Appendix H

Analysis of Investments & Outcomes Using Data from GLRI Focus Area 3 Projects & Program Reports

Researching the Effectiveness of Agricultural Programs

Analysis of Investments & Outcomes Using Data from GLRI FA3 Projects & Program Reports

FINAL

October 2019

Sarah Kruse, PhD

Tess Gardner, MSEM

AMP Insights

Acknowledgements

This report was funded by the Great Lakes Commission as part of Researching Effectiveness of Agricultural Programs (REAP), Cooperative Agreement GL-OOEO2209-0.

Contents

List of Figures

List of Tables

ACRONYMS

CoA	Census of Agriculture
CP	Conservation Practice
CRP	Conservation Reserve Program
CSP	Conservation Stewardship Program
CTA	Conservation Technical Assistance
EQIP	Environmental Quality Incentives Program
EWG	Environmental Working Group
GLC	Great Lakes Commission
GLRI	Great Lakes Restoration Initiative
IA	Interagency Agreement
NRCS	Natural Resources Conservation Service
OSU	The Ohio State University
PI	Principal Investigator
REAP	Researching Effectiveness of Agricultural Programs
US	United States
USGS	United States Geological Survey
WHIP	Wildlife Habitat Incentives Program

Executive Summary

This report has been produced in support of the project known as Researching the Effectiveness of Agricultural Programs (REAP) funded under a Great Lakes Restoration Initiative (GLRI) Cooperative Agreement between the U.S. Environmental Protection Agency and the Great Lakes Commission. The objective of REAP is to evaluate the impact on long-term on-farm behavior as a result of GLRI Focus Area 3 investments with four GLRI priority watersheds; the Genesee, Lower Fox, Maumee, and Saginaw watersheds. The analysis presented here is meant to serve as a starting point for determining if, and the degree to which, project design elements and funding structures impact socioeconomic outcomes.

This document describes the data available for analysis, provides a general overview of GLRI Focus Area 3 investments in the priority watersheds from 2010-2016 as well as summary outputs from analyses of project-level data including a) structure and elements of high-level projects; b) implementation of conservation practices (CPs); c) comparison of project elements with farm survey data provided by The Ohio State University (OSU); and d) cost effectiveness of various CP types. The document concludes with a summary ranking, an evaluation of projects and watersheds, and list of recommendations for future GLRI data collection based on findings from the previous sections.

Summary outputs of project-level data demonstrate that most projects involved multiple project elements (see Figure ES-1) and that the two project elements that are considered exemplary of Great Lakes Restoration Initiative projects – direct outreach and innovative capacity building – are included in 57% of the funded projects (see Figure ES-2). Overall the Maumee and Saginaw watersheds implemented the greatest percentage of projects with these two elements. It was also found that funding mechanism may play a role in the success that projects had in achieving stated goals for acres in conservation as a larger percentage of indirectly funded projects achieved the stated goals than directly funded projects. No conclusive pattern could be drawn between the achievement of stated conservation goals and project elements.

Figure ES-1. Total High-Level Projects by Number of Project Elements

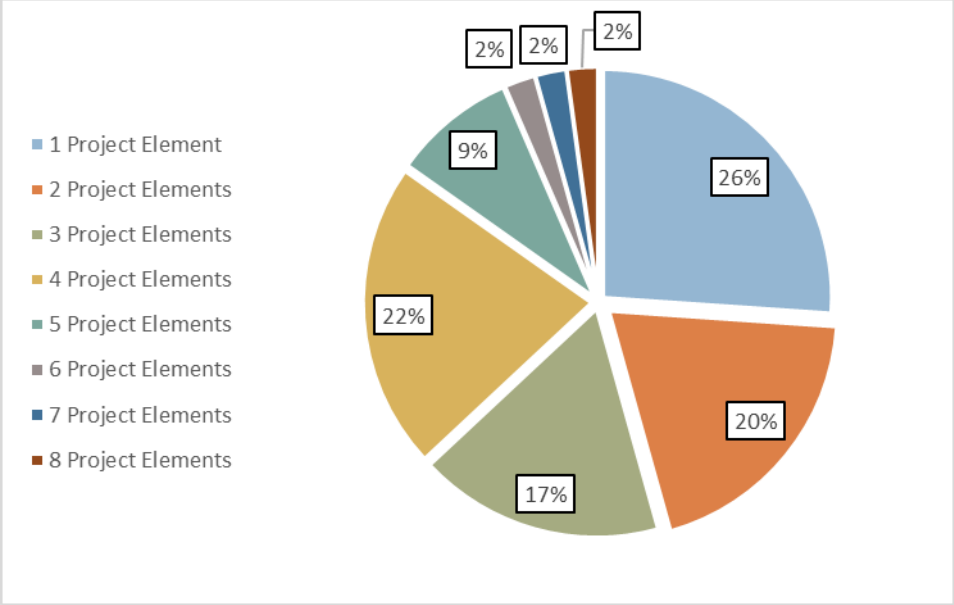
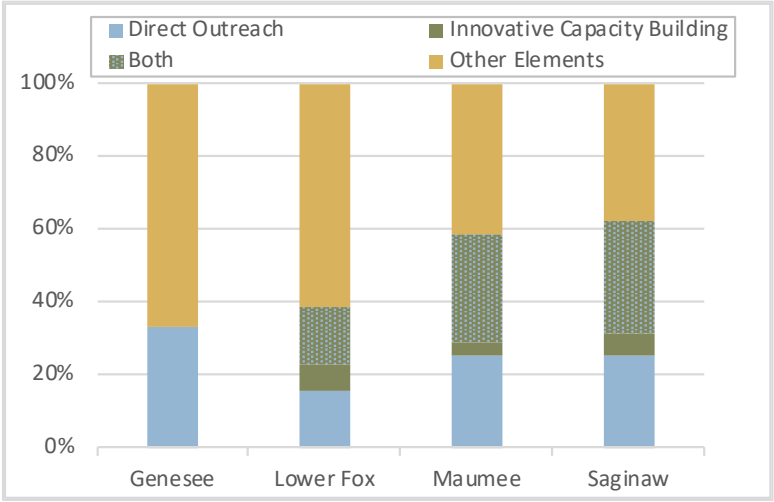


Figure ES-2. Projects with Direct Outreach and Innovative Capacity Building



The analysis of the implementation of conservation practices found that a majority of total project funding by watershed was allocated to conservation practices implementation, ranging from 53% (Maumee) to 68% (Genesee). The projects that funded conservation practices, however, were overwhelming indirectly funded projects (95%).

Of the 106 types of conservation practices implemented under these projects cover crops were the most frequently implemented conservation practice across all four watersheds both in total and in each watershed individually (see Table ES-1). In total, cover crops represented approximately a quarter of all conservation practices implemented. Outside of cover crops, however, variation was seen across the watersheds in terms of which conservation practices were most frequently implemented, and by units of conservation practices implemented, nutrient management (301,978 acres) and cover crops (275,876 acres) were the conservation practice types implemented on the greatest number of acres.

Table ES-1. CP Implementation by Type and Cost – Watershed

Practice Type	# of CPs	% of CPs in Watershed	Practice Type	$1000s	% of Funding in Watershed
Genesee			Genesee		
Cover Crop	62	12%	Waste Storage Facility	$ 2,025	37%
Heavy Use Area Protection	33	6%	Heavy Use Area Protection	$ 805	15%
Waste Transfer	33	6%	Cover Crop	$ 476	9%
Nutrient Mgmt	28	5%	Roofs and Covers	$ 413	8%
Prescribed Grazing	27	5%	Waste Transfer	$ 321	6%
Lower Fox			Lower Fox		
Cover Crop	258	16%	Waste Storage Facility	$ 4,466	32%
Critical Area Planting	126	8%	Cover Crop	$ 1,885	13%
Grassed Waterway	120	7%	Heavy Use Area Protection	$ 1,407	10%
Heavy Use Area Protection	106	7%	Waste Transfer	$ 760	5%
Mulching	103	6%	Waste Facility Closure	$ 717	5%

Table ES-1(Continued). CP Implementation by Type and Cost – Watershed

Practice Type	# of CPs	% of CPs in Watershed
Maumee		
Cover Crop	1,465	30%
Nutrient Mgmt	744	15%
Conservation Crop Rotation	480	10%
Amending Soil w/ Gypsum Produc	457	10%
Residue & Tillage Mgmt, No-Till	424	9%
Saginaw		
Cover Crop	349	24%
Nutrient Mgmt	304	21%
Integrated Pest Management	155	11%
Heavy Use Area Protection	70	5%
Residue & Tillage Mgmt, No-Till	58	4%

Practice Type	$1000s	% of Funding in Watershed
Maumee		
Cover Crop	$ 6,745	29%
Nutrient Mgmt	$ 4,328	19%
Conservation Crop Rotation	$ 2,738	12%
Residue & Tillage Mgmt, No-Till	$ 1,558	7%
Waste Storage Facility	$ 1,376	6%
Saginaw		
Nutrient Mgmt	$ 2,771	23%
Cover Crop	$ 2,346	19%
Agrichemical Handling Facility	$ 2,091	17%
Integrated Pest Management	$ 1,205	10%
Waste Storage Facility	$ 1,104	9%

The data reported for the projects themselves was primarily related to project structure, funding, and outputs such as acres of conservation achieved. The task of analyzing socioeconomic impacts by different project structures, however, required data on outcomes. To obtain this type of data, the results of a mixed mode survey conducted by the Wilson Lab, at OSU were used.

Based on the data available none of the intentions of the survey participants regarding participation in GLRI funded programs, current/future participation in government funded conservation programs, future use of cover crops, or future use of vegetative buffers were strongly correlated with inclusion of either a direct outreach element or an innovative capacity building element in a project. Where information on project structures failed to elucidate a clear correlation with survey results of interest, comparisons of survey data with applicable watershed characteristics were explored.

Across all project and watershed characteristics evaluated, however, animal sales as a percentage of total sales appeared to be the only characteristic that may influence the adoption of cover crops and vegetative buffers (see Table ES-2). It may be possible that cover crops are a more attractive CP in watersheds with higher animal sales as cover crops could be implemented on cropland devoted to producing feed crop for livestock. Since the cover crops themselves can also have value as feed crop, cover crops may be more widely implemented on cropland for livestock than on land where higher value crops may be grown or where there is less value to be gained from the growth of cover crops.

The results of the survey also indicated that, although agriculturalists in the four priority watersheds tend to rely on different sources of information – Genesee: Crop Advisor (34%), Lower Fox: Crop Advisor (45%), Maumee: Fertilizer Retailer (37%), Saginaw: University Extension (29%) – other local farmers were the information source stated to be most used “some” or “a lot” across the watersheds. This finding has bearing on how agriculturalists can be best engaged in future programs.

Table ES-2. Agricultural Sales, Cover Crops and Vegetative Buffers

Watershed	Average % Sales from Animals	More Cover Crops Next Year	Will Likely or Definitely Use Cover Crops w/o Incentives	More Buffers Next Year	Will Likely or Definitely Use Buffers w/o Incentives
Saginaw	32%	25%	58%	9%	39%
Maumee	39%	26%	56%	26%	55%
Genesee	69%	22%	76%	28%	55%
Lower Fox	79%	37%	66%	37%	58%

Finally, the project costs were examined from the only angle for which sufficient cost data were available – conservation practices by unit of conservation practice. This analysis of does not inform on the cost-effectiveness of the conservation practices with regard to impact on either water quality or socioeconomic outcomes, but rather provides some information on the least or most costly conservation practices per unit implemented and how these costs differ across watersheds (Table ES-3). Across all four watersheds combined, the most least costly conservation practice type was soil testing ($9/acre), followed by written integrated pest management plans ($13/acre). For the three practice types reporting implementation of more than 100,000 acres, integrated pest management was the most cost effective ($15/acre), followed by nutrient management ($25/acre) and cover crops ($42/acre).

Table ES-3. Cost of Conservation Practice Types by Watershed

	Genesee		Lower Fox		Maumee		Saginaw		Total	
Practice Type	Acres	Cost/Acre	Acres	Cost/Acre	Acres	Cost/Acre	Acres	Cost/Acre	Acres	Cost/Acre
Nutrient Mgmt	10,284	$ 8	28,671	$ 12	148,769	$ 29	114,254	$ 24	301,978	$ 25
Cover Crop	7,625	$ 62	57,623	$ 33	152,879	$ 44	54,988	$ 43	275,876	$ 42
Integrated Pest Mgmt			43,777	$ 16	18,555	$ 7	75,830	$ 16	138,162	$ 15
Residue & Tillage Mgmt, No-Till	4,711	$ 31	7,121	$ 11	67,917	$ 23	19,509	$ 12	99,258	$ 20
Conservation Crop Rotation			547	$ 11	44,856	$ 61	4,314	$ 4	49,716	$ 56
Soil Testing					37,131	$ 9			42,685	$ 9
Amending Soil Properties w/ Gypsum Prod					31,098	$ 26	5,330	$ 25	36,428	$ 26
Residue & Tillage Mgmt, Reduced Till			187	$ 12	25,443	$ 19	8,180	$ 16	33,810	$ 18
Heavy Use Area Protection	1,374	$ 586	6,611	$ 213	33	$ 3,331	18	$ 29,240	8,037	$ 356
Prescribed Grazing	1,578	$ 24	4,748	$ 53	157	$ 81	1,282	$ 32	7,764	$ 45
Conservation Tillage					7,313	$ 15			7,313	$ 15
Equipment Modification					5,767	$ 16			5,767	$ 16
Upland Wildlife Habitat Mgmt	3	$ 180	214	$ 3			4,025	$ 15	4,242	$ 14
Lined Waterway or Outlet	1,360	$ 28	1,325	$ 20	231	$ 49			2,916	$ 26
Forage and Biomass Planting	202	$ 290	1,333	$ 147	663	$ 152	164	$ 104	2,361	$ 157
Brush Mgmt					1,552	$ 81	470	$ 125	2,022	$ 91

This analysis of the impact of Great Lakes Restoration Initiative investments on socioeconomic impacts falls short primarily due to a lack of reported project outputs and data or long-term trends on project outcomes that can be analyzed alongside project data. As a result, this document concludes with a list of recommendations for future data collection related to this program. The recommendations, while not exhaustive, focus primarily on the importance of identifying the data needed to create relevant metrics and clearly defining such data at the beginning of each project, standardized reporting, consistently collecting data on outputs, and including the assessment of outcomes into projects themselves.

1. Introduction

This report has been produced in support of the project known as Researching the Effectiveness of Agricultural Programs (REAP) funded under a Great Lakes Restoration Initiative (GLRI) Cooperative Agreement between the U.S. Environmental Protection Agency and the Great Lakes Commission. The objective of REAP is to evaluate the impact on long-term on-farm behavior as a result of GLRI Focus Area 3 investments with four GLRI priority watersheds; the Genesee, Lower Fox, Maumee, and Saginaw watersheds. The analysis presented here is meant to serve as a starting point for determining if, and the degree to which, project design elements and funding structures impact socioeconomic outcomes.

This document is organized such that general information on how data were analyzed is described first. The next several sections of the document provide a general overview of GLRI investments in the priority watersheds from 2010-2016 as well as summary outputs from analyses of project-level data including a) structure and elements of high-level projects; b) implementation of conservation practices (CPs); c) comparison of project elements with farm survey data provided by The Ohio State University (OSU); and d) cost effectiveness of various CP practice types. The final section provides a summary ranking and evaluation of projects and watersheds based on findings from the previous sections.

2. Data

The primary source of data for analyses conducted as part of this effort was a database compiled by the REAP Project Management Team on the majority of GLRI Focus Area 3 investments distributed to the four priority watersheds – data were not included for GLRI investments in other focus areas. The database included two tabs – one on high-level projects and one on CPs implemented as part of the high-level projects. The information on the CPs was considered to be incomplete, but still was useful in understanding how and where GLRI funds were distributed.

A second source was data collected as part of mixed mode survey conducted by the Wilson Lab, at OSU. In early 2019, the OSU team mailed surveys to a stratified sample of farmers in all counties intersecting the four priority watersheds. Respondents could fill out the mail version or respond online. In order to ensure confidentiality, the OSU team provided survey results aggregated to the county-level for specific questions relevant to this effort.

3. GLRI Project Output Analysis

The total number of high-level projects funded by the GLRI from 2010-2016 was 34, with eight of the 34 projects implemented over multiple priority watersheds. Separating these projects by watershed resulted in a total of 59 projects (see Table 1). Within the high-level projects, a total of $95.8 million was recorded as GLRI funds distributed across the four priority watersheds over the time frame considered. It should be noted that the GLRI funds aggregated into the REAP Master Database may represent just the cost-share portion of project cost for government partners, such as those projects associated with NRCS.

Table 1. GLRI Focus Area 3 Projects and Funding by Watershed

Watershed	GLRI Funded Projects	Project Funds ($1000s)
Genesee	6	$ 7,994
Lower Fox	13	$ 24,321
Maumee	24	$ 43,999
Saginaw	16	$ 19,495

Funding for GLRI projects was allocated towards eight project elements (see Table 2). Information in the database was not specific enough, however, to parse out the funding allocated within each project to the specific project elements; however, the distribution and frequency of project elements across high level projects is assessed in Section 3.1.

Table 2. Project Elements

Project Element	Definition
CP Installation	Project funds provide monetary incentives to offset costs of CPs to benefit water quality
Outreach (Direct)	Project funds used to support in-person public and private meetings and individual interactions
Outreach (Indirect)	Project funds dedicated to producing mailers, press releases, fact sheets, newsletters, websites
Capacity Building (Traditional)	Project funds used to help existing agencies/programs increase implementation of widely-adopted traditional CPs
Capacity Building (Innovative)	Project funds used to help expand the use of innovative tools, methods, and CPs, that are not currently available through other major federal and state agricultural incentive programs
Monitoring & Research (Edge of Field)	Project funds allocated to measuring nutrient runoff leaving fields before it enters waterways
Monitoring & Research (Other)	Project funds allocated to measuring nutrients in-stream and in open water
Decision Support Tool Development or Application	Project funds supporting the development and usage of models and databases created to improve on-farm decision making and assist with strategic water quality investments

GLRI funding also could be categorized by the funding distribution pathway. First, grants could either be given to a non-Federal agency or a Federal agency, the latter though an interagency agreement (IA). Grants also could be considered either direct or indirect funding – direct grants were awarded to the recipients(s) would directly carry out the project, while indirect grants were awarded to recipient(s) who did not directly carry out the project, but rather, distributed funds to one or more sub-grantees who would then carry out the project.

Overall, $68.7 million was distributed as indirect grants – where funding was distributed to an entity engaged in activities (e.g., outreach, capacity-building, monitoring, etc.) that included providing funds to a producers that installed CPs among other activities (72%) and $27.1 million was distributed as direct grants (28%) – where funding was distributed directly to a producer or entity that installed CPs.

As seen in Table 3, approximately two-thirds of GLRI investments were awarded through IAs. The majority of IA grants were funded directly (69%), while the number of non-federal agency grants were split almost evenly between direct (48%) and indirect (52%). While funding (in terms of dollar value) of

non-federal agencies was again relatively evenly split between direct (47%) and indirect (53%) grants, the majority of funding allocated to IAs was done through the indirect grants.

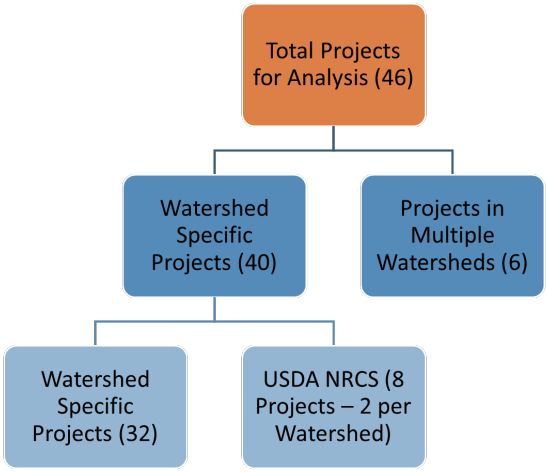
Table 3. Funding Distribution Pathways

	Funding Type	Non-Federal Agencies	Interagency Agreements
Projects (#)	Direct	16	9
	Indirect	17	4
	Total	33	13
Projects (% of Total by Recipient Type)	Direct	48%	69%
	Indirect	52%	31%
GLRI Investments ($1000s)	Direct	$ 16,438	$ 10,672
	Indirect	$ 18,433	$ 50,265
	Total	$ 34,872	$ 60,937
GLRI Investments (% of Total by Recipient Type)	Direct	47%	18%
	Indirect	53%	82%

3.1 Project Elements

As mentioned in the previous section, 34 unique high-level GLRI projects to reduce nutrient runoff from agricultural activities were implemented across the four priority watersheds between 2010 and 2016. Two of these 34 projects were subdivided to reflect investments in distinct priority watersheds and an additional six projects were implemented across two or more priority watersheds, but the reporting for these six projects was not broken out by watershed, so 46 projects were used for the purposes of analyzing project elements (see Figure 1).

Figure 1. High-Level Projects Analyzed

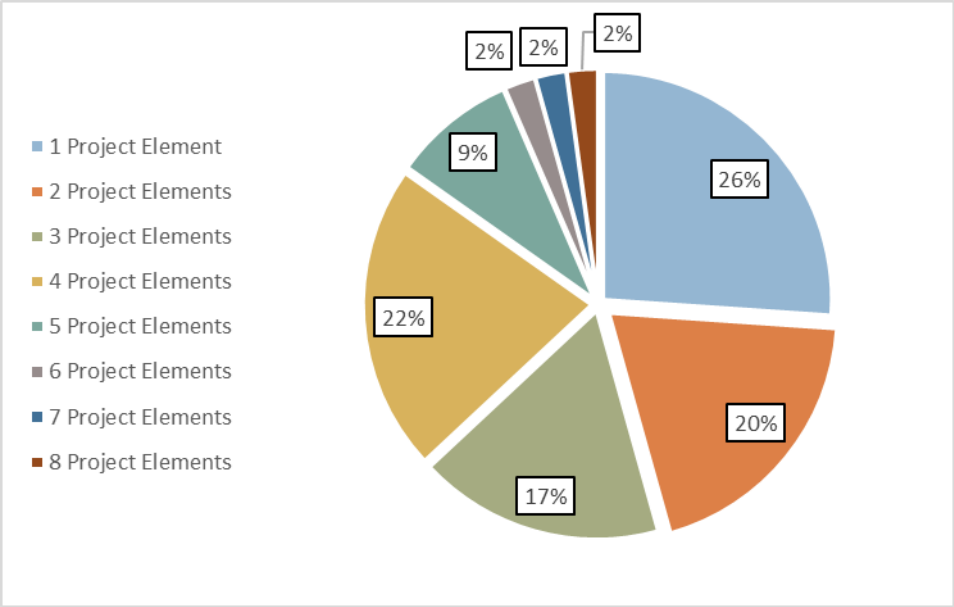


First, the number of project elements – conservation practices (CPs), direct outreach, indirect outreach, traditional capacity building, innovative capacity building, edge of field monitoring & research, other monitoring & research, and decision support tool development or application – undertaken by each project was calculated.

Of the 46 projects, the greatest percentage of projects (26%) implemented only one project element (see Figure 2), of which CP installation and edge of field monitoring & research were project elements most

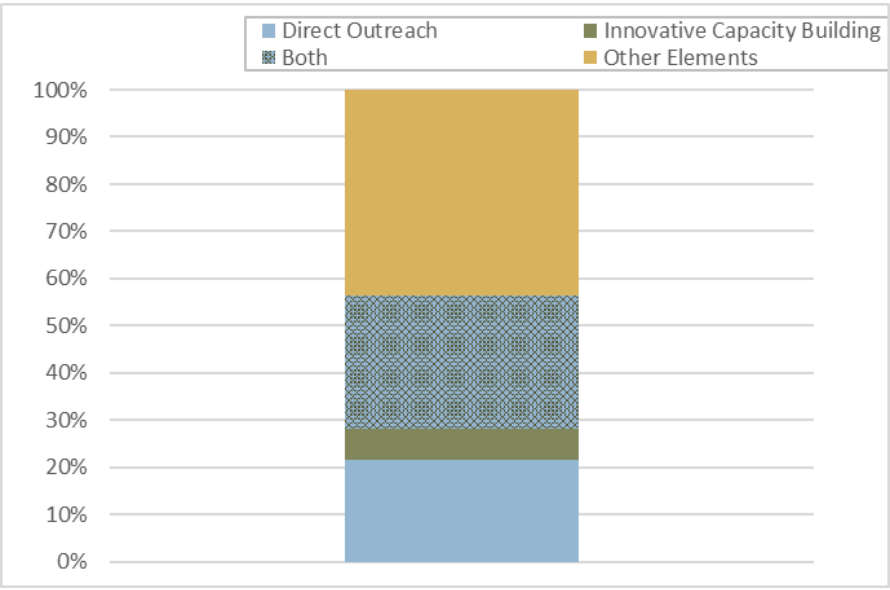
often implemented alone. The only project with all eight projects elements implemented occurred in the Lower Fox under the project titled *Targeting Outcome-Based Sediment Reduction in the Lower Fox Watershed*.

Figure 2. Total High-Level Projects by Number of Project Elements



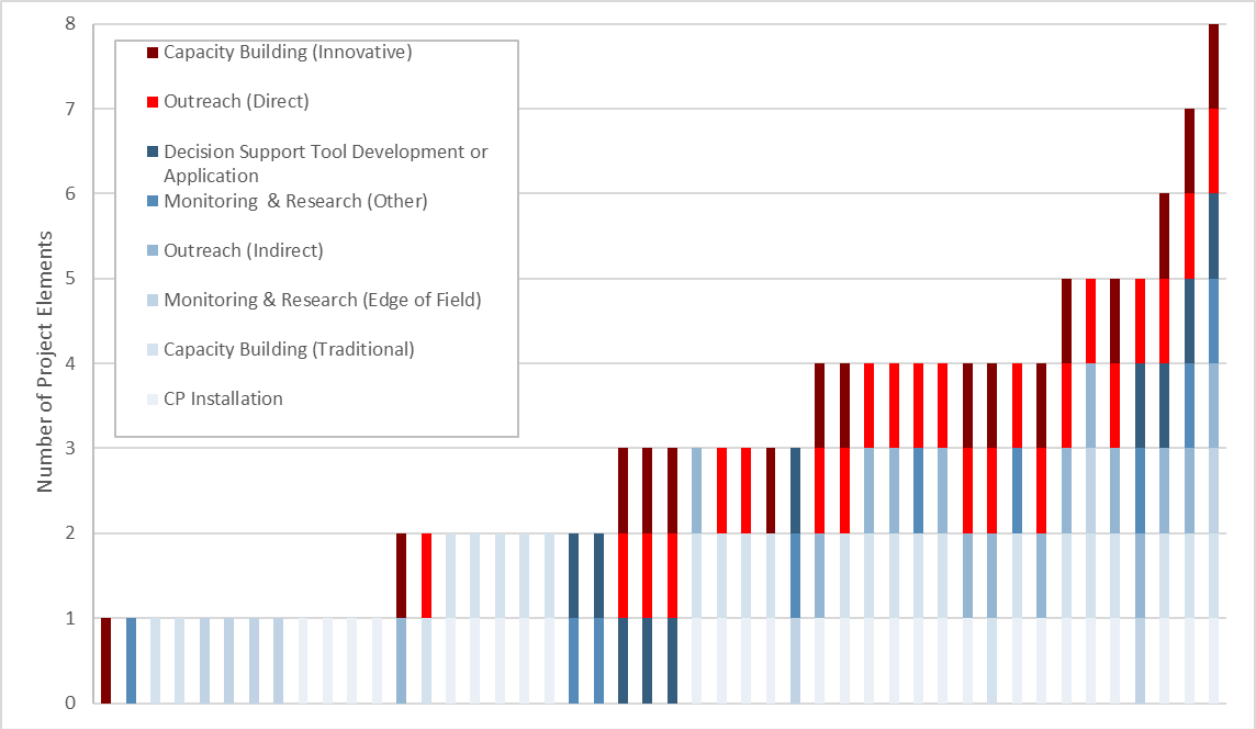
A more detailed analysis was done of two specific project elements – direct outreach and innovative capacity building – as they are elements exemplary of GLRI investment projects (as compared to traditional USDA-NRCS agricultural conservation programs that focus on direct payments to producers to install CPs), which aim to be more innovative than traditionally funded projects. Indeed, direct outreach and innovative capacity building appeared frequently in the 46 high-level projects with one of the two elements appearing in 57% of projects and both elements appearing in 28% (see Figure 3).

Figure 3. Projects with Direct Outreach and Innovative Capacity Building



These two elements, however, rarely appeared on their own as the only project element executed by a project. It is possible this result is a function of NRCS and USEPA policy and funding priorities that place a strong emphasis on CP installation. Of the 12 GLRI projects that implemented only a single project element, that project element was either direct outreach or innovative capacity building for only one project (see Figure 4). For projects with more elements, in which direct outreach and innovative capacity building appear more frequently, direct outreach was most frequently paired with CP installation and indirect outreach, while innovative capacity building was most frequently paired with direct outreach. Of the 15 projects that had multiple project elements, one of which was innovative capacity building, 13 also included direct outreach.

Figure 4. All Projects by Number and Type of Project Element



It also was of interest to explore how project elements were implemented differently across the four priority watersheds. For those six projects that were carried out in two or more watersheds, but not reported on separately, the project elements corresponding to that project were assumed to be implemented in each of the watersheds in which that project was active (see Table 4). It is interesting to note that CP installation was one of the most frequently used project elements in the Genesee and Lower Fox and that projects in both of these watersheds used innovative capacity building the least. In contrast, direct outreach was most frequently used by projects in the Maumee and Saginaw while edge of field monitoring and research was least used by projects in both these watersheds.

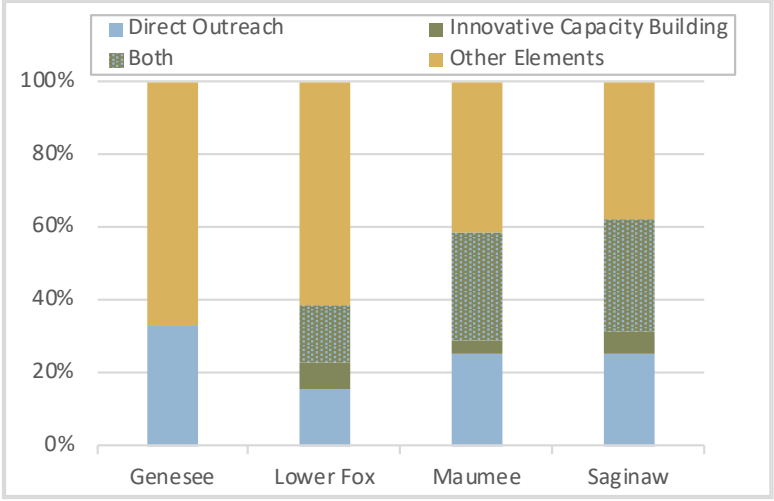
Table 4. Proportion of Projects by Project Element and Watershed

Watershed	CP Installation	Outreach (Direct)	Outreach (Indirect)	Capacity Building (Traditional)	Capacity Building (Innovative)	Monitoring & Research (Edge of Field)	Monitoring & Research (Other)	Decision Support Tool Development or Application
Genesee	50%	33%	33%	33%	0%	17%	50%	50%
Lower Fox	54%	31%	38%	54%	23%	31%	38%	38%
Maumee	46%	54%	29%	46%	33%	21%	25%	29%
Saginaw	50%	56%	38%	38%	38%	19%	25%	31%

Most frequently used within each watershed
Least frequently used within each watershed

The Maumee and Saginaw had the most direct outreach and innovative capacity building projects implemented in both raw values and as a proportion of total projects in the watershed (see Figure 5).

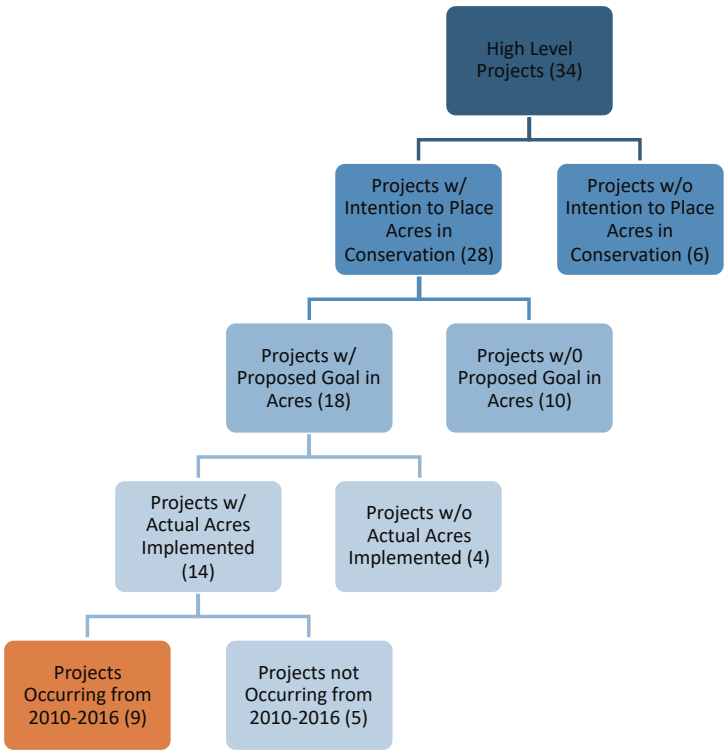
Figure 5. Projects with Direct Outreach and Innovative Capacity Building



3.2 Acres in Conservation

Twenty-seven of the 34 high-level projects (79%) intended to place acres in conservation, of which 18 were recorded as reporting a numerical proposed goal for acres in conservation. Of these 18 projects, 14 projects also reported actual acres in conservation in interim or final reports; however, only nine of the 14 projects had ended at or during the timeframe of interest (prior to 2016). For these nine projects, the acres in conservation were compared to the proposed acres in conservation to determine if the goal was met (see Figure 6).

Figure 6. Projects with Conservation Goals and Outcomes for Analysis



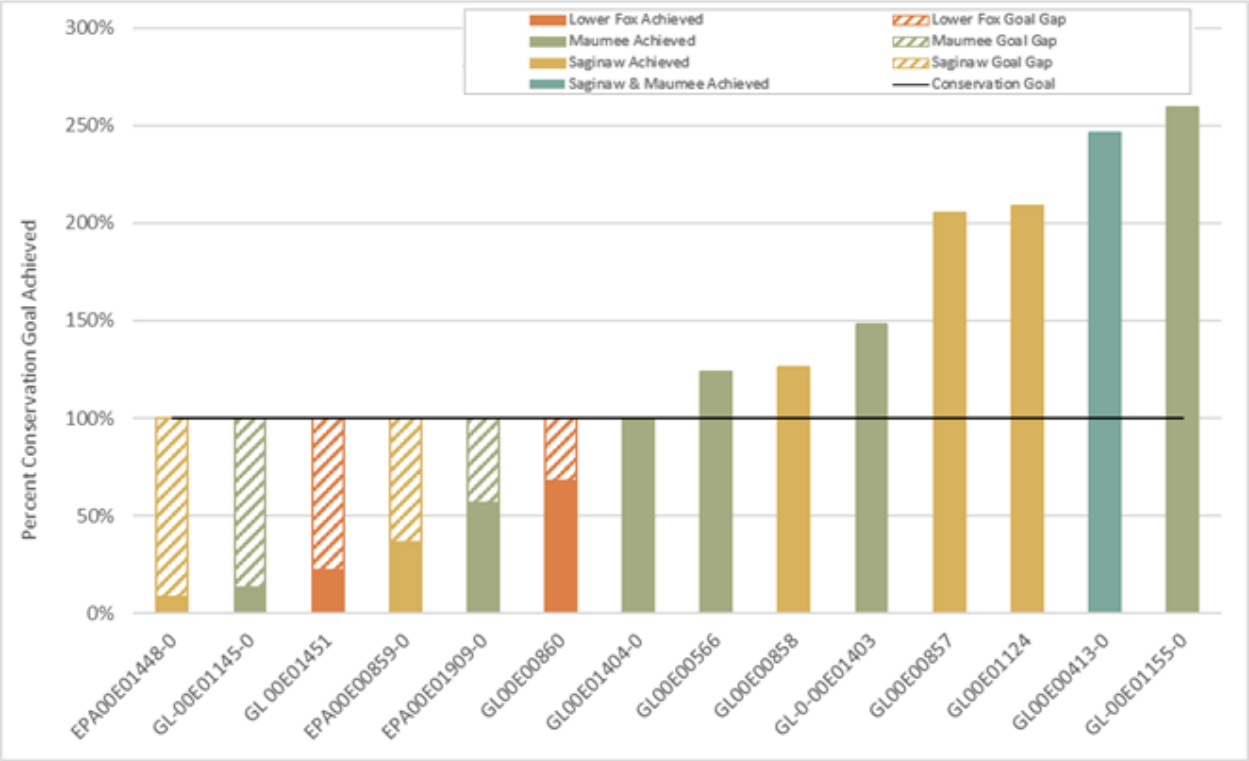
For the five projects with end dates after 2016, the proposed acres in conservation were divided by the project lifespan to get a per year figure for acres in conservation. This value was multiplied by the number of years of the project between its start date and the end of 2016. This value of estimated acres to be in conservation by the end of 2016 for the project to be on track with achieving the proposed acreage goal by the end of the project lifespan was then compared to the reported acres in conservation. This methodology necessarily makes assumptions about the processes involved in a project, such that projects for which there is a long planning process followed by quick implementation may be unfairly represented as in danger of not achieving the set conservation goal.

Overall, the number of actual acres of conservation slightly exceeded the proposed acres of conservation (see Table 5). This was not, however, due to each project achieving its stated conservation goal and was instead due to some projects exceeding their goal and making up for projects that fell behind their conservation goals (see Figure 7). Therefore, success in achieving conservation goals was not equal across projects or watersheds.

Table 5. Proposed Versus Actual Acres of Conservation Implemented Across All Reported Projects

Unit	Proposed	Actual
Acres	265,687	266,299
Percent of Proposed Acres		100%

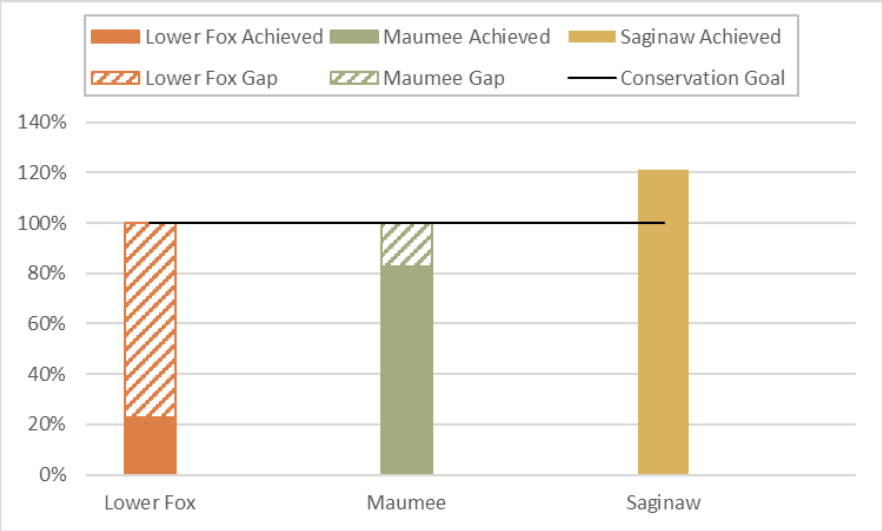
Figure 7. Proposed versus Actual Acres of Conservation by Reported Projects



Of those projects whose end date extended beyond 2016 and had not accomplished the project conservation goal (EPA00E01448-0, GL 00E01451, and EPA00E01909-0), none were on-track to achieve the proposed acres in conservation as assessed using the methodology described above. By watershed, the percentage of proposed acres of conservation actually accomplished (for those projects that reported both proposed and achieved acres in conservation) across all projects in Lower Fox, Maumee, and Saginaw were 23%, 83%, and 121% respectively (see Figure 8). Of the three projects in the Genesee, none reported both proposed and achieved acres in conservation.

As mentioned previously, not all projects had stated conservation goals that could be collected by the REAP PMT (either they did not exist or were not readily available through the documentation available to the REAP PMT) – including this as a requirement of projects in the future would allow for a more comprehensive assessment of GLRI investments.

Figure 8. Proposed versus Actual Conservation by Projects in Watersheds



Of the 14 projects whose success (or potential for success) at achieving the proposed acres in conservation could be assessed, the funding mechanism and projects elements were also tallied. Those projects that achieved or exceeded the conservation goal tended to be funded indirectly (see Table 6).

Table 6. Funding Mechanism for Projects Reporting on Achieved Acres in Conservation

Target Achieved	Direct Funding	Indirect Funding
Yes	2	5
No	5	2

Most of the 14 projects implemented three or more project elements with only one project apiece reporting one (achieved conservation goal), two (did not achieve goal), or eight (did not achieve goal) elements. There was no discernable trend in regards to the project elements present in projects that achieved their conservation goals as compared to those that didn't (see Table 7).

Table 7. Project Elements for Projects Reporting on Achieved Acres in Conservation

Target Achieved	CP Installation	Outreach (Direct)	Outreach (Indirect)	Capacity Building (Traditional)	Capacity Building (Innovative)	Monitoring & Research (Edge of Field)	Monitoring & Research (Other)	Decision Support Tool Development or Application	Outreach (Direct) and Capacity Building (Innovative)
Yes	6	6	5	6	3	1	1	0	3
No	7	5	5	5	4	1	1	2	4

Given that few discernible trends were identified from which conclusions could be drawn about the impact of project structures on the achievement of GLRI project conservation goals, it was of interest to see whether watershed characteristics might provide some potential explanatory correlations. One watershed characteristic in particular with potential to impact interest in conservation of agricultural lands is the tenure of agricultural operations (full ownership, part ownership, or tenant) with the hypothesis that a tenant would be less interested in investing in conservation of agricultural lands than a full owner. Although the four watersheds exhibited different trends with regards to percentage of total acres operated by tenure from 2007-2017, as reported in the Census of Agriculture (CoA), no discernible correlation was

uncovered between land tenure and the percentage of the proposed acres in conversation achieved, indicating that a range of factors (both project structure and watershed characteristics) likely impact conservation goals and these are difficult to observe with the limited data available.

4. Conservation Practices Output Analysis

While conservation practices (CPs) represent only one of the eight project elements identified for analysis in REAP, additional data points (e.g., practice type, units implemented, cost of implementation using GLRI funds, etc.) were collected on CPs allowing for more detailed analysis. One point that must be made when evaluating the number of CPs implemented and their aggregated costs is that many different types of CPs were funded and have been implemented with GLRI funding. The following summary statistics are not asserting that one CP is equal to another in regards to any characteristic such as type, scale, or effectiveness. In addition, the dataset on CPs does not specify if/when multiple CPs were implemented at a single location or if a single farmer or operation was the recipient of assistance to implement multiple CPs. Therefore, the total acreage that benefitted from CP implementation and the total number of farmers/operations engaged in the implementation of CPs through GLRI cannot be determined. For CPs that did report associated units implemented, estimates of total acreage that benefitted was calculated in Section 4.3.

4.1 Conservation Practices Summary

From 2010-2016, a reported $55.3 million (58%) of GLRI funding supported implementation of CPs in the four priority watersheds (see Table 8). It should be noted, however, that nine of the 23 GLRI funded projects reporting CP implementation did not include associated costs. Therefore, more than $55.3 million may have been spent to implement the 8,414 CP projects reported in Table 8. Almost half of reported GLRI funding directed at CPs went to efforts in the Maumee (42%), which implemented 58% of CPs reported.

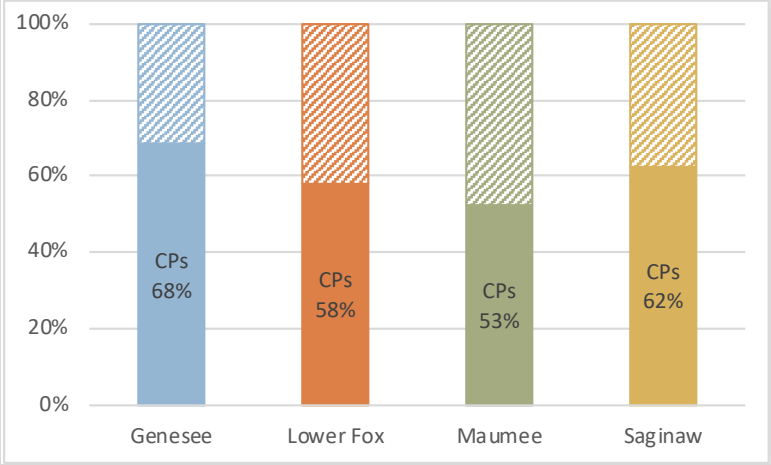
Table 8. Summary of Overall GLRI Focus Area 3 Funded Conservation Practice Implementation[1]

Output	Genesee	Lower Fox	Maumee	Saginaw	Total
Total GLRI Funding ($1000s	$ 7,994	$ 24,321	$ 43,999	$ 19,495	$ 95,809
GLRI CP Funding ($1000s)	$ 5,476	$ 14,062	$ 23,138	$ 12,135	$ 55,319
% Total Funding	8%	25%	46%	20%	—
% of Total CP Funding	10%	25%	42%	22%	—
# of CPs Reported	513	1,603	4,850	1,467	8,414
% of Total CPs Reported	6%	19%	58%	17%	—

Figure 9 shows the percentage of total GLRI Focus Area 3 investments in each watershed directed at CP implementation as reported in the REAP database. For all four watersheds at least half of total GLRI Focus Area 3 investments were spent on CP implementation, with the Genesee and Maumee having the highest percentage (68%) and lowest percentage (53%), respectively.

[1] Watershed values do not necessarily add to the total value as some practice types and associated funding were not identified by watershed.

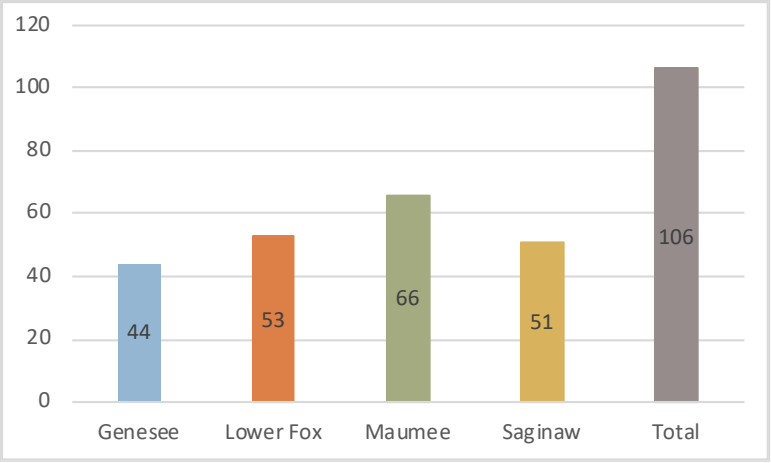
Figure 9. CP Funding as a Percentage of Total Watershed GLRI Focus Area 3 Investments



4.2 CP Implementation by Practice Type and Funding

In total, 106 different practice types were implemented, however, the number and type used varied by watershed (see Figure 10). The Genesee and Maumee implemented the lowest and highest number of CP types, respectively, which is not surprising given that these two watersheds implemented the lowest and highest number of CPs in total.

Figure 10. Number of CP Practice Types Implemented



Measured in terms of frequency of implementation, the most popular CPs across all four watersheds were cover crops (25%), and nutrient management (14%) (see Table 9). Results were similar, but not identical, when measured in terms of GLRI funding used to implement CPs, with cover crops (21%) and nutrient management (14%) also ranking in the top three in terms of funding allocation.

Table 9. Top Five CP Types Implemented by Frequency and Cost – Total

Practice Type	# of CPs	% of CPs in Watershed	Practice Type	$1000s	% of Funding in Watershed
Total			Total		
Cover Crop	2,138	25%	Cover Crop	$ 11,521	21%
Nutrient Mgmt	1,176	14%	Waste Storage Facility	$ 8,971	16%
Residue & Tillage Mgmt, No-Till	573	7%	Nutrient Mgmt	$ 7,546	14%
Conservation Crop Rotation	498	6%	Heavy Use Area Protection	$ 2,860	5%
Amending Soil w/ Gypsum Produc	489	6%	Conservation Crop Rotation	$ 2,760	5%

Table 10 shows the five most frequently reported CPs in terms of implementation (number of entries in the REAP Master Database) and costs (total costs covered with GLRI funding associated with a given CP across all entries). While cover crops, nutrient management, heave use area protection and residue & tillage management – no till were popular across the watersheds, there were also differences. For example, water transfers and prescribed grazing were more likely to be used in the Genesee, while the Lower Fox implemented more critical area plantings, grassed waterways and mulching. The Maumee was more likely to use conservation crop rotation and amending soil with gypsum products, while integrated pest management was most used in the Saginaw.

Table 10. Top Five CP Types Implemented by Frequency and Cost – Watershed

Practice Type	# of CPs	% of CPs in Watershed	Practice Type	$1000s	% of Funding in Watershed
Genesee			Genesee		
Cover Crop	62	12%	Waste Storage Facility	$ 2,025	37%
Heavy Use Area Protection	33	6%	Heavy Use Area Protection	$ 805	15%
Waste Transfer	33	6%	Cover Crop	$ 476	9%
Nutrient Mgmt	28	5%	Roofs and Covers	$ 413	8%
Prescribed Grazing	27	5%	Waste Transfer	$ 321	6%
Lower Fox			Lower Fox		
Cover Crop	258	16%	Waste Storage Facility	$ 4,466	32%
Critical Area Planting	126	8%	Cover Crop	$ 1,885	13%
Grassed Waterway	120	7%	Heavy Use Area Protection	$ 1,407	10%
Heavy Use Area Protection	106	7%	Waste Transfer	$ 760	5%
Mulching	103	6%	Waste Facility Closure	$ 717	5%
Maumee			Maumee		
Cover Crop	1,465	30%	Cover Crop	$ 6,745	29%
Nutrient Mgmt	744	15%	Nutrient Mgmt	$ 4,328	19%
Conservation Crop Rotation	480	10%	Conservation Crop Rotation	$ 2,738	12%
Amending Soil w/ Gypsum Produc	457	10%	Residue & Tillage Mgmt, No-Till	$ 1,558	7%
Residue & Tillage Mgmt, No-Till	424	9%	Waste Storage Facility	$ 1,376	6%
Saginaw			Saginaw		
Cover Crop	349	24%	Nutrient Mgmt	$ 2,771	23%
Nutrient Mgmt	304	21%	Cover Crop	$ 2,346	19%
Integrated Pest Management	155	11%	Agrichemical Handling Facility	$ 2,091	17%
Heavy Use Area Protection	70	5%	Integrated Pest Management	$ 1,205	10%
Residue & Tillage Mgmt, No-Till	58	4%	Waste Storage Facility	$ 1,104	9%

As can be seen from a comparison of the tables of CPs implemented overall (Table 9) and by watershed (Table 10), activity in Maumee has a proportionately large influence on the frequency and funding of the types of CPs implemented. Two CP types that are in the top five most implemented projects overall – conservation crop rotation and amending soil with gypsum products – and one CP type that is in the list of five CP types receiving the greatest amount of funding – conservation crop rotation – were only implemented in large amounts in the Maumee. This underscores the importance of analyzing future GLRI data by priority watershed because, without separating or weighting by watershed, the conclusions drawn from GLRI data could be heavily skewed by watersheds that have outsized impacts on the analysis.

4.3 CP Implementation by Units Implemented

The majority (99%) of CPs reported included information on the number of units implemented. Data first were analyzed across all four priority watersheds in total and then for each watershed individually. It should be noted that units reported were not necessarily unique – for example, cover crops planted on the same acre for four years in a row could have been counted as four acres. For this reason, total number of acres and percentage of total acres by practice type are not reported in order to avoid double counting. Improved tracking in future projects of CP units implemented would improve the robustness of this analysis.

Multiple units were used to measure CPs implemented (e.g., acres, feet, number). The unit most frequently used was acres, which was used for approximately 75% of the CPs implemented. As mentioned previously, 106 practice types were used across the four watersheds, however, only 81 reported both units implemented and associated implementation costs.

Across all four watersheds, nutrient management and cover crops were the practice types implemented on the greatest number of acres (see Table 11).

Table 11. Acres Implemented by Top Practice Types

Practice Type	# of Acres
Nutrient Mgmt	301,978
Cover Crop	275,876
Integrated Pest Mgmt	138,162
Residue & Tillage Mgmt, No-Till	99,258
Conservation Crop Rotation	49,716

Similar calculations were done at the watershed level. .

Table 12 includes the top five practice types in terms of acres implemented for each watershed. In general, CPs with the most acres implemented were similar between the watersheds – nutrient management, cover crops and residue & till management – no till were included in the top five practice types for all four watersheds.

Table 12. Acres Implemented by Top Five CP Types - Watershed

Practice Type	# of Acres
Genesee	
Nutrient Mgmt	10,284
Cover Crop	7,625
Residue & Tillage Mgmt, No-Till	4,711
Prescribed Grazing	1,578
Heavy Use Area Protection	1,374
Lower Fox	
Cover Crop	57,623
Integrated Pest Mgmt	43,777
Nutrient Mgmt	28,671
Residue & Tillage Mgmt, No-Till	7,121
Heavy Use Area Protection	6,611
Maumee	
Cover Crop	152,879
Nutrient Mgmt	148,769
Residue & Tillage Mgmt, No-Till	67,917
Conservation Crop Rotation	44,856
Soil Testing	37,131
Saginaw	
Nutrient Mgmt	114,254
Integrated Pest Mgmt	75,830
Cover Crop	54,988
Residue & Tillage Mgmt, No-Till	19,509
Residue & Tillage Mgmt, Reduced Till	8,180

It should be noted that the top five practice types by unit in the four watersheds do not dramatically differ from the top five practices by watershed based on number of projects or funding.

4.4 CP Implementation by Project Type

In total, 23 high-level projects reported implementing CPs as part of their GLRI funded efforts. Seven of these were categorized as direct grants, while the remaining 16 were indirect. Table 13 shows a summary of CPs and associated costs by funding type, however, it should be noted that only two direct grants and 11 indirect grants reported costs associated with the CPs implemented and this is reflected in the results. In total, for those projects that reported on GLRI investments used for CP implementation, projects funded indirectly accounted for 95% of CP implementation.

Table 13. CP Implementation by Funding Type

	Genesee		Lower Fox		Maumee		Saginaw		Total	
Funding Type	# CPs Reported	$1000s	# CPs Reported	$1000s	# CPs Reported	$1000s	# CPs Reported	$1000s	# CPs Reported	$1000s
Direct	0	$ -	5	$ 258	38	$ 2,206	25	$ -	73	$ 2,884
Indirect	513	$ 5,476	1,598	$13,804	4,767	$20,932	1,442	$12,135	8,341	$52,435

Direct and indirect grants implemented 16 and 97 different practice types, respectively, and cover crops were the CP most likely to be implemented under both direct and indirect grants.

4.5 CP Implementation by NRCS Phosphorus Priority Area (PPA)

While all CPs included in the dataset were implemented in one of the four priority watersheds, for the majority of them, it was also possible to identify whether or not they were implemented in an NRCS Phosphorus Priority Area (PPA). Table 14 shows the number of CPs implemented in PPAs by watershed as well as the amount of GLRI funding associated with their implementation. Note that the total number of CPs and total amount of GLRI funding are both less than values presented in previous tables —this is because some CPs did not included identification of the watershed in which they were implemented or whether they were implemented in a PPA.

Table 14. CP Implementation in NRCS PPAs

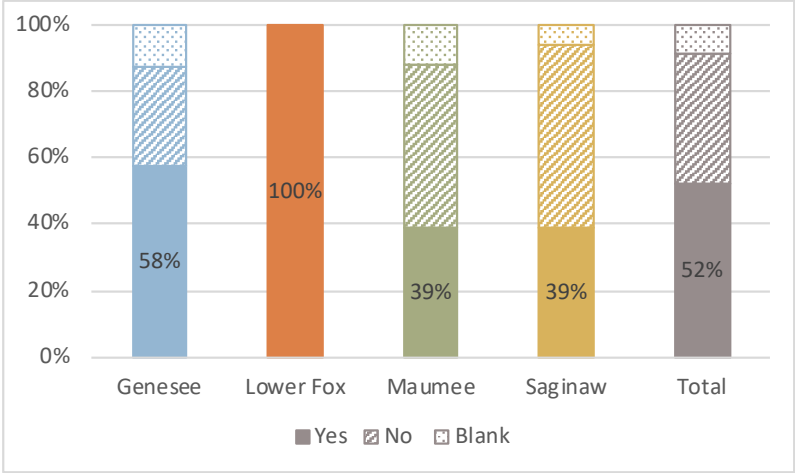
Implemented in NRCS PPA	Genesee		Lower Fox		Maumee		Saginaw		Total	
	# CPs Reported	$1000s	# CPs Reported	$1000s	# CPs Reported	$1000s	# CPs Reported	$1000s	# CPs Reported	$1000s
No	151	$ 1,810		$ -	2,335	$10,580	801	$ 6,463	3,287	$18,853
Yes	296	$ 3,286	1,603	$14,062	1,880	$ 9,381	573	$ 5,232	4,352	$31,961
Blank	66	$ 380		$ -	590	$ 3,177	93	$ 440	749	$ 3,996
Total	513	$ 5,476	1,603	$14,062	4,805	$23,138	1,467	$12,135	8,388	$54,810

All four watersheds implemented a higher percentage of CPs in PPAs as compared to the amount of watershed land area in PPAs (see Table 15 and Figure 11), with the exception of the Lower Fox as a result of the entirety of the watershed being considered a PPA. While the greatest absolute number of CPs implemented within NRCS PPA boundaries occurred in the Maumee, both Maumee and Saginaw had a lower percentage (39%) of total CPs in NRCS PPAs. Maumee also has the lowest percentage overall of CPs implemented in PPAs as compared to the percentage of watershed land area in PPAs. Again, with the exception of the Lower Fox which is all PPA, the Genesee has the greatest percentage of CPs implemented in the PPA for that watershed.

Table 15. Percentage of Watershed Land Area in PPAs

Watershed	Land Area in PPAs (%)
Genesee	23%
Lower Fox	100%
Maumee	20%
Saginaw	25%

Figure 11. Percentage of CPs in NRCS PPAs



5. GLRI Project Comparison with OSU Survey Data (Outcome Analysis)

In the following section, potential correlations between the GLC project element datasets and OSU survey data were assessed. More specifically, project data were compared with OSU survey data on participation in government programs; likeliness to participate in future programs; current and future use of cover crops and vegetative buffers; and the sources from which farmers receive information (e.g., direct outreach, NRCS, demonstration farms/field days).

As OSU data were aggregated at the county-level, it was necessary to develop a weighting schema to normalize county-level data to accurately represent the footprints of priority watersheds as all four encompass portions of multiple counties. For all analyses in this section, county-level survey data were weighted by the percentage of county area in the watershed and then summed.

5.1 Participation in GLRI Funded Programs

As part of the survey, participants were asked “Have you participated in any Great Lakes Restoration Initiative (GLRI) funded programs?” to which they could answer “Yes”, “No” or “Don’t Know”. Results from this question were aggregated to the watershed level and compared to GLRI funding and project element information.

Total GLRI funds allocated by watershed from 2010-2016 first were compared to the percentage of survey respondents that have participated in GLRI funded programs (see Table 16). While a definitive pattern does not emerge, it is interesting to note that the two watersheds with the highest funding in total (Maumee and Lower Fox) were the two watersheds with the highest participation rates in GLRI funded programs.

Table 16. GLRI Participation Compared to Total GLRI Focus Area 3 Funding

Watershed	GLRI Funding ($1000s)	% Participating in GLRI Funded Programs
Maumee	$ 43,995	12%
Lower Fox	$ 24,321	18%
Saginaw	$ 19,495	7%
Genesee	$ 7,994	5%

The percentage of survey respondents in each watershed that have participated in GLRI funded programs also were compared to the percentage of projects implemented in each watershed that contained a direct outreach and/or innovative capacity element. While no clear pattern of correlation emerged, this does not mean that direct outreach and/or innovative capacity building are not correlated with GLRI-funded program participation, but rather, that such a relationship could not be established with the limited, highly aggregated data available.

5.2 Participation in Government-Funded Conservation Programs

Similarly, participants were asked "Are you currently enrolled in any other government-funded programs for conservation" to which they could answer "Yes" or "No". Results from this question were aggregated to the watershed level and compared to project element information.

As with participation in GLRI funded programs, survey results were compared to total GLRI funding per watershed (see Table 17). The Lower Fox and Maumee again had the highest participation rates in government funded conservation programs.

Table 17. Participation Compared to Total GLRI Focus Area 3 Funding

Watershed	GLRI Funding ($1000s)	% Enrolled in Gov't Funded Programs
Maumee	$ 43,995	36%
Lower Fox	$ 24,321	28%
Saginaw	$ 19,495	19%
Genesee	$ 7,994	27%

The percentage of survey respondents in each watershed that were currently enrolled in any other government-funded conservation program were compared to the percentage of projects implemented in each watershed that contained a direct outreach and/or innovative capacity element; however, participation did not appear to be strongly correlated with either element. Again, this does not mean enrollment in government funded conservation programs is not correlated with specific project elements, simply that such a correlation was not able to be established with the limited data available.

5.3 Future Participation in Government-Funded Conservation Programs

Participants also were asked "Will you continue to participate in government-funded programs in the future" to which they could answer "Yes", "No" or "Don't Know". As seen in Table 18 , with the exception of the Maumee having the highest total funding and highest percentage of respondents likely to participate in future government conservation programs, no clear patterns of correlation could be identified.

Table 18. Participation Compared to Total GLRI Focus Area 3 Funding

Watershed	GLRI Funding ($1000s)	Likely to Participate in Future (%)
Maumee	$ 43,995	44%
Lower Fox	$ 24,321	41%
Saginaw	$ 19,495	31%
Genesee	$ 7,994	42%

Because no clear correlations between GLRI project structure and survey responses were found, trends in farm related income and conservation payments for the four priority watersheds from 2007-2017, as reported by the CoA, were compared to the survey responses to determine if applicable watershed characteristics might correlate with the survey results. No clear correlations were found between the survey respondents' likelihood to participate in future government programs and change in income from farm-related sources, change in income from conservation payments, or the percentages of income from conservation payments for this time period.

5.4 Cover Crops

Funding allocations and project elements were also compared to results from two survey questions focused on cover crops that asked:

- What are your plans for using cover crops on your farm next year?¨
  - Answer options: Do less, Do more, Do the same
- How likely are you to use cover crops in the future without incentives?
  - Answer Options: Will not use, Unlikely to use, Likely to use, Will definitely use

As with the participation data, survey results on plans for using cover crops on farms next year were compared to GLRI funding per operation and total GLRI funding per watershed (see Table 19). Survey respondents from the Lower Fox, which had substantially more GLRI funding per farm operation, were most likely to plan to use more cover crops on their farm next year (37%).

Table 19. Future Cover Crops Compared to Total GLRI Focus Area 3 Funding

Watershed	GLRI Funding ($1000s)	More Cover Crops Next Year
Maumee	$ 43,995	26%
Lower Fox	$ 24,321	37%
Saginaw	$ 19,495	25%
Genesee	$ 7,994	22%

As seen in Table 20, which is sorted from highest to lowest percentage of projects within each watershed containing a) a direct outreach element and b) an innovative capacity building element, the likelihood of respondents increasing use of cover crops on their farms next year does not appear to be strongly correlated with either element. It is interesting to note, however, that almost all respondents indicated that they intend to plant cover crops next year at a level similar to this year.

Table 20. Project Elements and Future Cover Crops

Watershed	% Projects w/ Direct Outreach	More Cover Crops Next Year	Same or More Cover Crops Next Year
Saginaw	56%	25%	100%
Maumee	54%	26%	98%
Genesee	33%	22%	100%
Lower Fox	31%	37%	97%

Watershed	% Projects w/ Innovative Capacity Building	More Cover Crops Next Year	Same or More Cover Crops Next Year
Saginaw	38%	25%	100%
Maumee	33%	26%	98%
Lower Fox	23%	37%	97%
Genesee	0%	22%	100%

The same comparisons were made to funding and project elements for responses on likeliness to use cover crops in the future without incentives (see Table 21).

Table 21. Cover Crops w/o Incentives Compared to Total Focus Area 3 GLRI Funding & Project Elements

Watershed	GLRI Funding ($1000s)	% Projects w/ Direct Outreach	% Projects w/ Innovative Capacity Building	Will Definitely Use Cover Crops w/o Incentives
Genesee	$ 7,994	33%	0%	24%
Saginaw	$ 19,495	56%	38%	15%
Lower Fox	$ 24,321	31%	23%	11%
Maumee	$ 43,995	54%	33%	10%

No general patterns of correlation emerged from these data either; however, it is interesting to note that respondents from the Genesee were most likely to state they will definitely use cover crops in the future without incentives even though this watershed does not stand out in any particular way with regards to funding or inclusion of specific project elements.

Given this somewhat anomalous result in regards to the Genesee, additional analyses were undertaken to attempt to uncover correlations of survey respondents' interests in future use of cover crops and underlying watershed characteristics. Four analyses were performed: (1) a comparison of survey responses on questions related to cover crops and change in tenure (full ownership, partial ownership, and tenant farming) of total acres of agricultural operations from 2007-2017; (2) a comparison of survey responses to trends and percentages of income from farm related sources and conservation payments; (3) a comparison of survey responses and the average proportion of watershed agriculture sales attributed to animal versus crop production and (4) a comparison of survey responses to the per acre value of agricultural land, per operation value of agricultural land, and the change in both from 2007-2017. Watershed characteristic variables were calculated from CoA data from 2007, 2012 and 2017.

No correlations were observed between the change in tenure of agricultural operations or income from farm related sources or conservation payments and survey respondents' likelihood to implement more cover crops with and without incentives. There was a correlation, however, with the average percentage of sales from animals by watershed, such that those watersheds with higher average sales from animals as a percentage of total sales (Genesee and Lower Fox) tended to report a greater likelihood to implement cover crops without incentives than those watersheds with lower average sales from animals as a percentage of total sales (see Table 22).

This result is not surprising as it is possible that cover crops may be a more attractive CP in watersheds with higher animal sales as cover crops could be implemented on cropland devoted to producing feed crop for livestock. Since the cover crops themselves can also have value as feed crop, cover crops may be

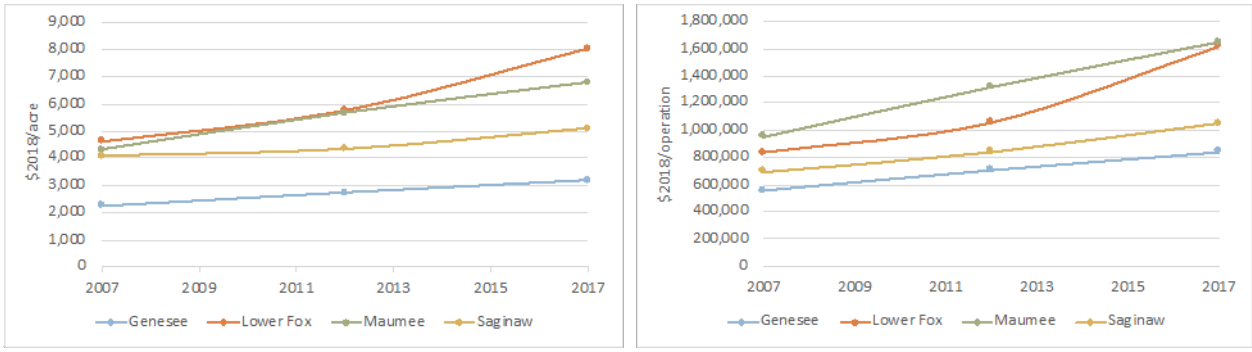
more widely implemented on cropland for livestock than on other cropland in the Saginaw and Maumee where higher value crops may be grown or where there is less value to be gained from the growth of cover crops. Additionally, however, it is recognized that there was limited data available particularly for GLRI projects in Genesee, indicating that some differentiating information on project elements or funding may not be represented here that helps to explain these trends without the overlay of watershed characteristics.

Table 22. Agriculture Sales and Cover Crops

Watershed	Average % Sales from Animals	More Cover Crops Next Year	Will Likely or Definitely Use Cover Crops w/o Incentives
Saginaw	32%	25%	58%
Maumee	39%	26%	56%
Genesee	69%	22%	76%
Lower Fox	79%	37%	66%

A correlation was also found in the comparison of survey respondents' likelihood to implement cover crops with and without incentives with the per acre and per operation agricultural land value. Higher per acre and per operation agricultural land value (see Figure 12) tended to yield a higher willingness to implement more cover crops, but a lower willingness to do so without incentives.

Figure 12. Agricultural Land Value (a) by Acre and (b) by Operation



This may, however, simply be a coincidence due the highest agricultural land value per acre and second highest land value per operation occurring in the Lower Fox. The Lower Fox appears to be a well-known focus of agricultural conservation activities and investments, therefore, operators in this watershed may simply be aware of the funding opportunities for implementing such CPs as cover crops and are willing to do so primarily because they know there is funding for it. This assumption was tested by comparing survey respondents' perception of funding opportunities available for implementing cover crops (i.e., survey respondents' answers to questions on enrollment in GLRI funded programs, enrollment in government programs, and likelihood to participate in future government programs) with their intentions regarding cover crops in the future (see Table 23).

Table 23. Perceptions of Funding Opportunities and Cover Crop Usage

Watershed	% Enrolled in GLRI Funded Programs	% Enrolled in Gov't Funded Programs	% Likely to Participate in Future Gov't Funded Programs	More Cover Crops Next Year	Will Definitely Use Cover Crops w/o Incentives
Genesee	5%	27%	42%	22%	24%
Lower Fox	18%	28%	41%	37%	11%
Maumee	12%	36%	44%	26%	10%
Saginaw	7%	19%	31%	25%	15%

A slight correlation is uncovered that suggests that watersheds where the perception of funding opportunities is high (Lower Fox and Maumee) agriculturalists exhibit a likelihood to use more cover crops in the future, but only if there is an incentive to do so. Watersheds where there is a perception of limited available funding (Genesee and Saginaw) show that their intentions to use cover crops are more muted, but are less affected by whether there is an incentive to do so or not.

5.5 Vegetative Buffers

Results from similar survey questions which focused on vegetative buffer use were also compared to project funding and elements:

- What are your plans for using vegetative buffers on your farm next year?¨
  - Answer options: Do less, Do more, Do the same
- How likely are you to use vegetative buffers in the future without incentives?
  - Answer Options: Will not use, Unlikely to use, Likely to use, Will definitely use

Survey results on plans for using vegetative buffers on farms next year first were compared to GLRI funding per operation and total GLRI funding per watershed (see Table 24). Survey respondents from the Lower Fox, which had substantially more GLRI funding per farm operation, were most likely respond that they were planning to use more vegetative buffers on their farm next year (37%).

Table 24. Future Buffers Compared to Total GLRI Focus Area 3 Funding

Watershed	GLRI Funding ($1000s)	More Buffers Next Year
Maumee	$ 43,995	26%
Lower Fox	$ 24,321	37%
Saginaw	$ 19,495	9%
Genesee	$ 7,994	28%

As seen in Table 25, which again is sorted from highest to lowest percentage of projects within each watershed containing a) a direct outreach element and b) an innovative capacity building element, the likelihood of respondents increasing use of vegetative buffers on their farms next year does not appear to be strongly correlated with either element. It is interesting to note, however, that almost all respondents indicated that they intend to maintain the buffers currently in place; however, this may be a result of the fact that buffers are often multi-year commitments.

Table 25. Project Elements and Future Vegetative Buffers

Watershed	% Projects w/ Direct Outreach	More Buffers Next Year	Same or More Buffers Next Year	Watershed	% Projects w/ Innovative Capacity Building	More Buffers Next Year	Same or More Buffers Next Year
Saginaw	56%	9%	96%	Saginaw	38%	9%	96%
Maumee	54%	26%	92%	Maumee	33%	26%	92%
Genesee	33%	28%	96%	Lower Fox	23%	37%	94%
Lower Fox	31%	37%	94%	Genesee	0%	28%	96%

The same comparisons were made to funding and project elements for responses on likeliness to use vegetative buffers in the future without incentives. Again, no general patterns of correlation emerged; however, it is interesting to note that, similar to the findings for cover crops, respondents from the Genesee were most likely to state they will definitely use vegetative buffers in the future without incentives.

Similar to the additional analyses conducted on survey responses regarding cover crops, survey responses on questions related to vegetative buffers also were compared to change in agricultural land tenure, income from farm related sources and conservation payments, the average proportion of watershed agriculture sales attributed to animal versus crop production, and agricultural land value. Trends and percentages were calculated from CoA data from 2007, 2012 and 2017.

Again, neither land tenure nor income from farm related sources or conservation payments were found to correlate with survey responses on questions related to vegetative buffers. Average percentage of sales from animals, however, exhibited a distinct correlation with survey responses on both the intent to put in more vegetative buffers next year and the likelihood of doing so without incentives (see Table 26). Similar to cover crops, vegetative buffers may represent additional financial incentives to livestock operations than to farming operations for cultivated crops. In cultivated crop operations, some land may need to be taken out of cultivation in order to create buffers, thereby reducing the potential value of the land. For livestock operations, the financial incentive may not be in creating value as in the case of cover crops, but rather may be a best practices action undertaken to protect operations from pollution sanctions produced by waste runoff. A cropping operation would not necessarily have the same incentives.

Table 26. Agricultural Sales and Vegetative Buffers

Watershed	Average % Sales from Animals	More Buffers Next Year	Will Likely or Definitely Use Buffers w/o Incentives
Saginaw	32%	9%	39%
Maumee	39%	26%	55%
Genesee	69%	28%	55%
Lower Fox	79%	37%	58%

The comparison of survey responses to agricultural land value uncovered a slight negative correlation only between land value and likelihood to implement vegetative buffers without incentives. Although there was not the disconnect between intention to use more buffers next year and likelihood to use buffers without incentives as there was with cover crops, intended usage of buffers was compared to the perception of funding availability (see Table 27).

Table 27. Perceptions of Funding Opportunities and Vegetative Buffer Usage

Watershed	% Enrolled in GLRI Funded Programs	% Enrolled in Gov't Funded Programs	% Likely to Participate in Future Gov't Funded Programs	More Buffers Next Year	Will Definitely Use Buffers w/o Incentives
Genesee	5%	27%	42%	28%	14%
Lower Fox	18%	28%	41%	37%	11%
Maumee	12%	36%	44%	26%	12%
Saginaw	7%	19%	31%	9%	13%

Similar to the finding with usage of cover crops, perception of funding opportunities appears to have a positive correlation with more intended future usage of buffers and a negative correlation with intended usage of buffers without incentives.

5.6 Cover Crops versus Vegetative Buffers

Results on likeliness to use cover crops and vegetative buffers both next year and in the future without incentives were compared. Respondents in the Lower Fox were most likely state that they plan to implement more of both practices next year on their farm (see Table 28); however, as seen in Table 29, Lower Fox respondents were the least or second to least likely to state they would definitely use vegetative buffers and cover crops in the future without incentives.

Table 28. Plans for Cover Crops and Vegetative Buffers Next Year

Watershed	More Cover Crops Next Year	More Buffers Next Year
Lower Fox	37%	37%
Genesee	22%	28%
Maumee	26%	26%
Saginaw	25%	9%

As mentioned previously, respondents from the Genesee were most likely to state that they would definitely use both practices in the future without incentives. When combining results for "will likely use" and "will definitely use", it is also interesting to note that respondents in all four watersheds would be more likely to use cover crops without incentives as compared to vegetative buffers (see second table in Table 29), which may be related to the "life of the practice". More specifically, cover crops are typically an annual practice so that the decision to implement the practice can be made each year, whereas vegetative buffers are often a multi-year commitment and require that land be taken out of production.

Table 29. Use of Cover Crops and Vegetative Buffers w/o Incentives

Watershed	Will Definitely Use Cover Crops w/o Incentives	Will Definitely Use Buffers w/o Incentives
Genesee	24%	14%
Lower Fox	11%	11%
Maumee	10%	12%
Saginaw	15%	13%

Watershed	Will Likely or Definitely Use Cover Crops w/o Incentives	Will Likely or Definitely Use Buffers w/o Incentives
Genesee	76%	55%
Lower Fox	66%	58%
Maumee	56%	55%
Saginaw	58%	39%

5.7 Information Sources

Finally, survey respondents were asked "How much do you rely on the following sources for information when introducing and managing new conservation practices on your farm" for which answer choices were "Not at all", "Some" and "A lot". Thirteen information source options were provided as well as two blank spaces, in which the respondent could write in other sources.

Figure 13 shows the distribution of reliance on various information sources by watershed. As can be seen, the information source most relied on "a lot" varied by watershed both by source and the degree to which is was relied upon: Genesee – Crop Advisor (34%), Lower Fox – Crop Advisor (45%), Maumee – Fertilizer Retailer (37%), Saginaw – University Extension (29%).

Figure 13. Information Sources by Watershed

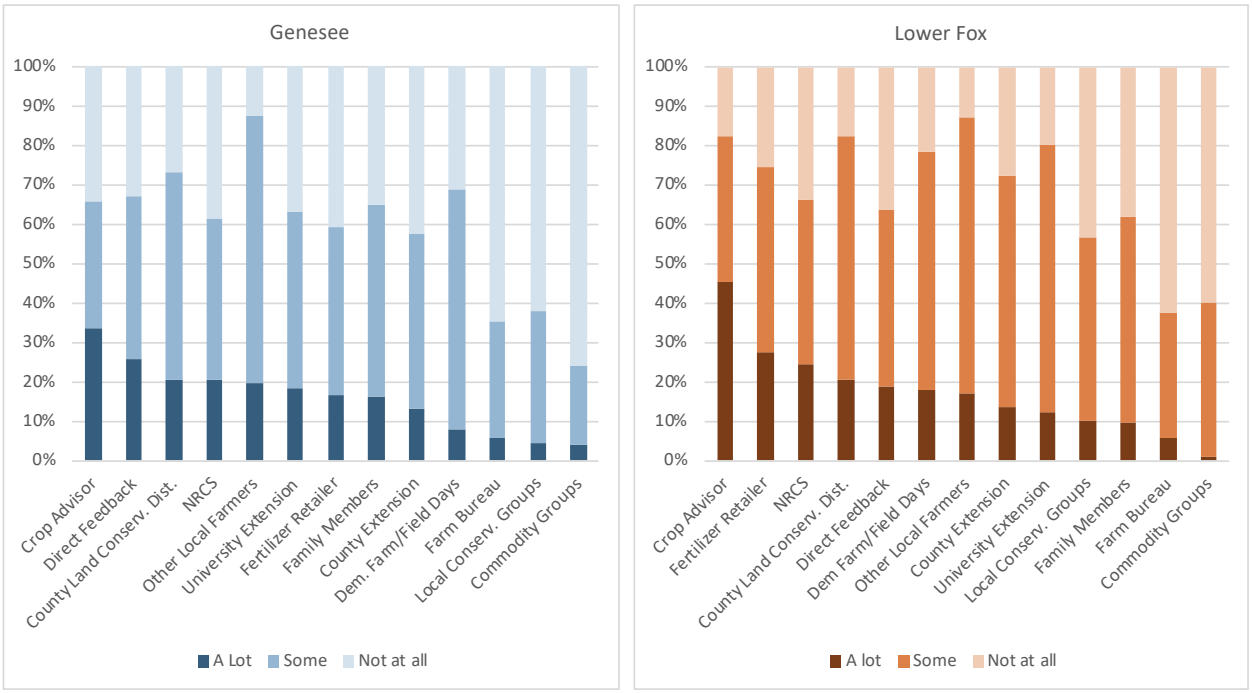
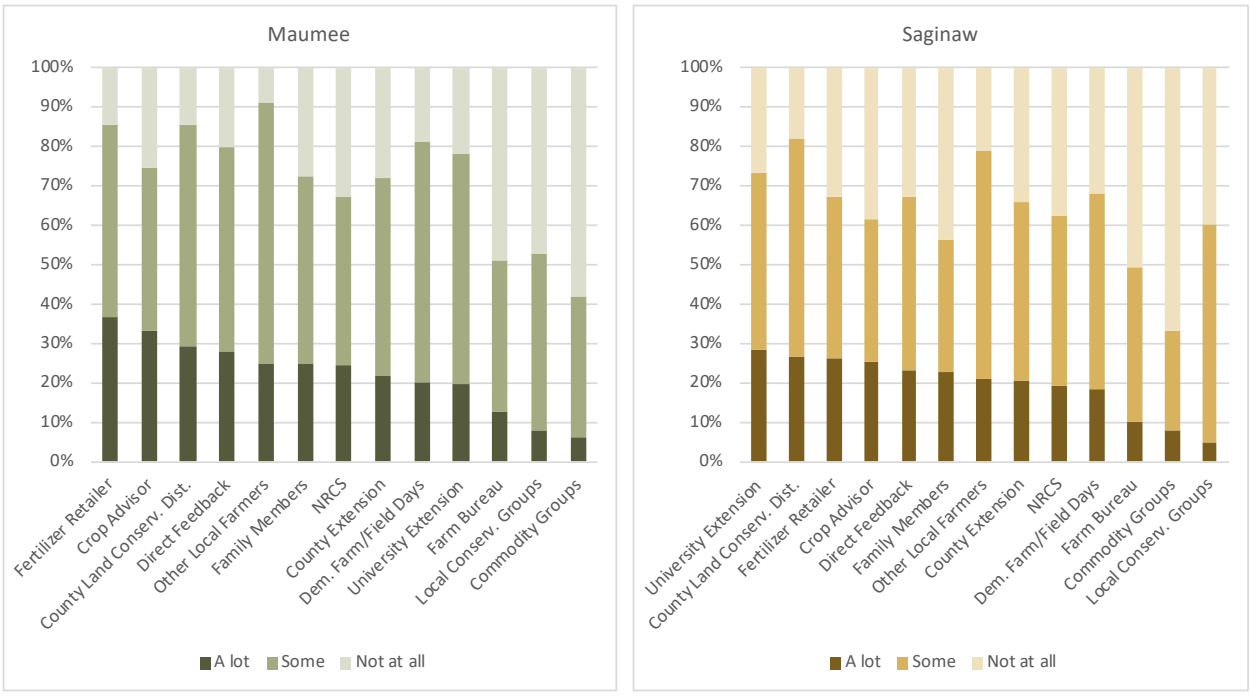


Figure 13 (continued). Information Sources by Watershed



Principal investigators (PIs) that received money from GLRI to implement projects or provide sub-grants for project implementation include, notably, county land and conservation districts, NRCS, universities, non-profit organizations, state and federal entities, and tribal organizations (see Table 30). Indirectly funded GLRI projects are typically implemented by county conservation districts or other local entities. As such, one would expect that, with higher proportions of projects with direct outreach, the preferred sources of information for respondents would align with the category of PI with the greatest number of projects.

Table 30. Number of GLRI Projects by Principal Investigator

Principal Investigator	Genesee Projects (#)	Lower Fox Projects (#)	Maumee Projects (#)	Saginaw Projects (#)	Total
Federal		5	8	6	19
State			5		5
Non-profit			2	2	4
Universities			2	2	4
County Land and Water District		1			1
Tribal		1			1
Other		1			1
Indirectly Funded Projects	3	5	7	6	21

Note: Genesee has no projects that were directly funded.

A review of the top five information sources used "a lot" within each watershed, however, shows six sources used regularly across all four watersheds – crop advisor, fertilizer retailer, county land conservation district, direct feedback, NRCS and other local farmers (see Table 31). The only information source in the top five used "a lot" that was unique to a single watershed was the reliance on university extension in the Saginaw. As mentioned previously, this was also the top source used "a lot" within this watershed.

Table 31. Information Sources Used "A Lot" by Watershed

Watershed	Direct Outreach	Information Sources Used "A Lot"				
		1st	2nd	3rd	4th	5th
Genesee	33%	Crop Advisor	Direct Feedback	County Land Cons. Dist.	NRCS	Other Local Farmers
Lower Fox	31%	Crop Advisor	Fertilizer Retailer	NRCS	County Land Cons. Dist.	Direct Feedback
Maumee	54%	Fertilizer Retailer	Crop Advisor	County Land Cons. Dist.	Direct Feedback	Other Local Farmers
Saginaw	56%	Univ. Extension	County Land Cons. Dist.	Fertilizer Retailer	Crop Advisor	Direct Feedback

There may be some alignment of the GLRI PIs to the information sources used "a lot" by respondents. In Saginaw, where there was significant direct outreach, university extensions and county land conservation districts are the first and second preferred sources of information for respondents and are two of the key PIs on GLRI projects (assuming that the six indirectly funded grants were implemented by or with the assistance of county land conservation districts). This is not true, however, in the Maumee where those two entities play a similar role as PIs, but are not ranked as highly as preferred sources of information. What should be noted, however, is that a crop advisor is somewhat of an ambiguous term as a crop advisor could be a representative of a private, local, or university entity.

Perhaps the most notable finding of this analysis, however, is that other local farmers were the information source stated to be most used "some" or "a lot" in three of the four watersheds – Genesee, Lower Fox and Maumee – and was the second most used in the Saginaw behind county land conservation district.

6. Per Unit Cost Analysis

Of the 23 high-level projects that reported CP implementation as part of their GLRI funded efforts only 20 reported the watershed in which the CPs were implemented. Eighteen of these 20 projects were implemented in a single watershed only: Genesee (3), Lower Fox (5), Maumee (6) and Saginaw (4), with the remaining two projects implementing CPs across two or more watersheds. The highlighted rows in Table 32 are projects that reported CPs implemented, but did not report out on the associated costs of implementation.

Table 32. CP Implementation by Project

	Genesee		Lower Fox		Maumee		Saginaw		Total	
GLRI Project	#CPs	$1000s	#CPs	$1000s	#CPs	$1000s	#CPs	$1000s	#CPs	$1000s
EPA00E00859-0									8	$ 88
EPA00E01448-0							18		18	
GL 00E01143					4				4	
GL 00E01423					2				2	
GL 00E01449					17				17	
GL 00E01451			7						7	
GL-0-00E01403					6				6	
GL-00E01450			3						3	
GL00E00413-0					5		7		12	
GL00E00857									6	
GL00E00858							1	$ 23	1	$ 23
GL00E00860			2	$ 258					2	$ 258
GL00E01124									7	
GL00E01404-0					25	$ 2,206			30	$ 2,627
GL97220600-0	5	$ 73							5	$ 73
NRCS-IA-EQIP-1					4,215	$19,961			4,215	$19,961
NRCS-IA-EQIP-2							1,374	$11,695	1,374	$11,695
NRCS-IA-EQIP-3			1,580	$13,513					1,580	$13,513
NRCS-IA-EQIP-4	447	$ 5,096							447	$ 5,096
NRCS-IA-GLSNRP-1					531	$ 971			531	$ 971
NRCS-IA-GLSNRP-2							67	$ 417	67	$ 417
NRCS-IA-GLSNRP-3			11	$ 291					11	$ 291
NRCS-IA-GLSNRP-4	61	$ 307							61	$ 307
Total	513	$ 5,476	1,603	$14,062	4,805	$23,138	1,467	$12,135	8,414	$55,319

It is important again to note that a CP could vary by both type and number of units implemented, so dividing total GLRI funds by CPs implemented using the values in the table above would be an incorrect way of calculating cost per unit. For projects that included CP type, number of units implemented and associated costs, a cost per unit analysis was conducted to assess the cost of implementing different CP types.

It is important to note that this analysis does not analyze the effectiveness of the CPs on desired water quality impacts, but rather analyzes the per unit cost of CPs by type. If a cost-effectiveness analysis were desired, the cost of implementing CPs would need to be correlated with some measure of water quality impact or change in a socio-economic attribute resulting from the CP implementation. With the data available for this analysis, neither comparison could be undertaken with sufficient rigor. Future efforts addressing data collection on GLRI projects should keep analysis of cost-effectiveness of the investments in mind when requesting reporting documentation from fund recipients. Relevant data could be time-series water quality measurements in water bodies downstream of specific CP implementation sites, changes in perception of CPs or agricultural impacts on water quality by agriculturalists who instituted specific CPs, time series data of the value of agricultural products for lands treated by specific CPs, etc.

As noted previously, the majority of CPs reported included the associated units implemented. Table 33 includes the estimated cost per acre for practice types reporting the twenty highest number of acres implemented. Note that for these practice types, the number of units implemented ranged from over 300,000 acres (nutrient management) to fewer than 1,000 (mulching and forest stand improvement). Implementation of fewer than 600 acres were reported for other practice types not included in Table 33.

Results are sorted from lowest to highest cost per acre. Across these practice types, the practice type with the lowest cost per unit was soil testing ($9/acre), followed by written integrated pest management plans ($13/acre). For the three practice types reporting implementation of more than 100,000 acres, integrated pest management was the lowest per unit cost ($15/acre), followed by nutrient management ($25/acre) and cover crops ($42/acre).

Table 33. Cost per Acre

Practice Type	Acres Implemented	Cost per Acre
Soil Testing	42,685	$ 9
Integrated Pest Mgmt Plan - Written	6,576	$ 13
Upland Wildlife Habitat Mgmt	4,242	$ 14
Integrated Pest Mgmt	138,162	$ 15
Conservation Tillage	7,313	$ 15
Equipment Modification	5,767	$ 16
Residue & Tillage Mgmt, Reduced Till	33,810	$ 18
Residue & Tillage Mgmt, No-Till	99,258	$ 20
Nutrient Mgmt	301,978	$ 25
Amending Soil Properties w/ Gypsum Prod	36,428	$ 26
Waste Recycling	2,416	$ 31
Cover Crop	275,876	$ 42
Prescribed Grazing	7,764	$ 45
Conservation Crop Rotation	49,716	$ 56
Agronomic System	2,944	$ 65
Brush Mgmt	2,022	$ 91
Forest Stand Improvement	827	$ 142
Forage & Biomass Planting	2,361	$ 157
Heavy Use Area Protection	8,037	$ 298
Mulching	634	$ 542

The per acre cost of various CPs also was examined at the watershed level. The top ten CPs for each watershed were included in the analysis (measured in terms of acres implemented) in order to highlight both number of acres implemented and cost per acre across the watersheds. As seen in Table 34, which is sorted by greatest to fewest total number of acres implemented, there was substantial variability across the watersheds in terms of acres implemented and cost per acre both within and between CPs. Note that cost is color coded by conservation practice type – with green representing the lowest cost per acre for each practice types across the watersheds in which it was implemented and yellow the highest cost. Three practice types were only implemented in the Maumee and, as such, were not color coded.

Table 34. Cost per Acre by Watershed

Practice Type	Genesee		Lower Fox		Maumee		Saginaw		Total	
	Acres	Cost/Acre	Acres	Cost/Acre	Acres	Cost/Acre	Acres	Cost/Acre	Acres	Cost/Acre
Nutrient Mgmt	10,284	$ 8	28,671	$ 12	148,769	$ 29	114,254	$ 24	301,978	$ 25
Cover Crop	7,625	$ 62	57,623	$ 33	152,879	$ 44	54,988	$ 43	275,876	$ 42
Integrated Pest Mgmt			43,777	$ 16	18,555	$ 7	75,830	$ 16	138,162	$ 15
Residue & Tillage Mgmt, No-Till	4,711	$ 31	7,121	$ 11	67,917	$ 23	19,509	$ 12	99,258	$ 20
Conservation Crop Rotation			547	$ 11	44,856	$ 61	4,314	$ 4	49,716	$ 56
Soil Testing					37,131	$ 9			42,685	$ 9
Amending Soil Properties w/ Gypsum Prod					31,098	$ 26	5,330	$ 25	36,428	$ 26
Residue & Tillage Mgmt, Reduced Till			187	$ 12	25,443	$ 19	8,180	$ 16	33,810	$ 18
Heavy Use Area Protection	1,374	$ 586	6,611	$ 213	33	$ 3,331	18	$ 29,240	8,037	$ 356
Prescribed Grazing	1,578	$ 24	4,748	$ 53	157	$ 81	1,282	$ 32	7,764	$ 45
Conservation Tillage					7,313	$ 15			7,313	$ 15
Equipment Modification					5,767	$ 16			5,767	$ 16
Upland Wildlife Habitat Mgmt	3	$ 180	214	$ 3			4,025	$ 15	4,242	$ 14
Lined Waterway or Outlet	1,360	$ 28	1,325	$ 20	231	$ 49			2,916	$ 26
Forage and Biomass Planting	202	$ 290	1,333	$ 147	663	$ 152	164	$ 104	2,361	$ 157
Brush Mgmt					1,552	$ 81	470	$ 125	2,022	$ 91

Some general findings include:

- The Lower Fox had the lowest cost per acre for six of the sixteen practice types evaluated and the highest per acre cost for only one.
- Three different watersheds had the lowest per unit cost for the three most implemented practice types: nutrient management – Genesee ($8/acre); cover crops – Lower Fox ($33/acre); and integrated pest management – Maumee ($7/acre).
- For practice types implemented in at least three of the four watersheds, the one with least variation in cost per acre was residue and tillage management – reduced till, with per unit costs ranging from $12/acre to $19/acre.
- It is unclear why the per unit cost for heavy use area protection was so high in the Saginaw.

Some highlights by watershed include:

- Genesee – Nutrient management was the practice type with the highest number of acres implemented and the lowest per acre cost ($8/acre).
- Lower Fox – While upland wildlife habitat management had the lowest per acre cost ($3/acre), only 214 acres were implemented using this practice type. Of the three most frequently implemented practice types, nutrient management was the most cost effective ($12/acre), followed by integrated pest management ($16/acre), and cover crops ($33/acre).
- Maumee – Integrated pest management was the lowest cost practice type ($7/acre), however, of the three most frequently implemented practice types, residue tillage and management – no till, had the lowest cost ($23/acre), followed by nutrient management ($29/acre) and cover crops ($44/acre).
- Saginaw – While conservation crop rotation had the lowest cost per acre ($4/acre), it was not one of the more frequently implemented practice types in the watershed. Of the top three, integrated pest management had the lowest per acre cost ($16/acre), followed by nutrient management ($24/acre) and cover crops ($43/acre).

7. GLRI versus Other Conservation Funding

In this section, total GLRI funding from 2010-2016 is compared to conservation subsidy data reported as part of the EWG Farm Subsidy Database. Conservation program subsidies reported by EWG include funding from four federal programs – Environmental Quality Incentives Program (EQIP), Wildlife Habitat Incentives Program (WHIP), Conservation Stewardship Program (CSP) and Conservation Reserve Program (CRP).

For GLRI projects whose entire funding distribution occurred within the timeframe of interest (2010-2016) the lump sum of the project funding was used. For those GLRI projects whose distribution fell partly outside of the 2010-2016 timeframe, it was assumed that funding was distributed evenly across years so that the funding value for the time period of interest was determined by dividing the total funding by the years of the project and multiplying by the number of project years that fell between 2010 and 2016.

Analysis was done in nominal dollars as lump sum GLRI funding amounts could not be consistently converted to real dollars without making multiple assumptions. The calculated GLRI investments were then compared to conservation subsidies distributed to the four priority watersheds as reported by county weighted by the percentage of each county's area in the watershed of interest.

Using this method of calculation, $71.6 million in GLRI investments were distributed from 2010-2016. In comparison, $141.3 million in conservation subsidies were distributed to the priority watersheds during this time period. A similar comparison could not be done at the watershed level as six projects occurred in multiple watersheds.

8. Summary Ranking and Evaluation

This section summarizes general findings, answers key REAP research questions addressed by the analyses conducted in previous sections and provides recommendations as to ways data could be collected in the future to allow for improved ranking and measure of indicators of success.

Table 35 provides a summary ranking of watersheds across key project structure and element types as well as outputs. As noted previously in this document, limited data, missing data, and variation in key watershed characteristics should be considered when interpreting these results (e.g., 100% of CPs being implemented in NRCS PPAs in the Lower Fox is not necessarily a result of effort, but rather that the entirety of the watershed being considered a PPA).

Table 35. Summary Ranking of Watersheds

	Project Structure (% of Projects)		Project Elements (% of Projects)		Acres in Conservation	PPAs
Watershed	Indirect Funding	Direct Funding	Direct Outreach	Innovative Capacity Building	Proposed Acres Achieved (%)	% of CPs in NRCS PPAs
Genesee	43%	57%	33%	0%	n/a	58%
Lower Fox	42%	58%	31%	23%	23%	100%
Maumee	29%	71%	54%	33%	83%	39%
Saginaw	38%	63%	56%	38%	121%	39%

Other notable findings are as follows:

- Of the 46 projects, the greatest percentage of projects (26%) implemented only one project element, of which CP installation and edge of field monitoring & research were project elements most often implemented.
- Direct outreach and innovative capacity building appeared frequently in the 46 high-level projects with one of the two elements appearing in 57% of projects and both elements appearing in 28%.
- The percentage of total funding by watershed allocated to CP implementation ranged from 53% (Maumee) to 68% (Genesee).
- Cover crops were the most frequently implemented conservation practice across all four watersheds both in total and in each watershed individually. In total, cover crops represented approximately 25% of CPs implemented. Outside of cover crops, however, variation was seen across the watersheds in terms of which CPs were most frequently implemented.
- In terms of units implemented, nutrient management (301,978 acres) and cover crops (275,876 acres) were the conservation practice types implemented on the greatest number of acres.
- In total, for those projects that reported on GLRI investments used for CP implementation, projects funded indirectly accounted for 95% of CP implementation.
- Based on the limited data available current participation in GLRI funded programs and current/future participation government funded conservation programs do not appear to be strongly correlated with inclusion of either a direct outreach element or an innovative capacity building element in a project.
- Across all project and watershed characteristics evaluated, animal sales as a percentage of total sales appears to be a characteristic with influence on the adoption of cover crops and vegetative buffers.
- Agriculturalists in watersheds who are aware of funding opportunities may be more likely to express interest in implementing more cover crops and vegetative buffers in the future, but are less likely to do so without incentives.
- The information source most relied on “a lot” varied by watershed both by source and the degree to which is was relied upon: Genesee – Crop Advisor (34%), Lower Fox – Crop Advisor (45%), Maumee – Fertilizer Retailer (37%), Saginaw – University Extension (29%).
- Other local farmers were the information source stated to be most used “some” or “a lot” in three of the four watersheds – Genesee, Lower Fox and Maumee – and was the second most used in the Saginaw behind county land conservation district.
- Across all four watersheds combined, the least costly conservation practice type was soil testing ($9/acre), followed by written integrated pest management plans ($13/acre). For the three practice types reporting implementation of more than 100,000 acres, integrated pest management was the most cost effective ($15/acre), followed by nutrient management ($25/acre) and cover crops ($42/acre).

Table 36 list key REAP research questions and whether analyses conducted as part of this effort were able to answer each question. Reponses then show, if the question was answered, what the findings were, and if not, why.

Table 36. REAP Research Question

Question	Was this question answered?	If YES, what were the findings? If NO, why not?
What project or program structure yields the highest levels of CP adoption by farmers?	Partially	The primary metrics for measuring results were number and units of CP implemented. As 95% of CPs were implemented using indirect funding, assessing the degree to which indirect/direct funding affected results was not able to be ascertained.
Where were most CPs installed (priority watersheds vs PPAs)?	Yes	All CPs analyzed as part of this effort were located in a priority watershed. Approximately 9% of CPs implemented did not report on whether they were implemented in a PPA or not. Across all four watersheds 52% and 39% of CPs were implemented or not implemented in PPAs, respectively. At the watershed level, including reponses left blank, the percentage of CPs implemented in PPAs were: Genesee - 58%, Lower Fox - 100%, Maumee - 39%, and Saginaw - 39%.
Which of these is most cost effective?	No	As information on the impact on water quality of each CP type was not available, a cost effectiveness analyiss could not be done; however, a cost per unit analysis was done. Of the ten CP practice types implementing the greatest number of units (measured in acres), the one with the lowest cost was soil testing, with an estimated cost of $9/acre, followed by integrated pest management, which had an estimated cost of $15/acre.
What were the most popular CPs installed (why)?	Partially	The CP most implemented in terms of both number and cost was cover crops. Cover crops were the most popular CP in total and in all four watersheds individually. In terms of units implemented, however, nutrient management (301,978) was the most popular CP, followed by cover crops (275,876 acres).
How many producers participated?	No	The number of land owners enrolled as part of GLRI funded projects was only reported for five of the 46 high-level projects. The total number of landowners enrolled for these five projects was 343 - Genesee (53), Lower Fox (19), Maumee (258), and Saginaw (13).

Table 36 (continued). REAP Research Questions

Question	Was this question answered?	If YES, what were the findings? If NO, why not?
How many acres were covered?	Partially	For CPs reporing units implemented, acres covered could be calculated. In total, 47 practice types used acres as the unit of measurement. For these, implementation of CPs on 1,030,505 acres were reported. However, the way that data was collected does not allow for the determination of total acres treated as the is no indication of whether mutliple CPs were implemented on the same acreage.
For each: How much did it cost? How long did it take?	Partially	For the 1,030,505 acres, total cost and average per unit cost were $33.6 million and $33/acre, respectively. Length of time was not able to be estimated (other than duration of the project—i.e., all these CPs were implemented between 2010-2016).
What structures to administer GLRI funding yielded the greatest results?	Partially	At the high-level GLRI project results were assessed by comparing the number of proposed acres in conservation to those that were achieved. Although no conclusions could be drawn about the impact of project elements on these results, indirectly funded projects (i.e., those awarded to recipient(s) who did not directly carry out the project, but rather, distributed funds to one or more sub-grantees) tended to be correlated with more projects that achieved the stated conservation goals than directly funded projects. In examining intent to continue to participate in future government programs and maintain or increase usage of cover crops or vegetative buffers with or without incentives no clear correlations could be drawn with the two key project elements examined (direct outreach and innovative capacity building).

Based on lessons learned during this effort, the following are recommendations as to ways data could be collected in the future to allow for improved ranking and measure of indicators of success:

- Identify data needed to create relevant metrics and clearly define at the beginning of each project
  - Information, to the extent allowable by privacy issues, on location of people engaged (by county, HUC8, zip), location of implemented CPs (by parcel), type of operations impacted (crop type, size, tax status, ownership details of age, sex, ethnicity).
  - Records of what entity does implement projects if the project is indirectly funded. This would help with the alignment of preferred sources of information (as reported by the OSU survey) to the organizations attempting to implement projects for/with agriculturalists.
  - Metrics associated with project elements (e.g., individuals reached and how, events held, number of contracts implemented).
  - Methodologies and metrics associated with changes in water quality resulting from specific GLRI project activities.
- Standardize reporting
  - Standardize reporting of units, type of information collected, metadata, etc. across entities collecting data/implementing projects and the projects themselves.
  - Provide funding recipients with a standardized template and require regular reporting as a part of their contract.
  - Break funding out by watershed (no grouping of watersheds where funding is distributed). Consider even a smaller spatial resolution as project(s) allow.
  - Break funding out by project element in order to see how funding was spent.

    - Clearly track CPs in terms of units implemented. Indicate whether some acres are treated with multiple CPs, if so, which CPs and which acres so that a total number of acres impacted could be calculated.
- Consistently collect data on outputs
    - For those projects whose timelines differ (start and end dates) still attempt to do yearly assessments of progress so there is some annual indication of whether the project is on-track to meet its goals.
- Conduct assessment of outcomes
    - Integrate assessments of project outcomes into the projects themselves including a list of outcomes in which the EPA is particularly interested. For example, the EPA may be interested in whether participant's perceptions about the financial benefit of implementing cover crops has changed or whether their trust of the NRCS is impacted by a project.
        - Example: for a workshop, follow up with a post-card questionnaire about how it impacted attendees.
        - Example: for cover crops implemented, follow up (in-person or by aerial imagery) to see if the practice is being continued post-investment.

Appendix A. GLRI Focus Area 3 Projects

Project ID	Project Name
EPA00E01448-0	Accelerating Outcome-Based Ag Conservation in Saginaw Bay
GL 00E01143	Alternative Ditches to Reduce Nutrients in the Upper Blanchard
EPA00E00441-0	Baird Creek Riparian Protection
EPA 00E00995-0	Binational Stakeholder Engagement for Nutrients in the Lake Erie Basin
GL00E00413-0	Cover Crops and Conservation Tillage Reduce NPS Pollution
GL00E00858	Erosion Reduction in the Swartz Creek Watershed
EPA00E01405-0	Expanded Maumee Tributary Monitoring To Measure Success Of Agricultural Conservation Actions
GL97220600-0	Improving Water Quality in NE Lake Ontario Basin
GL-00E01128-0	Improving Water Quality Restoration Partnerships in Michigan's Shiawassee and Flint River Watersheds
GL-00E01145-0	Increasing Nutrient Management Plan Expertise in Blanchard Watershed
GL00E01124	Kawkawlin River - Targeted Phosphorus and E. coli Reduction
GL-00E01155-0	Locating and Targeting High-Impact Farm Fields to Reduce Phosphorus Discharges
GL 00E01449	Maumee River Sediment and Nutrient Reduction Initiative
NOAA-IA-1	NOAA – Nutrient Runoff Risk Advisory Forecast Tool – IL, IN, NY (2015-686a)
NOAA-IA-2	NOAA Nutrient Runoff Risk Advisory Forecast Tool -Saginaw and Maumee Watersheds (2014-686)
BIA0157	Nonpoint Pollution Abatement
GL00E00566	Phosphorus Reduction: Variable Rate Technology Program
GL00E00860	Plum & Kankapot Creeks Riparian Protection (2)
GL00E01131-0	Powell Creek Nutrient Reduction Project
EPA00E00859-0	Sediment Reduction in the Sebewaing River Watershed
GL-00E01450	Silver Creek Sediment and Nutrient Reduction & Habitat Restoration
GL00E01408-0	Soil Health Agronomic Assistance & BMPs for Farmers in the Western Lake Erie Basin
GL-0-00E01403	Supplement Michigan's Targeted Response to Repair WLEB Health
GL 00E01423	Supplementing Michigan's Targeted Response to Repair WLEB through new Approaches
GL00E01404-0	Supporting Ohio Clean Lakes Initiative: Impaired Watershed Restoration
GL00E00857	Targeted Phosphorus Reduction in the Pigeon River Watershed
GL 00E01906	Targeting Hard to Reach Reductions - Additonal Streambank Protection in the Plum & Kankapot Creek Subwatersheds
GL 00E01451	Targeting Outcome-Based Sediment Reduction in the Lower Fox Watershed
GL00E01020-0	Watershed Improvements in Lye Creek in the Upper Blanchard Watershed
NRCS-IA-GLSNRP-1	Great Lakes Sediment and Nutrient Control Program-Maumee
NRCS-IA-GLSNRP-2	Great Lakes Sediment and Nutrient Control Program-Saginaw
NRCS-IA-GLSNRP-3	Great Lakes Sediment and Nutrient Control Program-Lower Fox
NRCS-IA-GLSNRP-4	Great Lakes Sediment and Nutrient Control Program-Genesee
EPA00E01909-0	Accelerating Farmer Adoption of Variable Rate Technology
GL00E00577-0	Best Management Practices in the Maumee River Basin
ACOE-IA	Great Lakes Tributary Model
USGS-IA-1	Forecast/Nowcast Great Lakes Nutrient and Sediment Loadings & Impacts of Nutrients from Agricultural Watersheds in Nearshore Areas
USGS-IA-2	Effects of Nutrient Runoff from Agricultural Watersheds
USGS-IA-3	Maumee River Edge of Field Monitoring
USGS-IA-4	Evaluation of Phosphorus Reduction - Fox River
USGS-IA-5	Saginaw River Edge of Field Monitoring
USGS-IA-6	Edge of Field Monitoring
NRCS-IA-EQIP-1	Supplementing Farm Bill Ag Conservation Programs-Maumee
NRCS-IA-EQIP-2	Supplementing Farm Bill Ag Conservation Programs-Saginaw
NRCS-IA-EQIP-3	Supplementing Farm Bill Ag Conservation Programs-Lower Fox
NRCS-IA-EQIP-4	Supplementing Farm Bill Ag Conservation Programs-Genesee

Note: For the purposes of analysis, NRCS-IA-GLSNRP ad NRCS-IA-EQIP projects were broken out by watershed. Project IDs for these projects are specific to this analysis and are not the actual cooperative agreement numbers.