek watershed, enrollment in conservation practices has exceeded a key threshold, with more than 50% of the watershed land area enrolled (Fig. 1A).

The Indian Creek Watershed Project, which is led by the Conservation Technology Information Center (CTIC), has also conducted a combination of monthly and weekly water water quality sampling from 2010 to 2015 at multiple stations (Fig. 1B). Parameters include: nitrate, total phosphorus (TP), total suspended sediment (TSS), dissolved oxygen, pH, specific conductivity, and water temperature (Table 1). In addition, a state- of-the art real-time USGS gaging station was installed in 2011 at the base of the watershed, just upstream of the town of

A. Indian Creek Watershed CSP Contract locations

B. Indian Creek Watershed (0713000), South Fork of Vermillion River, IL,

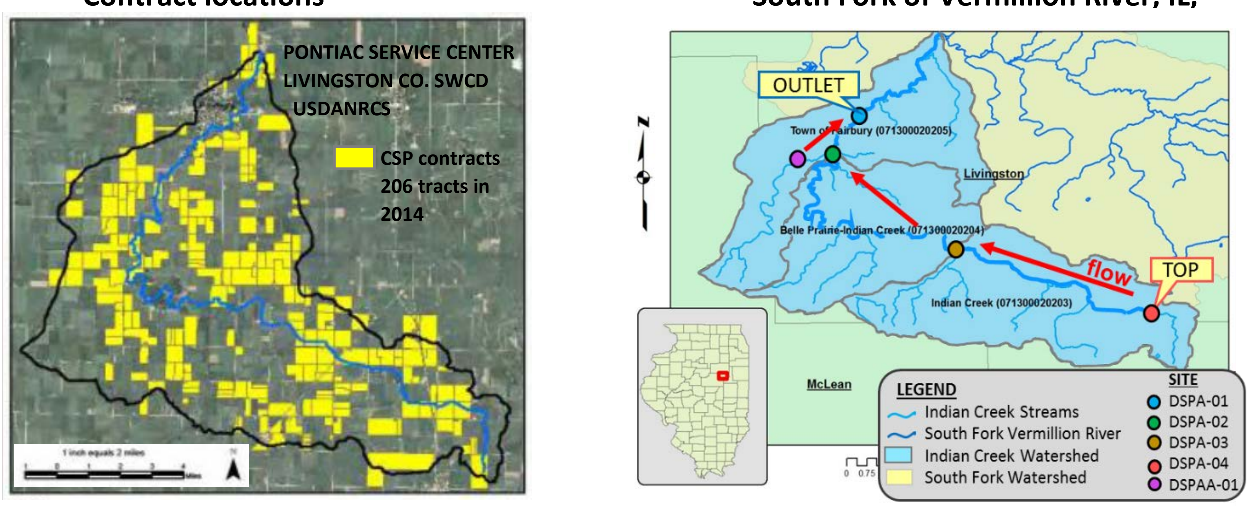


Figure 1. Indian Creek Watershed maps showing: (A) location of Conservation Stewardship Program (CSP) contracts in 2014 and (B) sampling sites located near the top and bottom of 3 sub-watersheds.

Fairbury, which includes a stage-flow gauge and a nitrate probe for high frequency measurement as well as communications hardware for real-time monitoring linked to a web interface. ***These real-time data from the Indian Creek gage may be viewed at the following link:*** http://waterdata.usgs.gov/usa/nwis/uv?05554300

The Indian Creek Watershed Project highlights the value of a locally led conservation initiative, and the value of having a strong, local partner on the ground to assist landowners with technical and educational assistance. This project is led by a local steering committee that is comprised of watershed residents from various walks of life. Since this watershed is primarily used for row crop agriculture, many of the members of this committee are either producers themselves or have strong ties to agriculture. The committee is a voluntary group that meets quarterly to discuss the aspects of the project and make recommendations to conservation practitioners in regard to operating the project.

Both field-scale studies and modeling simulations have indicated that nutrient and soil losses from farmland can be reduced using effective implementation of land conservation practices (Wu et al. 2004, Renschler and Lee 2005, Arabi et al. 2008, Zhou et al. 2009, CEAP 2011, Bosch et al. 2013). Other studies have suggested that reductions in stream/river nutrient levels could be coming in the future, but thus far have been delayed by time lags between field- and farm-level processes and river signals (Hamilton 2012, Sharpley et al. 2013).

By manipulating different facets of the 4-Rs of nutrient stewardship (Right fertilizer source at the Right rate, at the Right time, and in the Right place), we can impact the efficiency with which a given crop takes up nutrients that are applied to fields. For example, instead of applying a full rate of nitrogen in the fall to a corn crop planted the following spring, demonstration projects in the Indian Creek watershed have shown that we can minimize nitrogen losses to the environment by moving our nitrogen application to a spring application, or a partial spring application with the remainder side dressed on the crop after emergence. Also, using GPS technology to vary the rate of nitrogen across a field to target the highest application rates to areas where the crops have the greatest yield potential and minimizing applications in areas where the crops have the least potential, we can improve the efficiency of overall nutrient use. The same principle can be used in altering the placement of nutrients. Nutrients placed in a band where the plant can access them have a greater potential to be taken up by the crop than those that are simply broadcast across the soil surface.

All facets of the 4Rs of nutrient stewardship can be addressed using sound nutrient management planning. Advanced nutrient management planning gives farmers the opportunity to use sound agronomic principles and available technology to identify areas of their farms where they can improve the efficiency of nutrient use by the crop and minimize nutrient losses to the environment. Many nutrient management practices using the 4Rs can be easily implemented by farmers on their farms with a simple change in mindset and few changes to their equipment, and cost-share funding to implement the practices may be available from USDA and other agencies. In addition to landowner and partner interest in the story of Indian Creek, *this project also addresses a grand challenge of the National Academy of Sciences, to understand how the Earth's major biogeochemical cycles are changing.* People depend on these fundamental biogeochemical cycles to grow crops, sustain high soil quality, and purify our water resources. Improved understanding of the connections between people and biogeochemical cycles will ensure that real conservation success stories are actually achieved, sustaining crop yields as well as water quality, in well-coordinated communities such as those in the Indian Creek watershed.

METHODS

Discharge & Precipitation: We used daily discharge data measured at USGS guage 05554300 located at Indian Creek near Fairbury, IL starting in July, 2011 (Lat: 40°43'22", Longitude 88°31'48" NAD83, http://waterdata.usgs.gov/nwis/inventory/?site_no=05554300). Data for upstream sampling sites were provided by USGS and were calculated using a regional multiple regression method based on USGS guage 05554300 near Fairbury, IL. Discharge prior to July, 2011 was estimated using a drainage area ratio method based on discharge measured at USGS guage 05554500 located at Vermillion River at Pontiac, IL (Lat: 40°52'40", Long: 88°38'10" NAD27, http://waterdata.usgs.gov/il/nwis/uv?site_no=05554500). We found that estimates based on Pontiac were similar to values measured at Fairbury, IL after July, 2011.

Equation 1: $Q_{USGS\text{-}05554\underline{300}} = Q_{USGS\text{-}05554\mathbf{500}} * DA_{USGS\text{-}05554\underline{300}} / DA_{USGS\text{-}05554\mathbf{500}}$

We used precipitation data from the NOAA weather station GHCND: USC00112923 located at Fairbury WWTP, IL US (Elev: 690 ft. Lat: 40.751° N Lon: 88.498° W) (http://www.ncdc.noaa.gov/cdo-web/confirmation).

In order to identify days with elevated flow, we separated base flow from direct run-off using the USGS Watershed Hydrography Analysis Tool (WHAT) with a local mimimum method (Lim et al. 2005, https://engineering.purdue.edu/mapserve/WHAT/). We also identified days with "high" storm flow, which we defined as discharge during and following a storm event that was both > the annual mean discharge and elevated by >95% relative to base flow.

Water Quality: We analyzed existing water quality data for grab samples (provided by EPA) and USGS NO_3^- sensors. We used descriptive statistics (eg. box plots, time series, Q~C regressions) to compare grab sample data across sites and among years for: nitrate (NO_3^-), total phosphorus (TP), and total suspended solids (TSS). Because Q~C relationships were significant only for NO_3^-, and temporal patterns for NO_3^- were similar across sites, we focused load analyses on NO_3^-export from the outlet and used both sensor and grab data (DSPA-01 at Fairbury, IL).

We calculated daily, monthly, and annual NO_3^- export based on both grab sample data and NO_3^- sensor data using the composite model in the Loadflex package in R (Appling 2016). Methods for load estimation in Loadflex are user defined and we selected the default composite model because it accounts for seasonal variation in Q~C relationships and resulted in the lowest error. The default composite model estimates loads and error using a combination of a linear interpolation model (load= Q*C) and LOADEST regression model 9 (Runkel et al. 2004[equation 2]).

<u>*Equation 2*</u> *(LOADEST M9):* $a_0 + a_1 \ln Q + a_2 \ln Q^2 + a_3 \sin(2\pi dtime) + a_4 \cos(2\pi dtime) + a_5 dtime$

Model input included daily discharge, NO_3^- concentrations for all grab and sensor samples, and a subset of NO_3^- concentrations restricted to a weekly time interval to reduce autocorrelation for calibration of LOADEST. Because management and environmental conditions changed over time, we ran models separately for each year. Composite model output maximized utility of sensor data by using interpolation of all data to minimize error for estimates and by replacing estimates with empirical data when available.

To determine how changes in management could have affected water quality, overall and during critical periods, we compared total annual export from 2011 to 2015 as well as export during base-flow versus export during elevated flow and during high storm flow (95%>Qb).

RESULTS & DISCUSSION

Water quality- spatial patterns: As expected, increase in drainage area from the top to bottom of the watershed resulted in an increase in export of water and NO_3^- (Fig. 2 A,B). In contrast, NO_3^- concentrations and yields (export/area) were highest at the headwater site (DSPA-04, Fig. 2 C, D). This is consistent with other studies that have shown that headwaters typically have relatively high stream density (length) and low discharge compared to drainage area, which can result in relatively high NO_3^- concentrations that are diluted downstream. The proportion of upstream area with CSP contracts also appeared to be lower for DSPA-04 than for tributary and downstream sites (Fig. 1), which could have contributed to improved water quality downstream of DSPA-04. Similarities in NO_3^- yields and concentrations for downstream sites likely reflect uniform effects of management on N-inputs and water quality throughout most of the watershed.

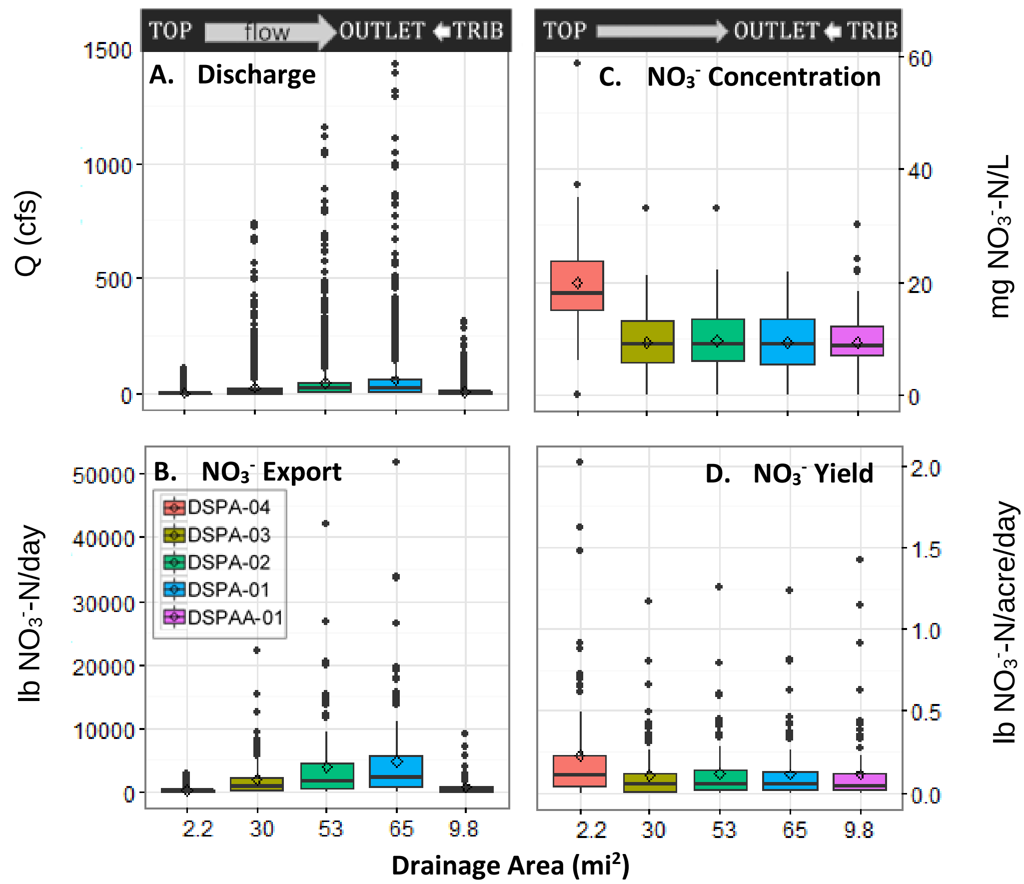


Figure 2. Box plots comparing ranges of values (quartiles, median = ▬ , outliers = ●, and mean = ◇) from Indian Creek sites show that (A) discharge and (B) NO_3^- export increased with drainage area while, on average, (C) NO_3^- concentration and (D) NO_3^- yield were 2x higher at the top of the watershed than for all other sites, which had similar values. Drainage area is given on the x-axis and sites are ordered from the top of the watershed to the outlet, with inputs from a tributary (TRIB) that is upstream from outlet shown on the far right. *Note: Only grab samples were included from DSPA-01 for consistency with other sites.

Similar to NO_3^-, spatial patterns for export of total phosphorus (TP) and total suspended solids (TSS) were driven by increase in discharge with drainage area from the top to bottom of the watershed. TSS concentrations and yields likewise tended to increase with drainage area (Fig. 3 D, F), but there were no obvious spatial patterns for TP concentration and yields (Fig. 3 A, C). Differences in patterns for TP and TSS *vs.* NO_3^- could reflect differences in adoption rates for BMPs that target N *vs.* BMPs that target erosion or P among sub-watersheds (i.e. The most widely adopted practices, such as split-N application, were related to N-management).

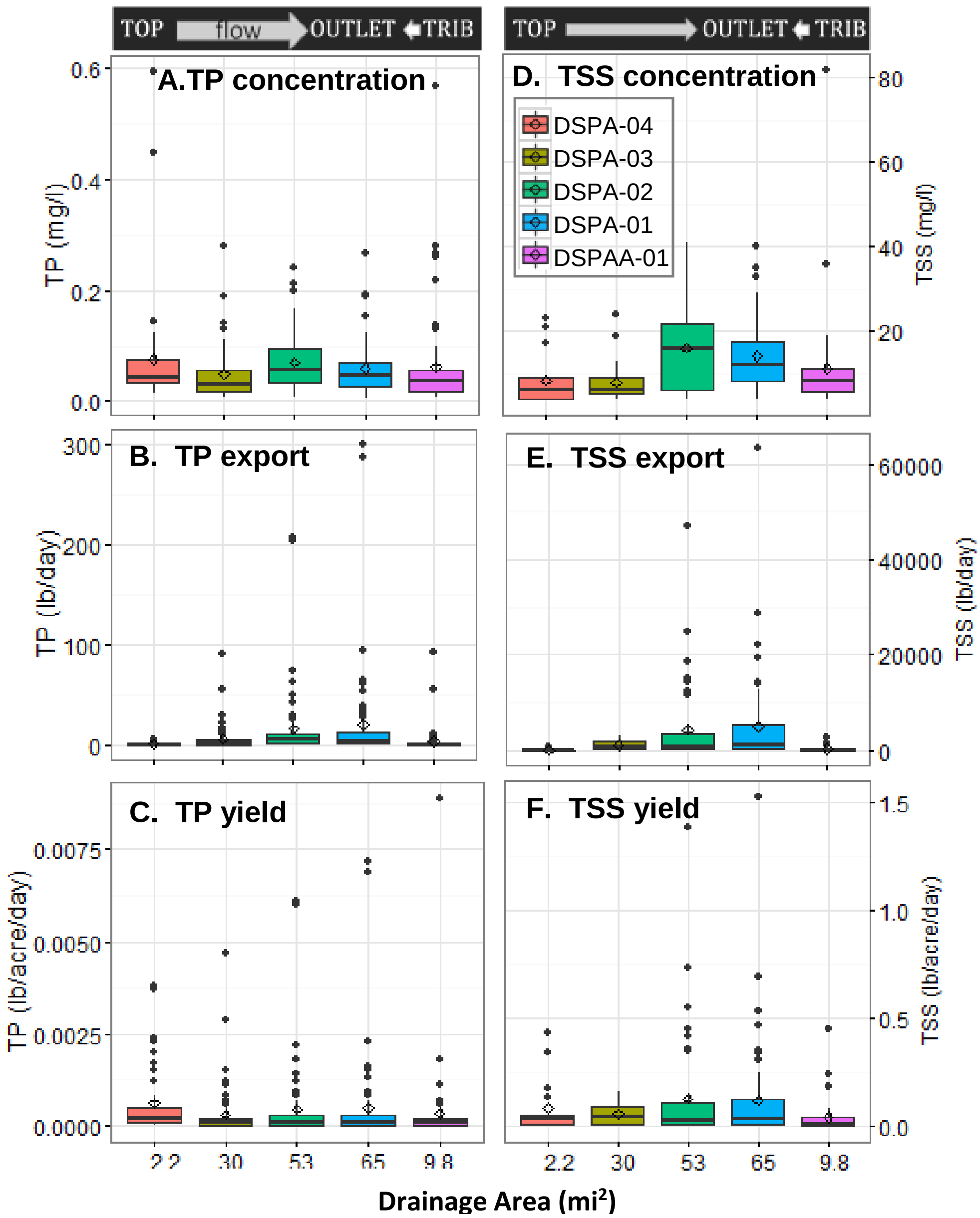


Figure 3. Box plots comparing range of values (quartiles, median, outliers, and mean) measured at Indian Creek sites for: TP (A) concentrations and (B) yields, and TSS (C) concentrations and (D) yields. Drainage area is given on the x-axis and sites are ordered from the top of the watershed to the outlet, with tributary site (TRIB) directly upstream of the outlet on the far right.

Water quality- temporal patterns: Seasonal and inter-annual variation was high for discharge (Q) and for concentrations and export of NO_3^-, TP, and TSS from the outlet (DSPA-01; Fig. 4,6).

Mean base flow ranged from 10 - 45 cfs, with a minimum of 0 cfs during a drought in 2012 and peak discharge of 1,430 cfs in 2015 (Fig. 4A, 8A). The hydrograph was very flashy and both seasonal timing and the magnitude of peak discharge events varied among years (Fig. 8A).

Mean NO_3^- concentrations ranged from 3.5 - 9.4 mg NO_3^--N/L (Fig. 4B). As expected, NO_3^- concentrations increased with discharge (Fig. 5) and timing of peak NO_3^- export coincided with peak discharge (Fig 8). However, despite an increase in peak discharge, there was a dampening of peak NO_3^- export from 2013 to 2015 (Fig. 8). Further, Q~C relationships during large storms suggest that, while increases in NO_3^- with discharge were highest the year following the drought (2013), for other years response of NO_3^- to storm flow events appeared to decline over time (2011 > 2014 >2015; Fig. 8C inset).

Considering export in context of N-loss from fields, NO_3^- yields ranged from 0.01 lb N/acre/day during the 2012 drought to 0.13 lb N/acre/day during the year after the drought, which is equivalent to 5-47 lb N/acre/year. This N-loss can account for a large portion of fertilizer application and emphasizes the importance of practices that increase field N-retention.

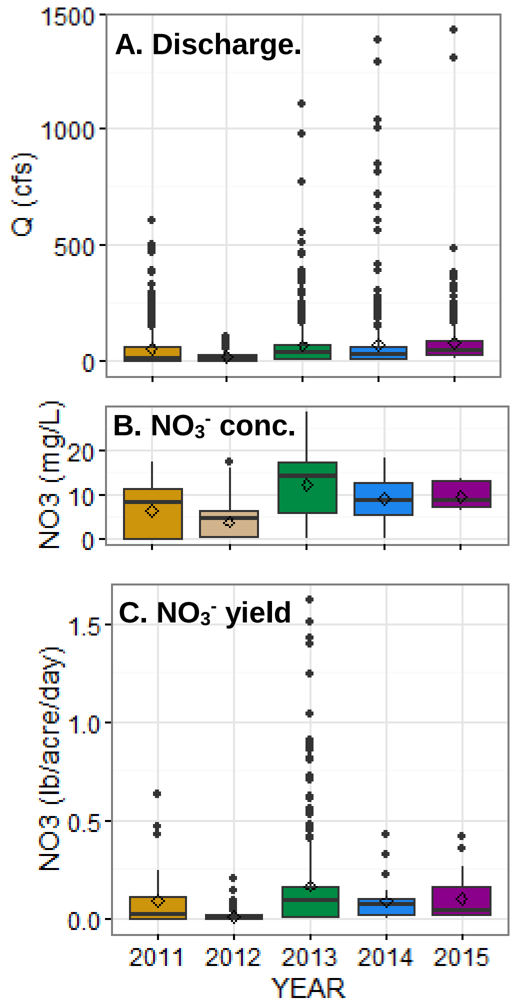


Figure 4. Box plots ranges for: (A) discharge (Q), (B) NO_3^- concentration, and (C) NO_3^- yields among water years. Includes empirical grab sample data in 2011, & grab + sensor for 2012-

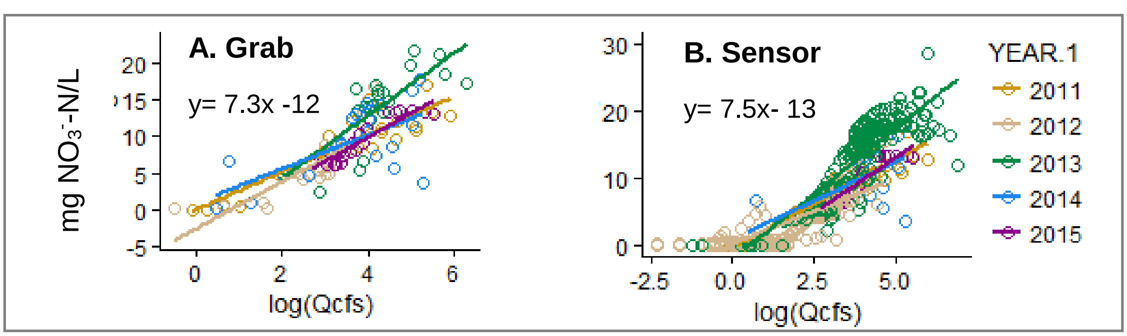


Figure 5. Relationship between discharge and NO_3^- concentration (Q~C) based on (A) grab samples & (B) sensor data. For sensor data, all values are shown but regressions exclude values for low flow during the fall when NO_3^- was near 0 & patterns diverged from other seasons.

Although TP and TSS concentrations and yields varied from year to year with environmental conditions, Q~C relationships were not significant for either TP or TSS, therefore we did not model export or yields (Fig. 6). Inter-annual patterns for TP concentrations and yields (based on empirical values) were generally similar to those for NO_3^- (Fig. 4, 6A, B). Despite lack of significance for the Q~C relationship, mean annual TSS concentrations and yields showed a slight trend of increase with discharge from 2012 to 2015 (Figure 4, 6C, D).

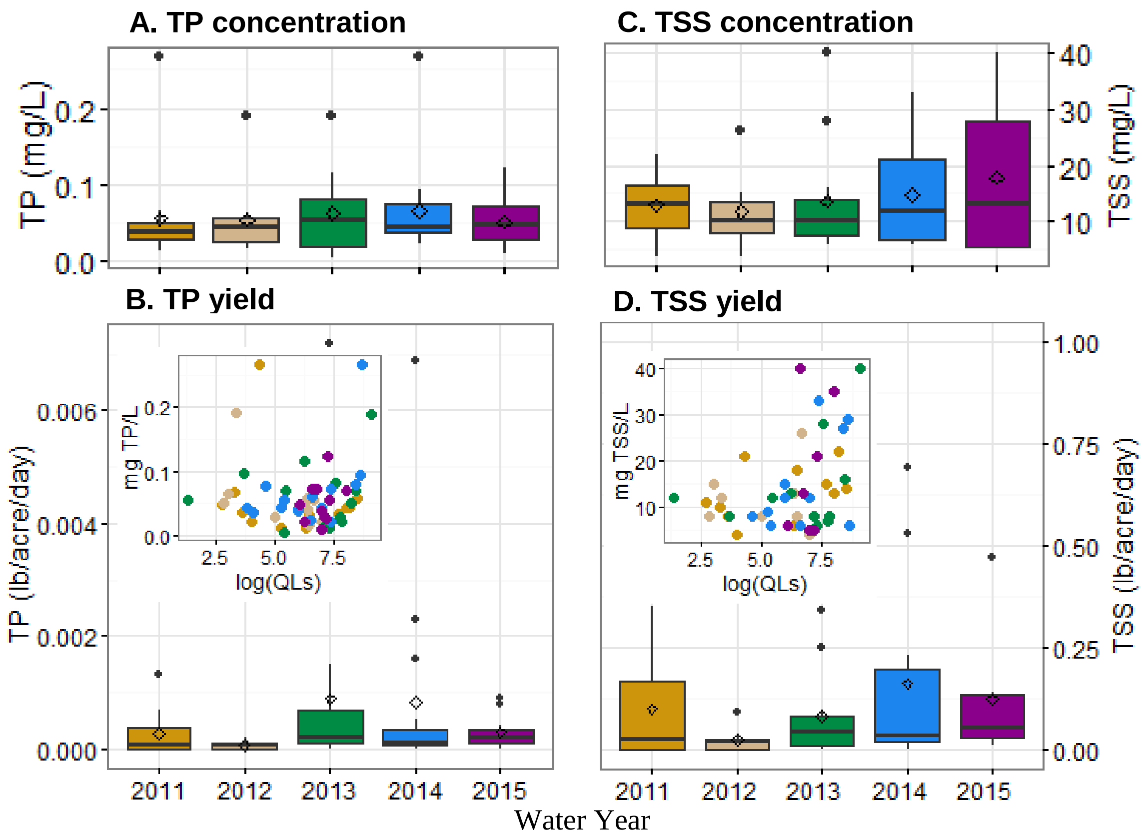


Figure 6. Box plots comparing years at outlet for TP (A) concentration and (B) yields as well as TSS (C) concentrations and (D) yields. Includes empirical grab sample data. Inset panels with scatter plots for discharge *vs.* concentration (Q~C) show that there was not a significant relationship between Q and either (B) TP or (D) TSS.

NO_3^- sensor vs. grab samples: To evaluate comparability of grab sample data (pre 7/2011) with later years including sensor data, we first compared concentrations measured with sensors to grab samples and found that values were consistent (Fig. 7, 8). Q~C relationships were also consistent (Fig. 5). However, sensors captured many more high flow events than grab samples as well as periods with low NO_3^- concentrations during low fall base flow, which improved estimates for annual export and resolution of data for evaluating impacts of management on NO_3^- export during storms, which is when most runoff occurs.

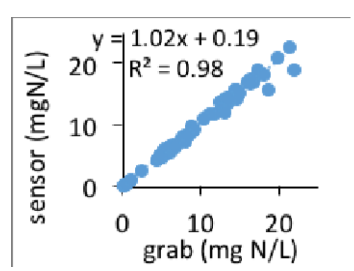


Fig 8. Comparison of NO_3^- sensor *vs* grab sample data

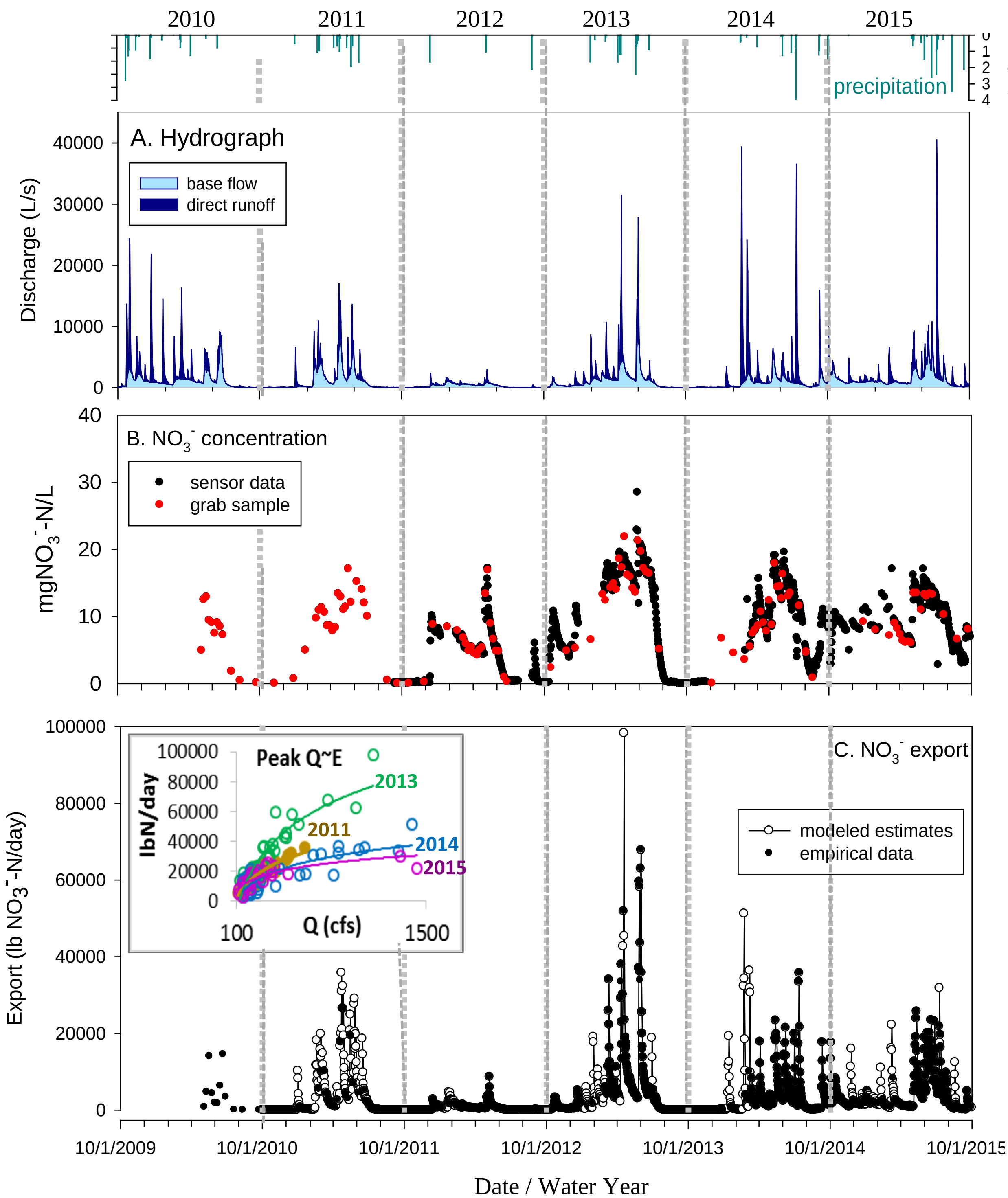


Figure 8. Daily time series showed that timing for (top) **precipitation during large storms** (when Q was 95% > Qb) coincided with peaks in the **(A) hydrograph** (Q = base flow (Qb) + direct run off), **(B) NO_3^- concentrations** (grab samples *vs.* sensor), and **(C) NO_3^- export** (empirical measurements and estimates from the Loadflex composite model). Export was lowest during a drought in 2012 and highest during the year following the drought (2013). For other years, the magnitude of NO_3^- export in response to Q during large storms appeared to decline somewhat over time (C, inset panel).

Cumulative export: The lowest total annual export of both water and NO_3^- occurred during a drought in 2012 while the highest export of NO_3^- occurred during the year after the drought (2013; Fig. 9). The majority of NO_3^- export for 2013 occurred during spring. Cumulative increases during this period were very high relative to discharge and could be the result residual NO_3^- remaining on the fields after the drought being flushed from the landscape during storms.

For other years, we observed an increase in total water export over time (2011 to 2015). However, NO_3^- export was similar for 2011 and 2014 despite much higher discharge in 2014. Likewise, despite higher water years, NO_3^- export was lower in 2014 and 2015 than for 2013. Reductions in NO_3^- export proportional to discharge could reflect conservation efforts at the end of the study.

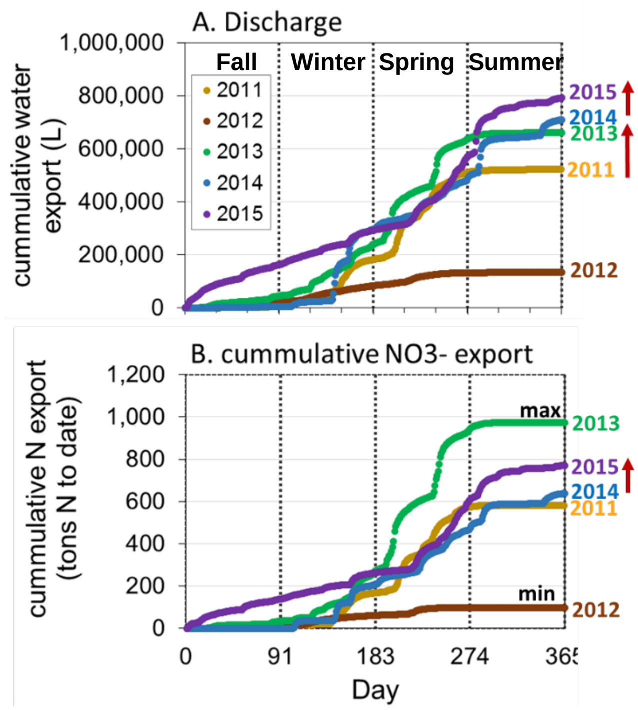


Figure 9. Cumulative increase in total export of (A) water and (B) NO_3^- for each water year where the value for each day is the sum of export on that day + all days prior (starting on Oct-1).

Export during storm events: Comparing individual storm events during the spring/summer across years, we found that for events with similar discharge, NO_3^- export declined from 2013 to 2015 (Fig. 10). While the 2012 drought could have contributed to high NO_3^- export in 2013, this could also reflect dampening of NO_3^- export during storms due to conservation.

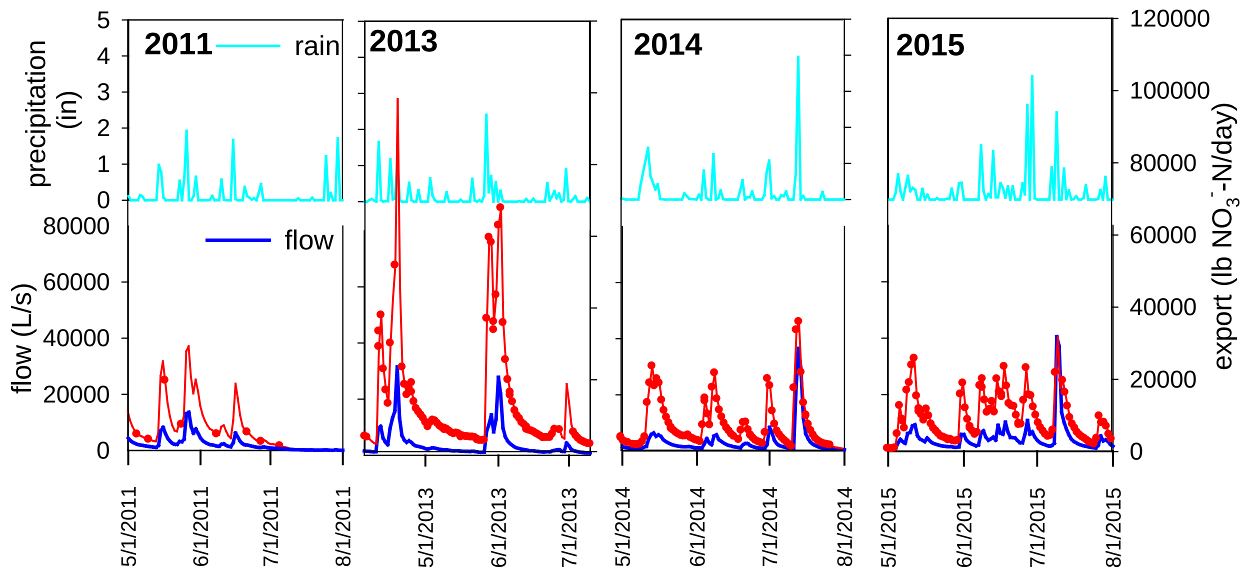


Figure 10. Comparison of precipitation and discharge to NO_3^- export during multiple storm events in late-spring through early summer for non-drought years.

Contribution of storm flow to seasonal and annual NO_3^- export: Precipitation was highest in the spring and summer (Fig. 12A). Discharge and NO_3^- export were highest February through July, but were relatively low compared to precipitation during summer when crops were growing (Fig. 12 A,B,C). Most (20-90%) of monthly NO_3^- export occurred on days with direct runoff. Days with direct runoff included 1-4 large storm events per month, which totaled < 50 days/ year but contributed 10%-75% of total monthly NO_3^- export (Fig. 12C).

On an annual basis, despite increases in precipitation and discharge, total export was similar for 2011 and 2014 and declined from 2013 to 2015 and patterns were driven by export during elevated flow. Export during large storms decreased from ~50% of total export in 2011 and 2013 to 30% of total export in 2015, which could reflect effects of conservation.

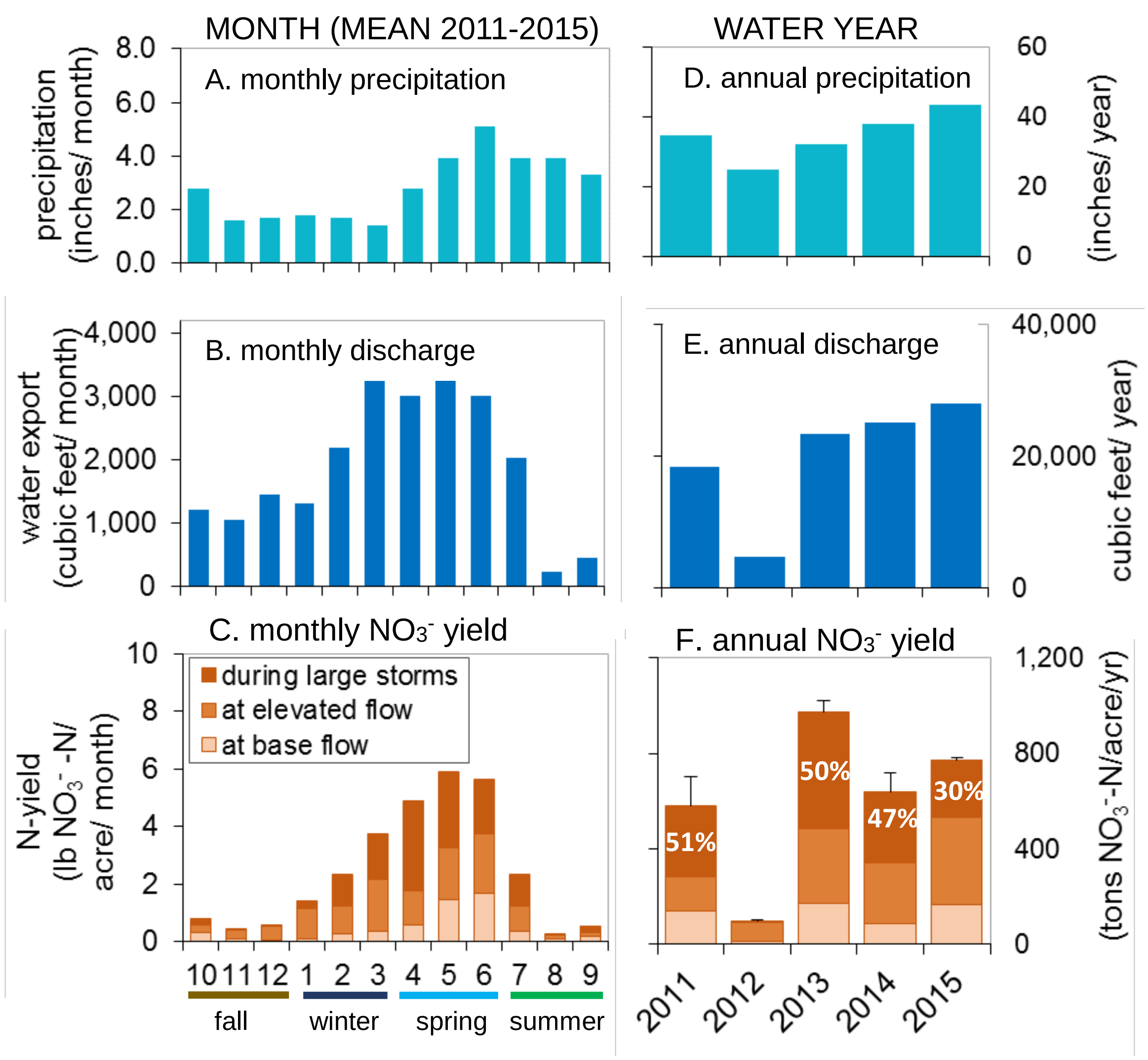


Figure 11. Comparison of total monthly (left) and total annual (right) (A, B) precipitation, (C,D) discharge, and (E,F) NO_3^- yields. Total NO_3^- yields are the sum of yields during base flow (Qb), when flow is elevated above Qb, and during large storms (defined as discharge greater than both annual mean and elevated by >95% above Qb). Monthly totals are the average of all years (2011-2015).

SUMMARY

- BMP area increased from ~ 7% to >50% of total watershed area from 2010 to 2015.
- NO_3^- yields and concentrations suggest that management had relatively uniform effects on NO_3^- inputs and water quality throughout the watershed.
- Majority of total annual NO_3^- export occurred during elevated flow, with 30% - 50% during high storm flow (discharge >95% above base flow), which was < 50 days/year.
- There was high annual variation in flow & NO_3^-, including a drought in 2012, but there also appeared to be a trend of decreasing NO_3^- export relative to discharge over time.
- NO_3^- export was greater in 2013 than 2014 and 2015 for similar size storms.
- This suggests that increases in BMP's, particularly those that decease runoff, could have improved water quality. Given that NO_3^- export was as high as 47 lbs/acre/year, improved N retention is important both for downstream water quality & crops.
- Although the signature of conservation can be difficult to detect due to high inter-annual variation in precipitation and flow, this project lays the groundwork for future studies and supports the value of monitoring, including high frequency sampling and sensors, to inform future management.

PRESENTATIONS

Linking Agricultural Conservation to Water Quality in the Indian Creek Watershed.
UH MahL, JL Tank, and S Powers. Presented at:

Indian Creek Project Meeting, Fairbury Indiana, February 29, 2016. (oral)
Society for Freshwater Science, Sacramento CA, May 22, 2016 (oral)
IWRA, Angola IN, June 9, 2016 (oral)
Indian Creek Tour, July 13, 2016 (one-pager)

Peer reviewed publication in progress

CITATIONS

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Social Science Evaluation Executive Summary

Indian Creek watershed project, Livingston County, Illinois


Photo courtesy of Conservation Technology Information Center

Prepared October 2015 by:
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Natural Resources Social Science Lab
Department of Forestry and Natural Resources
Purdue University

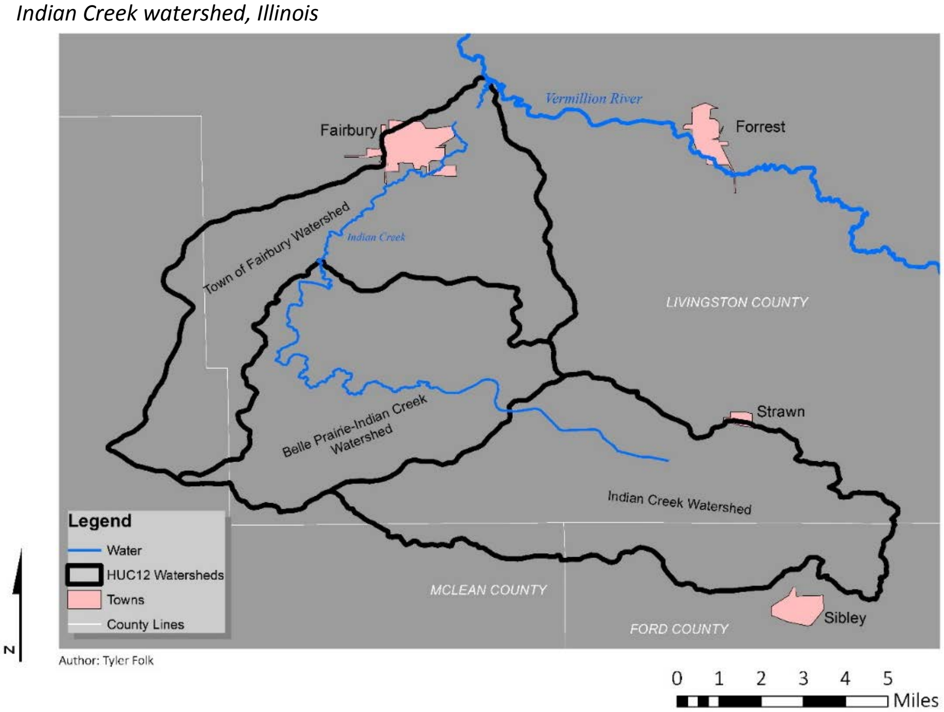
Executive Summary with Key Findings and Recommendations

Purdue University was engaged by the Conservation Technology Information Center (CTIC) to evaluate the Indian Creek watershed project by determining its successes and documenting key project elements that contributed to the project's success. What follows is a bulleted summary of key findings from the Indian Creek watershed evaluation. Information on the Indian Creek project itself and a detailed accounting of our findings can be found in the Indian Creek Watershed Social Science Evaluation Report.

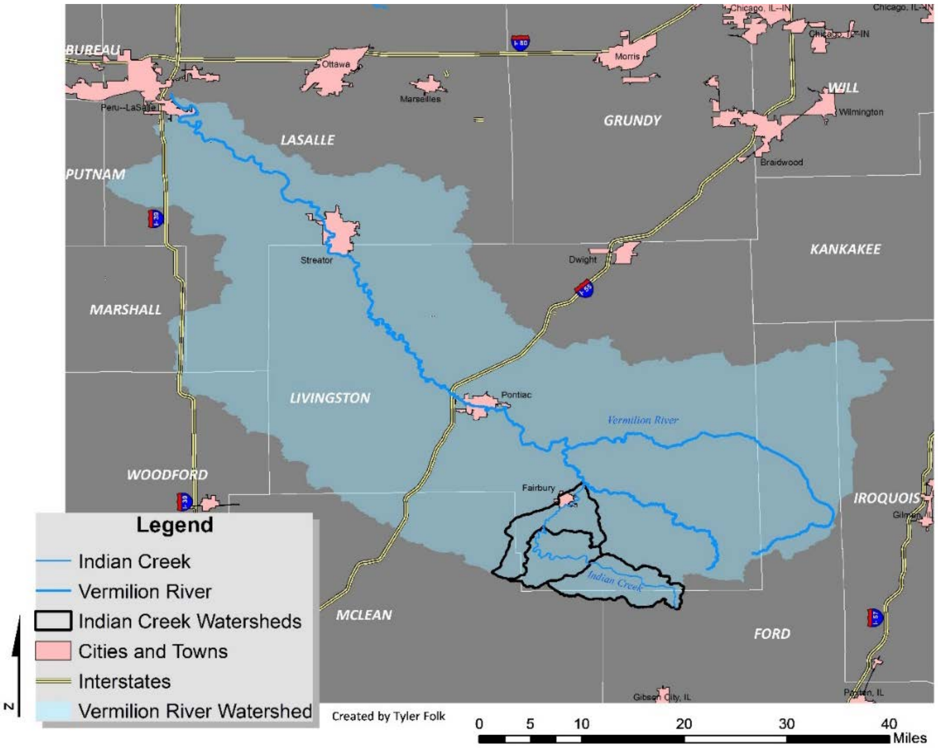
In brief, the Indian Creek watershed project is led by the Conservation Technology Information Center (CTIC) and in partnership with the Livingston County Soil and Water Conservation District (SWCD), the Illinois Environmental Protection Agency (IL EPA), USDA Natural Resources Conservation Service (NRCS), and many other conservation agencies and organizations, local citizens and farmers. The project focuses on improving water quality in a small agricultural watershed in central Illinois. It targets education and outreach, as well as cost-share funding, to encourage the voluntary adoption of conservation practices and systems that are known to improve on-farm nutrient use efficiency. The project goals were to treat 50 percent of farmed acreage in the watershed with conservation practices and systems, and measure water quality in Indian Creek to determine if voluntary adoption of such practices and systems, at this scale, can improve water quality.

The project has been funded in large part by a Section 319 nonpoint source pollution abatement grant from IL EPA. The project evaluation and report were funded by the Illinois Soybean Association.

Indian Creek watershed, Illinois



Vermilion River watershed, Illinois



Context

- The Indian Creek watershed is located primarily in Livingston County, Illinois. It is a 51,243 acre drainage area with agriculture as its primary land use, made up of three HUC12 watersheds.
- Indian Creek itself is not a 303(d) listed stream, however it flows into the Vermilion River which is listed as impaired.
- CTIC, the USDA Natural Resource Conservation Service (NRCS), and Livingston County Soil and Water Conservation District (SWCD) were able to secure two important funding sources for the Indian Creek watershed project:
    - The Livingston County SWCD secured Mississippi River Basin Healthy Watersheds Initiative (MRBI) funding from the State NRCS. MRBI funding is a reservation of NRCS Farm Bill program funds from the Conservation Stewardship Program (CSP) and Environmental Quality Incentives Program (EQIP), which are used to incentivize the use of conservation practices on agricultural lands. These program funds were targeted specifically to producers in the Indian Creek watershed. The SWCD worked with the newly formed Indian Creek Steering Committee to submit an application to NRCS for these funds.
    - Section 319 funding is funding that comes from Section 319 of the Clean Water Act. These funds are given to US EPA and allocated to projects by State water quality agencies. In Illinois, this agency is the IL EPA. CTIC applied for, and received, Section 319 funds from IL EPA to implement the outreach, demonstration, and education portions of the Indian Creek project.

Project details

- Through MRBI cost-share contracts, producers implemented various conservation projects that centered upon nutrient management, including different approaches to nitrogen application focused on the elements of the 4R Nutrient Stewardship framework, tissue testing, the use of precision technology for nutrient management, and writing a nutrient management plan. Other popular practices included the implementation of cover crops, conservation crop rotation, grassed waterways, and residue and tillage management.
- Section 319 funding was secured and utilized by CTIC to hire agronomists Dr. Harold Reetz (Reetz Agronomics) and Mr. Tim Smith (Cropsmith, Inc.) to work with producers to help them implement nutrient use efficiency demonstration plots on their farms. The demonstrations provided local data to producers who implemented the demonstrations and to the community at large.
- The Section 319 grant also funded one winter/annual meeting per year and one summer field day event per year. Demonstration plot data results were disseminated at these events, as well as information that educated producers on connections between agricultural practices, water quality, and soil health. In addition, the events were networking opportunities for producers to discuss demonstration plot data and experiences with conservation practice implementation with other producers.
- Local leadership in the NRCS and SWCD was an important aspect of the project. Terry Bachtold, SWCD resource conservationist, met face-to-face with every producer in the watershed to inform them about the Indian Creek watershed project and the cost-share programs available. Eric McTaggart, NRCS district conservationist, provided technical support to interested producers and recommended the program best suited to the producers' needs.
- The Indian Creek watershed project had a hands-on, empowerment focus. The project put information into producers' hands through their experimentation with changes in farm management, through the implementation of demonstration plot testing of nutrient management strategies, and through the dissemination of demonstration results and lessons learned at project sponsored meetings and events.

Project partners

- CTIC: CTIC is the backbone of this project. Chad Watts, CTIC project director, leads this effort and has been instrumental in coordinating the social and information sharing components of the project (e.g., quarterly steering committee meetings, annual meetings, field days, media contacts, and making presentations to groups about the project). He, along with CTIC project coordinator, Sue Tull, is also in charge of getting the word out about the project through email updates, newsletters, and media relations. Sue Tull also ensures that the project is on schedule and on budget. CTIC has been instrumental in bringing in additional funding for initiatives and projects that complement the ongoing conservation work in the Indian Creek watershed. As will be shown, project outreach provided by CTIC (and made possible through Section 319 funding) is an important aspect of this project's success.

- Livingston County Soil and Water Conservation District (SWCD): While the local SWCD office also provides coordination support for steering committee meetings, annual meetings, and field days, this agency provides the on-the-ground effort to gain project participation. Terry Bachtold, resource conservationist, is the face of the project. He hand-picked the steering committee, asking producers who were well regarded in the community and who were also motivated to implement conservation practices, as well as all local agriculture retailers and the Mayor of Fairbury, to participate. In addition to pulling together this core group, Terry Bachtold visited face-to-face with every producer in the watershed to tell them about cost-share and demonstration plot opportunities available through the project. Terry Bachtold is a trusted member of the community, to whom other people listen. He is a farmer himself and his family has lived in the community for generations. He is quiet and not pushy, yet passionate about conservation. Terry Bachtold' s standing in this community, his demeanor, and his passion about this watershed project, have been instrumental for producer participation.
- USDA Natural Resource Conservation Service (NRCS) staff: Eric McTaggart, district conservationist in the local NRCS office, administers the cost-share program contracts and provides on-farm technical assistance to help match producers with appropriate conservation measures for their farms. After Terry Bachtold recruited producer participants, Eric McTaggart and Livingston County NRCS staff helped producers identify priority conservation practices and systems that could address each farm's needs. They then explored appropriate program options to help farmers defray the cost of the practices and systems. Eric McTaggart would meet with producers at their farms, in the NRCS office, or during open houses, to recommend the program best suited to the producers' needs, and walk them through the applicable paperwork. Like Terry Bachtold, Eric McTaggart's demeanor is not pushy, which contributes to the trust of local staff in successfully contracting with producers in the watershed.
- Steering Committee: The steering committee was put into place prior to applying for NRCS MRBI funding. The current steering committee is made up of local SWCD and NRCS staff, local producers, local agricultural retailers, local agricultural lenders, interested citizens, and agronomists Harold Reetz and Tim Smith. The meetings are open and anyone is welcome to attend; for example, representatives from American Farmland Trust, The Nature Conservancy, and the Illinois Soybean Association have attended in the past. Many of the project sponsors, who represent agricultural industry leaders, also often attended steering committee meetings to participate in discussions, and to offer insights and expertise. These meetings serve several functions; the meetings are: 1) a place for the committee to discuss conservation practices and demonstration plots and determine which projects to include on the practice and demonstration menu; 2) a setting for the committee to recommend specific events and speakers for Annual Meetings and Field Days and then plan (and volunteer) for specific aspects of each event; 3) an informal venue for information sharing amongst all participants.

Project goals

- Implement conservation practices on 50 percent or more of the Indian Creek watershed's farmed acreage.
- Measure water quality in Indian Creek to determine whether voluntary implementation of priority conservation systems on at least 50 percent of the land in the watershed, over the six year timeframe of the project, is a sufficient implementation scale and timeframe to impact water quality.
- Provide educational assistance to watershed producers in order to make overall improvements to water quality in Indian Creek through the utilization of the 4R Nutrient Stewardship framework.

Evaluation method

The primary source of our data were 35 semi-structured interviews conducted between February and March of 2015 in Livingston County, Illinois and over the phone. Our first step in this process was to contact and interview key project staff[1] in order to understand the overall Indian Creek watershed project intent, process, and perceived achievements. Livingston County Soil and Water Conservation District staff then provided us with an initial list of producers (those participating in cost-share programs and those who did not participate) and steering committee members. As we learned more about the project's reach through interviews, attending meetings, and reading reports and news articles, we identified additional people, external to the project[2], to interview. The breakdown of our interviews is as follows:

- **12 producers (10 households)**
  - 8 participant
  - 4 non-participant
- **7 steering committee members**
  - Agronomists
  - Agricultural retailers
  - Agricultural advisors
- **6 key project and agency staff**
  - Conservation Technology Information Center (CTIC)
  - Livingston County NRCS and SWCD
  - Illinois EPA
  - Illinois Department of Agriculture
- **10 external to project**
  - Other County NRCS staff
  - Illinois America Water
  - Engineers
  - Non-profit conservation organizations

Perceived goals

- Overall, interviewee perceptions of the project goals corresponded with the actual intent of the project.
- The majority of the people interviewed discussed **improving water quality through changes in farming practices** that included reduced tillage practices and nutrient management practices and systems that encouraged nutrient use efficiency as project goals.
- One additional common goal that emerged was **education and information dissemination** to enable producers to apply new knowledge to their own farms.

[1] CTIC, NRCS, and SWCD staff.

[2] Contact information was found through public information available on the internet.

Perceived successes

- Interviewee perceptions of successes did not align with their perceptions of project goals.
- When asked about the project's successes, improved water quality was not mentioned.
- The most commonly expressed success was that the project **increased producer awareness** of how agricultural practices impact local water quality.
    - Implementation of conservation practices and utilization of the 4R Nutrient Stewardship framework can have positive influences on yields, profits, and water quality.
    - Increased awareness led some producers to pay more attention to agriculture's impact on local water quality and their farm's soil health, and to think about their own farm management practices in a different way.
- Another major theme that emerged was the perception that the project **increased public awareness** of producer efforts toward helping to improve water quality.
    - Many of the people interviewed spoke about the "public" in the context of **policy and regulation**. The Indian Creek watershed project was seen as an example of what can be achieved without regulation. This seemed particularly salient as the Illinois Nutrient Loss Reduction Strategy was in the process of rolling out.
- **Changes in behavior** were also specifically mentioned as a success.
    - Changes to when and how nitrogen was applied to crops (e.g., moving from fall application of nitrogen to a spring application and side-dress system).
    - Participation in cost-share programs in the watershed, including CSP renewals.

Learning

- Producers valued **networking** opportunities with other producers in order to discuss lessons learned from various different conservation practices and demonstration plots.
- Meetings where **nutrient use efficiency data** were presented and new technologies were demonstrated were important to producers.
- Going through the **CSP process** allowed producers to step back and think about their overall farming operations and question their farm management habits.
- **Hands-on implementation** of conservation practices on producers' own land allowed them to see, first hand, how the practice would or would not benefit their own farm operations.

Key takeaways

- One overall message expressed in interviews was the **sense of community** in this watershed; particularly that the community came together to work toward a common goal to test and implement conservation practices in order to improve water quality in Indian Creek that eventually impacted drinking water extracted from the Vermilion River.
- This community approach included **local leadership** from the SCWD and NRCS offices; people who were respected, trusted, who knew the producers in the watershed and could work well with them.
- The people interviewed said that it is important to **involve local producer leaders** in the project. These producers should be people who are **respected** in the community and whom others watch to see how they manage their farms. The leaders should be **willing to commit** to implementing conservation practices and/or demonstration plots and to **speak** about their experiences and farm management data.

- The value of **partnerships within the steering committee** was another key takeaway that emerged. While the Livingston County SWCD resource conservationist hand-picked the initial committee, the committee has an open door policy for participation. The committee is locally led, the producers have a strong voice, and the diversity of the people involved played to the strengths of each group. Not one single person or entity carried the committee. Rather, it was the strength of the whole.
- Participation of **local agricultural retailers** on the steering committee was seen by many as a key aspect of project success.
- Many of the people interviewed noted that **funding** was an important part of the project's success. **Cost-share funding** served as an incentive for producers to try new conservation practices, while 319 funds and sponsorship money were secured and utilized by CTIC to lead **outreach efforts, fund demonstration plots, and cover costs associated with marketing and communication**. These funding sources worked hand in hand to get producers to the table, to fund numerous cost-share projects, and to utilize demonstration plot data in outreach meetings to help producers think about different ways of managing nutrients on their own farms.

Challenges and improvements

- Interview data revealed that there is a disconnect between the intended goal of improved water quality and the perceived reality that improvements were detected. Although the people interviewed understood that improvements to water quality can take many years, they expressed a desire to see **more water data** in order to understand whether changes in farm management practices had a positive impact on water quality. Moreover, there was a concern over a **lack of baseline data** in Indian Creek prior to the project's start. Not having this baseline made measuring the water quality impact of the acreage enrolled in various conservation practices difficult.
- Another issue that emerged was a concern over the **intensity of resources (time and funding)** needed to implement the Indian Creek watershed project. It was recognized that the funding needed to cover cost-share programs and outreach components of the project would be **difficult to replicate or scale-up nationwide**.
- At the farm level, several interviewees mentioned that the **high price of corn** during the watershed project allowed them to feel more comfortable in trying new conservation practices, particularly in **alleviating financial risk** associated with establishing cover crops. As commodity prices decline, producers may feel that experimenting with conservation practices or new nutrient management strategies entails too much financial risk to pursue.
- Another issue conveyed was the Conservation Stewardship Program **contract process** with requirements that were seen as burdensome for three reasons: 1) For some producers, filling out the contract paperwork was perceived not to be worth their time in relation to potential benefits they might receive, along with the risk that the project may not even be accepted, 2) A few landlords did not want to be locked in a contract with one producer for a 5-year time period, and 3) One producer said that they wanted more flexibility in meeting their yield goals than a contract would allow.

Discussion and recommendations

Structure of the project

- **Local leadership** who knew the community, were trusted, and worked well with local producers, was a key component of producer participation in the Indian Creek watershed project.

  We recommend identifying dedicated local leadership, in some capacity, within potential conservation project communities. Ideally this person (or persons) should know/understand the community, work well with producers, be seen as knowledgeable and trustworthy, and be willing to be a visible part of the project and dedicated to working through challenges and barriers in order to achieve project goals.

- The project was community driven and locally led. Local leadership convened a **steering committee of diverse partnerships** prior to the project's inception, in order to apply for government funding. The partnerships developed on the steering committee helped move the project forward, kept it going for five years, and gave the project a sense of legitimacy. There is currently a sense from the steering committee members that they will continue to meet after the project officially ends, even if it is not as often.

  We recommend a similar approach to future conservation projects. Ideally the steering committee would be made up of all representatives of the agricultural community, including community members, in order to bring all stakeholder voices and strengths into decision making processes. Including local agricultural retailers should be considered an important component of the makeup of the steering committee, as these are the people who routinely advise producers – producers and retailers can work together toward the implementation of on-farm conservation practices.

Common goals

- Indian Creek flows through the Fairbury community and runs into the Vermilion River, which provides drinking water for the neighboring communities of Pontiac and Streator. Many producers were concerned that their practices might have an influence on their downstream neighbors. This **local goal** perhaps means more than an abstract problem hundreds of miles away in the Gulf of Mexico, as the producers we interviewed wished to help their **neighbors** and **community** at large.

  We suggest that incorporating local/community issues be considered in conservation project communities. Whether this is concern over fish, taking a float trip, providing drinking water, or improving the long-term sustainability and viability of local/personal farmland, community identity and local concern can be better conceptualized than problems many miles away.

- The **regulatory environment** provided another common goal for the producers in this area. The Illinois Nutrient Loss Reduction Strategy offered a convenient framework for producers in the Livingston County area to show that they take water quality seriously, and are working toward better farm management for the greater good as well as their own farm viability over time. One of the successful aspects of the Indian Creek watershed project, expressed by the people we interviewed, was that producers could try different practices in order to see what worked best for their own farms; this trial and error process was perceived to be more successful and beneficial than strict mandates on what to do when or how much fertilizer to use, etc. Producer motivations to implement conservation practices is of concern in any conservation project. Motivators such as farm stewardship, improving neighbors' drinking water quality, or a sense of off-farm environmental responsibility may be a more sustainable way to influence farm management practices over the long-term. However, "fear" of regulation is very real. We suggest that **linking voluntary conservation measures with State-wide programs** such as the Illinois Nutrient Loss Reduction Strategy, can put conservation projects, and what project leaders are asking producers to do, in a larger context.

In this case, because of the regulatory context, many producers expressed that they were working together as a community to show "regulators" that they can address environmental quality issues on their own. This sense of community and pride should not be underestimated. We recommend that conservation project communities identify their own issues that might foster a sense of community to work toward a common goal.

Awareness building among producers

- The project entailed **hands-on learning** by producers, thereby allowing them to see which conservation practices made most sense on their own farms. The project educated producers on alternative ways of managing their farms, as well as the impact of agriculture on water quality and soil health. Achieved through their own **experiments and data shared by other producers**, the education and outreach process contributed to producers' **awareness** that there are environmental problems (both on and off farm), and that different management practices can improve their own efficiencies while improving environmental quality.

  If producers are not aware of a problem, or don't believe the sources that say there is a problem, then they cannot or will not change their farming practices and routines – there is no need to fix something that works. The education on water quality and soil health provided at various meetings and field days, the hands-on nature of conservation practice implementation, and the sharing of nutrient management data was key to building awareness of agriculture's various impacts on the environment and various solutions to those impacts. This awareness then led to more curiosity and more effort to read and learn. We therefore recommend this multifaceted approach to learning and change for future conservation projects.

Watershed scale

- The people we interviewed told us that they felt the scale of the watershed was small enough to reach every farmer, yet big enough that there were enough producers to make enrolling 50 percent of the watershed's farmed acreage feasible. We were told that, because of this project, land enrolled in this project is now being managed in a different way. The success of this project has the potential to impact producers in neighboring counties and watersheds through data and information sharing. Indeed, the Indian Creek project partners have secured MRBI funding to expand into Vermilion River watershed headwaters.

  We suggest that future conservation projects consider the scale of the watershed as an important factor in choice of project context/location. The scale should carefully correspond with project goals.

Goals and data

- Many producers spoke of water quality as being a primary goal of Indian Creek watershed project. Despite this, almost everyone had questions about whether their efforts were making a difference toward improved water quality.

  We suggest that if water quality goals are an explicit aspect of a watershed project, it is important to provide transparent water data, as well as connections between agricultural practices and water quality. This data must be trusted and transparent, with little room to question the legitimacy of stated problems and goals. If such transparency is not possible, then other goals should be brought to the forefront of the conversation (e.g., soil health, long-term farm viability, etc.).

Social Science Evaluation Report

Indian Creek watershed project, Livingston County, Illinois

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Introduction

Overview

Purdue University was engaged by the Conservation Technology Information Center (CTIC) to evaluate the Indian Creek watershed project by determining its successes and documenting key project elements that contributed to the project's success. What follows is a bulleted summary of key findings from the Indian Creek watershed evaluation. Information on the Indian Creek project itself and a detailed accounting of our findings can be found in the Indian Creek Watershed Social Science Evaluation Report.

In brief, the Indian Creek watershed project is led by the CTIC and in partnership with the Livingston County Soil and Water Conservation District (SWCD), the Illinois Environmental Protection Agency (IL EPA), USDA Natural Resources Conservation Service (NRCS), and many other conservation agencies and organizations, local citizens and farmers. The project focuses on improving water quality in a small agricultural watershed in central Illinois. It targets education and outreach, as well as cost-share funding, to encourage the voluntary adoption of conservation practices and systems that are known to improve on-farm nutrient use efficiency. The project goals were to treat 50 percent of the farmed acreage in the watershed with conservation practices and systems, and measure water quality in Indian Creek to determine if voluntary adoption of such practices and systems, at this scale, can improve water quality.

The project has been funded in large part by a Section 319 nonpoint source pollution abatement grant from IL EPA. The project evaluation and report were funded by the Illinois soybean checkoff.

Funded by the **Illinois** soybean checkoff.

Project purpose – nutrient loss reduction and why it matters

Conventional agriculture practiced in the Midwest is connected to nutrient loading in waterbodies, which adversely impacts water quality and overall watershed health. In Illinois, nutrient runoff from agricultural land has been linked to reduced water quality, including excess nutrients that harm drinking water (IL EPA) and contribute to Gulf hypoxia (IL EPA; Rabalais et al. 2002). In fact, Illinois EPA estimates that between 1997 and 2011, approximately 20 percent of nitrate-nitrogen loading in water flowing to the Gulf of Mexico came from rivers in Illinois. Illinois EPA has targeted five watersheds for priority nutrient reductions due to nutrient losses from agricultural runoff in order to respond to the U.S. EPA's 2008 Gulf Hypoxia Action Plan (IL EPA). Corn and soybean production is an important source of grain, silage, and energy in the current marketplace, and is also a significant contributor to water quality problems as noted above. In light of this, producing food and ensuring healthy soils for future generations while also protecting water quality is an important set of issues for the agriculture industry and conservation professionals to address.

Incorporating conservation systems into farm management practices (e.g., utilizing cover crops or adjusting rates and timing of fertilizer applications on crops) has been shown to reduce nutrient loss from fields, which in turn can reduce nutrient loading in rivers and streams (IL EPA; Rejesus and Hornbaker, 1999), thereby improving water quality. Voluntary, cost-share, conservation programs are a popular approach to incentivize producer adoption of conservation practices (Reimer and Prokopy, 2014). Along these lines, Illinois recently introduced its Nutrient Loss Reduction Strategy, which seeks to address water quality impacts from both point (e.g., sewage wastewater) and non-point (e.g., water runoff from agricultural land) sources through voluntary goals and measures (IL EPA). The Indian Creek watershed project, located primarily in Livingston County, Illinois, is an example of a voluntary program aimed at reducing non-point source water pollution from agricultural land. This project has been held up as an exemplary and successful watershed project (Christiansen, 2013; Doran, 2014; Miller, 2014; SFTL) worthy of replication. To inform the possible successes and replicability of the Indian Creek Watershed project, this report documents, through the eyes of project participants and observers, the ways in which the project was successful and how such successes were achieved.

Indian Creek watershed – why this watershed?

The Indian Creek watershed conservation project was targeted by CTIC and several State and local partners in Illinois. Funding for this project came from a variety of sources. Two key funding sources were a Section 319 non-point source pollution abatement grant from IL EPA and funding from the USDA Natural Resource Conservation Service's Mississippi River Basin Initiative (MRBI).

- Section 319 funding is funding that comes from Section 319 of the Clean Water Act. These funds are given to US EPA and allocated to projects by State water quality agencies. In Illinois, this agency is the IL EPA. CTIC applied for, and received, Section 319 funds from IL EPA to implement the outreach, demonstration, and education portions of the Indian Creek project.
- MRBI targets cost-share funding to help producers implement conservation practices and systems in priority watersheds that have high nutrient concentrations located within the Mississippi River Basin; this, in order to mitigate hypoxia in the Gulf of Mexico. This MRBI funding is a reservation of NRCS Farm Bill program funds from the Conservation Stewardship Program (CSP) and Environmental Quality Incentives Program (EQIP), which are used to incentivize the use of conservation practices on agricultural lands. These program funds were targeted specifically to producers in the Indian Creek watershed. The SWCD worked with the newly formed Indian Creek Steering Committee to submit an application to NRCS for these funds.

The Indian Creek watershed, made up of three HUC12 watersheds, is part of the larger Vermilion River watershed. The Vermilion River flows into the Illinois River, which then makes its way to the Mississippi River and down to the Gulf of Mexico (IL EPA, 2009). The Vermilion River is a 303(d) [1] listed impaired river for excessive nitrates; meaning nitrate levels in the Vermilion are regularly above the maximum concentration level of 10 mg/liter set by EPA drinking water standards. Such high nitrate concentrations are detrimental to human health if consumed (EPA d).

CTIC, the Illinois Department and Agriculture, IL EPA, along with local NRCS and SWCD staff, identified the Indian Creek watershed for this conservation project for five key reasons:

1) The watershed, at 51,243 acres, was thought to be small enough to have a positive impact on Indian Creek's water quality if 50 percent of the watershed's farmed acreage was enrolled in a conservation project.
2) The small size of the watershed would enable SWCD staff to contact every producer in the watershed through face-to-face contact.
3) The watershed included a diversity of farms, from farms with thousands of acres to those with only 40 acres, as well as farms with livestock.
4) Producers in the area were known to be interested in, or already implementing, conservation practices; thus it was hoped producers in this area would be responsive to learning about and implementing such practices along with new ideas surrounding nutrient management.
5) The local SWCD office was staffed by a long-time resident who was also a farmer, and thus known and trusted by the producers in the watershed, thereby increasing the likelihood of enrolling 50 percent of the watershed's farmed acreage in conservation programs.

Once CTIC secured the Section 319 grant from IL EPA, Livingston County SWCD resource conservationist, Terry Bachtold, formed a steering committee of hand-picked area producers, local agricultural retailers, SWCD Board members, and the Mayor of Fairbury, IL. This steering committee came together to decide whether to

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[1] Required by the Clean Water Act, a 303(d) listing designates impaired and threatened streams, lakes, and river segments as not meeting pertinent water quality standards (EPA a). Once a water body is listed, each State in which the waterbody is located must develop Total Maximum Daily Loads for that waterbody – a calculation of the maximum amount of pollutant in the waterbody. If non-point source pollution is identified through the TMDL process, States may then apply for EPA Section 319 grants to fund assessment and control of the listed water bodies and their applicable pollutants (EPA b).

recommend that the Livingston County SWCD apply for NRCS MRBI funding. Once this was decided, the committee helped provide information for the grant application – an ultimately successful application.

Evaluating the Indian Creek watershed project

State and local agencies and others involved in the Indian Creek watershed project contend that the project has been particularly successful in achieving producer participation in cost-share programs. In addition to high levels of participation, the project has received attention from agricultural trade publications and conservation organizations, who highlight it as a model watershed conservation program. The Illinois Soybean Association, cognizant of the perceived success and potential toward reduction of nutrient loss from agricultural land, funded this project evaluation – *Was the project a success? What were the successes? What elements are needed to replicate the successes in other watersheds?* – CTIC sought out and engaged Purdue University to address these questions. We took a case study approach to this project evaluation, delving into the details of the community, attending meetings and field days, reading reports and news accounts of the project, and interviewing a broad cross-section of participants and observers.

The primary source of our data were 35 semi-structured interviews conducted between February and March of 2015 in Livingston County, Illinois and over the phone. Our first step in this process was to contact and interview key project staff[2] in order to understand the overall Indian Creek watershed project intent, process, and perceived achievements. Livingston County SWCD staff then provided us with an initial list of producers (those participating in cost-share programs and those who did not participate) and steering committee members. As we learned more about the project's reach through interviews, attending meetings, and reading reports and news articles, we identified additional people, external to the project[3], to interview. The breakdown of our interviews is as follows:

- **12 producers (10 households)**
  - 8 participant
  - 4 non-participant
- **7 steering committee members**
  - Agronomists
  - Agricultural retailers
  - Agricultural advisors
- **6 key project and agency staff**
  - Conservation Technology Information Center (CTIC)
  - Livingston County NRCS and SWCD
  - Illinois EPA
  - Illinois Department of Agriculture
- **10 external to project**
  - Other County NRCS staff
  - Illinois American Water
  - Engineers
  - Non-profit conservation organizations

[2] CTIC, NRCS, and SWCD staff.

[3] Contact information was found through public information available on the internet.

In addition to interviews, we attended the following gatherings in order to observe the function and content of each meeting and event:

- Steering Committee, January 28, 2015
- Annual Meeting, February 19, 2015
- Steering Committee, April 2, 2015
- Field Day, July 16, 2015

To gain understanding of project details and perceived achievements from the project lead perspective, we analyzed project reports. We also examined agricultural trade publications and conservation organization newsletters in order to gauge the external reach of the project:

- CTIC progress reports.
- Demonstration plot results reported by Dr. Harold Reetz.
- Conservation organization newsletters and publications.
- Agricultural trade publications such as AgriNews, AgWired, and Illinois Farmer Today.

Utilizing each of these data sources, we explored the following themes in order to report on project successes and key takeaways to be considered for new watershed projects:

- Details of the project.
- Perceptions of project goals.
- Motivations for participating (or not participating).
- Learning achieved through participation (and how learning occurred).
- Perceived project successes.
- Challenges surrounding the project, cost-share programs, and conservation practices.
- Suggested elements needed for successful implementation of a similar project in a different watershed.

These broad themes were covered in each interview through the use of a written interview guide. The interviews were then transcribed and the text analyzed for emergent themes within these broad categories. Project documents and agricultural trade publications provided additional data, yet also corroborated what we learned from the 35 interviews. The results reported here come from our interview data analysis process.

Putting the project into context

Indian Creek watershed

The Indian Creek watershed is located primarily in Livingston County, Illinois, with Ford and McLean Counties touching its southern and western edges respectively. It is a 51,243 acre drainage area with agriculture as its primary land use, made up of three HUC12 watersheds:

- Indian Creek (071300020203)
- Belle Prairie-Indian Creek (071300020204)
- Town of Fairbury (071300020205)

Figure 2 Indian Creek watershed, Illinois

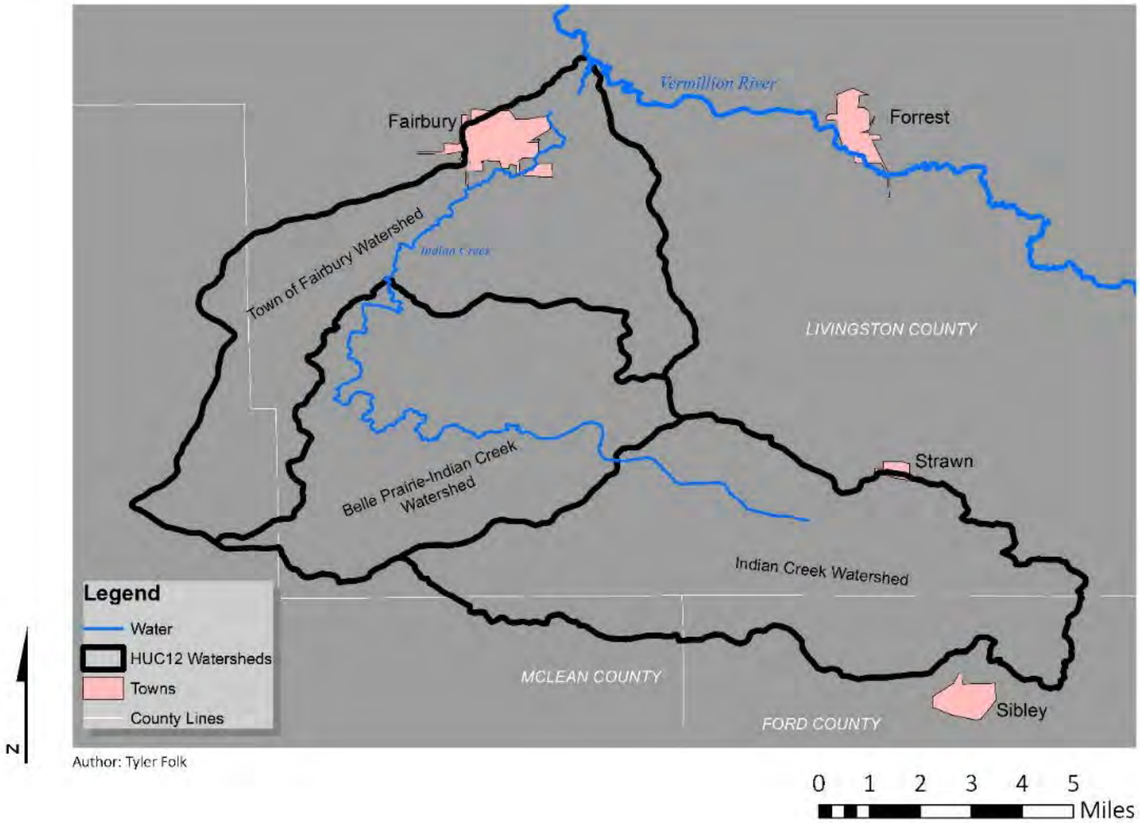
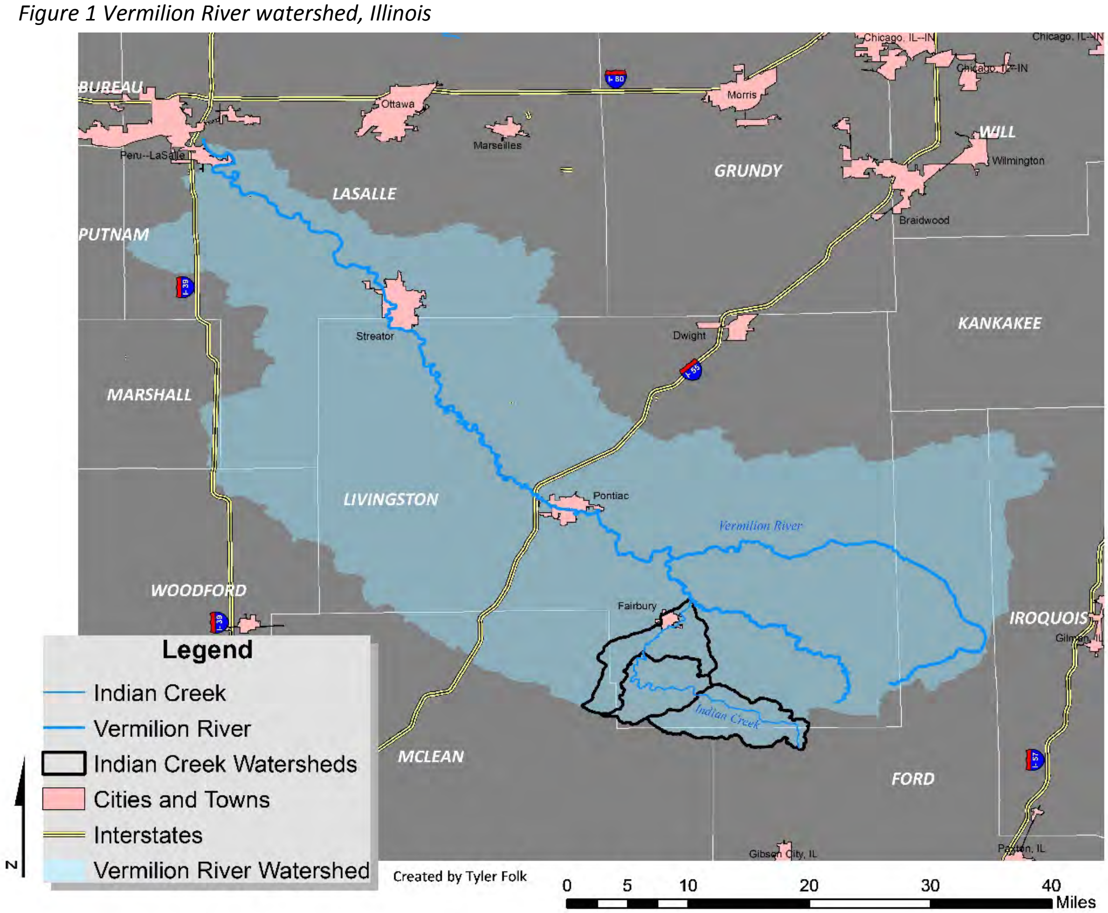


Figure 1 Vermilion River watershed, Illinois



Indian Creek itself is not a 303(d) listed stream, however it flows into the South Fork of the Vermilion River and then on to the main stem of the Vermilion River, which are both listed as impaired. Because of the Vermilion River's impaired listing, ongoing Total Daily Maximum Load calculations are required. The Vermilion River provides drinking water for Pontiac (2013 population estimate 11,688) and Streator (2013 population estimate 13,422), both of which are located downstream from the Indian Creek watershed and its principal community, Fairbury (2013 population estimate 3,689). The Vermilion's TMDL indicates that nitrogen and nitrate are "potential causes" of its listed status[4] (NRCS 2008). EPA drinking water standards through the Safe Drinking Water Act dictate a maximum concentration of 10 mg/liter of nitrate to maintain safe drinking water (EPA c). Illinois American Water, who administers the drinking water in this area, must treat the water from the Vermilion several times a year in order to meet the Safe Drinking Water Act standards. They do this either through mixing the river water with stored reservoir water with nitrate levels at or below 10 mg/liter, or through an ion exchange system if mixing water cannot achieve safe drinking water standards (Personal communication from Illinois American Water representatives). Because the Indian Creek watershed project is linked to the impaired waters of the Vermilion River, water quality has been monitored since 2010 at four sites (IL EPA a, 2014 p. 37). The goal for this project was to achieve nitrate levels at or below 10 mg/liter in Indian Creek (CTIC 2013).

Livingston County and the Fairbury Community

The Indian Creek watershed sits almost entirely within Livingston County. The County's 2013 estimated population was 38,186. The majority of the population in Livingston County was White (92.5%) in 2013. While Livingston County's poverty level (10.3%) was lower than Illinois as a whole (14.1%), there was a similar median household income and age distribution for those aged 25 – 54, with Illinois having a higher percentage of persons over 65 years old (15.9% versus 12.9%) (See Table 1). Although Livingston County and the State of Illinois had similar educational attainment for High School education and above, persons with a Bachelor's degree or higher was significantly lower in Livingston County (14.5%) than the State as a whole (31.4%).

Table 1 Livingston County Demographic Profile as compared with Illinois, 2013 U.S. Census American Community Survey

	Livingston County	Illinois
Population (estimated)	38,186	12,848,554
Race, White	92.1%	72.5%
Median age	40.9	36.8
Percent of persons aged 25 - 54	41.5%	41.4%
Percent of persons aged 65 years and over	12.9%	15.9%
Percent of persons with a High School education or higher (25 years and older)	86.1%	87.3%
Percent of persons with Bachelor's degree or higher (25 years and older)	14.5%	31.4%
Median household income	$54,614	$56,797
Percent of persons below the poverty line	10.3%	14.1%

Sources: U.S. Census b, U.S. Census c.

The City of Fairbury is the principal community and gathering place in the Indian Creek watershed. It is located in the upper/northern portion of the watershed, and approximately 15 miles southeast of Pontiac, which is the county seat of Livingston County (see Figure 2). In 2013, the estimated population of Fairbury was 3,713, a 1.2 percent decline from 3,757 in 2010 (US Census a). Fairbury is the hub of the Indian Creek project. Steering committee meetings are held in the community room at Dave's Grocery, the community's grocery store that also contains a vibrant and well frequented café. The project's Annual Meetings and the indoor portions of their Field Days are generally held at the First Baptist Church of Fairbury, which is located next door to Prairie Central High School. Fairbury's downtown houses its City offices, a library, the post office, several shops and restaurants, and financial service retailers. Entering the town from the east, you'll find a Fairbury mainstay, McDonald's

[4] Nitrogen and nitrates found in water bodies can be due to runoff from fertilizer use on agricultural land (EPA c).

Family Restaurant. We had several meetings at this restaurant, and never failed to see a group of farmers sitting in the front room chatting over coffee. Overall, time and again we were told that this is a tight-knit community – *"…This is a very community minded area. People are very connected to each other through social activities as well as just personally related…"* – we certainly felt this sense of community during our visits.



We were told that one of the reasons the Indian Creek watershed was chosen as a potential location for a Section 319 grant application, was the diversity of crops and livestock in the area – *"There's a lot of diversity in this watershed that you don't see throughout Illinois. There's a lot of specialty crops, turkeys and poultry, a lot of livestock diversity, both crops and animals that maybe you don't see a lot in other watersheds. They're just typically pure corn-soybean, although that still is the dominant crop."* – Indeed, while corn for grain and soybeans for beans make up the majority of total harvested cropland in the three watershed counties, Livingston, Ford, and McLean Counties also include a good number of cattle and hogs.

Table 2 Indian Creek watershed County agricultural profile (Livingston, McLean, Ford counties) as compared with Illinois, 2012

	Livingston County	McLean County	Ford County	Illinois
Total harvested cropland (acres)	614,333	635,582	290,265	22,373,010
Corn, grain (acres)	323,873	347,414	159,490	12,263,259
Corn, silage/greenchop (acres)	2,626	1,756	543	171,562
Soybeans, for beans (acres 2012)	277,323	279,769	125,449	8,933,457
Cattle and calves inventory (number)	10,510	12,139	3,032	1,127,630
Hogs and pigs inventory (number)	236,426	173,116	4,114	4,630,796

Source: Ag Census (2012)

Producer participation – conservation practices and demonstration plots

As part of the Indian Creek watershed project, producers could participate in two overall project types: 1) changes to farm management through conservation practices and, 2) implementation of nutrient use efficiency demonstration plots. First, through cost-share programs (primarily CSP and EQIP), producers implemented agreed upon conservation practices or systems on their farm, or took land out of cultivation, for a period of time[5]. Producers then received payments to defer the cost of lost yields or the cost of changing farm management practices. Second, the project received Section 319 funding through IL EPA. This funding was allocated to CTIC to assist in organizing the Indian Creek Watershed project, to lead the educational and outreach portion of the project, and to fund the implementation of nutrient use efficiency demonstration plots on producers' land. Section 319 funding also paid for a portion of the gage and nitrate probes for the water monitoring equipment. Details on the conservation practices and demonstration plots implemented are described next.

Cost-share programs

The majority of practices implemented through the project centered upon nutrient management, including different approaches to nitrogen application, tissue testing, the use of precision technology for nutrient management (right source, right rate, right place, right time), and writing a nutrient management plan. Other

[5] The EQIP program is a maximum of 10 years. CSP contracts are for 5-years.

popular practices included the implementation of cover crops, conservation crop rotation, grassed waterways, and residue and tillage management. These practices were implemented by producers. Technical assistance was available from NRCS/SWCD staff if needed. The following tables list the types of practices contracted, the number of contracts per practice, and the number of acres covered within each practice.

Table 3 Conservation practices under contract through the CSP program, 2010 through 2013 (2014 unavailable)

Conservation Practice (CSP)	Contracts	Acreage
Nutrient management - nitrogen application	27	15,469.5
Nutrient management - tissue testing	27	14,239.6
Pesticide drift reduction	7	4,243.3
Cover crop	7	2,622.3
Nutrient management - precision technology	5	2,901.1
Air emissions	3	1,218.7
Nutrient management - nitrification inhibitors	3	1,123.0
Nutrient management - livestock	2	708.9
Locally grown and marketed farm products	2	365.0
Weed management	1	1,165.9
Grazing management	1	15.0
Livestock forage	1	12.0
Water facilities - wildlife escape	1	10.0
Waste management	1	1.0
TOTAL	**88**	**44,095.3**

Notes: Contract information provided by the NRCS office in Livingston County, IL.
Some acreage could be included under more than one contract/practice.

Table 4 Conservation practices under contract through EQIP and CTA programs, 2010 through 2014

Conservation Practice (non-CSP)	Contracts	Acreage
Waste Recycling, Storage, and Transfer	16	1,837.3
Conservation Crop Rotation	8	2,499.6
Grassed Waterway	5	22.7
Subsurface Drain	5	6,097.0
Composting Facility	4	4.0
Cover Crop	4	135.7
Access Road	3	950.0
Comprehensive Nutrient Management Plan - Written	3	5.0
Reduced Till	3	1,527.4
Nutrient Management	2	258.9
Seasonal High Tunnel System for Crops	2	4,000.0
Upland Wildlife Habitat Management	2	8.2
Windbreak/Shelterbelt Establishment	2	440.0
Agricultural Energy Management Plan, Headquarters - Written	1	1.0
Conservation Cover	1	4.1
Critical Area Planting	1	0.9
Filter Strip	1	4.1
Pumping Plant	1	1.0
Roofs and Covers	1	1.0
TOTAL	**65**	**17,797.9**

Notes: Contract information provided by the NRCS office in Livingston County, IL.
Some acreage could be included under more than one contract/practice.

Demonstration plots

Another important component of this watershed project were nutrient use efficiency demonstration plots. These plots provided valuable data to the producers who implemented the demonstrations on their farms and to the community at large, as the agronomists in charge of the plots presented the previous year's demonstration data at each annual winter meeting. Through our interviews, we found that plot demonstration data was a key aspect of the success of this project. The demonstrations provided local data to local producers, with the producers and agronomists who worked the plots available to speak about their experiences and findings with other producers and the public. To accomplish this portion of the project, CTIC utilized Section 319 funding to hire agronomists Dr. Harold Reetz (Reetz Agronomics) and Mr. Tim Smith (Cropsmith, Inc.) who then worked with producers in the watershed area to implement nutrient use efficiency demonstration plots on their farms. Each year the project staff and agronomists worked with the steering committee, including producers, to create a "menu" of plot demonstrations from which interested producers could choose. Small plot demonstrations were typically about a half-acre in size, worked with small-plot equipment or hand labor. Larger demonstrations, performed with regular farmer-scale equipment, were approximately 15 to 20 acres in size. Table 4 shows the number of demonstration available on the demonstration menu, the number of demonstrations initiated, and the number of producers engaged in the demonstration plots between 2011 and 2014.

Table 5 Demonstration and nutrient use efficiency plots implemented, 2011 through 2014

	Available demonstrations	Demonstrations initiated	Number of producers engaged
2011	6	6	3
2012	10	10	6
2013	13	11	7
2014	9	9	9

Notes: Contract information provided by Reetz Agronomics.
Some producers contracted for more than one demonstration plot.

Structure of the project – the people and organizations who made this project work

Through our interviews and document review, we identified the following organizations and people as being key to the processes and successes of the Indian Creek watershed project. Here, we highlight each key partner and their function as part of the day-to-day workings of the project. In the Key Takeaways section, we elaborate on the importance of each of these organizations and people toward the success of this project.

CTIC

CTIC is the backbone of this project. Chad Watts, CTIC project director, leads this effort and has been instrumental in coordinating the social and information sharing components of the project (e.g., quarterly steering committee meetings, annual meetings, field days, media contacts, and making presentations to groups about the project). He, along with CTIC project coordinator, Sue Tull, is also in charge of getting the word out about the project through email updates, newsletters, and media relations. Sue Tull also ensures that the project is on schedule and on budget. CTIC has been instrumental in bringing in additional funding for initiatives and projects that complement the ongoing conservation work in the Indian Creek watershed. As will be shown, project outreach provided by CTIC (and made possible through Section 319 funding) is an important aspect of this project's success.

Livingston County SWCD

While the local SWCD office also provides coordination support for steering committee meetings, annual meetings, and field days, this agency provides the on-the-ground effort to gain project participation. Terry Bachtold, resource conservationist, is the face of the project. He hand-picked the steering committee, asking producers who were well regarded in the community and who were also motivated to implement conservation practices, as well as all local agriculture retailers and the Mayor of Fairbury, to participate. In addition to pulling together this core group, Terry Bachtold visited face-to-face with every producer in the watershed to tell them about cost-share and demonstration plot opportunities available through the project. Terry Bachtold is a trusted member of the community, to whom other people listen. He is a farmer himself and his family has lived in the community for generations. He is quiet and not pushy, yet passionate about conservation. Terry Bachtold' s standing in this community, his demeanor, and his passion about this watershed project, have been instrumental for producer participation.

USDA NRCS, Livingston County office

Eric McTaggart, district conservationist in the local NRCS office, administers the cost-share program contracts and provides on-farm technical assistance to help match producers with appropriate conservation measures for their farms. After Terry Bachtold recruited producer participants, Eric McTaggart and Livingston County NRCS staff helped producers identify priority conservation practices and systems that could address each farm's needs. They then explored appropriate program options to help farmers defray the cost of the practices and systems. Eric McTaggart would meet with producers at their farms, in the NRCS office, or during open houses, to recommend the program best suited to the producers' needs, and walk them through the applicable paperwork. Like Terry Bachtold, Eric McTaggart's demeanor is not pushy, which contributes to the trust of local staff in successfully contracting with producers in the watershed.

Steering Committee

The steering committee was put into place prior to cost-share funding applications. This early recruitment helped to ensure local buy-in and commitment to the project. The current steering committee is made up of local SWCD and NRCS staff, local producers, local agricultural retailers, and agronomists Harold Reetz and Tim Smith. The meetings are open and anyone is welcome to attend; for example, representatives from American Farmland Trust, The Nature Conservancy, and the Illinois Soybean Association have attended in the past. Many of the project sponsors, who represent agricultural industry leaders, also often attended steering committee meetings to participate in discussions, and to offer insights and expertise[6]. The committee meets quarterly. These meetings serve several functions; the meetings are: 1) a place for the committee to discuss conservation practices and demonstration plots and determine which projects to include on the practice and demonstration menu; 2) a setting for the committee to recommend specific events and speakers for annual winter meetings and summer field days and then plan (and volunteer) for specific aspects of each event; 3) an informal venue for information sharing amongst all participants.

Indian Creek watershed project goals

The participants and partners of the Indian Creek watershed project worked to achieve the following three project goals (CTIC, 2013):

- Implement conservation practices on 50 percent or more of the Indian Creek watershed's farmed acreage.
- Measure water quality in Indian Creek to determine whether voluntary implementation of priority conservation systems on at least 50 percent of the land in the watershed, over the six year timeframe of the project, is a sufficient implementation scale and timeframe to impact water quality.
- Provide educational assistance to watershed producers in order to make overall improvements to water quality in Indian Creek through the utilization of the 4R Nutrient Stewardship framework.

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[6] Project sponsors can be found at the following website: http://www.ctic.purdue.edu/IndianCreek/Sponsors/.

Perceptions of the project – goals and success

In the following pages, we report on the details of our evaluation by presenting prevalent themes that emerged from our interview transcript analysis. We begin by reporting on the perceived goals of the project, followed by what our interviewees thought were the successes of the project. We then move to more specific aspects of the project, including why producers decided to participate, what our interviewees learned, and how and whether behaviors changed because of participation in the project. The analysis presented here includes all of the interviews we conducted for this project, including producers and non-producers.

Perceived Goals

WATER QUALITY

INFORMATION

EDUCATION

Perceived goals of the project

Nutrient management for water quality

Each person we interviewed was asked what they thought was the primary goal of the Indian Creek watershed project. This was asked so that we could get a sense of whether the understanding of the overall project, by the people we interviewed, matched the actual intent of the project. Overall, interviewee perceptions of the project goals corresponded with the actual intent of the project. Interviewee perceptions centered on nutrient loss reduction for improved water quality of Indian Creek and downstream to the Vermilion River. Most answers, from producers and non-producers, included a discussion about improving water quality through changes in farming practices including tillage and nutrient management.

> "...that we could make a difference in water quality by what farmers out here in the watershed are doing; how they're tilling the land and how they're applying the nutrients, and tweaking and adjusting their decision making process over here, can make a difference over here in water quality." *(Producer participant)*

> "...the plan itself is looking at fine-tuning management practices to basically improve production and minimize potential negative impact on environment. So fine-tuning nitrogen management, fine-tuning phosphorous and potassium utilization, looking at it from a standpoint of not sacrificing yields, but also maintaining good environmental quality." *(Ag Retailer, soil testing)*

Discussion

PROJECT MESSAGING, EDUCATION, AND OUTREACH EFFORTS APPEAR TO HAVE BEEN SUCCESSFUL.

That these responses correspond to one of the intended goals of the project — to encourage nutrient management through the 4R Nutrient Stewardship framework[7] (CTIC 2013, 14) — indicates that project messaging, education, and outreach efforts were successful in conveying a message that changes in farm management practices can influence downstream water quality.

[7] The 4R Nutrient Stewardship framework asks producers to think through the following four principles: right source, right rate, right time, and right place. This framework is meant to reduce nutrient loss by efficiently utilizing nitrogen fertilizer so that the nutrient goes to the crop when and where it is needed. See http://www.nutrientstewardship.com/what-are-4rs for more information.

Information – for local farmers and beyond

In addition to improved water quality goals, there was one additional common goal that emerged from our interviews – education and information dissemination to enable producers to apply new knowledge to their own farms.

> "...the bottom line is that's really why they're doing this, is to get that information and then to get it back into the farmer's hands so that they can see what it's gained."
> *(Producer participant)*

> "What we're trying to do is demonstrate best practices so that we can then use those as an educational piece and use the information from those. Publish that, the results if you will, so that other people catch on and say maybe that's a good practice for me to try."
> *(Project and agency staff)*

> "I think – and just stating again my opinion here – is that they just really want to be able to offer and just be that source of information for producers if they want to participate in these programs…whether it's financial assistance or just information…quite a few people may not directly have an interest in the adjacent water quality issues, but they definitely want to see what they can do on their farm to help soil quality and a lot of these things do tend to lead to improved water quality and knowing that a lot of these things are connected, so I think they (the project leaders) do a good job with just being basically an information source for all of these things." *(Conservation NGO)*

This project had a hands-on, empowerment focus. The project put information into producers' hands through experimenting with changes in farm management, through the implementation of demonstration plot testing of nutrient management strategies, and through the dissemination of demonstration results and lessons learned at project sponsored meetings and events. Thus, that *information* emerged as a project goal makes sense, as the project intent was to empower this community to learn, to change, and to build a culture of adaptation and learning that could last past any official watershed project:

> *"...part of the idea behind 319 money is they want something to kind of kick start and then it can be sustainable...if we could spur the locals to have an interest and create that infrastructure then that would be more likely to continue." (Project and agency staff)*

Perceived Successes

INCREASED PRODUCER AWARENESS

INCREASED PUBLIC AWARENESS

BEHAVIOR CHANGE

PRODUCER PARTICIPATION

Perceived successes of the project

Although improved water quality through changes in nutrient management practices was, overall, both a perceived goal and the actual intent of the project, our interviewees did not discuss improved water quality as a perceived *success*. Indeed, several interviewees expressed the desire to see more water quality data and hoped that changes toward conservation practices were having a positive impact on Indian Creek. In addition, they did not have confidence that the water quality data that had been gathered was telling the full water quality story, including a healthy fish population in Indian Creek[8] and less than "normal" weather cycles creating artificially high nitrogen loads[9]. Changes to water quality can take time (IL EPA, Meals et al., 2010; Tomer and Locke, 2011). The five year time span of the project included a very dry year in 2012 followed by a very wet spring in 2013, combined with a lack of baseline data for Indian Creek, did not contribute to an overall picture of whether nutrient loading in Indian Creek decreased due to this specific project[10].

Discussion

ALTHOUGH THE PROJECT GOAL OF IMPROVED WATER QUALITY DID NOT APPEAR TO BE MET, THE PROJECT WAS SEEN AS AN OVERALL SUCCESS.

Despite issues surrounding water quality data, the people we interviewed expressed many successes of the Indian Creek project. The two most discussed successes were **increased producer awareness** and **increased public awareness**. These successes should be noted in their potential toward positive influences on producers' yields, soil health, and long term farm viability, if not also future water quality. Our interviews suggest that participation in the Indian Creek watershed project contributed to producers' willingness to learn and experiment with new ideas. We conjecture that this new awareness and willingness to experiment could contribute to this community's ability to adapt to changing climate conditions. The following section describes the major themes of success that emerged from our interviews.

Increased producer awareness – building a culture of experimentation and learning

The most commonly expressed success discussed by the people we interviewed was that the project increased producer awareness of how agricultural practices impact local water quality.

> *"I think the other thing is just having people aware where we're at. That, hey folks…as wonderful as our community is, there's things that we can address." (Producer participant)*

Through participating in this project, whether through a CSP contract, a demonstration plot, or simply going to meetings, producers realized that there are different ways to manage nutrients than what is typically practiced in the Corn Belt (e.g., fall application of nitrogen). They learned that these practices can have positive influences on yields, profits, and water quality.

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[8] Several interviewees mentioned a fish shock test at Indian Creek that occurred CTIC's 2013 National Conservation in Action Tour. This experience appeared to be a point of pride for many of the people we interviewed, as they told us that the shock test indicated that the creek was healthy.

[9] The issue of water quality data will be discussed more fully in the "Challenges and improvements" section.

[10] Researchers at Notre Dame University are currently analyzing the water data to understand trends in the water quality of Indian Creek. Results will be available by the summer of 2016.

"I definitely think it's been successful in encouraging people to try new things and encouraging people to be aware of the fact that there are multiple ways of doing things. It's not just the way Grandpa did it and Pop did it and I'm going to do it this way. There are a variety of opportunities and options and I think, for the most part, most of the people involved with the project have been willing to get outside their comfort zone and try some things that they may not have tried otherwise." (Ag Retailer, soil testing)

"…overall I would say the biggest thing is it's an awareness thing for the producers…a source of gathering information. And then, to also put some of the practices into use on their own farms and to try them and to see how they work or if they work right and if they're satisfied with it. The bottom line is, if they do and it's economically feasible, producers will, for the most part, grab ahold of them and use them in the future...I do feel like they have made us aware of the options…to participate and what some of the benefits will be if you do participate (in a CSP type project)..." (Producer participant)

This new knowledge then also led some producers to pay more attention to agriculture's impact on local water quality and their farm's soil health, and to thinking about their own farm management practices in a different way.

"…before, we were always worried about how can we get our standing water, if we have water events, how do we get the water away from our soils and downstream as quickly as possible. And we've become really good at that. But in the same process, when you have all that tile, then you have…nutrients that go downstream and into our soil or whatever it might be…it's been a real awakening for some people…How do we do it better? What can we do to slow the water down? What can we do to keep the nutrients? …So now we're thinking more positive, in terms of how it affects…water quality, downstream effects of it. We can give the water away really quick, but when Pontiac is the recipient then...it's how people look at the bigger picture…(rather) than just their field and how to get the water off of that as quickly as possible. So it's opened some eyes..." (Participant producer)

"… (The) stewardship program, it makes you, if you don't know something, then you're not aware of it. If you know it, and you're aware of it, then you look at it a little harder." (Producer participant)

"We're paying more attention because of the (nitrogen use efficiency) experiments we've done and the ones that are going on in the project. We're paying more attention to articles in magazines that also talk about it and reinforce it, in the way of cover crops and side dressing and what(ever) else." (Producer participant)

Increased public awareness – improving water quality for neighbors and demonstrating voluntary conservation programs work

In addition to the project increasing producer awareness of agriculture's impact on local water quality and different ways of addressing nutrient management, the other major theme that emerged from our interviews was that the project increased public awareness of producer efforts toward helping to improve water quality.

Public as community

One participant producer talked about teaching moments with community members at church or at the grocery store as opportunities to talk about the watershed project, how the farms in the area effect water quality, and then how local farmers are trying to improve water quality in Indian Creek. Another spoke about similar ideas in terms of showing the local community that the producers in the watershed are taking responsibility toward local water quality.

"...when I rub shoulders with folks that come in here to church and my neighbors up at Dave's at the grocery store or whatever, and somebody says, 'Hey, what's this watershed thing?' It's an opportunity to say, 'Hey, it's about water quality.' Next time, 'Have you ever noticed the green scum on Indian Creek in late summer?' ...the creek runs through the golf course, so the guys golfing see when the water's high and when the water's low and when the water's rushing through there all dark and muddy or when it's nice and clear or when the green scum comes. I think just the awareness…what you guys are doing out in the field is affecting the creek. Well, yeah. We want to take responsibility for that. We want to try to clean it up so you feel like canoeing there in the middle of June and paddling around." (Producer participant)

"…in our summer and winter meetings, we'll have quite a few different people, not just producers or landowners, who will take part in the tours just to see how things are going. I think it's a way to branch out to the townspeople to let them know that we're trying different things to help clean up our water…we have to do something before we're told we have to do something. I think if we get that educational message…across to all of the community members…That we're trying. And it's not easy. And sometimes it's hard to quantify…So I think we're slowly getting through to as many people as we can. We're going to do our part anyway." (Producer participant)

The broader public

Others spoke about the "public" in the context of policy and regulation. Many of the people we interviewed felt that the voluntary conservation efforts being made in the Indian Creek watershed was an example of the positive impact voluntary measures could make on water quality. Interviewees spoke about how the levels of participation in the watershed and the amount of national press the project had received, showed that the producers in this area of Illinois were trying to help improve water quality.

"It can't help but be a good public relations thing. I don't know if public relations is the right word. But the public knows farmers are doing something about it. Even the farmers themselves think about it, whether they're doing a lot or not. It's in the news; it's in the farm magazines. This one guy comes to (Indian Creek watershed) meetings and writes articles. So even if you're not participating, if you read anything at all, you know what's going on. So, public awareness or farmer awareness. That's a start." (Producer participant)

The project's success then led to the reputation of the watershed community as one with "conservation-minded" producers, thus bringing in interest from outside entities like the Argonne National Lab to work in the watershed, or as a watershed project to emulate.

"...we've gotten a lot of good media coverage…After a few years it kind of snow balled where others started hearing, 'Well you have a lot of conservation-minded farmers in these areas who are willing to adopt practices'...some other folks coming in and start showing interest and wanting to put their programs in the watershed. We had folks from Argonne come down and they're doing a biomass study. We've done some other studies with tile monitoring...So a lot of it is social, in terms of just saying, 'We know there's a lot of good things going on because we've read about it.'" (Project and agency staff)

The nature of the Indian Creek watershed project meant conservation information disseminated beyond the watershed through sponsors located outside the state and through agricultural trade publication coverage. In addition, aspects of the project like CTIC's 2013 National Conservation in Action Tour brought policy makers from State and Federal agencies like NRCS and US EPA to the watershed area. Interviewees felt that the attention of the project by Federal policy makers was beneficial, as the project showed high levels of producer participation in voluntary conservation programs, thus alleviating the need for regulation.

"The people who come here from the companies that are sponsors are not just local people. We've got a couple of guys that'll be driving in from St. Louis. One comes in from Iowa. They come regularly to these meetings. And then, that extends out to other communities that they're working in….The project is being held up as an example of how people can work together to get something done about water quality and nutrient management. The practices that we're using get seen by people from all over. A year ago, we had the National Conservation tour here. That was a big deal actually. We had four busloads of people and we had the Chief of NRCS stop here; we had top people from U.S. EPA. Those folks don't get out to the…middle of Illinois in the Corn Belt very often. That attention is good...When they go back and make decisions, they see from the grassroots out here, what works and what things are being done and what the impact is. And, I think that's important." (Agronomist)

"It also lets the public in general or political leaders…see some new things first hand. Then it also gives those people who are making policy the opportunity to talk to people that are actually doing the work on the ground. And, to me, that's a great way for us as producers or local individuals to interact with those people that are going to influence those policy makers…If we can get the word out, especially from the aspect that, yeah, we're trying to clean up our act as far as what we put in the streams from our crops… " (Producer participant)

This idea of a project that highlighted producer participation in a voluntary conservation project related to the current regulatory environment in Illinois as well. The Indian Creek watershed project was seen as an example of what can be achieved without regulation, and seemed particularly salient as the Illinois Nutrient Loss Reduction Strategy was in the process of rolling out.

"The other thing that I think really helps a lot is that the Indian Creek watershed is really focused on nitrates and we're right in the middle of our nutrient loss reduction strategy…They've (Indian Creek project) been kind of out in front of this a little bit…They're heading with the wind on nutrient management…If the industry starts to change some, and farmers, and how they utilize all the different aspects of nutrients, then I think maybe we'll have some massive changes and start to make the corrections we've been working on here. It's possible that Indian Creek will be a model that what they've learned there helps to also support the nutrient loss reduction strategy." (Project and agency staff)

"I guess it's important that an initiative is being taken to try to support the initiative of what we heard the EPA's wanting to do (the Illinois Nutrient Loss Reduction Strategy)… It's going to take more than just us here in the Indian Creek watershed to do that. But an initiative means that you started somewhere to hopefully then, it can be spread to a bigger area…" (Steering committee member)

Other successes

Behavior change

There were other aspects of the Indian Creek watershed project that were specifically mentioned as successful, one being that it was apparent that producers were changing when and how they applied nitrogen on their crops:

"I think we did a pretty good job in the watershed as far as saying, look guys, the split applied nitrogen is really paying dividends, and I think if you talk to CPS and Brandt here in town, they will say that the amount of in-season nitrogen they're handling is up substantially over the last four or five year period. Now, whether that's all watershed or just economics or, I mean, there's tons of information out there that is pointing in this direction...." (Producer participant)

"...the biggest thing at least that I've seen in the two years since I've been here that have been a part of it that (project)...all the previous or how many ever years of farming, it's been pretty standardized (to) spread fertilizer in the fall, put a little fall anhydrous on; that's pretty much just been the normal...now maybe bring in more of that nitrogen application into the spring, and just doing different things..." (Ag Retailer, fertilizer)

We cannot directly associate changes in how and when producers in the Indian Creek watershed apply fertilizer, with the Indian Creek project. Like the comment above states, agronomic information points towards timing the application of nitrogen closer to when crops are planted (NRCS, 2012; Ribaudo et al., 2011). That being said, local agricultural retailers mentioned these changes over the course of the project[11] and a transition away from fall application has not been seen in high levels in the United States (Ribaudo et al., 2012).

Participation

Another successful outcome of the project was the level of participation in cost-share programs by producers in the watershed. This meant that project goals were met (almost 50 percent of the watershed enrolled in a cost-share program), but also meant that more acreage was being better managed.

"When we talked about the success of Indian Creek...when you look at from the NRCS side, the CSP enrollment, there's a lot of acreage. I mean the goal from the beginning to see what kind of water quality results we get, when you get 50% of the acreage in a watershed enrolled in some kind of practice, or very close to that, so that's success." (Project and agency staff)

"…we're successful because we've got several thousand acres that are being managed better because of (the project)." (Agronomist)

Many interviewees talked about how, even after many years, the producers in the watershed were renewing CSP contracts, members of the steering committee continued to be engaged, local producers kept volunteering to go out and talk about the project, and people kept coming to outreach events.

"...it's continued on for six years and still going strong and I think they're still signing up people for different projects and the CSP is still signing people up…We're still having our two field days a year, and getting people out." (Producer participant)

"I would say just one of the biggest successes is just the farmers' engagement. There are several farmer leaders that have really stepped up and put a lot of work into it into keeping the project going…farmers have a lot of work to do. They've got their day job of farming…I'm just impressed with the amount of work that folks that aren't getting paid to do this put into it…I think…40% of farmers in the watershed have participated in some way…I don't know any other watershed project that has gotten that kind of engagement." (Conservation NGO)

"One of the successes is that we've been able to amass and engage the steering committee and local farmers and keep the local farmers involved." (Project and agency staff)

[11] For more information, see the section on "Learning and behavior change" in this report.

Discussion

The perception that water quality goals have not been met could be detrimental to future conservation in this and other watersheds. Such a discrepancy can decrease producer trust in these types of government programs.

Thus far in this report, we have discussed whether project goals aligned with perceived goals and perceived successes. We have shown that although the actual project goals corresponded with what our interviewees' thought the project goals were, the successes discussed did not match these intended goals. The perception that water quality goals have not been met could be detrimental to future conservation in this and other watersheds, particularly if improving water quality is the impetus and a major goal of the watershed project; such a discrepancy can decrease producer trust in these types of government programs. There is much research to indicate that adoption of conservation practices have many benefits, including the potential of improved water quality (Kassam et al., 2009; Tilman et al., 2002; Tomer and Locke, 2011). Despite this apparent discrepancy between goals and success, the successes expressed by the people we interviewed indicate that many producers in this community want to, are willing to, and continue to try new conservation practices. Not only this, but the project has been perceived as successful from outside the watershed, thus spurring more research in this watershed and the desire to emulate aspects of this project in other watersheds. These perceived successes may, in part, be due to the project's emphasis on the benefits of the 4R Nutrient Stewardship framework, which emphasizes efficiencies and suggests increased farm profitability (Nutrient Stewardship)[12].

The remainder of this report unpacks successes and takeaways as discussed by the people we interviewed. In the next section we first present data that describes why producers decided to participate in the watershed project. These findings could be useful in targeting motivations of producers to participate in other watershed projects. We conclude this section by delving into details about what our interviewees learned through participating in the project, as well as how they learned.

Producer participation – why and what happened?

Producer participation

Voluntary

Producer-led

Cost-share funding

Lead by example

Why did producers participate?

Overall we found that producers appreciated the voluntary nature of the project and the flexibility in determining which conservation practices to implement through cost-share projects. Some producers felt that participating in the Indian Creek watershed project fit with their desire to steward their land, however we also found that financial incentives gave impetus for producers to step in and try new practices – the cost-share programs pushed producers into trying new things where they may not have otherwise. These themes are described next.

Voluntary, producer-led project

We asked producers why they decided to participate in the Indian Creek watershed project. Overall, the producers we interviewed knew that the Vermilion River was impaired. They also knew that water quality problems in the Mississippi River Basin and the Gulf of Mexico could translate to future restrictions on fertilizer use. Most producers felt that voluntary measures toward reduced nutrient loading in waterways was preferable to regulations.

[12] It is suggested that efficient use of nutrients can reduce input and labor costs, therefore increasing farm profitability (Harvesting the Potential).

"…in my mind…the Chesapeake Bay things that I read about…was frankly scary, and if we could do anything to keep from being mandated on how to manage our farms, if we could do it voluntarily, I think that was one of the original reasons for a lot of people being interested. At least, from my perspective…and the Gulf, we all know what's going on with that…It just seems like an unsurmountable task, to be able to keep nutrients out of water. But if they want to try, then that was our point in trying to get some more data and some more ideas and see where it goes…" (Producer participant)

Some producers felt that the voluntary nature of the Indian Creek watershed project spurred experimentation and innovation that would not occur if specific rules were enforced from above. Rather, by participating in this project, producers felt in control over their own farm operations through experimenting with practices that benefited their operations while also benefiting the downstream environment.

"I think…the biggest enemy…of the watershed would be regulation. That whoever would come in and say, 'okay, these are the parameters and this is what's going to happen'…I think it would squelch a lot of research, a lot of attempts at trying to quantify what works and what doesn't work…I think as soon as somebody comes in and says, 'nope, this is what we're doing', then I think you lose that incentive...(The watershed project) seems so open and I guess I can't ever see a point when we will stop learning something…even in the stupid years, you could always take something home. Or something to think about…" (Producer participant)

"To be able to pick out our enhancements that we wanted to use that would fit in with what we had time to do and wanted to do." "…if they would have said this, this, and this, you have to do to qualify for this, then it wouldn't have been, we might have just shucked it." (Producer participants)

Cost-share

With this regulatory context in mind, producers had the desire to try new practices that might alleviate future regulatory risk, while improving their own farm's efficiencies and positively impacting water quality. Thus, the cost-share aspect of the Indian Creek watershed gave producers the opportunity to try new practices with compensation that would alleviate financial risk.

"…with the cost sharing, you do some things that you maybe wouldn't do otherwise because you're not sure whether it's going to pay or not, or how well it's going to do…" (Producer participant)

"It was an opportunity to try things that we might not normally try, with a monetary compensation to make it more attractive to do. Hopefully, it was from a desire to do the right thing through the years, to evolve into better farming practices. I hope that was in our mind also." (Producer participant)

"The CSP has been a good program that way, I think. Gives you the chance to try different things and then rewarded us for our efforts." (Producer participant)

Lead by example/do the right thing

While regulation and cost-share incentives were important to many producers, some also felt that participating in the watershed project and implementing conservation practices was the right thing to do.

> *"…(Terry) came and got us involved in the CSP and then, right at the same time, the watershed project started and he asked me if we'd be involved, and I said, 'well, sure'…it was just a natural progression… And I looked at this, and it was like, well, okay, if I was ever going to volunteer or get involved in a community project, I mean, why wouldn't I do this one? I mean, it's right in the wheelhouse. It's right what we're doing…it just seemed like a natural fit." (Producer participant)*

> *"To me, you gotta lead by example…So, to me, that kind of falls right along my line of thinking is if I'm on a steering committee and they need people to do plots or whatever and I'm not willing to do one myself, or take the time to do it, and then talk about it afterward, then I don't have any business asking anybody else to do it. You gotta step up to the plate and do it." (Producer participant)*

MEETINGS

NETWORKING

CSP PROGRAM AND PROCESS

HANDS-ON LEARNING

Learning and behavior change – what and how?

Information sharing and producer education was an important component in the planning and implementation of the Indian Creek watershed project (CTIC, 2013). We therefore sought to understand what and how producers learned. We found that much of what was learned through the Indian Creek watershed project centered on nutrient management; specifically the 4R Nutrient Stewardship framework and nutrient use efficiency. Indian Creek field days also exposed producers to new conservation technologies and other topics related to Indian Creek (e.g., fish shock). Producers told us that face-to-face interactions with other producers were important to the learning process. Moreover, the hands-on nature of trying different conservation practices, the trial and error of implementing practices themselves, and the yield data producers saw coming from their own farms and other farms in the watershed, all contributed to producer learning and subsequent changes in behavior.

Meetings and networking

We found that producers valued networking opportunities with other producers in order to discuss lessons learned from various conservation practices. Also important were meetings where nutrient use efficiency data was presented and new technologies were demonstrated.

> *"A lot things (I learn) are just talking with other producers when you're at these meetings, different things they've tried. And they've had their different pieces of equipment that is relatively new and they try to have that on display and that type of thing. But, visiting with different people is valuable, the biggest thing." (Producer participant)*

> *"I think (the field days are) very important from a producer's standpoint because it gives them an opportunity to see some new practices. Like, last year…they had this little rectangular shaped robot that put out cover crop…It went down (the) seed corn plot and came around and made a couple passes to plant annual rye and some radishes…They also flew a drone over the top to see how that's going to be coming into some new technology…So I think it gives guys an opportunity to see that." (Producer participant)*

CSP process and hands-on learning

Going through the CSP process allowed producers to step back and think about their overall farming operations and question their farm management habits. In addition, there is a difference between reading about the benefits of various practices and being able to experiment with them yourself, thus hands-on implementation of conservation practices on producers' own land allowed them to see, first hand, how the practice would or would not benefit their own farm operations.

> *"The CSP program got us to sit down (think)…we're no tilling beans here and we're strip tilling corn here. Well, why aren't we doing it over here? ...Let's take a step back and let's look at what we're doing and does it make sense? It was healthy for us…I don't know if it was the combination of that and having the benefit of my son coming back in and saying, you know, Dad, there's different ways of doing things…" (Producer participant)*

> *"I think if you try it on your own on a smaller piece of acreage and you see some benefits, I think that goes a long way to go on. That's kind of how I started with the cover crops. I started with 40 acres and just keep pumping it up and see if we can get the whole thing eventually." (Producer participant)*

> *"We have learned on nitrogen application, the season changes the requirements, the amount of nitrogen you need, because apparently you lose a lot of nitrogen, say, in a wet year. And so we've learned some of those things by doing the nitrogen stock analysis in the fall." (Producer participant)*

Behavior change

As we have mentioned, changes in producer behavior were identified as one of the successes of this project. The Indian Creek watershed project sought to influence producers' behaviors through participation in cost-share programs and through their being exposed to nutrient use efficiency data (CTIC, 2013). We found that participation in the Indian Creek watershed project through cost-share contracts and dissemination of data resulting from demonstration plots not only spurred learning, but also contributed to some producers changing farm management behaviors. The people we interviewed spoke primarily of changing nutrient management practices after seeing results of various nutrient management strategies on their farms.

> *"…we did renew (our CSP)…we're going to do the split rate nitrogen, but actually, we ended up doing it on all our acres…what we have done I think has been beneficial to our farming operation and just farming in general…that we all need to try different things and see what will work and what won't work." (Producer participant)*

> *"We changed our nitrogen management practices because of them (demonstration plots)… on all those (our) acres, we changed our nitrogen management…My reasoning was the higher the yield on the strips, the more nitrogen went into the crop, as opposed to leaching into the groundwater which eventually goes down Indian Creek. So, we were basing things off of yield and our tests had included the 4R's…So we tried to incorporate that (the 4R's) into the strips, and year after year the same practices came up with the highest yield. And so, after a couple years, we went to that practice." (Producer participant)*

> *"Between the CSP program and then, now the Indian Creek watershed…we've drastically changed how we do, particularly our nitrogen. And, basically, really, all of our nutrients…some of (our changes) was because of CSP, and some of it was because of the watershed and some of the results that we were seeing…But, because of that information (through yield mapping), and also what we saw from the watershed…this fall, we didn't put any (nitrogen) on. Previous fall…maybe 10 percent. We got exposed to the 4R strategy…all of our nitrogen needs are now in the season when the crop's growing." (Producer participant)*

"I would go back to the split application of nitrogen and the variable rate of the fertilizer. I think those are the big things that we're seeing that on more acres. People taking a bigger look at the 4R program...We've put some power in those tools..." (Ag Retailer, fertilizer)

Takeaways

LOCAL STAFF

PRODUCER LEADERS

DIVERSE LOCAL REPRESENTATION ON STEERING COMMITTEE

COMMON GOAL

FUNDING

Key Takeaways

Our evaluation of the Indian Creek watershed project found that the intended goal of the project, to improve water quality through changes in conservation practices, was understood by the people we interviewed. We also found that although water quality was the major intended outcome of the project, perceived project successes centered on increased producer and public awareness of the links between agriculture and water quality, as well as the efficacy of conservation practices to improve farm efficiencies while positively influencing water quality. Our interviewees reported success in the number of producers and amount of acreage enrolled in cost-share programs and demonstration plots. We found that the project also appeared to be successful in teaching producers alternative ways of managing nutrients on their farms. Through our interviews, we gathered a picture of why the Indian Creek watershed project seemed to work so well. In addition to our own analysis, we asked the people we interviewed what *they* would take away from the Indian Creek watershed project if they were to begin a new project somewhere else. Their answers coincide with our conclusions. In this section we present principal takeaways as described by the people we interviewed. Although this project is located in a specific community in a specific watershed, these themes can be thought of as ingredients for a potentially successful watershed project[13]. The themes we discuss here may already exist in a particular watershed, or they could be developed and fostered in target watersheds for future implementation.

Community approach

Discussion

THIS COMMUNITY CAME TOGETHER TO WORK TOWARD A COMMON GOAL – IMPROVED DRINKING WATER FOR DOWNSTREAM NEIGHBORS.

One overall message that came through our interviews was the sense of community in this watershed; particularly that the community came together to work toward a common goal to test and implement conservation practices in order to improve water quality in Indian Creek. Key to this idea of community was involving the *entire* community, from producers, to Future Farmers of America students, to local agricultural retailors in the watershed area. As will be detailed in this section, the architects of the Indian Creek watershed project sought to ensure that the project was a community-driven, locally led process of education toward improvement of a community resource.

"...it was a kind of a community effort to try to get more than just operators or farmers involved, get the whole community because it is the whole community that kind of feeds off of Indian Creek... Another nice thing was we have a very strong local presence as far as our school system goes and the FFA chapter that we have. So it's a good educational opportunity for all of us in the community, even from students all the way to older producers, and older landowners. So I think that, particularly the community approach, was a good way for us to do it and that got more people involved." (Producer participant)

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[13] See Babin et al.'s (in press) article which lays out social criteria to consider in the selection of watershed conservation projects that can contribute to the likelihood of project success.

"Here in the Livingston County area, for the last 30, 40, 50 years, there's always been a good working relationship between Extension and Farm Bureau and NRCS and SWCD and FSA and all the various governmental and quasi- organizational groups…Good working relationships amongst all of the various entities that can be involved. And that includes the fertilizer chemical dealers, the fertilizer chemical association, the various Ag groups and organizations, the fertilizer supply companies…all the way up and down through the food chain…from the Ag suppliers. And, locally here in the watershed, we've had a very good buy-in amongst the various organizations. So, you've got to have good rapport; you've got to have good working relationships; and people have to work for a common cause… Those things have to be in place, in my opinion, before you can expect to have the level of apparent success that we've had."
(Ag Retailer, soil testing)

"And everybody feels like they're a part of it. It's not like… (we) come in here and show them how to do something and we leave. The farmers are just as much a part of it as we are… And I feel like we're almost a part of the community here when we come up here." (Agronomist)

Strong, respected, and trusted local staff

Discussion

LOCAL NRCS AND SWCD STAFF WERE RESPECTED AND TRUSTED BY WATERSHED PRODUCERS.

The community approach included local leadership in the SCWD and NRCS offices; people who were respected, trusted, who knew the producers in the watershed and could work well with them. The people we interviewed spoke about the influence of specific people, as well as the Livingston County SWCD Board, as contributing to the success of this project. Terry Bachtold (SWCD Resource Conservationist) was, by far, mentioned by name as key to getting producers to sign up for cost-share programs, to join the steering committee, and to speak in public about their experiences. Eric McTaggart (NRCS district conservationist) was also mentioned as someone who was adept at determining which cost-share program would work best for each producer, and then walking them through the application process. Together, these two local staff people appear to be hugely influential in the success of this project.

"If we're starting with the NRCS office, you've got to have somebody in there that can be either nice enough, persuasive enough, to encourage the farmers to sign up…Terry's…a nice guy but he's not a…preacher about the whole thing…You've got to have a nice guy that doesn't rub anybody the wrong way…" (Producer participant)

"I can't say enough about Eric and Terry…There's so many things (programs) available, and they've made…this community, Livingston County, so aware of everything that's out there available…They've been invaluable. So, if you can get that right leadership at NRCS and Soil and Water…but you gotta have those couple, in our case, it was Terry and Eric, that and our Soil and Water District Directors are an active bunch of guys. And they're a bunch of glass half full guys. They're always positive… it's like anything else, it runs out of energy…they were more of that steady, Steady Eddy, kinda keep it goin' kind of a thing…that's no different than the band boosters or 4-H Club or whatever."
(Producer participant)

"I think the leadership of this watershed started with Terry, and a lot of the reason they chose Indian Creek is because that's the watershed he lives and works in. He's not somebody that came in from the outside and just took the job. He's been established there for a long time and he has a lot of relationships with farmers there. He's seen sort of as an equal because he is a farmer too." (Project and agency staff)

"…I have an opinion that places where we're successful are where there's just really some good leaders that can help engage others, and especially if they're producers. So that watershed has some really good farmers that have strong convictions and are good leaders. Sometimes I think its staff people or partners might have that particular person too, and usually they're people that are working hard and very strong in their conviction…for the actual practices, having good District Conservationists there with Eric too is a big deal. Ultimately that's where the rubber's kind of hitting the road. If you didn't have a really quality DC there, maybe the implementation part of this doesn't go quite so well either." (Project and agency staff)

"Clone Terry. Or, have somebody like that... Somebody in the community that knows people, has the contacts… it's his attachment to the community, his knowledge of it…that allows everybody else to come in and do the job." (Agronomist)

The quotation from the interview above mentions that a key takeaway from the Indian Creek watershed project would be to "Clone Terry." In line with this person's remarks, Terry Bachtold' s personality, his time living in the Fairbury community, his status as a farmer, and his relationship to the producers can be found in other people in other watersheds. The key is to identify strong, respected, and trusted local staff who are passionate about their work, believe in their message, and can communicate the benefits of conservation so that producers will risk change by trying new conservation practices.

Producer leaders who are willing to share

Discussion

LOCAL PRODUCERS WHO WERE RESPECTED IN THE COMMUNITY WERE ASKED TO BE PART OF THE PROJECT FROM THE VERY BEGINNING. THESE WERE LEADERS WHO WERE WILLING TO SHARE THEIR FARM MANAGEMENT EXPERIENCES AND DATA WITH THE LARGER FARMING COMMUNITY.

Not only do you need good local leadership for a successful conservation project, our interviewees told us that it is important to involve local producer leaders. These producers should be people who are respected in the community and whom others watch to see how they manage their farms. They should be willing to commit to implementing conservation practices and/or demonstration plots and to speak about their experiences and farm management data.

"I think they did a really good job of finding a group of farmers that were willing to put plots in and, not only that, but invite the community in to see what was going on, on their farm and to explain it..." (Ag Retailer, fertilizer)

"Well, I'd go visit my NRCS and SWCD people, get them on board. You need somebody committed…I'd find me about a handful of farmers that would be committed, that are active in conservation, that would be willing to do plots and such, and get them on board…the key really is those farmers. You need the farmers cooperating and willing to do the plots and help support the data that you're going to put together, or you don't really have much..." (Steering committee member)

"You know just getting the right partners in the right places, finding the right farmers, who are good spokesman who are willing to help…if you find farmers who farm the dark corners of the county that nobody watches, it's not as influential. But some of these guys, they're on Soil and Water Board, they're in the community, they're doing all these things. People know them, people understand what they do. And they're kind of watching what they do because they're seen as the innovators. I think that's important to identify those folks." (Partner and agency staff)

Steering committee – diversity of participants

Discussion

THE PROJECT STEERING COMMITTEE WAS MADE UP OF A DIVERSITY OF STAKEHOLDERS FROM THE LOCAL COMMUNITY; THUS GIVING THE PROJECT A LOCAL FOCUS. THE COMMITTEE WAS ABLE TO RELY ON EACH OTHER'S STRENGTHS TO FULFILL PROJECT GOALS AND ACTIVITIES.

The value of partnerships was another key theme that emerged from our interviews. The partnerships in this watershed project included local staff and producer leaders, as well as many other stakeholders. Key here was the involvement of the Mayor when the project first began, and an invitation to participate, to all local agricultural retailers. The agronomists that ran the demonstration plots were a part of the steering committee, as were staff from CTIC. Other conservation NGO's would participate periodically. While Terry Bachtold hand-picked the initial committee, the committee had an open door policy in terms of meeting participation. We were told that the committee was locally led, that the producers had a strong voice on the committee, and that the diversity of the people involved played to the strengths of each group. Not one single person or entity carried the committee. Rather, it was the strength of the whole.

"The key thing is to have a strong steering committee…If you can get a dozen, half a dozen strong cooperators, farmers, producers, plus some of your local technical people from NRCS or the Soil and Water Conservation District, or Department of Ag, whoever are willing to make the effort, that's the key. If you can get that committee going and, again, it gives some town people, some local government people, so they all see what's going on…That's really it. Get that community involvement that everybody wants to talk about but it's not always easy to get… (and) we need some strong leaders who are willing to have a vision and not be afraid to speak up and do it." (Producer participant)

"… (Terry) surrounded himself with a lot of different types of people, whether it was from the equipment industry or the agronomy industry, and it made it seem like this was a big deal…" (Producer participant)

"…they also have a lot of farmer participation and I think it's because they bring everybody to the table. You know, at that landowner meeting they also had representatives from the fertilizer dealership, the implement dealership, I think somebody from John Deere was there, they had a few landowners, and they had professionals; they also had some ag crop specialists, some insurance guys, anybody that could be a part of the program…(were) pretty much at the table. And that was impressive to me. Everybody had some part to say about it, whether it's selling you a product or something you're going to use, or maybe you're going to use this guy's expertise for consulting or crop advice or something like that. So I think it's the fact that they bring in every angle of agriculture to try to get conservation on the ground. And that's pretty smart. It's speaks well to a lot of producers, I think." (Conservation NGO)

As noted in the comment above, bringing "in every angle of agriculture" into the project was significant. The participation of local agricultural retailers on the steering committee was seen by many of the people we interviewed as a key aspect of project success. These retailers are the local producers' trusted advisors, and their involvement impacted the perceived legitimacy of the project.

> *"…bringing industry in makes them (the producers) want to be a part of it too because that's mainly from farmers listening to Ag retailers and the folks they buy products and services from. So when they're on board, it's not just a Soil and Water person, CTIC coming in from the outside, it's their own people they've been working with that can get them to buy into the message and the program and that's really the importance to the farmers as well. Their own Ag retail guys that they're used to working with." (Partner and agency staff)*

The locally-led aspect of the project was seen as important by many of the people we interviewed. Local direction allowed the producers themselves, along with local agricultural retailers, to communicate on-the-ground realities of the different conservation practices and nutrient use efficiency plots proposed by project agronomists and NRCS and SWCD staff. It follows that by utilizing local knowledge, the menu of practices and demonstrations watershed producers could choose from were more likely to be trusted and therefore implemented, than practices dictated from above.

> *"…probably the most critical (component) to have successful watershed planning and implementation is to have the local planning committee directing…what things are going to be looked at, what the resource concerns are from a natural resource standpoint, but also looking at what practices or programs would be the best fit to address those and then also providing direction on how to go about implementing it…they're the ones who know their neighbors and we may have some idea here in the field office that, from our knowledge or experience, that we think this would be the best way to go. When you talk to the local folks, you may be completely wrong."*
> *(NRCS District Conservationist, bordering County)*

Funding

Discussion

THE AVAILABILITY OF COST-SHARE FUNDING AND OUTREACH/EDUCATION FUNDING WAS SEEN TO BE IMPORTANT TO THE SUCCESS OF THIS PROJECT. THIS SAME ASPECT WAS ALSO CONSIDERED TO BE A CHALLENGE TO REPLICATE IN THE FUTURE AND A DETRIMENTAL TO THE UPTAKE OF CONSERVATION PRACTICES ON THE BASIS OF THEIR ON AND OFF FARM BENEFITS.

In addition to the people involved and the structure of the project, many of the people we interviewed noted that funding was an important part of the project's success. The benefit of funding was two-fold. First, cost-share funding served as an incentive for producers to try new conservation practices and systems. Second, Section 319 funds and sponsorship money were secured and utilized by CTIC, an outside organization, to lead outreach efforts, fund demonstration plots, and cover costs associated with marketing and communication. These funding sources worked hand in hand to get producers to the table, to fund numerous cost-share projects, and to utilize demonstration plot data in outreach meetings to get even more producers to think about different ways of managing nutrients on their own farms.

"…the first thing is you have to have money…If you don't have the money, it's really difficult to do things at the scale that needs to be done…there's the Farm Bill money, there's a little bit of State money, there's never enough money to go around. You have to have the money to do everything that CTIC is doing…you have to have the money to do all of the outreach…you get people excited to enroll in these programs and then there isn't enough money to go around…maybe…they won't want to go through the process…again because it is sort of a process to fill out the paperwork and then wait and see if you get any funding and if you don't… that's kind of a waste of time… But then if you have the money there, but you don't have all the outreach to let farmers know practices that they can implement and that there's extra money in their watershed…you can have all the money there, but you don't have the outreach to get them in the door…You have to have the outreach and once you have the outreach, you have to have the money there for the farmers, and vice versa." (Partner and agency staff)

"I go back to CTIC too, especially on this project, the PR type of work, to do that pretty well helps as well…we're not doing everything on the cheap, you've got buses for tours, nice buses, and the ability to do everything pretty quality because there's money there and the skill of CTIC to do that, I think that's pretty big too. So that people do pay attention because they see something kind of I'm not saying glossy, but pretty well-done in a big way." (Partner and agency staff)

Improvements

WATER DATA – BASELINE AND OUTCOMES

TOO RESOURCE INTENSIVE TO SCALE-UP

DEPENDENT ON HIGH COMMODITY PRICES

COMPLEX AND INFLEXIBLE CONTRACTS

MORE PARTICIPATION

Challenges and improvements

As part of our interviews, we specifically asked if there was anything that our interviewees would change with the project if they could – what sort of improvements could be made to make the watershed project better? When asked directly, the people we interviewed had a difficult time coming up with improvement ideas. However, as we analyzed interview transcripts, several key challenges and ideas for improvements emerged. These aspects of the watershed project are discussed next. Some concerns relate to cost-share projects as a whole, and thus can be considered in the larger Farm Bill project context. Other concerns were related specifically to the Indian Creek watershed project, but are relevant to other watersheds. Thus the following findings can aid in the development of future projects, while informing the larger aspects of cost-share programs as a whole.

Data and outcomes

Interviewee thoughts on water quality wove its way throughout this project. Because the funding for the Indian Creek watershed project stemmed from issues of water impairment in the Mississippi River Basin, that water quality emerged as a prevalent theme is not surprising. As we have discussed, our interviewees understood that the goal of this watershed project was to improve water quality in Indian Creek and, eventually, the Vermilion River. Time and again, however, we found that there was a disconnect between this goal and the perceived reality of actual water quality.

Our analysis suggests that the people we interviewed understood that improvements to water quality can take many years. Moreover, many people talked about "wild" weather years skewing the water data (particularly the 2012 drought), and that there may not be "normal" weather years anymore.

"…2012, you might as well toss it out the window… (the) ups and downs of our weather cycles…is what's gonna be normal. And so it's been difficult to get a baseline started. I'm concerned that it's a process that doesn't just happen on one, two, even five years of data. It's probably a ten year thing, at least…Nobody could foresee the kind of drought we had in '12. And nobody could see the incredible yields and production we had in '14... (Producer participant)

"We've had some pretty wild years, with the 2012 drought. Then 2013, the early season rains…if we'd a quit monitoring in 2012, we'd have been geniuses. There was no nitrates in the water because there was no water to move. 2013 was a much different story, we'd a looked like we hadn't done anything in the spring of 2013 when all those residual nitrogen that was left in the soil from 2012 we got all that rain…we didn't get to this point with nitrates in the stream overnight, and it remains to be seen how long it takes for those changes on the land to translate to changes in the water…" (Partner and agency staff)

Despite this environmental understanding, the people we interviewed expressed a desire to see more water data in order to understand whether changes in farm management practices had a positive impact on water quality.

"…research and demonstration just takes time and multiple years to really…show a lot of changes and different things happening…I'm not so sure on the demonstration and research that I've seen a lot of things that tell us that this is the way to go...from our agency's perspective in promoting the types of practices that they're demonstrating and researching…being equipped with…some answers or some data and information that could be used in promotion…it might be that I've just missed that too, and not seen a lot of the actual data…it seems like sometimes at the events the data's not quite ready…then maybe, I just haven't gone back to look for it on the website…I'm not saying that it doesn't exist, it's just that…I haven't seen a lot other than what Tim presents each year." (Partner and agency staff)

"I've not seen those readings (on water quality data). I know they talk about it. I don't know if they're just waiting 'til they get everything accumulated before they start talking about it..." (Ag Retailer, fertilizer)

Or, as in the following example, one producer desired a firm conclusion in terms of the proper amount of nitrogen to apply depending upon the season (e.g., dry versus wet).

"It will be interesting to see, as the project continues to unfold, to just see what some of the conclusions are…This is what happened each year, and here's kind of the average for each of these four or five years…you need four or five, ten years of information to really draw a right conclusion… It would be good if we could draw some kind of a conclusion, what kind of nitrogen we need to put on for corn, and maybe not hurt ourselves on the real good years, but not put so much on that we're environmentally unfriendly either." (Producer participant)

In addition to the lack of Indian Creek specific water data during the project years, several of the people we interviewed mentioned a lack of baseline data in Indian Creek prior to the project's start. Not having this baseline made measuring the water quality impact of the acreage enrolled in various conservation practices difficult.

"One of the things we don't have on this project is baseline data. What were farmers doing when we started it and what changes that they've made… It'd be nice if we could do that. That'd help measure this, whatever success that we (achieved)" (Agronomist)

In spite of a lack of baseline data and the difficulty in gathering the project's full water quality story, one of the people we interviewed felt that the difficult weather years would give them a good indication of how Indian Creek could handle a "worst case scenario" in terms of nutrient loading.

> *"There's really no normal years anymore…it's good to see, how well does the watershed react in terms of extremes in terms of drought and extensive wet years. So you…have an idea of what the watershed is capable of producing, in terms of nutrient load… we got maybe one normal year in 2011 under our belt and then we got the drought followed by extensive wetness. So, in that case we sort of feel like we've seen what we feel like could be the worst case scenario, in terms of nutrient load…We didn't have that baseline data (for Indian Creek) that we really would have liked to have had say five years of data before the project started…We sort of started at the same time, so in that case it's kind of hard to show…cause and effect of before and after. What we're trying to do is show some sort of trend over time, from the beginning of the project to the end." (Partner and agency staff)*

Overall, we suggest that the seeming disconnect between the goals and outcomes of the Indian Creek project could be a detriment to this project, as well as future watershed projects. Although there are benefits in addition to water quality in the adoption of conservation practices and the utilization of the 4R Nutrient Stewardship framework, this disconnect could increase distrust of conservation programs and might hamper progress toward producer adoption of conservation practices, for example:

> *"..it's a challenge because, you talk to these farmers…you've got to make these changes so we can impact water quality. You know at the end of the day, if we don't see a measurable impact in water quality, they can say, 'what'd we even do that for?' Poof it's all gone." (Partner and agency staff)*

Discussion

IF WATER QUALITY GOALS ARE PART OF A WATERSHED PROJECT, IT IS IMPORTANT TO CONSIDER EXPRESSLY CONVEYING THE REALITIES OF WATER QUALITY IMPROVEMENTS THROUGH ALL AVENUES OF THE PROJECT. GOALS SUCH AS SOIL HEALTH OR INCREASED FARM EFFICIENCIES MAY ALLEVIATE SOME RISK ASSOCIATED WITH INCORPORATING WATER QUALITY GOALS ALONE.

Water quality improvements are a long-term endeavor. Therefore, if water quality goals are part of a watershed project, it is important to consider expressly conveying the realities of water quality improvements through all avenues of the project. In addition, the Indian Creek watershed project instituted an educational approach to producer participation. Because of this educational focus, project leaders conveyed additional benefits of utilizing conservation practices such as the 4R Nutrient Stewardship framework: *"…we've tried to build that case that this is also agronomically and economically sensible. It's not just about water quality." (Partner and agency staff)* Although the people we interviewed generally understood the difficulties of obtaining water quality data, instituting additional project goals with outcomes that are easier/faster to measure or more personally salient than water quality may enhance producer satisfaction with the overall program. For example, goals such as soil health or improved farm efficiencies may alleviate some risk associated with incorporating water quality goals alone.

Scaling up cost-share programs

Another issue that emerged from our interviews was a concern over the intensity of resources needed to implement the Indian Creek watershed project. It was recognized that the large amounts of funding needed to cover cost-share programs and outreach components of the project would be difficult to replicate or scale-up nationwide.

> *"…to the extent that we're doing it (cost-share programs) here in the Indian Creek watershed…Politically, we can probably not afford it nationwide… And, I don't say that critically of anybody, but just saying from my viewpoint, as a taxpayer, I don't think it would be good to do this all across the Corn Belt or the Midwest." (Producer participant)*

> *"The thing that would be different for other watersheds would be to get the support Indian Creek has in terms of funding and resources. There's a lot of resources poured in there…If we were going to expand this all the way across the state, it would take a lot of resources. That was a bit of a question that the Soil and Water Conservation District Board initially had was how much of our resources would be pulled away from a full County program to focus on Indian Creek… if Livingston (County) wanted to expand to two other watersheds within their county, would they have the horses to be able to do that?...Is there enough there within their office and their district to be able to expand to that kind of level?...what's happened to so many watersheds is they kind of fizzled if they didn't have continuous support of funding from somewhere…How long does it take to sustain a good effort here in the watershed?" (Partner and agency staff)*

Recall that one of the takeaways mentioned by the people we interviewed was the issue of funding. The cost-share dollars plus outreach funding was seen to be a beneficial mix. Indeed, several producers mentioned the cost-share component of the project as one of the reasons why they decided to participate. Other people thought that cost-share programs were a crutch, or if not available, an excuse not to implement conservation practices even though such practices are seen to have long-term benefits. A few of the people we interviewed expressed some hope that projects like Indian Creek might have a broader reach to neighboring communities and watersheds. That in conveying the benefits of conservation practices in terms of farm management (with a potential added bonus that water quality might improve), producers might take up such practices because it makes sense for their farms. This, rather than relying on Farm Bill funding to experiment with new farm management practices.

Farm economics

Discussion

COMMODITY PRICES MAY INFLUENCE PRODUCER LIKELIHOOD OF TAKING ON THE RISK OF TRYING NEW FARMING PRACTICES.

At the farm level, several interviewees mentioned that the high price of corn during the watershed project allowed them to feel more comfortable in trying new conservation practices, particularly in alleviating financial risk associated with establishing cover crops. As commodity prices decline, producers may feel that experimenting with conservation practices or new nutrient management strategies entails too much financial risk. This then suggests more emphasis on cost-share programs in a lower corn price future, as well as less participation in future watershed projects.

"As long as you are not reducing their profit margin, their bottom line, and they can maintain production and profitability, and still raise crops, raise their produce in an efficient manner, there is no reason not to pursue these things. If they're starting to suffer financially from reduced income, then it's much more challenging." (Ag Retailer, soil testing)

"Well, of course, we went through a good time to start this project with commodity prices being as good as they were. So, that helps, you know, people are more willing to experiment probably when the margins aren't so tight…Cover crops cost some money to put out, and you like to see a benefit from them, especially if there isn't much money in it. So, that type of thing would be maybe a little bit of a drawback."
(Producer participant)

"And, we've been blessed enough to have the resources available to say, 'I'll try that'. Okay, it's gonna cost 20 bucks an acre more. Okay, I'll try that on a 40 or whatever…So, that makes it easier…It looks like we're moving into a less profitable time frame here. When you bring corn from…5.50, 6 dollars down to where we're at currently, 3.50, 4 dollars. Not that we can't be profitable at that level…And so I worry about, when you get into that kinda climate, where margins are going to be tighter per acre, are guys gonna be willing to spend fifteen, twenty dollars an acre on cover crop seed, knowing that they're gonna have to come back with a ten or fifteen dollar application to get it terminated next spring?"
(Producer participant)

Contracts and paperwork

Discussion

BURDENSOME AND INFLEXIBLE COST-SHARE CONTRACTS CAN BE A DETERRENT TO PARTICIPATION.

Another issue our interviewees conveyed, including producers who did not participate in the program, was the Conservation Stewardship Program contract process; a program that funded numerous projects in the watershed. The paperwork involved and contract requirements were seen as too burdensome for a three reasons: 1) For some producers, filling out the contract paperwork was perceived not to be worth their time in relation to potential benefits they might receive, along with the risk that the project may not even be accepted, 2) A few landlords did not want to be locked in a contract with one producer for a 5-year time period, and 3) One producer told us that they wanted more flexibility in meeting their yield goals than a contract would allow. This is an issue that cannot be controlled at the watershed level. As the CSP program is refined, and voluntary nutrient reduction programs are implemented, flexibility in the contract process may warrant a discussion at the Federal level.

"…CSP is so different from what we've ever done in the past. Until you get walked through the entire process, I don't think you could read a publication and understand it very well. You have to go talk to some(one), your neighbor that has done it, or talk to Terry or I and get a synopsis of it, or just kind of wade through the process to fully get a grip on what it means to you if you sign up and do it. Because it's only been around for 5 years so it's not like they know it." (Project and agency staff)

"Well, my good friend that farms, and he's not part of the Indian Creek watershed project, but he and his brother and nephew farm together. And they looked into CSP…and when they saw the amount of paperwork involved, signing up landlords and everything involved, they just walked away from it. They said it was too much red tape and too much work…"
(Producer participant)

"We rent probably a little over half of (our land)…we would have had it 100% in it (CSP), but one of the landowners chose not to participate, just from a standpoint they didn't want to sign up for the long term obligation to rent me the farm. And, we've been farming the farm for, oh, thirty, almost thirty years, so I don't know why that was an issue…so that was their choice, so those acres are not in…" (Producer participant)

"The thing that gets in my craw is that, number 1…I think we had to come up with our deeds. Worse yet, we had to get the landlords to sign a paper that says that to the best of their knowledge, we would be farming their land for five years…every year, they (NRCS) ask us if anything's changed before they pay us. Well, if we've lost land, our payments may be lower…if we aren't honest and don't tell them that and they find out later that we didn't tell them the truth, they could kick us out of the whole program, probably, and stop all the money. So I don't see what the point is in having the landlord sign up, or sign that paper." (Producer participant)

Participation

Discussion

INCREASING PARTICIPATION INSIDE AND OUTSIDE THE WATERSHED WAS DESIRED.

Despite the perceived successes of the Indian Creek watershed project, notably in the number of contracts and acreage enrolled in cost-share programs, many of the people we interviewed reflected on the desire to increase participation. This concern of participation included engaging producers who are not interested in conservation, spreading awareness of conservation and nutrient management benefits to the larger community, involving more producers in demonstration plot tests, and keeping watershed meetings interesting and relevant in order to encourage attendance.

"As long as everything stays voluntary, you have these certain pockets of areas where people are really innovative and creative and they talk to each other and they're excited to try new things, or at least willing to. And then, you get other areas where they don't want to do anything, 'cause they don't have to." (Conservation NGO)

"Probably the challenge is still just getting, just like last night, getting more people, if there's some way you could get more people there, more local community, more farmers…that's been a challenge and probably will continue to be a challenge to get more people aware of what's being done." (Steering committee member)

"We'd like to get more farmers actively involved in doing plot work if we could." (Agronomist)

"…you get too long a meeting with a monotone voice and this, all kinds of PowerPoints. All you need is the last two sentences, the conclusion of what you ought to be doing." (Producer participant)

Non-participant farmer reasoning

As part of this evaluation, we interviewed four producers who did not participate in the Indian Creek watershed project through a cost-share program or demonstration plot. In interviewing these producers we wanted to understand if they knew about the watershed project and why they decided not to participate. All four producers knew about the project and had reasons for not participating: 1) Lack of time, 2) Governmental involvement, 3) Contracts and paperwork, 4) Skepticism of project goals and data.

One major reason for non-participation was time, *"…other things going on. Just didn't want to get involved in it."* Another reason revolved around governmental involvement. One producer expressed skepticism toward the involvement of IL EPA and their lack of local knowledge about farming in the Livingston County area (and how to farm in general). Two producers took issue with using public tax payer money to fund individual farmers, especially in funding conservation projects they felt producers should be implementing anyway. Indeed, each of these four producers had implemented conservation practices on their farms already, including moving away from fall application of nitrogen. In terms of the CSP contract process, one producer mentioned their landlord not wanting to commit to a five year contract. Another did not want to be locked in to specific nitrogen rates, as there was some distrust in testing data, *"…when I read through the fine print…it told us that if our soil tests were above a certain level, that we couldn't put more fertilizer on… (It's) hard to trust the numbers and we know what value we get off of putting a certain amount of fertilizer on…we just didn't want to have the government be meddling with that…"*.

Along these lines of not trusting data, one producer felt that the goals of the Indian Creek watershed project were not clear. This person felt that there needed to be clear science to back up any claims toward project outcomes such as water quality. This producer was unconvinced that there was a water quality issue, expressing worry that the government and environmental groups tweak numbers to convey the story they want told (e.g., there is a water quality problem in the Indian Creek watershed). This issue of distrust is especially concerning and feeds into our interviewees' desire to see and understand the water quality data coming out of the project. If the express goal of this project centers on water quality, then a transparent avenue for describing the data collection process and conveying the data should be available and accessible[14].

Discussion and recommendations

Structure of the project

- **Local leadership** who knew the community, were trusted, and worked well with local producers, was a key component of producer participation in the Indian Creek watershed project.

  We recommend identifying dedicated local leadership, in some capacity, within potential conservation project communities. Ideally this person (or persons) should know/understand the community, work well with producers, be seen as knowledgeable and trustworthy, and be willing to be a visible part of the project and dedicated to working through challenges and barriers in order to achieve project goals.

- The project was community driven and locally led. Local leadership convened a **steering committee of diverse partnerships** prior to applying for government funding. The partnerships developed on the steering committee helped move the project forward, kept it going for five years, and gave the project a sense of legitimacy. There is currently a sense from the steering committee members that they will continue to meet, even if it is not as often.

[14] Water monitoring data is available on the USGS website: http://nwis.waterdata.usgs.gov/il/nwis/inventory/?site_no=05554300&agency_cd=USGS. However this data lacks interpretation or analysis on the potential effects of enrolled acreage in conservation practices on the data presented.

We recommend a similar approach to future conservation projects. Ideally the steering committee would be made up of all aspects of the agricultural community, including community members, in order to bring all stakeholder voices and strengths into decision making processes. Including local agricultural retailers should be considered an important component of the makeup of the steering committee, as these are the people who routinely advise producers – producers and retailers can work together toward the implementation of on-farm conservation practices.

Common goals

- Indian Creek flows through the Fairbury community and runs into the Vermilion River, which provides drinking water for the neighboring communities of Pontiac and Streator. Many producers were concerned that their practices might have an influence on their neighbors. This **local goal** perhaps means more than an abstract problem hundreds of miles away in the Gulf of Mexico, as the producers we interviewed wished to help their **neighbors** and **community** at large.

  We suggest that incorporating local/community issues be considered in conservation project communities. Whether this is concern over fish, taking a float trip, providing drinking water, or improving the long-term sustainability and viability of local/personal farmland, community identity and local concern can be better conceptualized than problems many miles away.

- The **regulatory environment** provided another common goal for the producers in this area. The Illinois Nutrient Loss Reduction Strategy offered a convenient framework for producers in the Livingston County area to show that they take water quality seriously, and are working toward better farm management for the greater good as well as their own farm viability over time. One of the successful aspects of the Indian Creek watershed project expressed by the people we interviewed, was that producers could try different practices in order to see what worked best for their own farms; this rather than being told specifically what to do or how much fertilizer to use, etc. Producer motivations to implement conservation practices is of concern in any conservation project. Motivators such as farm stewardship, improving neighbors' drinking water quality, or a sense of off-farm environmental responsibility may be a more sustainable way to influence farm management practices over the long-term. However, "fear" of regulation is very real. We suggest that linking voluntary conservation measures with State-wide programs such as the Illinois Nutrient Loss Reduction Strategy, can put conservation projects, and what project leaders are asking producers to do, in a larger context.

  In this case, because of the regulatory context, many producers expressed that they were working together as a community to show "regulators" that they can address environmental quality issues on their own. This sense of community and pride should not be underestimated. We recommend that conservation project communities identify their own issues that might foster a sense of community to work toward a common goal.

Awareness building among producers

- The project entailed **hands-on learning** by producers, thereby allowing them to see which conservation practices made most sense on their own farms. The project educated producers on alternative ways of managing their farms, as well as the impact of agriculture on water quality and soil health. Achieved through their own **experiments and data shared by other producers**, the education and outreach process contributed to producers' **awareness** that there are environmental problems (both on and off farm), and that different management practices can improve their own efficiencies while improving environmental quality.

If producers are not aware of a problem, or don't believe the sources that say there is a problem like impaired drinking water quality, then they cannot or will not change their farming practices and routines – there is no need to fix something that works. The education on water quality and soil health provided at various meetings and field days, the hands-on nature of conservation practice implementation, and the sharing of nutrient management data was key to building awareness of agriculture's various impacts on the environment and various solutions to those impacts. This awareness then led to more curiosity and more effort to read and learn. We therefore recommend this multifaceted approach to learning and change for future conservation projects.

Watershed scale

- The people we interviewed told us that they felt the scale of the watershed was small enough to reach every farmer, yet big enough that there were enough producers to make enrolling 50 percent of the watershed's farmed acreage feasible. We were told that, because of this project, land enrolled in this project is now being managed in a different way. The success of this project has the potential to impact producers in neighboring counties and watersheds through data and information sharing. Indeed, the Indian Creek project partners have secured MRBI funding to expand into Vermilion River watershed headwaters (Personal communication with an American Farmland Trust representative).

  We suggest that future conservation projects consider the scale of the watershed as an important factor in choice of project context/location. The scale should carefully correspond with project goals.

Goals and data

- Many producers spoke of water quality as being a primary goal of the Indian Creek watershed project. Despite this, almost everyone had questions about whether their efforts were making a difference toward improved water quality.

  We suggest that if water quality goals are an explicit aspect of a watershed project, it is important to provide transparent water data, as well as connections between agricultural practices and water quality. This data must be trusted and transparent, with little room to question the legitimacy of stated problems and goals. If such transparency is not possible, then other goals should be brought to the forefront of the conversation (e.g., soil health, long-term farm viability, etc.).

Next steps/further research

- Through this evaluation, there appear to be many successful aspects of the Indian Creek watershed project. Our findings suggest that this project has contributed to an added sense of community surrounding conservation. In addition, as noted previously, there is uncertainty surrounding water quality impacts resulting from the acreage enrolled conservation practices. The steering committee, as it currently operates, provides a structure and a space for information sharing and learning. Members of this committee have expressed a desire to continue meeting after project funding ends, although perhaps not to the same extent. We maintain that this project has provided an overarching networking structure that could facilitate future learning and data sharing, which we propose might also contribute to the adaptive capacity of this community in the face of changing and uncertain weather patterns and climate.

  We therefore suggest future follow-up on this project specifically to address: 1) The project's impact on water quality and, 2) The long-term sustainability of the learning network and if behavioral changes are maintained over time.

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Adoption of Agricultural Conservation Practices:
Insights from Research and Practice

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

We present much of this discussion as a dialogue between two authors, Linda, a Purdue researcher, and Dan, a conservation practitioner, and conclude with important considerations and recommendations for conservation professionals in the field who are trying to encourage conservation practice adoption.

Analysis of Past Research

(Linda, a researcher's view)

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

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

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

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

Farm Size and Type

(Linda, a researcher's view)

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

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

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

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

Specialized Equipment and Management Techniques

(Dan, a practitioner's view)

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

Photo courtesy of USDA NRCS

Environmental Attitudes, Motives

(Linda, a researcher's view)

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

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

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

Social Networks

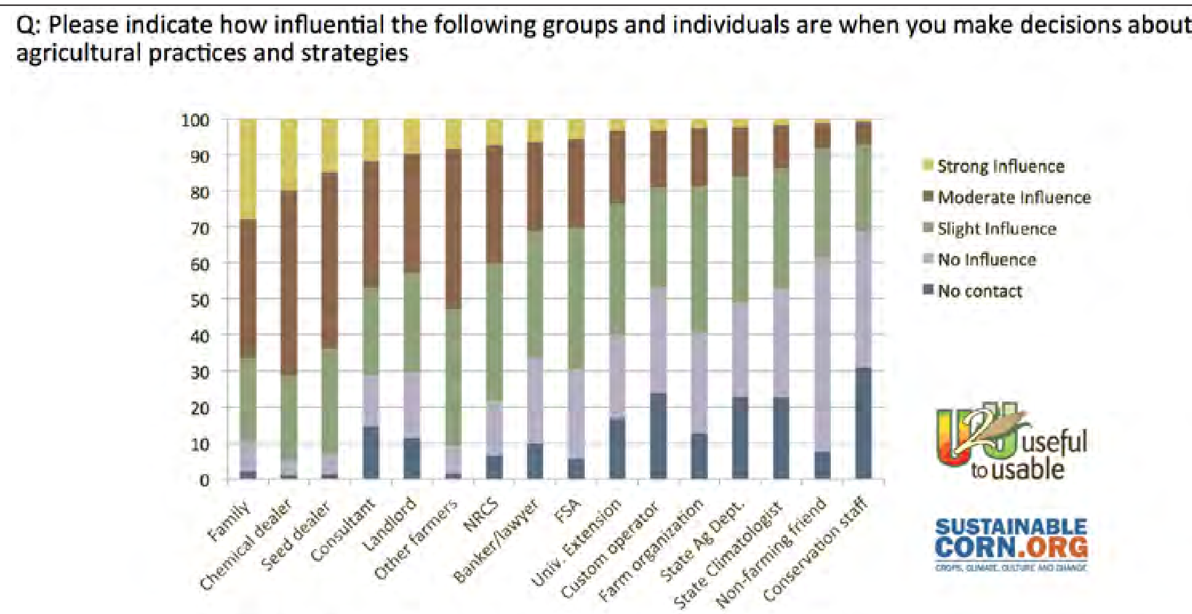
(Linda, a researcher's view)

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

Photo courtesy of USDA NRCS

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

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



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

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

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

Ambassadors and Partnerships

(Dan, a practitioner's view)

One thing that really helped accelerate adoption of conservation cropping systems in Indiana is the well respected, successful, and innovative farmer who engages in a conservation practice and shares the knowledge. Farmers who try something new and different each year, but never stick with it for long, are poor ambassadors for a practice. However, if others see that a well-respected farmer in the community has success with a practice, then you often see rapid diffusion through the community. This is happening in Indiana with cover crops. Farmers see cover crops working for others, become curious, and ask for more information. Here support from agribusiness is also crucial. The Purdue research has shown that farm chemical dealers, seed dealers, and crop consultants—three actors that farmers trust most—are the key people who need to be aware of conservation practice specifics. These three groups need information to respond to their customers, information they can get from us. It doesn't happen overnight, but when we train seed dealers and crop consultants whose customers are already asking them about cover crops, it becomes a win-win situation for both business and the environment. This united messaging leads to local coops and seed dealers working with local conservation professionals to put out cover crop demonstration plots and host field days to spread the word.

Photo courtesy of USDA NRCS

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

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

Systems Thinking

(Dan, a practitioner's view)

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

Photo courtesy of USDA NRCS

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

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

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

Practice Characteristics

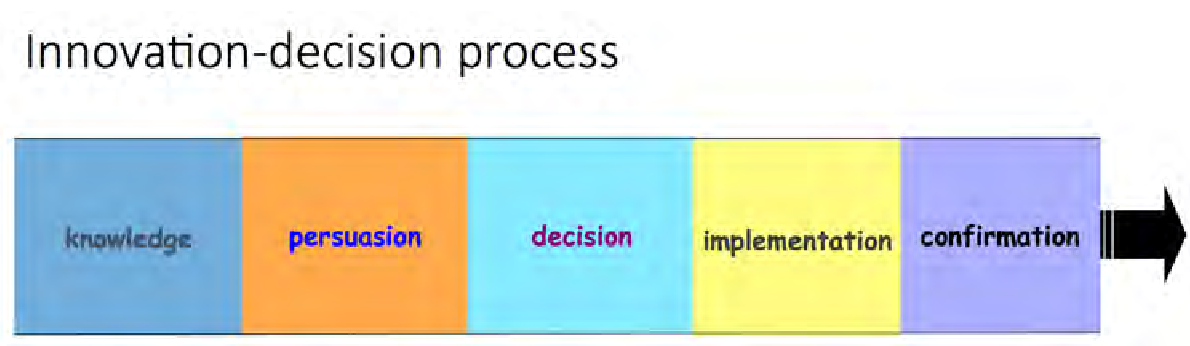
(Linda, a researcher's view)

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

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

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

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



Pathway of innovation adoption. From Rogers, 1995.

No-till: Risk vs. Reward *(Dan, a practitioner's view)*
Change is complicated. Take a second to reflect; why do you make the decisions that you do?

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

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

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

Photo courtesy of USDA NRCS

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

Photo courtesy of USDA NRCS

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

Maintenance

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

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

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

Where Programs Succeed—or Fail

(Linda, a researcher's view)

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

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

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

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

Conclusions

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

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

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

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

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WATERSHED MOMENTS IN COMMUNITY BUILDING: ORGANIZING A WATERSHED PROJECT

The Indian Creek Watershed Project offered many lessons to the residents of Livingston County, Illinois, and the many farmers, agribusiness leaders, conservation agency officials and policymakers who came to visit between 2010 and 2016. Dozens of meetings of stakeholders from throughout the region, scores of demonstration plots, a data-rich study of the impact of widespread adoption of best management practices (BMPs) on water quality in the creek, and deep exploration of conservation systems on farms across the 52,000-acre watershed have had a significant impact on the landscape, the creek and the people who live in the watershed.

But one of the most enduring legacies of the Indian Creek Watershed Project may well be the leadership lessons taught by the program's organizers. Conservation systems and BMPs can vary from farm to farm, and, likewise, every community has different dynamics. Still, good organizational practices can be adopted and applied to enhance the impact of projects like Indian Creek across the country.

Backed by his conservation district board, Terry Bachtold, ag resource coordinator for the Livingston County Soil and Water Conservation District (SWCD), launched the Indian Creek Watershed Project with USDA Natural Resources Conservation Service (NRCS) district conservationist Eric Gerth in 2010. Bachtold described three phases to developing a watershed program.

"First, plan ahead," he advised. "Make sure you know what you want to do in that watershed. Pick a small watershed, not a large one, because you can work with all the producers in a smaller area. The next thing is to hand-pick your steering committee. Make sure you have producers and retail outlets that you know and are willing to try different things. The third phase is promotion. Try to hook up with somebody who can help you do the promotion—that can go a long way."

Indian Creek runs through central Illinois

SMALL WATERSHED, BIG IMPACT

Bachtold and Gerth saw the importance a small watershed could play in demonstrating the effects of adopting conservation farming practices on a majority of the farm acreage in the drainage area. They realized that working with a smaller number of people in a concentrated area could facilitate greater participation and a higher proportion of land enrolled in the project.

In 2010, they found funding and logistical support through NRCS's Mississippi River Basin Initiative (MRBI), a massive effort dedicated to reducing nutrient loads in the Mississippi River system that contribute to the vast, hypoxic "dead zone" in the Gulf of Mexico.

Because Indian Creek feeds into the Vermilion River—the source of drinking water for the cities of Streator and Pontiac—the project secured further support through the State of Illinois Environmental Protection Agency (Illinois EPA), funded in part with a pollution abatement grant through Section 319 of the Clean Water Act. In addition, the Conservation Technology Information Center (CTIC) helped recruit and coordinate the efforts of a wide range of partners from among its members in agribusiness, academia and the conservation community to support the project and develop a watershed-wide demonstration plot program.

Individual farmers within the Indian Creek watershed also have more impact than their counterparts in many other areas, noted Bachtold. He explained that most of the land in the watershed is owned by the operators who farm it—there is little rental or absentee ownership. That critical dynamic simplified decision-making and implementation of conservation practices that could otherwise have involved negotiating with landowners.

Importantly, the project was not seeking to reinvent any wheels. Many farmers in the Indian Creek watershed had already proven themselves open to adopting conservation farming practices, participating in previous outreach efforts and incentive programs. Just as important, program organizers focused on systems to improve fertilizer use efficiency and reduce off-field flow of nutrients that were already well established, scientifically proven and chosen for their fit with local conditions.

In fact, much of the demonstration program was built on the 4Rs of Nutrient Stewardship, a fertilizer management program developed by the International Plant Nutrition Institute (IPNI) and The Fertilizer Institute that emphasizes the right nutrient source, at the right time, at the right rate, in the right place.

Terry Bachtold (left) and Chad Watts of CTIC discuss demonstration plots for the Indian Creek Watershed Project

Terry Bachtold is a local farmer and conservation district coordinator

CLEAR GOALS

One of the early strengths of the Indian Creek Watershed Project was that its leaders set clear goals from the start.

The key objectives included:

- Implementing productive, profitable conservation practices on 50 percent or more of the acreage in the watershed.
- Measuring water quality in Indian Creek to determine whether the voluntary implementation of conservation practices on at least 50 percent of the land in the watershed during the six-year timeframe of the project could impact water quality.
- Providing education and technical assistance to help watershed producers adopt nutrient management and conservation farming practices.
- Engaging the community in the effort to protect water quality, from farmers and other community leaders steering the project to agricultural retailers and other experts spreading the word about nutrient use efficiency.

As the project got underway, Bachtold and Eric McTaggart—who replaced Gerth as NRCS district conservationist in the summer of 2010—set a schedule for quarterly steering committee meetings, one general winter meeting and an annual summer field day. Their goals were to disseminate information, show progress and keep stakeholders, farmers and funders engaged in the process.

Building the project on a foundation of clear, measurable goals created targets to both reach and quantify, and made the project attractive and comprehensible to supporters. It also zeroed in on practices and improvements that could be funded through NRCS programs such as the Environmental Quality Incentives Program (EQIP) and the Conservation Stewardship Program (CSP).

Purdue University social scientists Sarah P. Church and Linda Stalker Prokopy studied the process and dynamics of the Indian Creek Watershed Project and published an extension bulletin on their findings. The researchers also produced videos conveying success stories from the program's success in building its steering committee and working with agribusiness. They noted that the producers participating in the program sought to demonstrate that voluntary conservation measures could be an effective way to reduce nitrogen loss and help meet water quality goals.

"The Illinois Nutrient Loss Reduction Strategy offered a convenient framework for producers in the Livingston County area to show that they take water quality seriously, and are working toward better farm management for the greater good as well as their own farm viability over time," Prokopy and Church wrote in Purdue Extension Bulletin FNR-511-W, *Indian Creek Watershed Project: Key Takeaways for Success.*

"We suggest that linking voluntary measures with state-wide programs such as the Illinois Nutrient Loss Reduction Strategy, can put conservation projects, and what project leaders are asking producers to do, in a larger context," they added.

Indian Creek feeds into the water supplies of Streator and Pontiac downstream

IN SYNC

The importance of state and federal programs to the success of the Indian Creek Watershed Project highlighted one of the first stumbling blocks the organizers encountered.

"We started in July of 2010, and NRCS typically runs from October 'till October, so that first year we only had three months to go out and get some producers involved in those programs," Bachtold recalled. "But once we had our first winter meeting and interviewed some people, we got them into the next signup. You just can't go out and talk to producers and say, 'we have this great program—tomorrow you can enroll in it.' You have to think ahead and get people lined up a year ahead."

THINKING LOCAL

Local leadership and local issues kept the Indian Creek Watershed Project focused and relevant.

At Purdue, Church and Prokopy note that local goals—like improving water quality for downstream neighbors, or improving the long-term viability of local farmland—are more compelling to producers in a watershed than more abstract, distant objectives like helping reduce the hypoxic zone a thousand miles downstream in the Gulf of Mexico.

The researchers also pointed out the importance of engaging respected local leaders from the very start of the project.

"The first thing is to make sure your local board—soil and water conservation board or whoever you're working with—is on board," agreed Bachtold, who spoke personally with every farmer in the watershed to explain the program. "You need the local board behind you, and you also need somebody that actually wants to go out and talk to the producers. That's the big thing. Producers get more confident in talking to a person they know rather than having somebody else come in from outside and say, 'well, we've got this program: yes or no?' They like working with local people, so the more local you can do the project, the better off you are."

More than half of the watershed's farmland added conservation practices

HAND-PICKED COMMITTEE

Before signing people up to try conservation practices, Bachtold and Gerth identified people within the watershed whom they felt would be engaged and productive members of the project's steering committee, then asked each one personally to join. Everyone who was invited to serve on the committee agreed to take the post.

The pair aimed for diversity—from small produce farmers to larger grain growers, livestock producers, agribusiness leaders and the mayor of Fairbury—as well as for people who had the respect of their neighbors. Not everyone was an early adopter of conservation practices, but each one had already proven to be willing to try farming systems that improved his or her operation.

Mike Trainor, a local farmer and elevator owner who was deeply involved in the steering committee, said the diversity of the farmers' experience was important in creating a broad reflection of the community rather than a conservation-farming clique.

"I think the key was that they chose farmers that were farming different ways," Trainor said. "A lot of times we preach to the choir, to the point that we get all of us together that are conservation-minded. It's the other 25 percent out there that isn't—how do we get them on board with us? Hopefully, together we can do that."

Mike Trainor liked the steering committee's diversity

John Traub appreciated perspectives from ag businesses

DIVERSE PERSPECTIVES

John Traub, a steering committee member and demonstration plot host, pointed out that having both farmers and agribusiness people on the committee provided valuable perspective.

"Unless you've got the producers who are willing to say, 'OK, I believe in this and I'm willing to spend time on this and I'm willing to spend some money on this,' you're not going to accomplish a whole lot," Traub noted.

"If I have retailers or businessmen that I respect telling me, 'you know, John, you maybe ought to try doing this,' it's encouraging, and it validates," he added.

The importance of diverse perspectives and pooled strengths was reflected at every level of the project, pointed out Chad Watts, project director for CTIC in West Lafayette, Indiana.

Voluntary conservation improved water quality

"Every partner—whether it was the local farmers or ag retailers, government agency people, non-profit groups, scientists, or agribusiness people—brought different skills, priorities and funding sources to the project," Watts said. "Often, one group is expected to bring everything to the table in order to make a project successful. The Indian Creek project was built on the strength of many partners, many perspectives and expertise from all over, and that helped make it so successful."

INVOLVED LEADERS

Church and Prokopy noted that no single person or group dominated the committee, so each member was able to contribute to the committee's decision-making process.

Another step toward success was empowering the steering committee to actually steer the program, added Bachtold. Regular meetings, ample information on options and directions, reports on progress, and open conversation kept the group engaged and in charge.

"It wasn't as if we came in and said, 'hey, we're going to do this,'" Bachtold noted. "So anytime we made decisions on plots or any programs we wanted to offer, they gave input on everything, so I think that makes them feel more like they're part of the project."

Keeping leaders involved required making the meetings interesting. Speakers on conservation topics, often brought in from outside the area, helped create value for the committee members and keep them engaged through the six-year program.

THE NEXT LEVEL

As the project gained traction on a local level, CTIC widened its outreach and education program to share results of the demonstration plots and community-building efforts with conservation-minded audiences across the country. Researchers from Purdue University studied the social science aspects of the project, while scientists from the University of Notre Dame focused on water quality studies; both teams shared results with the community and published academic papers. And a wide range of other sponsors and cooperators helped organize, fund and execute the demonstration plots.

John Traub said broader exposure and a wider range of participants were vital to building on the project's momentum and bringing it to a higher level at a time when many programs start to lose their luster.

"With CTIC coming on board, it not only gave us a whole other level of exposure, but also a sense of credibility and along with that, a sense of importance," he noted. "Plus, it brought another energy: 'you know, we're not working out here alone in the middle of Illinois. These folks are interested.' It really gave us a boost around the time we needed it."

CHOICES

The demonstration plots—nine per year—provided producers in Indian Creek with a range of practices to observe, question and try on their own farms. Church and Prokopy pointed out that the farmers they interviewed for their study appreciated the hands-on, trial-and-error process. The producers also preferred the opportunity to choose conservation systems that suited their farms far more than the prospect of strict regulations on fertilizer rates.

"The light in front of us is telling us that regulation is coming, we have to do something about our water quality," said Mike Trainor. "Rather than having someone coming to you and say, 'this is the way you have to do it,' try two or three different things on your own farm. Find out what works for you. It's just going to make it a lot easier to go forward."

Local livestock operations got deeply involved in the project, too

Bachtold (left) visited more than 100 farmers to build participation

RIGHT PEOPLE, RIGHT TIME

In addition to great leadership practices, clear goals, a dedicated steering committee and good organization, the Indian Creek Watershed Project benefited from a couple of measures of good luck.

First, Terry Bachtold himself is widely credited for the success of the program. A local farmer with deep roots, family ties and lifelong friends in the community, Bachtold was earnest, committed and driven enough to personally visit 100 of his neighbors to solicit their involvement in the program. There is little doubt that he was the right man for the job—a variable that can't be forced into place.

Second, the project gained momentum during a period in which commodity prices enjoyed record highs. Some producers around the country chased the high prices by plowing and planting as much as they could to maximize yields. But a couple of years of good profits gave many farmers in the Indian Creek watershed the cash to invest in new equipment and the confidence to try some new practices without fear that a mistake or learning curve would pull them under. In periods of tighter margins, widespread adoption of conservation systems would likely have been a harder sell.

OUTSIDE THE BOX

The Indian Creek Watershed Project was successful on a range of levels, from providing evidence that widespread adoption of conservation practices could have a measureable effect on water quality in just a few years to providing a model for community building and voluntary conservation.

It also had a powerful impact on the economic and environmental sustainability of individual farms.

"It's an excellent program—you get to thinking outside the box," said Danny Harms, who hosted nitrogen rate and timing strip trials on the farm he operates with his father and uncle in the watershed. Based on the results of their strip trials and what they observed around the watershed, they methodically adopted a system to improve their nutrient use efficiency by shifting their nitrogen applications to springtime and spoonfeeding their crops.

Danny Harms says demonstration plots inspired changes on his farm

"If it wasn't for this program, we'd probably still be doing what we were doing even 10 or 15 years ago as far as applying fall ammonia—it was simple and we got it out of the way.

"It's a good way to try something, and as far as the funding for it, it's an incentive for the farmer to give it a shot," Harms added. "We had to purchase equipment to make a change, so if it wasn't for the program, we probably wouldn't be doing what we're doing right now."

Success in Indian Creek is inspiring other watershed groups

Indian Creek Watershed Project Sponsors:

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Produced by the Conservation Technology Information Center (CTIC)

Funding provided (in part) by the Illinois EPA through Section 319 of the Clean Water Act

www.ctic.org/IndianCreek/

On-Farm Plots

One of the highlights of the six-year-long Indian Creek Watershed Project was the chance for farmers to visit (or host) on-farm demonstrations. Those demonstrations put a variety of conservation practices and products to the test in real-world, field-scale conditions, and gave farmers a chance to assess their effectiveness in their own backyard—literally.

Dr. Harold Reetz of Reetz Agronomic Services and Tim Smith of Cropsmith guided the demonstration plot program throughout the Indian Creek project, helping develop protocols, oversee plot establishment and analyze data.

But even without an organized, watershed-wide program driving the effort, on-farm plots can be a powerful learning tool—and Reetz says all it takes is a little planning.

"It seems complicated, but it isn't," Reetz notes. "The thing where most people fall down is they do their plots as an afterthought. If it's an afterthought, it's usually done in a hurry and mistakes are made."

Dr. Reetz offers these suggestions for establishing reliable demonstration plots:

- Choose your site carefully. "Make sure it represents the area you're working with," says Reetz. Don't relegate a plot to your worst ground and expect it to reflect what would happen on better soil. Instead, pick a field that has the soils and topography that are typical for where you would try to fit the practice or product into your operation.

- Start simple. Stick to one variable, especially at the beginning. Does changing rates impact yields? Which hybrid yields best on this field?

- Plan replications. To get reliable results and minimize the chance that some unseen variable is impacting the data, scientists replicate their plots. For every trial plot you put out—for instance, a half rate of N—make sure you repeat it four times. Let's say your trial has three treatments (for instance, a full rate, half rate and no N). Name each treatment 1, 2 or 3. Write those numbers on a piece of paper, put them in a hat, and mix them up. Then draw out a set of plots on a field map. Pull a number out of the hat and assign it to one of the plots on your map, writing the number in the first box. Pull the next number and assign it to the next plot. Repeat the process of mixing and selecting random numbers until your map is full. Now your replications are randomized.

- Think about the data before you start planting. Make sure the information you get from your plots fits the sort of data table or chart you want to see at the end. Reetz suggests laying out a table in Excel first. If you had three treatments—full rate, half rate and no nitrogen, for instance—and four replications of each, would you get the data you need to fill your table?

- Use your GPS tools. "With today's equipment, we can do plots without any measuring or staking," Reetz points out. "Just program it into your card."

• Organize your plot width to fit your equipment. There's no magic number for on-farm plots, so keep things simple. "If you're planting with a 12-row planter, then use 12-row plots; if you've got a 6-row planter, make 6-row plots," Reetz suggests. "Make it fit your equipment."

• Plan for rows at least 200 feet long. That gives you and your combine enough room to get into the plot and register yield. If the plot rows are too short, your grain could end up in the hopper before you even realize you've harvested the plot.

• Keep clean. Thoroughly clean your planter boxes between plots. Make sure your application equipment is calibrated and that every row is working properly.

• Pay attention! "Even though it's your objective, it's amazing how many times people forget to make the change when they get to the plot," Reetz laughs. "Pay attention and try not to make mistakes when you're out there." Make sure you know where to switch seed, rates or products, then make sure you do it.

• Ask for help. Your local extension agent is probably an expert at plot work. So is your local seed company representative. Don't be afraid to ask them for help in planning your trial.

The most important thing to remember about on-farm plots, says Reetz, is to just give them a try.

"Don't be afraid to do it," he says. "You would learn a lot about your farm that way."

Indian Creek Watershed Project Sponsors:

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Produced by the Conservation Technology Information Center (CTIC) www.ctic.org
Funding provided (in part) by the Illinois EPA through Section 319 of the Clean Water Act.

Cover crops can be extremely effective tools for managing crop nutrients, improving soils and protecting water quality. Nationwide surveys conducted by the Conservation Technology Information Center (CTIC) and USDA's Sustainable Agriculture Research and Education (SARE) program indicate that many farmers see a yield benefit after using cover crops. Demonstrations in the Indian Creek Watershed Project in Livingston County, Illinois, have highlighted the benefits, challenges and opportunities offered by cover crops in central Illinois and many other parts of the Corn Belt.

Three Top Benefits

Cover crops offer three key benefits, according to Terry Bachtold, agriculture coordinator for the Livingston County Soil and Water Conservation District:

- Reducing soil compaction
- Sequestering nitrogen in the soil
- Erosion control.

Seeded after harvest, cover crops reach into the soil to take up nutrients left behind by the previous cash crop. After the cover crop is terminated—by killing frosts in some cases, or by springtime herbicide applications in the case of other species—those nutrients are returned to the soil by microbial action for use by subsequent cash crops.

Deep-rooted cover crops, particularly tillage radish, can help break up compaction in the soil. And vegetation on the soil surface, coupled with soil-holding roots below the ground, can reduce the chances of soil and nutrients leaving the field—a great benefit in areas like the Indian Creek watershed, where heavy spring rains are common.

Select Species Carefully

There are a host of other benefits to cover crops, from weed suppression to nitrogen fixation, soil moisture conservation and providing pollinator habitat, depending on the choice of cover crop species and the timing of planting and termination. Many farmers find that blends of cover crop species can be especially beneficial. For instance, a combination of nitrogen-fixing legume, hardpan-breaking radish and fibrous-rooted grass can deliver multiple benefits and help establish a healthy, effective stand.

However, timing is a major variable in using cover crops properly.

For instance, a combination of oats and tillage radish is a great cover crop mix after corn silage or wheat in central Illinois, but a poor fit after full-season corn or soybeans. oats and radish must be seeded in his area by September 10 in order to produce adequate growth before killing frosts, so waiting until after grain harvest would be too late. Aerial seeding can work, though variables like the architecture of the corn hybrid—which can influence how much seed reaches the ground—and lushness of foliage can have major impacts on success.

The Indian Creek Watershed Project

The Indian Creek Watershed Project is a locally led program that provides educational, technical, financial and social support for producers to develop, implement and maintain comprehensive conservation systems.

It combines on-farm research, demonstration projects, a support network for area farmers, public and private technical resources and an outreach strategy to communicate about best management practices (BMPs) to farmers and the wider public.

A wide range of conservation systems, demonstrated and implemented on a local level, allow farmers to assess BMPs in real-world, field-scale conditions. In all, new conservation practices have been adopted on more than 60 percent of the watershed's farmland since the project began in 2010. A water quality monitoring program will track the impact of BMPs on the watershed scale on water quality in Indian Creek.

For fields with corn or soybeans, cereal rye may be a better choice. Affordable, easy to seed, and reliably killed by winter frosts in the central and northern Corn Belt, cereal rye is a favorite for many farmers starting to work with cover crop systems. Cereal rye roots can extend as far as six feet into the soil, making them a great scavenger of nitrogen and other nutrients and a powerful shield against erosion.

Note Your Herbicides

The Indian Creek Watershed Project brought to light another important variable in the success of cover crops: the possibility that residual herbicides applied to protect the previous cash crop could be carrying over and reducing the establishment of cover crops.

Bachtold says herbicides will be the subject of further study, but cautions farmers who are considering the use of cover crops to choose their herbicides and rates carefully. Consult with experienced growers or crop consultants for insight into herbicide effects in the soils, conditions and cover crops common in your area.

Great Resources Available

In addition to the Indian Creek cover crop demonstrations, there is a big and steadily growing body of research on cover crops that can fit a wide range of farms. For more information, start with **www.ctic.org/Cover Crops/ or www.ctic.org/CoverCropMath**, or contact your local Extension agent or soil and water conservation district.

Produced by the Conservation Technology Information Center (CTIC) www.ctic.org
Funding provided (in part) by the Illinois EPA through Section 319 of the Clean Water Act.

Enhanced Nitrogen Sources

Fall applications of nitrogen (N) have long been popular for their convenience, allowing producers to find a window of good weather for application and avoid the chances of having fertilizer application add further delays to planting in a wet spring.

There are conditions under which fall application of N works well. In areas of the Corn Belt where soils reliably freeze through the winter, anhydrous ammonia applied when soil temperatures remain below 50 degrees F, deep enough in the soil and in soil conditions that are neither too wet nor too dry—or too coarse or too poorly drained—can overwinter and be available for corn in the spring.

However, if soils warm in the fall or early in the spring, nitrifying bacteria in the soil can convert ammonium-N to nitrate-N, which is prone to leaching or further conversion into a gas—a process called denitrification. Water infiltrating into the soil and sinking to the water table can carry nitrate with it. If heavy winter rains fill the soil with water and the soil warms up, denitrification can convert nitrate into nitrogen gas, which floats away into the atmosphere.

Whether by nitrification or denitrification, a significant percentage of fall-applied nitrogen can be moved out of the field before the crop even has a chance to reach for it. That is a waste of money. It can also be a significant source of water pollution as nitrate is leached into groundwater or drained through soil or tile lines into rivers, streams and lakes.

Protecting N

A growing array of products is coming online to minimize the conversion of applied nitrogen to mobile forms in the soil. As a result, they can help make fall applications more economically and environmentally sustainable.

During the Indian Creek Watershed Project, several stabilized-nitrogen fertilizers were compared with each other and with conventional forms of N. Among them were:

Agrotain®, a urea granule that contains a urease inhibitor, which slows the activity of the enzyme that converts urea into carbon dioxide and ammonia gas.

ESN®, a urea granule coated with a polymer to delay its exposure to soil bacteria. Moisture enters the polymer shell, dissolves a portion of the granule, and diffuses into the soil to become available to plants. The process delays the release of the urea to better match crop demand while protecting it from leaching.

SUPERUTM, a urea-based granule formulated with urease blockers and denitrification inhibitors to reduce loss from nitrate leaching, denitrification and volatilization.

Several demonstration plots also assessed the performance of MicroEssentials® (MESZ), a nutritionally balanced MAP granule formulated with zinc and sulfur.

Many Variables

A wide range of variables come into play when assessing the value of enhanced forms of nitrogen. Temperature, rainfall and soil conditions impact the rate at which nitrogen is converted by soil microbes or how quickly external coatings are permeated. The timing of nutrient uptake is also strongly influenced by hybrid choice. Different hybrids will demand different rates of nitrogen on different days.

Demonstration Plot Results

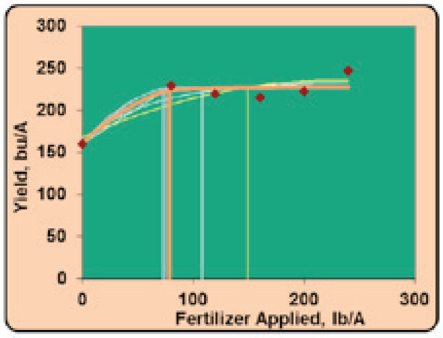
In all, stabilized nitrogen fertilizers performed about as well as or better than conventional fertilizer sources across a wide range of rates and application timings.

	Yield Average 4 Reps Bushel per Acre			
N Rates	ESN	Spring NH3	Super U	Urea
0	222.5	229.2	209.1	199.6
80	261.3	238.7	264.6	274.2
120	245.5	211.2	257.2	247.7
160	241.5	195.3	254.0	245.3
200	189.0	181.5	203.4	217.5
240	195.8	171.8	190.4	198.7

In a 2013 replicated trial comparing various nitrogen sources, spring-applied at five rates on the farm of Terry Bachtold in the Indian Creek watershed, pre-plant urea yielded the most corn at three rates (80, 200 and 240 pounds per acre). SUPER U was the top performer at rates of 120 and 160 pounds of N per acre.

However, it is also important to look at the nitrogen use efficiency (NUE) of enhanced nitrogen vs. conventional forms. A 2014 trial in the Indian Creek watershed demonstrated that the most efficient N rate for SUPER U was 78 pounds of N per acre, compared to 184 pounds of N per acre for urea (see charts below). The most striking result is that the extra 106 pounds of N applied as urea yielded only six more bushels of corn. Clearly, farmers could have made greater profits—and, extrapolated to similar soils across the watershed, applied 1 thousand tons less fertilizer that season—by using the enhanced nitrogen product.

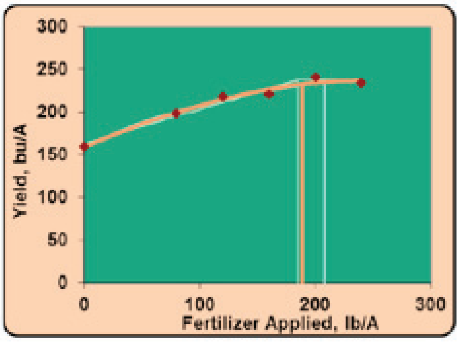
Super U



Super U	
Rate	Yield
0	160
80	229
120	220
160	215
200	223
240	247

Best Rate (lb/A):	79
Yield at Best Rate (bu/A):	224

Urea



Urea	
Rate	Yield
0	160
80	198
120	218
160	221
200	241
240	234

Best Rate (lb/A):	189
Yield at Best Rate (lb/A):	232

A trial on Herb Steffen's farm—a low-phosphorus site in the Indian Creek watershed—allowed plot organizers to compare the benefits of di-ammonium phosphate (DAP) against MicroEssentials (MESZ), a mono-ammonium phosphate (MAP) granule formulated with sulfur and zinc.

In 2012, drought compromised yields dramatically. However, the Steffen plots responded significantly to the addition of P. Applying 70 pounds of phosphorus as DAP increased corn yield by up to 5 bushels per acre. Applying 70 pounds of phosphorus as MicroEssentials increased yields by 15 to 18 bushels of corn per acre over the no-P plots. The extra impact may be attributable for increasing incidences of sulfur and zinc deficiencies in corn in the Midwest.

Enhanced fertilizer formulations can play a valuable role in both improving nutrient efficiency in the field and minimizing off-target movement of crop nutrients. Results in the Indian Creek Watershed Project—which is promoting best management practices in the majority of its watershed and investigating their impacts on water quality—indicate that these products may be very useful tools.

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Maximum Economic Rate of Nitrogen (MERN)

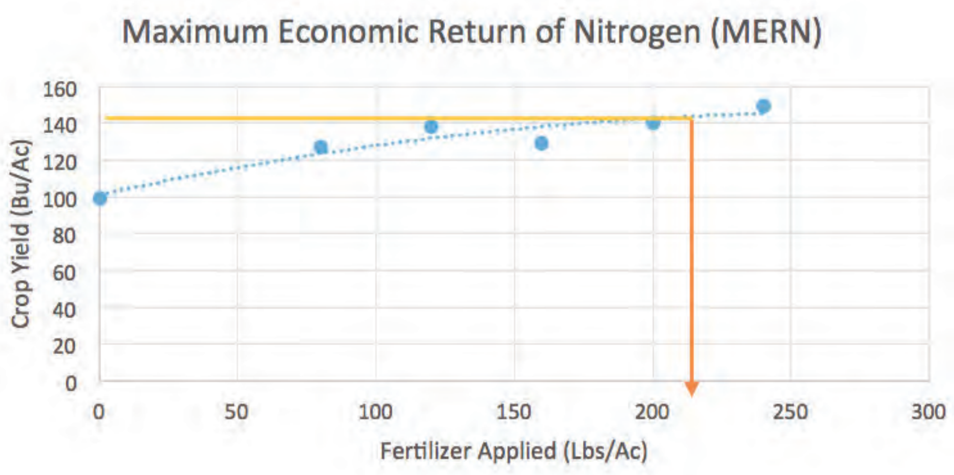
Finding the Target for Your Fields

Nutrient efficiency is as important for your bottom line as it is for the environment. When you apply too much nitrogen, you risk losing a significant amount to leaching, volatilization or runoff—which means you've paid for nutrients that could end up contributing to water or air pollution without benefiting your crop. If you apply too little, you are denying your crop the opportunity to reach its profitability potential.

The Maximum Economic Rate of Nitrogen (MERN) is a calculated value that indicates the point at which investing in more nitrogen (N) starts yielding less income per dollar.

Under good growing conditions, crops will still respond to more nitrogen with yield increases beyond the MERN value. However, every additional dollar invested in nitrogen after that point returns less profit.

MERN is a great measure of the optimum rate for crop, site and conditions. Rate is one of the 4Rs of Nutrient Stewardship—the right source, at the right rate, at the right time and in the right place—so understanding MERN helps fine-tune the 4Rs for your farm.



The figure above illustrates a MERN worksheet for a demonstration plot on the Kevin and Dan Harms farm in Livingston County, Illinois, in 2012. The Crop Nutrient Response Tool developed by the International Plant Nutrition Institute (IPNI) calculates several response curves, then identifies where the return on nitrogen investment starts to level off. That's the MERN.

Variations in MERN

Because MERN factors in crop growth, applied nitrogen, commodity prices and nutrient costs, it can be a highly variable number from field to field or from year to year.

For instance, MERN values calculated for corn on Marcus Meier's farm in the Indian Creek watershed in 2012 indicated that the maximum economic return was achieved at just 62 pounds of N per acre. That's because corn was not responding to nitrogen during the extremely dry 2012 growing season, so adding more N to a stalled crop would not have created greater profit.

By contrast, calculating the MERN on a nitrogen use efficiency demonstration on the same farm in 2014 indicated that the optimum topdress N rate was 159 pounds of N per acre (contributing to a total N application for the season of 199 pounds per acre). Comparing the plot's yield to a check plot that received no N that season, every 2.58 pounds of applied N contributed one bushel of corn, adding 77 bushels per acre to the hopper before yield response started tapering off.

MERN values also reflect current markets. In 2012, they were calculated on the assumption of corn values of $4.00 per bushel and nitrogen prices of 50 cents per pound. Just as weather conditions change from year to year, impacting MERN, prices will likely lead to different rates from crop to crop.

MERN in the Indian Creek Watershed Project

In the course of analyzing the extensive series of demonstration plots and field trials in the Indian Creek Watershed Project, organizers calculated MERN for dozens of crops.

Among the findings is that fall applications of nitrogen often exhibited lower MERN values than spring applications or split applications in the same field. This reflects losses of fall-applied N, reducing nitrogen efficiency.

MERN calculations for Project plots are available in the annual reports from the Indian Creek Watershed Project. If you would like to calculate your own MERN values, IPNI's Crop Nutrient Response Tool is accessible online at **http://phosphorus.ipni.net/article/NANE-3068**.

For more information on the 4Rs of Nutrient Stewardship, visit www.nutrientstewardship.com. For information about the Indian Creek Watershed Project, visit **www.ctic.org/IndianCreek** or call CTIC at (765) 494-9555.

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SPRING AND SPLIT APPLICATIONS OF NITROGEN

Fall applications of nitrogen (N) have long been popular for their convenience, and because they reduce the risk of delayed fieldwork and late planting due to spring rains. However, fall-applied nitrogen is at greater risk of loss to the environment through volatilization, leaching and runoff. Lost N represents lost investment in the crop, lost potential, and a threat to water quality.

Switching all or some of the nitrogen application to spring can improve nitrogen use efficiency (NUE) and reduce environmental loss of N. It's no surprise that shifting some or all N application fits the 4Rs of Nutrient Stewardship: the right source, at the right rate, at the right time and in the right place.

Split Applications

Among the best management practices demonstrated widely during the five-year Indian Creek Watershed Project is split timing of N application. A portion of the crop's nitrogen need is applied in the fall or early-preplant in the spring, and supplemented with an application later in the spring. In many demonstrations, various sources of nitrogen were compared to ascertain their nitrogen use efficiency (NUE)—the amount of N utilized by the crop rather than potentially lost to the environment.

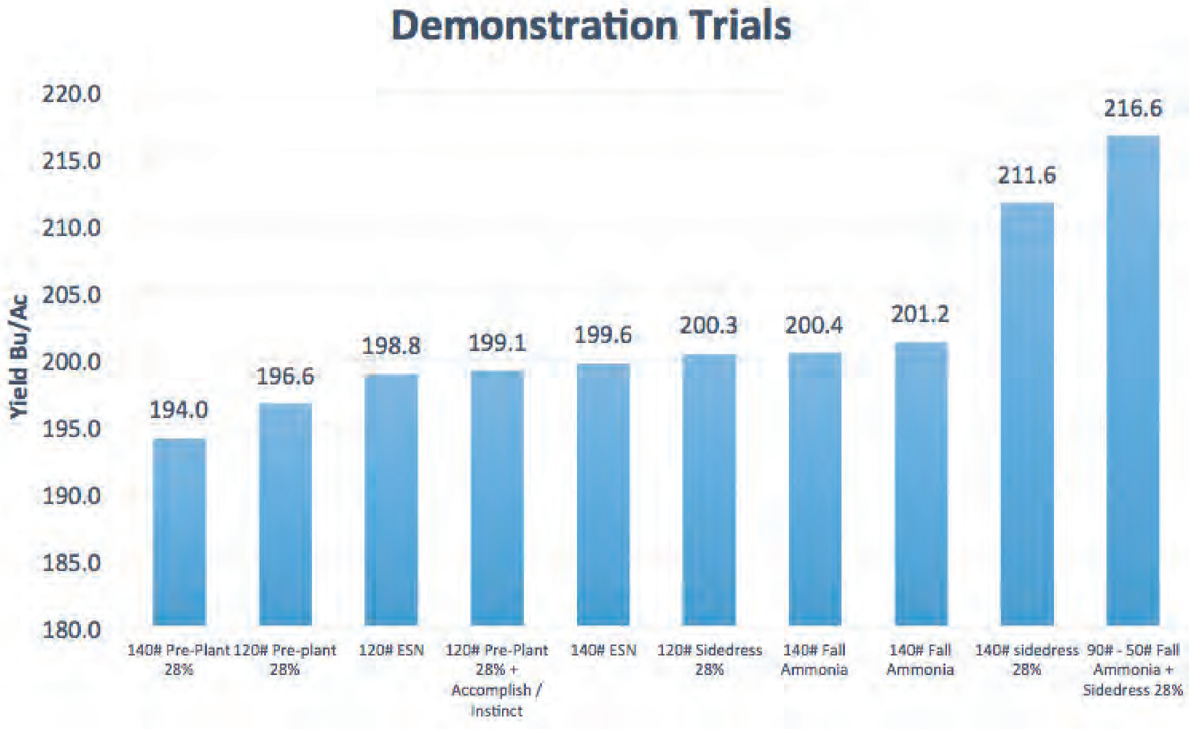
Spring timing varied between an early side-dress application and late-season top-dressing—guided by monitoring weather and crop conditions—during the rapid period of growth immediately prior to tasseling.

In all, spring side-dress applications typically resulted in the highest yield, while fall applications delivered the lowest yield and lowest NUE. Split applications were similar to fall applications in yield, but had higher NUE levels.

Harms Farm

In 2011, Kevin and Dan Harms began a series of nitrogen timing demonstrations. That year, each practice plot received 100 pounds of MicroEsssentials (MESZ) fertilizer, a granule combining phosphorus, sulfur and zinc in a 10-40-0-10S-1Zn formulation, delivering 12 pounds of N. An additional 42 pounds of actual N per acre were applied when the Harms used 28-percent UAN solution as carrier for pre-emergence herbicides. In all, three full-rate treatments received 204 pounds of applied N, and plots testing the NUE of ESN stabilized nitrogen received 179 pounds of N, or 80 percent of the full rate.

The N rates were relatively high and variability across the fields may have influenced the results, but researchers with the Indian Creek Watershed Project noted that spring side-dress plots had the highest yield. A 2013 trial on the same farm demonstrated the best results from a split application of fall anhydrous and a spring side-dress application of 28% UAN solution.



By applying some or all of the season's N closer to the period of root uptake, a greater percentage of applied nitrogen is available for the crop. That improves nitrogen use efficiency, maximizes the potential of your fertilizer and your crop, and reduces the chance that your costly nutrients will wash downstream or into the groundwater with winter or spring rains.

Those reasons—and the results of many trials in the Indian Creek Watershed Project showing yield benefits from spring-applied nitrogen—make split applications a great Best Management Practice for protecting the environment and your bottom line.

For more information on the 4Rs of Nutrient Stewardship, visit www.nutrientstewardship.com. For information about the Indian Creek Watershed Project, visit **www.ctic.org/IndianCreek** or call CTIC at (765) 494-9555.

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THE PICTURE OF CONSERVATION

Illinois project paints a perfect picture of conservation in action

By Robin Miller

Leonardo da Vinci once said water is the driving force of all nature. Today, many farmers would agree with his statement as they find themselves in the middle of community discussions about protecting the vital resource. The Indian Creek Watershed Project is a great example of one of these discussions.

The Indian Creek Watershed, located in eastern Illinois, consists of 51,000 acres on 104 farms. It is part of the Vermillion River watershed that drains into the Illinois River. The towns of Streator and Pontiac both draw water from the Vermillion River to supply drinking water for residents. However, the Vermillion River has been identified by the state as an impaired waterway under the Clean Water Act due to nitrate levels occasionally recorded above the 10-milligrams-per-liter safe-drinking-water standard set by Illinois.

That's what drove the Conservation Technology Information Center (CTIC) to coordinate the Indian Creek Watershed project. CTIC is a nonprofit organization that promotes conservation agriculture and technology that is productive and profitable for farmers.

"Our goal was to gather all those in the watershed who were interested in water quality and use our resources to identify and fund conservation-management practices with profit potential for each landowner in the watershed," says Chad Watts, CTIC project director, at the United Soybean Board-sponsored Confluence Project water-quality tour.

CTIC worked with the Livingston County Soil and Water Conservation District to contact all 104 farm operators in the watershed to provide assistance on farmers' conservation plans. Many farmers participated in demonstration-plot experiments to measure nitrogen-use efficiencies, nitrogen timing, nitrification inhibitors, fertilization rates and placement, cover crops, controlled drainage and reduced tillage. More than half enrolled in programs to enhance their conservation systems. Almost half of the watershed's acres are enrolled in the Conservation Stewardship Program (CSP), which awards farmers payments for conservation performance – the higher the performance, the higher the payment.

Watts attributes the success of the project to the diverse set of local citizens, including farmers, who were allowed to steer the project's strategy. "Everyone's goal was the same – to increase nutrient efficiency and protect the water near their homes," says Watts.

> **EVERYONE'S GOAL WAS THE SAME – TO INCREASE NUTRIENT EFFICIENCY AND PROTECT THE WATER NEAR THEIR HOMES.**
> **- Chad Watts, CTIC project director**

If he knew about the work in Indian Creek today, Leonardo might say agreement and action preserve water's position in nature. For more information about CTIC's work, please visit *www.ctic.org/IndianCreek.*

The Indian Creek Watershed Project focuses on the four Rs (right source, right rate, right time and right place) of nutrient management. At public field days, community members share information on how to tie water-quality gains to conservation practices on farms.

Indian Creek Watershed Project
2014 Accomplishments

The Indian Creek Watershed Project continues to attract attention regionally and nationwide.

- CTIC delivered three presentations on Indian Creek at the Soil and Water Conservation Society annual meeting.
- The project was featured in the United Soybean Board's "Improving Our Waterways" Midwest tour in August 2014.
- The project was visited by the Fishers and Farmers Fish Habitat Partnership steering committee with members from multiple surrounding states.
- CTIC staff, producers from the project area and Soil and Water Conservation District staff are speaking at conferences across Illinois and beyond.
- CTIC receives questions from many groups and individuals asking about our "recipe" for making Indian Creek such a successful project.
- The American Farmland Trust has modeled other watershed protection projects in Illinois on the model we have developed in Indian Creek.

In August, CTIC and our partners held a successful summer field tour with more than 140 people in attendance, where we:

- Highlighted soil health as well as the nutrient management practices and principles being demonstrated on area farms.
- Displayed a high-boy sprayer that was modified to plant cover crops in standing corn.
- Demonstrated new technologies by highlighting unmanned aerial vehicles and row-bots.
- Introduced tour participants to the fish species that live in the creek and explained what their presence indicates about water quality.
- Highlighted water quality by looking at the extensive water quality data collected as part of the project.
- Put water quality efforts into context by hearing how the Illinois American Water Company in Pontiac addresses pollution removal from drinking water.

Working with six farmers in the watershed, the project demonstrated best practices in real-world conditions all season long, spotlighting products and practices that can help improve nutrient use efficiency.

We held our first sponsor focus group meeting, bringing together project sponsors to:

- Help determine the future of the demonstration program.
- Review the preliminary demonstration plot data.
- Encourage them to communicate directly with the project's agronomists.

Working with IL EPA and the Soil and Water Conservation District, we secured funding to analyze water quality data collected in Indian Creek collected throughout the project.

Our winter meeting drew more than 60 people for presentations highlighting the results of the demonstrations and discussing new techniques and strategies for nutrient use efficiency.

We conducted a farmer focus group meeting with eight producers. Among the highlights:

- Producers all noted a positive impact on the community because of the project.
- It was also noted that farming practices in the watershed and area have changed since the project started, with a shift toward higher nitrogen use efficiency – primarily switching to more spring-based and in-season nitrogen applications.
- A report on the focus group is available from Chad Watts at watts@ctic.org.

Contact Chad Watts, CTIC Project Director, for details about the project and these accomplishments at watts@ctic.org or 574-242-0147.

Want to learn more?

CTIC's successes go far beyond Indian Creek as we lead and share expertise in many other projects and initiatives. You can find information on our work with water quality, soil health, cover crops, pollinators and more at www.ctic.org.

December 2015

As we head into 2016, the final season of the six-year Indian Creek Watershed Project, it's a great time to reflect on the wide range of partners who have made the program such a huge success.

CTIC brings together people from across conservation agriculture, from policymakers to researchers, Ag retailers, agribusiness leaders, association organizers, local districts and farmers. Together we build insight and share information to advance conservation farming.

Few projects demonstrate the contributions of as many CTIC members as the Indian Creek Watershed Project. The commitment of stakeholders from the halls of USDA to the fields of Livingston County, Illinois, has made Indian Creek a model for watershed projects throughout the Midwest and across the country.

Through the Indian Creek Watershed Project, we are learning how water quality improves when over half of a watershed adopts conservation practices. We're demonstrating conservation practices on the field scale. And we're learning about leadership, organization and farmer outreach.

In this issue of Conservation Partners, we'll explore a few of the many dedicated partners and their involvement in the Indian Creek Watershed Project, including:

Livingston County Soil and Water Conservation District

- Trainor Grain
- Purdue University
- The Fertilizer Institute
- and more

This project is funded in part by the Illinois Environmental Protection Agency through Section 319 of the Clean Water Act.

Local Districts

Livingston County Soil and Water Conservation District

Ask anyone about the Indian Creek Watershed Project and it doesn't take long for them to bring up Terry Bachtold's name. Terry is the agriculture resource coordinator for the Livingston County Soil and Water Conservation District (SWCD), and the tireless engine that has kept the project going from the start.

In fact, if you ask most people about the secret to the success of the Indian Creek Watershed Project, they'll point to the mutual trust and cooperation among a wide range of stakeholders, the commitment of more than half of the watershed's farmers to adopting new conservation practices on their land, the well-designed demonstration plots, and the informative field days. Many will mention CTIC's help in marshaling partnerships and coordinating field days and communications. And just about all of them will mention Terry by name.

Terry and his colleagues at the Livingston County Soil and Water Conservation District embody the vital role of districts across the country in getting conservation on the ground. Local knowledge. Community connections. And deep commitment to helping farmers become more environmentally and economically sustainable.

Terry Bachtold (left) is agriculture resource coordinator for the Livingston County SWCD and Chad Watts is the Project Director for CTIC.

This project is funded in part by the Illinois Environmental Protection Agency through Section 319 of the Clean Water Act.

Government Agencies

Illinois Environmental Protection Agency

In the world of conservation farming, government agencies play a vital role in setting policies and creating programs that can promote effective, sustainable farming practices.

Boosts from funding were vital to the launch and success of the Indian Creek Watershed Project, according to Terry Bachtold of the Livingston County Soil and Water Conservation District. Section 319 funding through the Illinois Environmental Protection Agency (IEPA) provided critical support for the demonstration plots, farmer meetings, field days, steering committee operations and SWCD assistance. In fact, IEPA injected nearly $750,000 into the watershed to support the project. The 319 grants also attracted more than $573,000 in additional matching funds.

IEPA instituted an extensive water quality grab sampling program in Indian Creek and partnered with the U.S. Geological Survey to establish a long-term continuous monitoring station in the watershed. Together, the water quality testing programs will provide great insight into the impact of conservation practices on tens of thousands of acres of farmland on the health of the stream.

The USDA Natural Resources Conservation Service's Mississippi River Basin Initiative provided additional funds - through Environmental Quality Incentive Program and Conservation Stewardship Program - to help farmers take the risk of trying new farming practices and see the results.

Through the Indian Creek Watershed Project, farmers have partnered with state agencies and other stakeholders to become partners in water quality protection. The voluntary adoption of practices that improve nutrient use efficiency and farmers' bottom line also improves soil and water quality, creating a model of teamwork and conservation that can be emulated in other watersheds.

Agribusiness Association

The Fertilizer Institute

A long-time CTIC member, The Fertilizer Institute (TFI) represents the industry's leading fertilizer companies and tirelessly promotes the responsible stewardship of crop nutrients. The 4Rs of Nutrient Stewardship — the right fertilizer source at the right rate at the right time, in the right place — which the Institute developed with the International Plant Nutrition Institute, are a central theme for the Indian Creek Watershed Project.

Adherence to the 4Rs improves nutrient use efficiency (NUE) and reduces the chances of nutrients moving from farmland to local streams. Demonstration plots throughout the Indian Creek watershed compared rates, placement and timing, and introduced farmers to a range of fertilizer formulations designed to improve NUE and keep nutrients in the field.

TFI data indicates that U.S. corn farmers improved nutrient use efficiency by 105 percent between 1980 and 2014. Inspiration from the success of programs like the Indian Creek Watershed Project could drive farmers and industry alike to improve even further.

This project is funded in part by the Illinois Environmental Protection Agency through Section 319 of the Clean Water Act.

Growers Associations


Caroline Wade is the Nutrient Watershed Manager at Illinois Corn.

Illinois Soybean Association

Grower associations connect CTIC to thousands of farmers and other stakeholders, making them an invaluable link in the chain that focuses on conservation systems that can make growers more profitable and achieve soil, water and air quality goals.

Tapping into the potential to build capacity for both leadership and conservation in the countryside, the Illinois Soybean Association has sponsored Dr. Prokopy's social science research into the Indian Creek Watershed Project—a win for growers not just in Illinois, but across the country.

Illinois Corn Marketing Board

Nitrogen use efficiency is vital for both the economic and environmental sustainability of corn production. That's why the Illinois Corn Marketing Board's involvement in the Indian Creek Watershed Project was such a win-win. Their support funded demonstrations of nitrogen rate trials and 4R principles on Mike Trainor's farm, showcasing sustainable practices in real-world conditions and inspiring adoption of conservation systems. Plus ICMB supported the continuation of important water quality monitoring in Indian Creek, enabling us to evaluate water quality impacts of conservation system adoption in the watershed.

This project is funded in part by the Illinois Environmental Protection Agency through Section 319 of the Clean Water Act.

Ag Retailers

Trainor Grain

Mike Trainor's roots run deep in the Indian Creek watershed. Mike manages the fertilizer operation in his family's grain elevator and ag retail business in Wing, Illinois, and farms nearby. His family was among the first in the county to go no-till, and Mike has been a strong proponent of the 4Rs of Nutrient Stewardship for years.

As an ag retailer and a farmer, he has been at the fore of test plots and demonstrations of a range of enhanced efficiency fertilizers that slow the conversion of N into leachable forms, as well as split applications and other strategies to reduce the chances of nutrients moving into Indian Creek.

Local ag retailers like Mike Trainor—and their state association, the Illinois Fertilizer and Chemical Association—are key partners in the Indian Creek Watershed Project. Livingston County farmer John Traub sums up the importance of their perspectives, especially in tight times.

"If I have retailers or businessmen that I respect telling me, 'you know, John, you maybe ought to try doing this,' it's encouraging. It validates," Traub says. "We depend a lot on our local retailer and the people we do business with for agronomic advice and recommendations on a lot of things. We look at all the university work and a lot of other research, but when the local guy—the guy you trust and do business with—is comfortable and saying, 'I think we ought to try this, it's a good idea,' that really puts the icing on the cake.'"

Mike Trainor manages the fertilizer operation in his family's grain elevator and ag retail operation.

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Independent Agronomists

Harold Reetz & Tim Smith

Farm-scale demonstration plots, and the lessons learned from them year after year, are among the most widely anticipated products of the Indian Creek Watershed Project.

Harold Reetz of Reetz Agronomics and Tim Smith of Cropsmith have coordinated the demonstration plots in the watershed since the project's start. They have taught farmers how to plan, plant and manage on-farm trials, presented findings at annual meetings and field days, collected data and published reports to share findings from the plots nationwide.

Using a model developed by long-time CTIC partner, the International Plant Nutrition Institute, Reetz and Smith have emphasized the importance of assessing nitrogen fertilizer in terms of nitrogen use efficiency (NUE) or maximum economic rate of nitrogen (MERN)— emphasizing profitability, not just yield.

Thinking in NUE terms is a key step in understanding and adopting the 4Rs of Nutrient Stewardship, a philosophy developed by IPNI and The Fertilizer Institute.

A lasting legacy of the project, annual reports and fact sheets developed from the demonstration plots in the watershed will continue spreading the insight gained from the program for years to come. Contact CTIC for copies.

University Research

Dr. Linda Prokopy,
Purdue University

The Indian Creek Watershed Project offers insight into so many pressing subjects: water quality, nutrient management, soil biology and chemistry, agronomy and agricultural economics, to name a few.

But it is also a prime case study in leadership and management. Dr. Linda Prokopy, professor of Forestry and Natural Resources at Purdue University, has been studying the social sciences behind the success of the Indian Creek Watershed Steering Committee. Her research seeks insight into the social indicators that can measure effectiveness and predict outcomes of projects like Indian Creek.

A video by Prokopy and her team shares tips and observations from members of the steering committee that can help other watershed groups gain traction on similar challenges. It's a great example of the wide range of research that CTIC projects can facilitate.

This project is funded in part by the Illinois Environmental Protection Agency through Section 319 of the Clean Water Act.

Other CTIC Projects Bring People Together

The Indian Creek Watershed Project is just one great example of collaboration between people and organizations bringing a wide array of angles on conservation to the table. The coming year will include many more, including:

- Do the Math on Cover Crops which harnesses the brainpower of farmers, crop advisors, beekeepers, agricultural economists, agronomists, soil scientists and Ag retailers to plumb the economics of cover crops.
- The Big Pine Watershed Project in Indiana, where we follow a model similar to that of the Indian Creek project. Along with peers in Indian Creek, 15 farmers in the Big Pine watershed will use Field to Market's Fieldprint Calculator to assess their operations, work with crop advisors and guide the adoption of conservation systems. Funded by the United Soybean Board, Indiana Corn Marketing Council and Indiana Soybean Alliance, this one-year project uses the Fieldprint Calculator to complement demonstration taking management and detect the use of cover crops across the landscape. This project will connect the place watershed-wide and drive continuous improvements through conservation systems.
- Using Operational Tillage Information System (OpTIS) to estimate and monitor crop residue expertise of Applied GeoSolutions of New Hampshire with CTIC and a wide range of partners on the ground to harness remote sensing technology for conservation — launching us into a new generation of opportunities.

Get Involved in Indian Creek!

The final year of the Indian Creek Watershed Project will be a big one—high-profile demonstration plots, big field days, final reports and a big spotlight on one of the most successful watershed projects in the nation.

There's still time to get involved as a sponsor. Contact Chad Watts for details.

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Indian Creek Watershed Project

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Our appreciation also goes to our partners on this project: Illinois Environmental Protection Agency, Livingston County Soil and Water Conservation District, Natural Resources Conservation Service and United States Geological Survey.

CTIC — Conservation Technology Information Center