

Clean Water Grows

Six Successful Cover Crop Outreach Efforts

Lara Bryant
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Rye. Credit: Practical Farmers of Iowa.

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Introduction



Hudson River. Credit: US EPA.

...cover crops are proving to be a valuable agricultural practice that can significantly reduce pollution flowing into water bodies and help meet nutrient reduction goals.

The New York City watershed is often heralded as a model of a successful public-private partnership for effectively protecting water quality. By working with farm and forest owners upstream, the city has been able to use land management strategies to protect drinking water quality for more than 8 million downstream New York City residents.¹ The story begins with an agreement between New York City and the Environmental Protection Agency (EPA).² In order to meet water quality standards without having to build a multi-billion dollar water purification system, the city decided to address the source of the problem upstream by investing in a watershed protection program in the Hudson River valley that would provide the same water quality at a much lower cost while providing additional environmental benefits. Over the years, the program has evolved to a multi-stakeholder agreement between New York City and a number of watershed partners, working together to address water quality issues using conservation easements and best management practices on agricultural land.^{1,2}

Across the United States, 41,509 water bodies are considered too polluted to meet water quality standards.³ When it has been determined that a river, lake or stream cannot be used for drinking, swimming, or fishing, local authorities often face difficult decisions to address these water quality deficiencies. Constructing water quality treatment infrastructure can be a costly means of meeting water quality standards. Alternatively, addressing non-point sources of nutrient pollution can improve water quality at a much lower cost. As more states and watersheds adopt nutrient reduction strategies, increasing numbers of local entities will look for innovative ways to improve water quality through agricultural stewardship. In particular, cover crops are proving to be a valuable agricultural practice that can significantly reduce pollution flowing into water bodies and help meet nutrient reduction goals.

Cover crops are non-commodity crops that are typically grown during the non-growing season, when the soil would otherwise be bare. Farmers who invest in cover crops typically do so for higher yields, nutrient retention, soil tillage, forage for livestock, reduced erosion, reduced input costs, and a more sustainable cropping system overall.



Rye. Credit: Practical Farmers of Iowa.

Recently, cover crops have become more popular, due in part to local and regional support strategies that have encouraged planting more cover crops. Iowa, Ohio, and Missouri are in the process of developing nutrient reduction strategies; all three draft plans mention cover crops as an important practice for improving water quality.^{7,8,9} Throughout the Chesapeake Bay watershed, stakeholders continue to devote considerable resources to planting cover crops, to achieve water quality goals. Still, cover crops are not yet standard practice for agricultural producers across the United States.

This report provides **six case studies** of successful local and regional efforts to improve water quality by increasing cover crop adoption. As other watersheds

Nutrient Reduction Potential of Cover Crops

Upstream agriculture, mainly in Midwestern states, is the cause of 70 percent of nitrogen and phosphorus loading to the Gulf of Mexico, resulting in severe hypoxic conditions.⁴ Research shows that cover crops have the potential to reduce nitrogen and phosphorus pollution to rivers and streams at a lower cost than some means of point-source reduction. A study by Kovar et al. shows that planting cover crops resulted in a 41% reduction in total phosphorus runoff.⁵ The cost of phosphorus pollution reductions from the examples in this document range from \$0.36-\$40/lb of phosphorus. An analysis of phosphorus control strategies for the Fox-Wolf Basin in Wisconsin showed that the average incremental cost of point-source reduction was \$73/lb of phosphorus.⁶

Cover crops are not a substitute for point-source pollution control; nutrient pollution must be addressed from all sources. However, efforts to increase cover crop adoption will certainly improve water quality, for a much lower investment than installing expensive infrastructure. Such a high-value practice is well-worth the cost.

across the country struggle with meeting water quality goals, these case studies offer examples of innovative ways to reduce non-point source pollution.

Each case is unique, occurring at different scales, with different drivers, and with varying levels of funding and other resources. Although no single program can be replicated in precisely the same way, we found several common program elements and lessons learned. Water utilities, watershed groups, water quality coalitions, and municipal boards may consider these common elements when pursuing similar efforts to help landowners and farmers address non-point pollution, improving water quality in our lakes, rivers, and streams, while reducing costs to utilities and ratepayers to ensure safe water.

Ohio Water Treatment Facilities Invest in Cover Crops



Cover crop field day. Credit: Greg McGlinch, Darke SWCD.

“The biggest take away is that we didn’t design the program and hand it to stakeholders on a plate. We developed it with and for stakeholders. They designed it. You can’t take this program and use it as a cookie cutter solution in another area; you have to build trust.” –Sarah Hippensteel Hall, Miami Conservancy District

Nearly ten years ago, impending water quality criteria for the Great Miami River Watershed in Ohio inspired local municipalities to find a cost-effective way to reduce total nutrient loading in the watershed’s rivers and streams.¹⁰ Faced with \$422 million in upgrades to local water treatment plants, and limited resources, the communities would have been forced to significantly raise consumer prices. The district found that paying upstream farmers for conservation practices would cost approximately \$50 million dollars to achieve the same amount of nutrient reductions, while providing ancillary benefits to the environment, such as carbon sequestration and shading to the streams to provide better fish habitat.

With grant funding from the USDA and the US EPA, the Miami Conservancy District (MCD) developed a pilot program for nutrient trading. **Stakeholder involvement was a critical part of the process.** The district held over 100 meetings with stakeholders on the federal, state and local level to build trust and support for the concept.¹⁰ Sarah Hippensteel Hall of MCD emphasized this as one of her most important lessons learned from the project.

Pollution limits for the Miami River watershed are still pending; until those limits are in place, the program will remain in its pilot phase. In the meantime, all the “trades” taking place are actually not trades at all; treatment plants are buying the rights to credits for potential use at a more favorable ratio in the future.¹⁰ In the absence of any regulation, there is nothing to comply with and therefore, no immediate use for the credits. However, after eleven rounds of sign-ups since 2005, the framework for the program is established and **572 tons of nutrient reductions** have already occurred (reduction calculations are based on EPA’s Region V Load Reduction Spreadsheet model).¹⁰ Hall expects that demand for credits will go up by an order of magnitude when the nutrient criteria are in place.

From the perspective of the farmers selling the credits, the program is already in operation. Cover crops are a popular practice used to generate the credits. Farmers visit their county Soil and Water Conservation Districts (SWCDs) with a plan to put conservation practices on their land, and technical experts from the SWCD use the spreadsheet model to calculate how much phosphorus and nitrogen can be prevented from entering waterways

Partners in the Miami Conservancy District Nutrient Trading Program:¹¹

- County Soil and Water Conservation Districts
- Ohio Farm Bureau Federation Inc.
- ODNR – Division of Soil and Water Conservation
- USDA Natural Resources Conservation Service
- The Miami Conservancy District
- Cities of Dayton, Englewood, and Union
- Butler County Department of Environmental Services
- Tri-Cities North Regional Wastewater Authority

by implementing those practices.^{12,13} Then the pounds of nutrient reductions are entered into a reverse auction bidding system; the farmers enter their savings in dollars/pound and then bids are ranked. Sellers with lower prices for reductions win the bid; for example, a price of \$1.20 per pound for nutrient reductions will lose to a price of \$1 per pound (cover crop bids ranged from \$0.36/lb to \$2.00/pound for the pilot program).¹⁴ Technical experts, like Greg McGlinch at Darke SWCD, then work with the winning bidders to put the practices in place to achieve the nutrient reductions. A **system of checks and balances** ensures the certainty and reliability of the reductions; to name a few, practices are verified by the SWCD, the Department of Natural Resources verifies each application for accurate use of the model, and MCD collects water quality data.¹⁰

Cover crops are popular in Darke County in the Miami River watershed where 5,442 acres were planted through the program. “On average I see one to two farmers a week who come in to ask about cover crops. We just had a cover crop workshop with 165 people in attendance,” says McGlinch.¹² For outreach, the program does news releases but relies primarily on word-of-mouth and personal outreach from SWCD staff to farmers. Every year since the program began, Darke SWCD’s participation grew. McGlinch says the trading program is **easy to implement**, with a lot less paperwork than federal cost-share programs. Perhaps the administrative ease of the program is connected to the adaptive philosophy of its administrators. “We trusted an **adaptive approach**,” says Hall.¹⁰ “The program did not have to be perfect before we launched it. We knew we were going to change and adapt.”



Credit: Greg McGlinch, Darke SWCD.

Ohio Case Study at a Glance

- EPA plans to administer nutrient criteria in the Miami River Watershed; the criteria is still impending, but the Miami Conservancy District already has a pilot program in place that is an innovative nutrient reduction strategy.
- The Miami Conservancy District used USDA and EPA funding to administer a nutrient trading program.
 - Farmers implement conservation practices, and local water treatment plants “bid” on the rights to expected nutrient reductions.
 - 572 tons of nutrient reductions occurred in the program’s pilot phase.
 - Farmer prices for cover crop implementation ranged from \$0.36-2.00/lb of phosphorus reduced.
- Cover crops are a popular practice to achieve these reductions.
 - Darke SWCD reports 5,442 acres of cover crops planted in their district throughout the program.
- The program’s strengths are an adaptive approach and stakeholder-involvement in the design.

Wisconsin Innovates with Adaptive Management



Credit: Clean Lakes Alliance.

“Adaptive management is a phosphorus compliance option that allows point and nonpoint sources (e.g. agricultural producers, storm water utilities, developers) to work together to improve water quality in those waters not meeting phosphorus water quality standards. This option recognizes that the excess phosphorus accumulating in our lakes and rivers comes from a variety of sources, and that reductions in both point and nonpoint sources are frequently needed to achieve water quality goals.” –Wisconsin Department of Natural Resources¹⁸

Stakeholders in the Yahara watershed in Wisconsin are taking an innovative approach to address non-point source pollution. The Yahara River connects four glacial lakes and flows south to join the Rock River. These connected water bodies are a highly valued, scenic natural resource to three Wisconsin counties.¹⁵ Unfortunately, the lakes have a phosphorus pollution problem, and the TMDL indicates that close to 50 percent of the watershed's phosphorus load comes from agricultural land.¹⁶ The Yahara rivers and lakes are not on the EPA's list of impaired waters yet, and local and regional stakeholders are working together to keep the Yahara watershed from reaching an impaired level, requiring it to be added to the list.¹⁷

When state officials began to look at creating nutrient reduction criteria, they quickly realized the limitations associated with traditional implementation approaches, which primarily focused on point sources of pollution. This singular focus makes it difficult to achieve nutrient reduction goals on a watershed scale. In addition to traditional implementation approaches, Wisconsin became the first state to allow a more holistic approach, called **adaptive management**.

Yahara watershed's adaptive management strategy aims to improve water quality by **addressing nutrients from all sources and targeting the least cost mix of practices** that will meet nutrient reduction goals. This approach results in moving resources where they are needed within the watershed, which sometimes involved moving money across municipal boundaries.¹⁶ The Yahara Watershed Improvement Network (WINs) pilot project is a four-year project to implement a mix of agricultural and non-agricultural phosphorus control practices from 2012-2015.¹⁹ The diverse project partners contribute financially toward a common fund for Yahara WINs, used to reduce phosphorus loads.

According to Kathy Lake, Environmental Specialist at Madison Metropolitan Sewerage District (MMSD), the utilities could spend large amounts of money to reduce point-source pollution and make little to no impact on the phosphorus load in the watershed. The adaptive management strategy allows MMSD and other point sources to work with non-point sources to achieve phosphorus reduction goals for the watershed. In

Yahara Pride Farms

Water utilities could not implement non-point source strategies without the help of partners. The Dane County Land Conservation Department works with agricultural producers to promote agricultural practices to improve water quality.¹⁶ Clean Lakes Alliance, a non-profit dedicated to protecting water bodies in the Yahara watershed, has been a key player in the effort to engage farmers in addressing non-point source pollution problems.¹⁷ Clean Lakes Alliance initiated the independent, farmer-led Yahara Pride Farms Board, which is tasked with developing a voluntary certification program for conservation practices in the watershed.²⁰ Participants enjoy the benefits of Yahara Pride branding, which conveys the message of good stewardship to a broader community.¹⁷ Don Heilman, President of the Clean Lakes Alliance and board member of Yahara Pride Farms, credits the board's success to its **farmer-to-farmer approach**, and the time and effort (two years) spent **building trust** between the board and farmers in the community.¹⁷

addition to a variety of other agricultural practices, cover crops are a major focus of the non-point source strategy in Dane County, Wisconsin.

The pilot program pays for baseline data, as well as installing practices to improve water quality in the Sixmile Creek watershed. The pilot's success will be evaluated for overall cost-effectiveness and community support. Lake says the goal of watershed adaptive management is not based on the amount of nutrient reductions but on in-stream water quality improvement.²

Like Miami Conservancy District's nutrient trading program, Wisconsin's adaptive management approach and utilization of cover crops for nutrient reduction is still in its infancy. While the adaptive management approach may be more cost-effective than a traditional approach focused on point-source regulation, the results are less certain. The University of Wisconsin collected in-stream water quality data for the initial cover crop program in



Credit: Clean Lakes Alliance.

Cover Crops in the Yahara Watershed

Dane County and the Yahara Pride Farm Team initiated a program to increase cover crop adoption in 2012, in the Sixmile Creek and Yahara River watershed. Yahara Pride Board members personally approached farmers and landowners to explain the benefits of cover crops.¹⁷

The program resulted in **422 acres of cover crops** planted in the 35 farm area of the Sixmile Creek watershed, and 894 acres throughout the Yahara River Watershed, for a total of \$35,760 in cost-share payments (\$40/acre).¹⁹ Models estimated that the practices reduced runoff by approximately **400 pounds of phosphorus** during the winter of 2012-2013. That is approximately 1lb/acre, at a **cost of \$40/lb.**¹⁹ Yahara Pride Farms expects to plant at least 1200 acres of cover crops in the watershed in the upcoming year.¹⁷

Funding for cover crops in the Yahara watershed is not limited to the regional and municipal point-sources contributing to the Yahara WINs fund. Dane County received a \$1.3 million grant from USDA's Mississippi River Basin Initiative (MRBI), providing most of the funding for installing conservation practices in the watershed and Dane County has budgeted nearly \$1 million annually in the next few years toward this project.¹⁹ The MRBI practices are contracted through a standard sign-up with the Natural Resources Conservation Service (NRCS) Environmental Quality Incentives Program (EQIP), which may be perceived as less flexible than the simple approach employed by the Yahara Pride Farm Team. The Sand County Foundation also provided a grant to Yahara WINs to install four United States Geological Survey (USGS) monitoring stations.¹⁷ Private agribusinesses have contributed to Yahara Pride Farms cover crop program.



Wisconsin Case Study at a Glance

- Yahara WINs innovative adaptive management approach is the first of its kind in Wisconsin.
- Diverse stakeholders from point sources and other parties pay into a common fund to reduce phosphorus loading in the watershed by reducing non-point source pollution from agricultural lands.
- The cover crop cost share program in the pilot area pays \$40/acre, resulting in approximately 1 pound of phosphorus reductions per acre. The program cost approximately \$40/pound in nutrient reductions.
- The pilot program is a four-year project which hopes to expand watershed-wide in 2015.



Aerial seeding. Credit: Clean Lakes Alliance.

the pilot area to calibrate the existing models.¹⁷ **Cover crops will need to be used routinely to show long-term water quality benefits.** One potential hurdle to demonstrating verifiable results (from a regulatory compliance standpoint) could be concerns about privacy from the producers and difficulties in maintaining their trust.¹⁶

Despite these uncertainties, it is clear that the Yahara WINs project has led to a successful collaboration between agricultural and non-agricultural stakeholders

toward achieving common goals. For 2013, Yahara WINs aims to reduce phosphorus in the pilot project area by an additional 3100 pounds, and to increase phosphorus reductions each year through 2015.¹⁹ The pilot project's **goal** is to expand to the entire watershed in 2015 and its **ultimate success** will be measured in terms of improved in-stream water quality. In the meantime, other watersheds can look at this adaptive management approach as an example for how to work across boundaries and utilize partners with common goals and complementary strengths.

Indiana Covers a lot of Ground

The Indiana State Department of Agriculture established the Clean Water Indiana (CWI) program to provide financial assistance to landowners and conservation groups to implement conservation practices to reduce nonpoint-source pollution.²¹ This case study presents two examples of how local groups utilized CWI and other federal and state programs to reduce nutrient pollution by increasing cover crop adoption.

Jasper and Newton Counties

The Iroquois and Kankakee Rivers flow through the corn and dairy country of Jasper and Newton Counties in Northwest Indiana and both rivers are subject to TMDLs.²⁵ In 2010, the Jasper and Newton County Soil and Water Conservation Districts (SWCD) were awarded a watershed planning grant by the Environmental Protection Agency's Section 319 grant program to establish and implement a plan to reduce the total pollutant load in these rivers.²⁶ The watershed steering committee determined that cover crops were a key tool to address their water quality concerns, providing the “biggest bang for the buck and the biggest potential benefit for the farmer.”²⁷

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Radish. Credit: Dan Perkins.

Indiana’s Conservation Cropping Systems Initiative

Indiana is at the forefront of cover crop adoption in the Corn Belt states, with 68,141 acres planted with funding from the Natural Resources Conservation Service (NRCS) in 2011, out of 12.7 million acres of cropland.^{22,23} This is partially due to Indiana’s Conservation Cropping Systems Initiative (CCSI). Launched in 2009, CCSI is a systematic approach to production agriculture that focuses on several conservation practices, including cover crops.²⁴ Funding for CCSI is provided by the U.S. Department of Agriculture (USDA) and the Indiana State Department of Agriculture, National Fish and Wildlife Foundation, Indiana Corn Marketing Council, and the Indiana Soybean Alliance, with administrative support by the Indiana Association of Soil and Water Conservation Districts.

According to Dan Perkins, Certified Crop Advisor (CCA) and Watershed & Conservation Specialist at Jasper SWCD, the project goal was to plant 10,000 acres of cover crops in the county in five years.²⁷ After four years of outreach effort, the SWCD has planted **6,000 acres** to cover crops. With the completion of the watershed plan, the project goal shifted from an acreage goal to **targeting cover crops where they will be most beneficial**, and to farmer-focused advising, ensuring each farmer is successful with cover crops, a requirement for long-term implementation.

An additional Clean Water Indiana (CWI) grant provided cost assistance of \$20/acre, up to 40 acres per farmer, for planting cover crops. Perkins says the cost-share was a “gateway to get to know farmers and give them a taste of the power of cover crops, by direct experience on their farm fields.”²⁷ The district matched the cost-share and the program enrolled six farmers the first year. The SWCD increased the outreach effort with signs and winter workshops, as well as reports, radio and newsletters. The next year they received more funds, and enrolled twelve farmers. Perkins and others worked with farmers on an individual level, ensuring their success and encouraging new adopters. The SWCD also worked with local cooperatives and crop advisors, educating them on cover crop implementation by speaking at customer appreciation days and conducting staff trainings on cover crop tips and success stories. Perkins states that, “our goal is to keep the discussion going about cover crops and ultimately work ourselves out of the need to promote cover crops, because local CCAs, ag businesses, and farmers are promoting the practice.”

In recent years, the SWCD dug soil pits in the fall and spring, so that farmers could see **visual evidence** of the drainage benefits of cover crops. “This has been one of the most effective tools for convincing farmers they are getting benefits from cover crops. It was a great avenue to get the neighbors and ag community out to see cover crops at work,” says Perkins.

As with many other examples in this report, cover crops were one tool used in a systems approach to achieve better water quality, improved soil health, and more profitable farming. **Personal interaction** between farmers and technical advisors, such as Dan Perkins, is a clear key to Jasper and Newton SWCD’s successful results.

“Our goal is to keep the discussion going about cover crops and ultimately work ourselves out of the need to promote cover crops, because local CCAs, ag businesses, and farmers are promoting the practice.” –Dan Perkins, Certified Crop Advisor (CCA) and Watershed & Conservation Specialist at Jasper SWCD

Fountain, Parke, and Vermillion Counties

Fountain, Parke, and Vermillion County Soil and Water Conservation Districts in western Indiana formed a regional collaborative to use Clean Water Indiana (CWI) funds for a highly successful three-year cover crop outreach effort. The three districts decided to invest in more on-the-ground outreach to promote conservation practices. That outreach effort included hiring Larry Timm, a retired seed dealer and no-till farmer.²⁸ Meg Leader of Vermillion County SWCD considers this money well-spent. “Using the CWI grant to pay for Larry’s time and expenses meant that his expertise was available



2012 Field Day with nearly 100 participants. Credit: Meg Leader.

to everyone," says Leader. Timm was an irreplaceable resource to cover crop farmers in the region, able to adjust equipment to run more efficiently or advise producers on which cover crops to plant, and when.

Available technical assistance from a qualified regional expert was the key to getting more cover crops on the ground. Timm has met with individuals more than 1000 times and facilitated nearly 40 events, ranging from small group meetings to field days with 100 participants. In addition to hours of individualized interactions with local farmers, Timm and the SWCD staff facilitate regular small group meetings in each of the counties, providing an informal venue for people to ask and answer questions on conservation practices.

In addition to valuable technical assistance, the CWI grant funds some cost-sharing for cover crops, varying in each county from \$20-30/acre.²⁸ In 2012, the cost share funds were used to plant nearly 1,500 acres of cover crops, for a total cost of \$16,020, or \$10.68/acre, achieving the following nutrient reductions:

- 2,380 tons year of sediment (\$6.75/ton),
- 2,942 lbs/year phosphorus (\$5.44/lb), and
- 5,880 lbs/year of nitrogen (\$2.73/lb).

In just two years, the initiative has been responsible for **7,000 acres of cover crops** across three counties (USDA also offered funding for cover crops, helping to achieve this goal).

These outreach efforts provide excellent examples of how regional support strategies can be tailored to local needs with great success.



2011 Cover Crop Tour. Credit: Meg Leader, Indiana Association of Soil and Water Conservation Districts.

Indiana Case Study at a Glance

- Clean Water Indiana (CWI) provides funding for local groups to use conservation practices to reduce nutrient pollution.
- Jasper and Newton County used a CWI grant to provide outreach and cost-assistance for cover crops. They planted 6,000 acres of cover crops in 4 years and are currently targeting conservation to the most beneficial areas.
- Fountain, Parke, and Vermillion Counties used CWI funding to provide technical and cost assistance to farmers using cover crops. They planted 1,500 acres in 2 years, for a total cost of \$16,020, or \$10.68/acre, achieving the following nutrient reductions:
 - 2,380 tons year of sediment (\$6.75/ton),
 - 2,942 lbs/year phosphorus (\$5.44/lb), and
 - 5,880 lbs/year of nitrogen (\$2.73/lb).

Michigan Builds a Network for Effective Partnerships



Credit: MAEAP.

State and federal funding provides a flexible framework for on-the-ground cover crop outreach in Michigan. The statewide Michigan Agriculture Environmental Assurance Program (MAEAP) and the federally mandated Great Lakes Restoration Initiative (GLRI) provide support for increasing cover crop adoption in Michigan.

Michigan Agriculture Environmental Assurance Program (MAEAP)

MAEAP was developed in 1997 by a coalition of farmers, commodity groups, and government and non-government stakeholders to help farmers get the necessary support to voluntarily prevent or minimize agricultural pollution risks.²⁹ Farmers who participate in MAEAP's **voluntary, systems-based approach** can be verified as environmentally sound and in compliance with state environmental laws. In fiscal years 2010-2012, MAEAP verified farms were responsible for the following nutrient reductions to water bodies:

- 669,099 fewer tons of sediment (59,475 dump trucks),
- 1,134,962 fewer pounds of phosphorus (283,740 tons of algae prevented from growing in surface waters), and
- 2,529,047 fewer pounds of nitrogen (30 billion gallons of water that could have been contaminated).³⁰

Cover crops are one option in a bundle of cost-effective best management practices for MAEAP verification. Other practices utilized by MAEAP farmers are nutrient management plans, conservation tillage, livestock exclusion, and pest management, to name a few.³⁰ From 2010-2012, there were 40,557 acres of cover crops planted on MAEAP verified farms.³⁰

The Great Lakes Cover Crop Initiative

In 2009, the federal government authorized more than \$1 billion in funding for the Great Lakes Restoration Initiative (GLRI).³¹ A GLRI grant funded the Great Lakes



Credit: Allegan Conservation District.

"We need to reframe the conservation message in terms of economic advantage rather than sacrifice for the greater good."

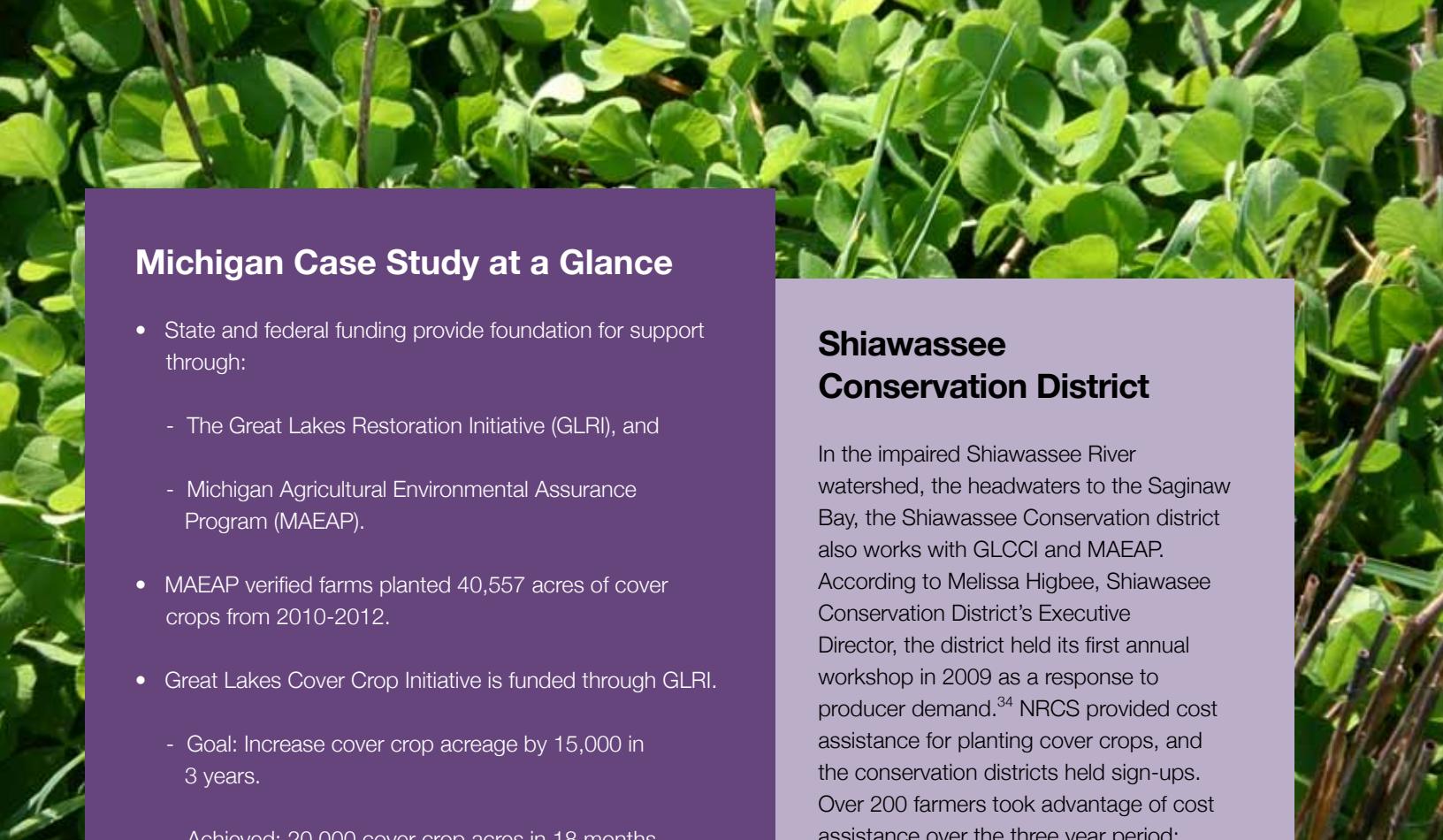
—Mark Ludwig, Project Manager at the Allegan Conservation District

Cover Crop Initiative (GLCCI), a cooperative agreement administered by the Conservation Technology Information Center (CTIC).³² Under the grant agreement, Purdue University, Michigan State University, and Ohio State University Extension work collaboratively toward a **goal** of increasing cover crop acreage by 15,000 acres in three years. GLCCI **accomplished their goal** in the **first eighteen months** and has now increased cover crop planting by over **20,000 acres**.

Allegan Conservation District

The Macatawa watershed is adjacent to Lake Michigan, where phosphorus and sediment are the major pollutants of concern. The Allegan Conservation District (ACD) determined that cover crops were a critical practice for achieving pollution reduction goals. ACD is providing technical support for a GLRI grant awarded to the Macatawa Area Coordinating Council to improve water quality in two agriculturally dominated sub watersheds of the Macatawa and worked with GLCCI to increase cover crop adoption.³³ Mark Ludwig, Project Manager at the Allegan Conservation District, established the Soil Health Working Group meeting series to encourage farmer to farmer education on soil health (also posted to You Tube). Cost assistance was offered for cover crops in 2012, three farmers enrolled 162 acres. Outside of the project area, additional cover crops were planted without compensation. Ludwig notes, **"Cover crops are gaining popularity due to their bottom line advantages.** We're making considerable progress by promoting cover crops as part of a system including reduced tillage and careful attention to soil health issues. The early adopters are showing that it's possible to have good conservation outcomes while maintaining yields and reducing expenses such as fuel costs. We need to reframe the conservation message in terms of economic advantage rather than sacrifice for the greater good."

Christina Curell of Michigan State University credits their success to **timing** and to the **reputation of the professionals** engaged in the initiative. Well-known educators with established contacts work alongside conservation districts and with NRCS, providing technical assistance and helping to distribute cost share assistance. When asked why farmers adopt cover crops in the region, Curell says that, though every farmer is different, "it comes back to money. It's an economical decision." Wind and water erosion is a big issue in the Great Lakes. Cover crops increase the water-holding capacity of the soil and make farming more sustainable."³²



Michigan Case Study at a Glance

- State and federal funding provide foundation for support through:
 - The Great Lakes Restoration Initiative (GLRI), and
 - Michigan Agricultural Environmental Assurance Program (MAEAP).
- MAEAP verified farms planted 40,557 acres of cover crops from 2010-2012.
- Great Lakes Cover Crop Initiative is funded through GLRI.
 - Goal: Increase cover crop acreage by 15,000 in 3 years.
 - Achieved: 20,000 cover crop acres in 18 months.



“Some farmers have been champions, and that is our trick of the trade. Champions demonstrate the practices and set the pace for their neighbors.”

—Melissa Higbee, Shiawasee Conservation District

Shiawassee Conservation District

In the impaired Shiawassee River watershed, the headwaters to the Saginaw Bay, the Shiawassee Conservation district also works with GLCCI and MAEAP. According to Melissa Higbee, Shiawassee Conservation District's Executive Director, the district held its first annual workshop in 2009 as a response to producer demand.³⁴ NRCS provided cost assistance for planting cover crops, and the conservation districts held sign-ups. Over 200 farmers took advantage of cost assistance over the three year period; some farmers even planted cover crops without receiving this benefit. Higbee says that “we have had a lot more signups in the past three years. Some farmers have been champions, and that is our trick of the trade. Champions demonstrate the practices and set the pace for their neighbors. Cover crops are not just a buzz word now, there is a lot more implementation.”³⁴

Photo credits:
Allegan Conservation District.

Iowa Develops Leaders

Iowa contributes between 10 to 17 percent of nitrogen and 5 to 10 percent of phosphorus pollution delivered to the Gulf of Mexico.³⁵ The Iowa State Nutrient Reduction Strategy has a goal of reducing nutrient loads to the Gulf by 45 percent. The strategy's science assessment points to cover crops as the most effective practice for achieving nutrient reductions.^{9,36} Iowa's Nutrient Reduction Strategy indicates cover crops may be planted on 60-95 percent of row crop acres in Iowa (23 million acres are planted to row crops in Iowa – that is nearly 70 percent of land area in the state).^{35, 37} If all corn-corn and corn-soybean acres were planted to cover crops, then the baseline of nitrogen and phosphorus loading would be reduced by 28% and 50%, respectively.⁹

Although the nutrient reduction strategy is still in development, cover crop outreach efforts are already going strong in Iowa. Several groups have been strong proponents of cover crop adoption in the state, including NRCS, Practical Farmers of Iowa (PFI), and Iowa Learning Farms. PFI has been specializing in on-farm research and farmer-to-farmer outreach since 1985, beginning their cover crop work with funding from Green Lands Blue Waters in 2007, followed by a 2009 grant from Sustainable Agriculture Research and Education (SARE), Iowa Department of Agriculture and Land Stewardship, and the Walton Family Foundation.³⁷

In 2009, PFI began to partner with Iowa Learning Farms, the National Laboratory for Agriculture and the Environment, and the Leopold Center, to create the Iowa Cover Crop Working Group. Based on the philosophy that peers learn best from peers, the Iowa Cover Crop Working Group began **increasing leadership training**



Credit: Practical Farmers of Iowa.

Iowa's Nutrient Strategy points to cover crops as the most effective practice for achieving nutrient reductions.

to cover crop farmers. PFI recruits farmers to do on-farm research of new practices, which PFI rigorously designs. The research farmers host field days, providing a casual environment to learn about new practices and technologies. In the spring of 2013, PFI cover crop farmers and staff cooperated on 34 events (workshops, field days, and conference sessions) with 1,605 farmers attending – a dramatic increase from previous years.³⁷ In all of 2012, PFI held 15 field days with 700-800 in attendance.

Iowa Case Study at a Glance

- Iowa Nutrient Reduction Strategy has a goal of 45% reduction in nutrient loading to the Gulf. The strategy outlines several nutrient reduction scenarios that would include cover crops as a means to achieving nutrient reduction goals.
 - One scenario proposes planting 60% of 21 million acres (12.6 million acres) of corn and soy acres with cover crops, as part of the nutrient reduction strategy.
 - Another scenario proposes planting 95% of corn-soybean planted acres to cover crops.
 - If all 21 million corn-corn and corn-soybean acres were planted to cover crops, the following reductions are possible (from the baseline):
 - 28% of nitrate loading (79,000 short tons)
 - 50% of phosphorus loading (8,500 short tons).
- Practical Farmers of Iowa promotes cover crops with leadership development and grassroots outreach efforts. PFI's outreach effort paves the way and serves as a model and vehicle for a larger statewide effort when and if the nutrient reduction strategy is implemented.



Credit: Practical Farmers of Iowa.

Sarah Carlson, Research and Policy Director for PFI, says that fear of water quality regulations has been a concern for Iowa farmers for the past five years, and now that the Iowa Nutrient Reduction Strategy has been released with an emphasis on cover crops, the subject often comes up in meetings.³⁷ When and if the strategy is implemented, PFI's outreach efforts will have paved the way and will be of great value to other parties wishing to increase cover crop adoption in Iowa. Says Carlson, "if the Iowa Department of Agriculture and Land Stewardship (IDALS) says that we need to have 60% of cropland in the state in cover crops...I think it's really possible to do that. We have the pieces in place."^{37,38}

Investing in Cover Crops Yields Record-Breaking Growth in Maryland

For decades, the Chesapeake Bay's nutrient pollution problems have been the focus of an intensive restoration effort. Over the years, regional and national entities have entered into agreements to set numeric goals for reducing pollution in the Bay.³⁹ Since 2009, the jurisdictions of the Chesapeake Bay (Delaware, the District of Columbia, Maryland, New York, Pennsylvania, Virginia, and West Virginia) have set two-year short-term restoration goals for the Bay.³⁹ In Maryland especially, cover crops have been a key part of accomplishing short term nutrient reduction goals.

Since 1999, cover crops have been one of several agricultural best management practices supported through the Maryland Agricultural Water Quality Cost-Share (MACS) Program, funded by the state's Chesapeake Bay Restoration and Chesapeake Bay Trust Funds.⁴⁰ MACS is part of a larger strategy to improve water quality in the Chesapeake Bay.⁴¹ Maryland Department of Agriculture (MDA) and the soil conservation districts in the state administer the program.^{40,42} Maryland's 2013 Chesapeake Bay milestone goal for cover crops was to plant 355,000 acres of cover crops; MDA surpassed this goal by 21% during the 2011-2012 planting season.^{40,41} MACS estimates that the cover crop plantings prevented 2.58 million pounds of nitrogen and 86,000 pounds of phosphorus from entering Maryland waterways.⁴¹

How did Maryland Department of Agriculture exceed their goal? A local conservation district attributes the program's success to **attractive reimbursement rates, easy enrollment, and consistent funding.**⁴³



Credit: Maryland Department of Agriculture.

Cover crop plantings prevented 2.58 million pounds of nitrogen and 86,000 pounds of phosphorus from entering Maryland waterways.



Credit: Maryland Department of Agriculture.



Credit: Maryland Department of Agriculture.

Maryland Case Study at a Glance

- Chesapeake Bay Trust and Restoration Funds provide the funding for:
 - Maryland Agricultural Water Quality Cost-Share (MACS) Program
- Maryland Department of Agriculture's Cover Crop Program is supported by MACS.
- Goal: 355,000 acres of cover crops by 2013.
 - Goal exceeded: Maryland planted 429,818 acres of cover crops by 2012 (over 40% of cropland acres).
 - In 2013, the program signed up 600,000 acres (60% of eligible acres).
- Cover crops prevented nutrient runoff by:
 - 2.58 million pounds of nitrogen, and
 - 86,000 pounds of phosphorus.
- Program strengths:
 - consistent funding (\$19.8 million in 2011-2012),
 - attractive cost-shares,
 - program consistency, and
 - heavy promotion.

The Maryland Cover Crop Program also promotes their program to great effect, and uses an adaptive approach to make small tweaks along the way while maintaining overall consistency.⁴²

In 2006, when the Chesapeake Bay Restoration fund was established as a permanent funding source, MDA took steps to assess and improve the program by soliciting feedback from Maryland farmers, by means of a questionnaire developed by The Schaefer Center for Public Policy. The results helped MDA tailor the cover crop program. MDA repeated the questionnaire in 2009 and adapted the program once again.⁴² MACS now offers two different cost-share options; one for farmers who plan to harvest their cover crops and another for farmers who did not plan to harvest, and offers bonuses for better management practices; the cost shares offered are \$25-35/acre and \$45-55/acre, respectively.⁴¹

MDA found that while small changes improved the program, **overall consistency was important to farmers, who need to know what to expect as they plan ahead each year.** MDA followed up the two surveys by the Schaefer Center with a smaller one of their own to see how the changes were working. “Our numbers have gone up since. Feedback has been a big plus,” says Dawn Bradley of MDA.⁴² In addition to periodic surveys, a technical advisory committee of farmers, district personnel, University of Maryland researchers, and NRCS meets each year to assess the previous year’s program and find opportunities for improvement.

MDA has a strong outreach effort, advertising the program through direct mail, signage, newspaper ads and feature articles, phone calls, and even bumper stickers.⁴² Each year, the program sends a reminder to sign-up for the cover crop, using a mailing database for farmers in the state of Maryland, and a list of approximately 5000 past participants. Local businesses are enlisted to display large banners advertising the program.

Clearly the program works for Maryland. NASS statistics show that Maryland has 940,000 cropland acres available for planting cover crops – by 2012, farmers had planted **428,818 acres.** By 2013, the program has enrolled 600,000 acres, or 60% of eligible acres.⁴²

Common Elements of Success

While each of the six case studies applied different methods of increasing cover crop adoption, they also share some common elements that were crucial to their success. Entities involved in each of these case studies found ways to reduce nutrient pollution through innovative partnerships to encourage agricultural producers to adopt cover crops on agricultural land.

Each of the case studies used a variety of **outreach methods**, including **media, other advertisements in the community, individual outreach, field demonstrations, and meetings** or workshops (see **Table 1**). Nearly every program employed some sort of

individual, one-on-one outreach. Although mail, e-mail, and phone calls were used, program staff emphasized that their **personal outreach** to individual farmers was crucial to program success.

In addition to outreach tools, each of the six case studies covered in this report possess a number of other **common elements of program design** or management (see **Table 2, page 19**).

The programs start with a **water quality goal**, and then seek the means to implement a non-point source strategy, usually by securing **state or federal funding**. Most of the programs involve some sort of **cost assistance for farmers** implementing the practice. Some offered **technical assistance or leadership training**. Many of the programs did not focus solely on cover crops, but included cover crops as a **systems approach** for achieving good farm management and better water quality. A few programs focused on **targeting** cover crop acres where they will be most beneficial. Most of the programs **measured progress toward a quantitative goal** (such as a number of acres), and built the method and metrics for measuring success into their program design. All of the programs relied on successful **partnerships**.

Table 1: Common Outreach Methods Used by Successful Cover Crop Initiatives.

Outreach Methods	Jasper SWCD, IN	Vermillion SWCD, IN	GLCCI, Allegan, and Shiawassee in Michigan	Practical Farmers of Iowa	Miami Conservancy District, OH	Yahara WINs, WI	Maryland Cover Crop Program
Media (Newsletters, Reports, Radio)	✓		✓	✓	✓	✓	✓
Other Advertisement (Signs, flyers)	✓	✓	✓	✓		✓	✓
Individual Outreach (Mail, e-mail, phone calls, staff visits with farmers)	✓	✓	✓	✓	✓	✓	✓
Demonstration Plots/Field Days	✓		✓	✓		✓	
Group Meetings/Workshops	✓	✓	✓	✓		✓	

Note Table 1 and 2 are not score cards to compare the different initiatives to each other, but to illustrate the most common elements appearing in multiple programs.

Conclusion

Each person who was interviewed for these case studies chose to emphasize different **keys** to their respective programs' success, summarized in the following list.

- Stakeholder involvement
- Easy implementation
- Easy enrollment
- Adaptive approach/flexibility
- Farmer-to-farmer approach/champions
- Building trust/reputation of experts
- Visual evidence (demonstration plots)
- Technical assistance from qualified experts
- Consistent funding
- Attractive reimbursement rates
- Program consistency
- Bottom line advantages of cover crops
- Timing

It was also clear from conducting interviews that **enthusiasm** is a key to success - enthusiasm for cover crops, conservation practices, and a job well done. With the proper support and enthusiastic, dedicated program staff, many more innovative strategies to promote cover crops will evolve.

While the level of success and cost effectiveness will vary across different incentive programs, it is clear from these examples that cover crops can be a valuable tool to reduce nutrient pollution and help meet water quality goals in a cost-effective manner. Although cover crop programs may encounter barriers – a lack of funding, a lack of flexibility in methods to meet pollution control requirements or the uncertainty of pursuing a non-traditional, non-point source strategy – the costs are much lower than implementing expensive infrastructure.

Going forward, program leaders can use pilot projects to reduce risk and test results. State and federal authorities can also increase opportunities for regulated point source entities by adopting policies that encourage cooperation with non-point sources to achieve water quality goals.

The continued success of cover crop outreach programs across the United States will pave the way to a future with clean water.

Table 2: Common Elements of Program Design.

Program Components	Jasper SWCD, IN	Vermillion SWCD, IN	GLCCI, Allegan, and Shiawassee in Michigan	Practical Farmers of Iowa	Miami Conservancy District, OH	Yahara WINs, WI	Maryland Cover Crop Program
Cost-Share	✓	✓	✓		✓	✓	✓
Quantitative Goal	✓		✓			✓	✓
Targeting for Impact	✓		✓		✓		✓
Focus on one-on-one interaction with farmers	✓	✓	✓	✓	✓	✓	
Impending/Active Nutrient Criteria as Driver	✓		✓	✓	✓	✓	✓
Part of Systems Approach		✓		✓	✓	✓	✓
Multi-Stakeholder Partnerships			✓	✓	✓	✓	✓
Federal or State Funding	✓	✓	✓	✓	✓	✓	✓
Leadership Training/Emphasis on Champions			✓	✓			
Emphasis on Feedback and Adaptation					✓	✓	✓
Actively Measuring Progress/Impacts		✓		✓	✓	✓	✓

Sources

- ¹ Description of the Council & What We Do. *Watershed Agricultural Council* (2013). at http://www.nycwatershed.org/aw_description.html
- ² Water | Region 2. US EPA (2010). at <http://www.epa.gov/region2/water/nycshed/filtad.htm>
- ³ National Summary of Impaired Waters and TMDL Information. US EPA (2013). at http://iaspub.epa.gov/waters10/attains_nation_cy.control?p_report_type=T
- ⁴ Gulf of Mexico | Nutrient Policy Data. US EPA (2013). at <http://www2.epa.gov/nutrient-policy-data/gulf-mexico>
- ⁵ Kovar, J. L., Moorman, T. B., Singer, J. W., Cambardella, C. A. & Tomer, M. D. Swine manure injection with low-disturbance applicator and cover crops reduce phosphorus losses. *J. Environ. Qual.* **40**, 329–336 (2011).
- ⁶ Kramer, J. M. *Analysis of Phosphorus Control Costs and Effectiveness for Point and Nonpoint Sources in the Fox-Wolf Basin*. (Resource Strategies, Inc., 1999). at <http://www.ecw.org/ecwresults/foxwolfbasin.pdf>
- ⁷ Nutrient Reduction Strategy Framework for Ohio Waters - Draft. (2011). at http://epa.ohio.gov/portals/35/documents/nutrient_reduction_strategy_framework.pdf
- ⁸ Broz, B. Committee searching for nutrient reduction strategies. *University of Missouri Extension* (2013). at <http://extension.missouri.edu/news/DisplayStory.aspx?N=1704>
- ⁹ Iowa Nutrient Reduction Strategy. (2012). at <http://www.nutrientstrategy.iastate.edu/sites/default/files/documents/NRSfull.pdf>
- ¹⁰ Hall, S. Miami Conservancy District nutrient trading program, personal communication to Lara Bryant, April 23. (2013).
- ¹¹ Great Miami River Watershed Water Quality Credit Trading Program. *Miami Conservancy District* at http://miamiconservancy.org/water/quality_credit.asp
- ¹² McGlinch, G. Darke County Soil and Water Conservation District, cover crops as part of nutrient trading program. Personal communication to Lara Bryant, March 12. (2013).
- ¹³ Soil & Water Resources: Load Reduction. *Ohio Department of Natural Resources* at <http://www.dnr.state.oh.us/tabid/24157/Default.aspx>
- ¹⁴ Newburn, D. A. & Woodward, R. T. An Ex Post Evaluation of Ohio's Great Miami Water Quality Trading Program1. *JAWRA Journal of the American Water Resources Association* **48**, 156–169 (2012).
- ¹⁵ Yahara Lakes History & Setting. - *Office of Lakes and Watersheds - Dane County, Wisconsin* at <http://www.danewaters.com/articles/historyandsetting.aspx>
- ¹⁶ Lake, K. Yahara WINs pilot project, personal communication to Lara Bryant. (2013).
- ¹⁷ Heilman, D. Yahara Pride Farms Cover Crop Outreach, personal communication to Lara Bryant. (2013).
- ¹⁸ Wisconsin's adaptive management. *Wisconsin Department of Natural Resources* (2013). at <http://dnr.wi.gov/topic/SurfaceWater/adaptiveManagement.html>
- ¹⁹ Madison Metropolitan Sewerage District. *Yahara WINs Pilot Annual Report 2012*. (Madison Metropolitan Sewerage District, 2013). at <http://www.madsewer.org/YaharaWINs/Resources/Annual%20Report%202012.pdf>
- ²⁰ Clean Lakes Alliance. at <http://www.cleanlakesalliance.com/>
- ²¹ Clean Water Indiana. *Indiana State Department of Agriculture* at <http://www.in.gov/isda/2379.htm>
- ²² NRCS. Indiana Soil Health Successes. (2011). at <http://www.in.nrcs.usda.gov/technical/Soil%20Health/Indiana%20Soil%20Health%20Successes.pdf>
- ²³ State Fact Sheets: Indiana. *USDA Economic Research Service* (2013). at <http://www.ers.usda.gov/data-products/state-fact-sheets/state-data.aspx?StateFIPS=06&StateName=California#.UXqxJVGcHnh>
- ²⁴ Conservation Cropping Systems Initiative. at <http://www.in.gov/isda/ccsi/>
- ²⁵ Total Maximum Daily Loads (TMDLs) and Stormwater. EPA (2012). at http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/stormwater_index.cfm#introduction
- ²⁶ Clean Water Act Section 319. EPA (2013). at <http://water.epa.gov/polwaste/nps/cwact.cfm>
- ²⁷ Dan Perkins. Jasper and Newton County Soil and Water Conservation District's cover crop outreach effort, personal communication to Lara Bryant. (2013).
- ²⁸ Leader, M. Regional collaborative effort in Indiana, personal communication to Lara Bryant. (2013).
- ²⁹ About | Michigan Agriculture Environmental Assurance Program. at <http://www.maeap.org/about>
- ³⁰ Wilford, J. FY 2010, 2011, 2012 MAEAP Environmental Outcomes; personal communication to Lara Bryant. (2013).
- ³¹ Carey, J. *The Case for Farm Bill Conservation Programs in the Great Lakes Region*. (Healing Our Waters-Great Lakes Coalition, 2012). at <http://www.nwf.org/~media/PDFs/Regional/Great-Lakes/03-21-12-Great-Lakes-Farm-Bill-Report.pdf?dmc=1&ts=20130418T1548567656>
- ³² Currell, C. Great Lakes Cover Crop Initiative, personal communication to Lara Bryant. April 12. (2013).
- ³³ Ludwig, M. Allegan Conservation District cover crop project, personal communication to Lara Bryant. April 12. (2013).
- ³⁴ Higbee, M. Shiawassee Conservation District cover crop outreach effort, personal communication to Lara Bryant. March 12. (2013).
- ³⁵ Caspers-Simmet, J. Iowa Nutrient Reduction Strategy to reduce nitrogen, phosphorus loads in water here and at Gulf. *Agri News* (2013). at <http://www.agrinews.com/iowa/nutrient/reduction/strategy/to/reduce/nitrogen/phosphorus/loads/in/water/here/and/at/gulf/story-5146.html>
- ³⁶ Carlson, S. Cover Crops: Right Practice, Right Time. *American Agriculturist* (2013). at <http://farmprogress.com/story-cover-crops-right-practice-right-time-14-95152>
- ³⁷ Carlson, S. Practical Farmers of Iowa's cover crop outreach effort, personal communication to Lara Bryant. March 29. (2013).
- ³⁸ Andrews, A., Carlson, S. & Brown, C. Iowa Learning Farms Cover Crop Workshop at Dordt College | Iowa State University Extension and Outreach. (2013). at <http://www.extension.iastate.edu/node/16815>
- ³⁹ Chesapeake Bay Program. What Guides Us - *Chesapeake Bay Program*. Chesapeake Bay Program (2012). at <http://www.chesapeakebay.net/track/guides>
- ⁴⁰ Governor O'Malley Announces Record Cover Crop Acreage Planted by Maryland Farmers. *Maryland Department of Agriculture* (2012). at <http://news.maryland.gov/mda/press-release/2012/02/21/governor-omalley-announces-record-cover-crop-acreage-planted-by-maryland-farmers/>
- ⁴¹ MACS. *Maryland Agricultural Water Quality Cost-Share Program Measure for the Bay: 2012 Annual Report*. (Maryland Department of Agriculture, 2012). at http://mda.maryland.gov/resource_conservation/counties/MACSA2012final.pdf
- ⁴² Bradley, D. Maryland Cover Crop Program, personal communication to Lara Bryant. March 29. (2013).
- ⁴³ Maryland Cover Crop Program. *Queen Anne's Soil Conservation District* (2011). at <http://www.qascd.com/maryland-cover-crop-program/>

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