

Monitoring and Predicting Ecosystem Functions in Agricultural Systems

Final report for NEPA14-001

Project Type: PDP State Program

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Projected End Date: 10/31/2017

Grant Recipient: The Pennsylvania State University

Region: Northeast

State: Pennsylvania

State Coordinator:

[Dr. Kristy Borrelli](#)

The Pennsylvania State University

Project Information

Summary:

Ecosystem functions, processes and monitoring methods that lead to clean air, water, and sufficient, quality food production are necessary for Ag Service Providers (ASPs) and farmers to understand in order to make management decisions that reduce negative consequences associated with farming. Monitoring and prediction methods for maintaining soil health was chosen as the focus topic for this project because it provides a direct example of how sustainable management can improve multiple ecosystem services simultaneously, while meeting a direct need of regional agriculture. Embedding education and outreach about ecosystem services in the context of soil health was needed as identified by several other factors in the region. First, information from an earlier needs assessment survey identified that ASPs had a low understanding about monitoring methods for carbon (C) and nitrogen (N) but a high understanding about the processes and management tactics associated with C and N cycling. Additionally, a rise in the need for non-biased information and training about the fundamentals as well as more advanced topics, such as monitoring and prediction methods, has resulted from many federal, university, private sector, and farmers' efforts to increase knowledge and outreach about the importance of soil health among practitioners from various backgrounds. Finally, practical research information about cover crops, soil organic matter, and complex crop rotations being generated at Penn State University needed to be extended to ASPs and farmers. As a result, soil health management was an ideal topic to develop a training program about ecosystem services since it provided a relatable topic that was able to somewhat demystify the complexity associated with ecosystem management as a whole since it was presented in the context of farm management. The approach was to focus on a couple of particularly difficult to comprehend aspects of soil health including 1) soil organic matter interpretations within soil

health lab test results and 2) nutrient contributions from cover crops on cash crops. Two pathways were used to provide education.

The first pathway involved closely engaging with small groups of ASPs on two specific small projects including a soil health survey that helped them understand organic matter and soil health tests and a predictive cover crop model field trial that provided better understanding of nutrient dynamics in cover crop rotations. ASPs leading these projects were more familiar with the processes and management tactics associated with C and N cycling, but still unfamiliar with monitoring methods for C and N. ASPs collaborated with farmer-cooperators on these individual projects to collect soil samples for a soil health survey in year 1 and to establish demonstration plots to estimate nitrogen contributions to cash crops following a cover crop mix (e.g. the predictive cover crop model) in year 3. Project findings from both studies were incorporated into outreach activities for farmers that were hosted by ASPs.

The second pathway involved broad-based education of larger, variable groups of ASPs and farmers about soil health monitoring and management that incorporated results from the more intensive survey and monitoring work and were presented by the state coordinator. These larger, more variable groups often needed more information about basic soil science principals impacting soil health management since many typically served in a consulting role and less in the research realm.

In 3 years, 900 service provider and 871 farmers participated in the educational programs offered in both pathways described above. Of these, 158 ASPs and 209 Farmers verified changes in knowledge, attitudes, skills, and awareness about areas of learning that included:

- Characteristics of Soil Organic Matter
- Methods to Measure Soil Organic Matter
- Interpreting Results of Soil Organic Matter Measurements
- Methods to Measure Soil Health
- Soil Health Testing Tool Assessments
- Cover Crop Species Impacts on Nitrogen Supply and Retention and Effects in Mixtures
- Monitoring Nitrogen and Carbon Cycling in Crops and Soils
- Impacts of Farm Management on Soil Health including Opportunities to Build Soil Health
- Soil Health Lab Testing Opportunities, Limitations, and Alternatives

Project participants were surveyed annually and at the end of the project about whether and how they had used information learned in educational activities for farmers and/or other service providers. Fourteen soil health survey participants reported using the information from the project in education programs and presentations including: 2 workshops where soil health survey results were shared with 64 farmers; 14 presentations to farmers and ag service providers attended by 60 farmers and 228 service providers. Presentation events included the New England CCA Conference, NRCS and PA Extension Agent training meetings, a cover crops workshop in NY, a farmer pasture walk and organic vegetable production meeting. Two ASPs shared Cover Crop Mixes factsheets with their listserve audiences.

One ASP soil health survey participant developed extensive outreach efforts as a result of his participation in the project. This individual conducted a soil health

survey on 30 farms with farmer collaborators in year 3 and presented on-farm survey results in 2017 to 138 Farmers, 83 ASPs and 30 Ag Professionals at 3 farmer-focused events (PASA Farming For the Future Conference, Tuscarora Organic Growers “Crop Improvement” Meeting, and PASA’s 3rd Annual Soil Health Conference) and 1 professional conference (2017 ASA-CSSA-SSSA Annual Meetings).. He also developed 2 magazine/newsletter articles, one for the PASA e-newsletter and another for Organic Matters Magazine.

Another ASP leading two field demonstrations for the digital decision tool in southeastern PA presented the project findings at a winter soil health workshop in December 2017 to 24 farmers and 12 ASP participants.

In total, 14 ASPs provided information learned through this project with 309 farmers and a minimum of 258 ASPs using a variety of methods in a broad range of formats.

Performance Target:

Twenty ag service providers offer training to farmers about monitoring and managing ecosystem functions or directly monitor ecosystem functioning on a client’s farm, reaching 1,000 farmers managing 10,000 acres of land.

Twenty farmers monitor one or more ecosystem function on their farm and take actions to improve or maintain ecosystem functioning on 2,000 acres of land.

Introduction:

As a whole, society depends on services provided by ecosystem functions that lead to clean air, water, and sufficient food production. Maintenance of ecosystem functioning in the form of improved carbon (C) and nitrogen (N) cycling, biodiversity, and pest regulation can reduce the need for synthetic and purchased inputs, reduce environmental contaminants, and slow the spread of pesticide resistant organisms, thus increasing the sustainability of agricultural production. Farmers and agricultural service providers (ASPs) who are knowledgeable about ecosystem functioning, processes, and monitoring methods are better prepared to adjust their management practices accordingly to alleviate non-sustainable consequences associated with farming.

An earlier needs assessment survey completed by 99 ASPs identified several patterns about the current knowledge of processes, monitoring and prediction methods, and management tactics. The survey results indicated that understanding of monitoring methods for C and N cycling and pest regulation were low, and that ASPs had a high understanding about the processes and management tactics associated with C and N cycling but not with pest regulation. These findings identified a need to develop a training program that focused on monitoring and prediction methods that related to ecosystem functions of C and N cycling and pest regulations, predominantly as they are impacted by soil health. Educating ASPs and farmers about the importance of maintaining soil health while introducing them to many approaches for understanding and managing it allowed a comprehensive assessment of the importance of soil health's direct or indirect impacts on multiple ecosystem functions in a way that was practical and accessible.

Over the course of three years, ASPs participated in a soil health survey that allowed them to evaluate resources for interpreting soil health lab tests and to use a predictive cover crop model to choose an appropriate cover crop mixture to manage N needs at a specific farm. Both projects were done with farmer cooperators who hosted farm-based research projects. Information derived from those projects has been incorporated into farmer workshops and other outreach events hosted by

participating ASPs. Information from these projects also further enhanced fundamental information about soil health and cover crop management, which was presented to a wider group of ASPs and farmers, by ASPs or the State Coordinator. Due to inherent complications of the impact of soil health and management on organisms, the majority of the project focus was on N and C cycling and very little was presented on pest regulation. Using a collaborative approach for professional development, this state project enhanced the growing movement towards improving soil health by helping to build a strong community of practitioners in PA and across the northeast and mid-Atlantic regions.

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Educational Approach

Educational approach:

The objective of this project was to facilitate more extensive outreach about monitoring and prediction methods for managing ecosystem services related to soil health with cover crops in agronomy-based cropping systems. The educational approach was to focus ASPs attention on a couple of particularly difficult to monitor aspects of soil health including the importance of soil organic matter in soil health tests and nutrient contributions from cover crops while also enhancing their understandings of the basic soil science principals impacting soil health management. Two pathways were used to provide education. The first involved closely engaging with small groups of ASPs on specific small projects including a soil health survey and the predictive cover crop model. For this educational approach, ASPs collaborated with farmer-cooperators to collect soil samples for a soil health survey and to establish demonstration plots to estimate nitrogen contributions to cash crops following a cover crop mix (e.g. the predictive cover crop model). Project findings were incorporated into outreach activities for farmers that were hosted by ASPs. The second pathway involved broad-based education of larger, variable groups of ASPs and farmers about soil health monitoring and management that incorporated results from the more intensive survey and monitoring work.

Educational activities are described as they occurred in the yearly milestones; below is a summarized description of the project's educational program and events.

Soil Health Survey

- 10 ASPs conduct a soil health survey of agricultural lands. The purpose of the survey was to teach ASPs about the currently available soil health testing services and to build a preliminary dataset of soil health measurements for

Pennsylvania agricultural fields. Ag service providers in the cohort each collected soil samples from 2 to 4 farm fields and submitted the samples for analysis by various testing labs.

- The State Program coordinator compiled the results of the soil health tests and distilled them into a PowerPoint presentation, which was delivered to the cohort via a webinar training. The presentation described the measurements that were conducted by each of the soil health testing services and compared the results of the soil health tests to the measurement of percent organic matter that is widely available through conventional soil testing labs. An important result from this work is that the simple and inexpensive measurement of percent organic matter can predict many of the advanced soil health metrics. The PowerPoint presentation was made available to ag service providers in the cohort to use in their educational programs.
- As a result of participating in the 'Soil Health Survey', 6 of 6 service providers who filled out a follow up survey increased their knowledge of soil health testing methods and increased their likelihood to include information about soil health monitoring in their education programs.

Predictive Cover Crop Model

- The state coordinator hosted 3 video conference meetings with 3 ASPs who were planning to use the prediction model with farmers throughout the course of the project to orient them to the digital cover crop model, to plan field demonstration plot set up, and to discuss other related details of the project. Because each site was managed differently and each ASP had individual scenarios on their farms, additional questions were addressed one-on-one via phone or email on a case-by-case basis with each ASP.
- Each ASP/farmer pair was supplied with calculator outputs and reasoning for the mix chosen (prepared by state coordinator) and the cover crop seeds needed to make the appropriate mixture and all necessary soil and plant-tissue tests were covered by the state project. All plot maintenance and sample and data collection was led by the ASP and farmer.
- State Coordinator presents result findings from the predictive cover crop model to 12 ASPs in mid-December 2017 in preparation of their identifying information to include in 2018 Winter Farmer Conferences.

Broad Presentations to ASPs and Farmers (Education Pathway 2, presented by State Coordinator):

- Mid-Atlantic Crop School. November 2016. Ocean City, MD. University of Maryland. 180 ASP participants.
- Pennsylvania Women in Ag (PA WAgN) Annual Conference. December 2016. PA WAgN Penn State University. 3 Farmer and 19 ASP participants.
- PA Agronomic Education Conference (PAES). January 2017. Pennsylvania Agriculture Partners. 27 ASP participants.
- Planting Green Field Day. June 2017. Centre Hall, PA. Northeast SARE and Penn State Extension. 13 Farmer and 68 ASP participants.
 - 14 participants indicated a moderate to considerable change in knowledge about 'soil health and cover crops' and 27 participants indicated a minimal to considerable change in knowledge about 'planting green'. 14 participants reported that the event exceeded and 22 reported that it met their

expectations.

- Farmer Soil Health Field Day. August 2017. McVaytown, PA. Penn State Extension. 40 Farmer and 5 ASP participants.
- Farmer Soil Health Field Day. October 2017. Dubois, PA. Penn State Extension. 7 Farmer and 18 ASP participants.
- Mid-Atlantic Soil Health Conference. October 2017. Manheim, PA. USDA-NRCS. 17 Farmer and 153 ASP participants.
- Cropping Strategies for Managing Soil Health Webinar hosted by state coordinator in February 2017. Topics included:

Webinar Day 1 60 ASP Participants

- Fungal Endophytes: Fungi that Facilitate Farm
- Understanding Biological Seed and Soil Treatments

Webinar Day 2 50 ASP Participants

- Impacts of Grazing Management on Soil Health
- No-till and Grazing Integration to Improve Soil

Webinar Day 3 16 ASP Participants

- Double Cropping with Fall Manure
- Crediting N Supply from Cover Crops and Soil Organic Matter

Milestones

Milestone #1

What beneficiaries do and learn:

Year 1 Milestone Accomplishments

Proposed Completion Date:

October 31, 2015

Status:

In Progress

Accomplishments:

Year 1 (October 1, 2014 – September 30, 2015) Milestone Accomplishments

1. 40 ag service providers attend an introductory webinar training about the 'Soil Carbon Challenge' and learn about factors affecting soil carbon (C) inputs, losses, and storage and different tests that are used to measure the quantity and quality of soil C. (October 2014)

Complete. Based on input from a cohort of ag service providers interested in learning about monitoring soil carbon cycling and soil health testing, we abandoned the 'Soil Carbon Challenge' idea and instead focused on conducting a soil health survey of agricultural fields in Pennsylvania. Details of the 'Soil Health Survey' are described under the next milestone.

2. 25 ag service providers embark upon the 'Soil Carbon Challenge' by working with a cooperating farmer to use a soil C computer model to predict how different crop rotations and management practices might affect soil C storage. Using results from the model, ag service providers work with cooperating farmers to develop a soil C management plan to be implemented over the next 3 years. Ag service providers submit baseline soil samples for analysis by State Program personnel. (November 2014-March 2015)

Complete. The Pennsylvania State Program organized a cohort of 10 agricultural service providers, including 8 county extension educators, one non-profit employee, and a soil test lab director to conduct a soil health survey of agricultural lands. The purpose of the survey was to teach the ag service providers about the currently available soil health testing services and to build a preliminary dataset of soil health measurements for Pennsylvania agricultural fields.

Ag service providers in the cohort each collected soil samples from 2 to 4 farm fields and submitted the samples for analysis by the Cornell Soil Health Lab, the Woods End Lab Solvita Soil Health Tool, and the Penn State Ag Analytical Lab.

The State Program coordinator compiled the results of the soil health tests and distilled them into a PowerPoint presentation, which was delivered to the cohort via a webinar training. The presentation described the measurements that were conducted by each of the soil health testing services and compared the results of the soil health tests to the measurement of percent organic matter that is widely available through conventional soil testing labs. An important result from this work is that the simple and inexpensive measurement of percent organic matter can predict many of the advanced soil health metrics. The PowerPoint presentation was made available to ag service providers in the cohort to use in their educational programs.

As a result of participating in the 'Soil Health Survey', 6 of 6 service providers who filled out a follow up survey increased their knowledge of soil health testing methods and increased their likelihood to include information about soil health monitoring in their education programs. Two extension educators already used the soil health testing summary PowerPoint at workshops in December 2015, reaching 64 farmers. Three more extension educators plan to use the PowerPoint at workshops they are organizing in winter of 2016.

Update. Note that 2016 winter workshops on Soil Health with Extension educators will now be in summer/fall 2017.

3. 80 ag service providers and 80 farmers attend a hands-on workshop at the Farming for Success field day. Beneficiaries increase knowledge of soil C monitoring, including:
 - Soil testing methods to measure quantity and quality of soil C including total organic matter by loss on ignition, total carbon by combustion analysis, active C by permanganate oxidation, and 24 hr flush of CO₂ by the Solvita CO₂ Burst test

- Predicting soil C storage using computer models (June 2015)

Complete. The Pennsylvania State Program was not able to participate in the Farming for Success field day because of a schedule conflict. However, we gave two presentations on monitoring soil C at the York County Crop Day and the Adams County No-Till Conference in February 2015 which reached a total of 225 farmers and ag service providers. We also gave presentations on monitoring soil health, which includes soil C measurements, at the Mid-Atlantic Fruit and Vegetable Convention in February 2015, the Pennsylvania Association for Sustainable Agriculture Summer Conference in August 2015, the Pennsylvania NRCS Advanced Soil Health training in August 2015, and a grazing workshop in September 2015, reaching another 255 farmers and ag service providers.

Based on surveys conducted at those events, 85 out of 98 respondents increased their knowledge about soil organic matter. Seventy out of 98 respondents increased their likelihood to measure soil organic matter.

Milestone #2

What beneficiaries do and learn:

Year 2 Milestone Accomplishments

Proposed Completion Date:

October 31, 2016

Status:

Completed

Date Completed:

October 31, 2017

Accomplishments:

Year 2 (October 1, 2015 – September 30, 2016) Milestone Accomplishments

1. 25 ag service providers participating in the 'Soil Health Survey' attend a follow-up webinar to learn about the different management strategies being implemented by the cooperating farmers and to share challenges and successes from the first year of the project. (January 2016)

Complete. Twelve county extension educators who participated in the 'Soil Health Survey' met for a follow-up webinar on October 15, 2015, to discuss the results of the survey. Following the webinar, 6 of 6 service providers who filled out a survey increased their knowledge of soil health testing methods and increased their likelihood to include information about soil health monitoring in their education programs. As of our annual report submitted in December 2015, we had verified that two extension educators already used the soil health testing summary PowerPoint at workshops, reaching 64 farmers. Three more extension educators planned to use the PowerPoint at workshops they organized in winter of 2016. Detailed verification of outcomes from the 'Soil Health Survey' will be conducted at the end of the year for reporting in the December 2016 annual report.

Update. To date, the 'Soil Health Survey' has involved 15 service providers in sample collection and outreach regarding soil health testing. Samples will

continue to be collected in 2017 to create a more robust and accurate data set and to involve newly hired Extension educators in the project. Findings from the survey indicate that although Soil Health Tests (e.g. Cornell Comprehensive Soil Health Tests and the Wood's End Soil Health Tool) serve as good indicators for estimating complex soil biological factors, and are useful tools for assessing soil health as a whole, they are expensive and are not useful as resources for determining specific management factors such as crop fertilizer rates. Comparison of these tests to a standard soil organic matter test from a typical soil testing lab (e.g., Penn State Ag. Analytical Services Lab), shows strong correlation among each individual sampling factor with soil organic matter (e.g., CO₂ bursts, SLAN, and aggregate stability). Because soil organic matter is a key indicator of soil health due to its impact on physical, chemical, and biological soil properties, this study has found that it is an accurate and affordable indicator of soil health as a whole that might be more useful as an annual sampling resource for farmers and service providers. These research results have been presented at numerous farmer and service provider-based field days and conferences in 2015-16 (discussed below in Milestone 4). Development of this information into farmer-based publications and resources will be developed in 2017. Additionally, as part of this initiative, 18 Extension Educators on the Field and Forage Crop team were supplied with soil sampling equipment to better prepare them to sample and assess soil health on farms with farmers. Also in relation, Penn State Extension/NE SARE will be conducting several soil health workshops in summer/fall 2017 led by a total of 9 service providers, to provide outreach to farmers in areas that have not been receiving soil health training.

Complete. As described in Year 3 Milestones 1 and 3. Development of specific resources for managing soil health are described in Year 3 Milestones 4, 5, and 6.

2. 75 ag service providers and 50 farmers attend an ecosystem functioning webinar series with 2 presentations on monitoring N cycling and 3 presentations on monitoring insect pests and pollinators. Beneficiaries increase knowledge of the following methods used to monitor ecosystem functioning:

- Predicting N mineralization potential and fertilizer recommendations using the Solvita test
- Measuring cover crop biomass N content using NDVI sensors
- Predicting N fertilizer recommendations using computer models
- Measuring pollinator activity with bee visitation counts
- Measuring ground-dwelling predatory insects with pitfall traps
- Predicting risk of damaging stages or populations of insect pests using computer models (February-March 2016)

Complete. On April 21, 2016, twenty-five extension educators and specialists on the Penn State Extension Field and Forage Crops team attended a webinar presentation on tools for predicting N cycling processes that can be used in the adaptive management of cover crops to prevent nitrate leaching and offset fertilizer N inputs. These tools include a graphical chart that can be used to plan a cover crop mixture to balance the goals of preventing N leaching and supplying N to a subsequent crop, the use of NDVI sensors to measure cover crop biomass, and a simple equation that can be used to predict the N fertilizer replacement

value of a cover crop based on site-specific measurements.

The topic of predicting N mineralization potential using Solvita tests was not included in the webinar presentation. Rather, this content area was incorporated into the 'Soil Health Survey' materials described in outcomes to milestone one.

Note. See Milestone 3 below for progress on the "Predictive Cover Crop Model" for updated outcomes and in-progress work related to predicting N mineralization potential, measuring biomass with NDVI sensor and predicting N fertilizer recommendations with computer models.

The latter portion (the final 3 bullet points) of Milestone 2 will be revised in 2016-2017. Rather than focusing on insect monitoring, we will present aspects of soil ecology and soil organism activity as described in Year 3 Milestone 3.

In-progress. The impacts of soil ecology and organism activity related to soil health will be presented as part of a recorded webinar series. Targeted towards an Extension audience, in the 'Cropping System Strategies for Managing Soil Health' webinar series, the two specific talks related to ecology are:

- Fungal Endophytes for Facilitating Farming – which will focus on microbes that live in tissues of plants without negative effects and how they are impacted by agricultural management practices.*
- Understanding Biological Seed and Soil Treatments – which will focus on the prophylactic approach of treating seeds to prevent pathogens without a definitive need to take precaution. The impacts of these treatments on crop and soil health will be discussed.*

Other talks in the series include:

- Impacts of Grazing Management on Soil Health*
- No-till and Grazing Integration to meet Farmer Objectives and Improve Soil*
- Double-Cropping with Fall Manure*
- Crediting N Supply from Cover Crops and Soil Organic Matter*

(February 2017)

Complete. Described in Year 3 Milestone 3.

- 3. 2 Extension Educators work with State Program personnel to field test methods to measure cover crop biomass N content using NDVI sensors and predict N fertilizer needs in a subsequent corn crop using computer models. (April-May 2016)*

In Progress. Following the April 21, 2016 webinar described in the outcomes for milestone two, three extension educators and one NRCS soil conservationist signed up to work with the State Program to test tools for adaptive N management of cover crops with farmer collaborators starting in June 2016. This will be referred to as the 'Predictive Cover Crop Model' in year 3 milestones.

Update. 3 Extension educators have identified 4 farm locations, with farmer cooperators to evaluate a digital tool for predicting N cycling processes that can be used to manage cover crops, reduce N leaching, offset N fertilizer inputs, and achieve optimal crop yield. Soil samples were collected and analyzed from each site for % organic matter in order to determine cover crop seeding mixture suitable for reducing NO₃-N leaching according to the model. Cover crops were

planted at all site locations in Fall 2016. (April- Sept 2017)

Complete. Described in Year 3 Milestone 4.

4. 150 ag service providers will attend hands-on training session about the importance of monitoring soil organic matter and utilizing it to mitigate crop drought and heat stress at the Farming For Success Field Day on June 23, 2016 in Landisville, PA.

Complete. We presented an overview and demonstration of soil health at the Farming for Success Field Day on June 23, 2016 in Landisville, where 180 farmers/ag service providers were in attendance. Presentations related to soil health, and use of cover crops to improve nutrient cycling, were also given at the Mid-Atlantic Soil Testing and Plant Analysis Working group in February 2016, the New England CCA meeting in February 2016, the Organic Vegetable Production for Beginners conference in April 2016, the Pennsylvania Association for Sustainable Ag Summer meeting in July 2016, The joint meeting of regional soil testing experiment station collaborators in July 2016, and the Cover Crops in Concorde Workshop in September 2016, reaching another 260 farmers and ag service providers. Additionally, soil health information from the state program was featured at 4 regional field days in PA and one NRCS training session in NC and another in PA reaching 240 additional ag service providers and farmers. In May 2016, an eXtension Webinar 'Making the Most of Mixtures: Considerations for Winter Cover Crops in Temperate Climates' was presented and is available online. Attendees unknown but 11 service providers were involved. Two NRCS service providers shared the Cover Crop Mixes Factsheets with their listserve audiences - users unknown. In total, over 685 farmers and service providers received information about soil health at conferences, workshops, field days, and classes between October 2015-16.

Milestone #3

What beneficiaries do and learn:

In April 2016, Kristy Borrelli replaced Charlie White as NE SARE PDP Coordinator for Pennsylvania. Borrelli and White have similar backgrounds and interests and agreed to continue forward with projects initiated by White. Small adaptations have been made to milestones to reflect Borrelli's interests and program direction and to build off of White's experiences in years 1 and 2.

15 ag service providers continue to participate in the ongoing 'Soil Health Survey.' In order to provide more robust information about baseline soil health properties across PA resulting from different management practices, soil samples will be collected from additional farm sites and analyzed by the State Program personnel in 2016-17. Outcomes will be presented to ag service providers by the state coordinator at extension in-service meetings and workshops, and made available to supplement existing PowerPoint presentations. (October 2016 - March 2017)

Proposed number of agriculture service provider beneficiaries who will participate:

15

Actual number of farmer beneficiaries who participated:

248

Actual number of agriculture service provider beneficiaries who participated:

Proposed Completion Date:

October 31, 2017

Status:

Completed

Date Completed:

December 21, 2017

Accomplishments:

Complete. Although they found the results to be important and meaningful to farmers, the majority of agricultural service providers (ASPs) involved in this project had already had sufficient exposure to the 'Soil Health Survey' as described in the Milestones from years 1 and 2, and there was little interest from many of them to participate in the continuation of the survey. However, the previous years' project findings motivated one ASP to lead an additional, separate soil health survey. The potential impact from widespread outreach and direct collaboration with farmers with this influential ASP was great. In response, the PA State PDP Program supported 1 ASP to conduct the soil health survey.

Participation in this project allowed the ASP to educate 30 farmers across PA directly about soil health concerns and solutions on their own farms. This project is now well-established and will continue in coming years, independently from NE-SARE State Program. State Coordinators (Borrelli and White (former)) assisted the ASP to interpret and present project findings. The ASP presented on-farm survey results to 138 Farmers, 83 ASPs and 30 Ag Professionals at 3 farmer-focused events and 1 professional conference, and also developed 2 magazine/newsletter articles featuring the information. Described here:

Presentations

- Data-driven Farming and Citizen Science with FARMDATA. 2017. PASA Farming For the Future Conference. 22 Farmers and 21 ASP participants. On a scale of 1 to 5, Change in Knowledge increased 1.16 points and Likelihood to Make a Change increased to 2.89. The Program Overall was rated at 3.37.
- Tuscarora Organic Growers "Crop Improvement" Meeting. 2017. 23 Vegetable Farmers Participated in the event. No Evaluation Data was collected.
- PASA's 3rd Annual Soil Health Conference. 2017. 93 Farmers and 62 ASP participants. On a scale of 1 to 5, Change in Knowledge increased by 0.51 points. The Program Overall was rated at 3.80.
- Setting and Exceeding Benchmarks for Soil Health. 2017. ASA-CSSA-SSSA Annual Meetings, Tampa, FL. 30 agricultural professional participants. No evaluation data available.

Articles

- Setting and Exceeding Benchmarks for Soil Health. 2017. PASA e-newsletter.
- Soil Health Journey at Spiral Path Farm. 2017. Organic Matters Magazine.

Upcoming

Additionally, information from this study will be presented by the ASP and Borrelli with participating farmer cooperators at one full-day and one half-day workshop at the PASA Farming for the Future Conference in February 2018. Expected attendance is 30 farmer participants per session.

- Holistic Soil Health 101 – Wednesday 9:00 am to 5:00 pm
- Developing Your Farm’s Soil Health Strategy – Thursday 9:00 am to 12:30 pm

Complete

Information generated from the Soil Health Survey in years 1 and 2 was presented to 80 Farmer and 470 ASP participants by Borrelli at several field days and workshops in year 3. These included:

- Mid-Atlantic Crop School. November 2016. Ocean City, MD. University of Maryland. 180 ASP participants.
- Pennsylvania Women in Ag (PA WAgN) Annual Conference. December 2016. PA WAgN Penn State University. 3 Farmer and 19 ASP participants.
- PA Agronomic Education Conference (PAES). January 2017. Pennsylvania Agriculture Partners. 27 ASP participants.
- Planting Green Field Day. June 2017. Centre Hall, PA. Northeast SARE and Penn State Extension. 13 Farmer and 68 ASP participants.
 1. 14 participants indicated a moderate to considerable change in knowledge about ‘soil health and cover crops’ and 27 participants indicated a minimal to considerable change in knowledge about ‘planting green’. 14 participants reported that the event exceeded and 22 reported that it met their expectations.
- Farmer Soil Health Field Day. August 2017. McVaytown, PA. Penn State Extension. 40 Farmer and 5 ASP participants.
- Farmer Soil Health Field Day. October 2017. Dubois, PA. Penn State Extension. 7 Farmer and 18 ASP participants.

Mid-Atlantic Soil Health Conference. October 2017. Manheim, PA. USDA-NRCS. 17 Farmer and 153 ASP participants.

Milestone #4

What beneficiaries do and learn:

Complete ‘Soil Health Survey’ findings will be compiled and published as an extension bulletin or in an open access journal targeted towards agricultural service providers (e.g., The Journal of Soil and Water Conservation) with the intent of reaching a wider regional audience. (September 2017)

Proposed Completion Date:

December 31, 2017

Status:

In Progress

Accomplishments:

The publication is 'in preparation'.

Milestone #5

What beneficiaries do and learn:

As a complimentary component of 'The Soil Health Survey,' 25 service providers will receive information about soil organism activity under cover crops and diversified cropping systems as presentations in an in-service webinar and at traditionally scheduled regional field days (e.g., Farming for Success in Landisville, PA or York County Crop Day). Online resources will be available to a broad audience of service providers and producers.

Proposed number of agriculture service provider beneficiaries who will participate:

25

Actual number of agriculture service provider beneficiaries who participated:

126

Proposed Completion Date:

October 31, 2017

Status:

Completed

Date Completed:

February 20, 2017

Accomplishments:

It was apparent after conversations with Soil Ecologists and observing research data collected on soil organism activity under cover crops that information about these populations was complicated, not well understood, and difficult to apply to practical farm management strategies. As a result, "soil organism activity" as a sole topic was not suitable for field days or other outreach intended to prepare ASPs to assist farmers in managing soil health. Interest in information about the living soil system and strategies for managing soil health however, was high among ASPs. In February 2017, a 3-day webinar series focused on "Cropping Strategies for Managing Soil Health" was presented to 126 ASPs.

The webinar series was organized and lead by Borrelli and information was presented by 6 Penn State Extension Specialist and Educator experts for each topic area. Related topics were presented as hour-long pairs where each individual webinar was 30 minutes long. Live webinars were recorded and available as online resources on the Penn State Extension website. In the end, information included in the webinar series was presented at an academic level suitable as an educational resource for an ASP audience, but it was not intended for them to incorporate the information into their outreach programs with other ASPs and farmers. Although Extension experts have continued to present these topics at multiple meetings with ASPs and farmers, these outreach activities were independent of the NE-SARE State Program and are not reported here.

Cropping Strategies for Managing Soil Health Webinar topics included:

Webinar Day 1

- Fungal Endophytes: Fungi that Facilitate Farm
- Understanding Biological Seed and Soil Treatments

Available at:

<https://meeting.psu.edu/p43gk91za/?launcher=false&fcsContent=true&pbMode=normal>

60 ASP Participants

Webinar Day 2

- Impacts of Grazing Management on Soil Health
- No-till and Grazing Integration to Improve Soil

Available at:

<https://meeting.psu.edu/p42eamxh84r/?launcher=false&fcsContent=true&pbMode=normal>

and

<https://meeting.psu.edu/p7hec8lsi0j/?launcher=false&fcsContent=true&pbMode=normal>

50 ASP Participants

Webinar Day 3

- Double Cropping with Fall Manure
- Crediting N Supply from Cover Crops and Soil Organic Matter

Available at: N/A

16 ASP Participants

Milestone #6

What beneficiaries do and learn:

4. State coordinator will establish demonstration plots on four farms and oversee intensive site monitoring with four PA ag service providers (3 extension educators, 1 NRCS conservationist) and experienced PA cover crop producers to field test the digital predictive cover crop model described in Year 2 Milestone 3. State Coordinator will collaborate with this small cohort of service providers throughout the demonstration (site visits and via phone) to review project findings and troubleshoot producer's questions and challenges throughout the duration of the project. The predictive model will be available to a wide audience and serve as a planning resource for determining site-specific cover crop mixes and seeding rates in the form of downscaled digital calculators and brief support videos, such as monitoring in-season crop N using handheld crop sensors.

Proposed number of agriculture service provider beneficiaries who will participate:

4

Actual number of farmer beneficiaries who participated:

4

Actual number of agriculture service provider beneficiaries who participated:

Proposed Completion Date:

September 30, 2017

Status:

Completed

Date Completed:

December 21, 2017

Accomplishments:

Demonstration sites were established and lead by 3 Extension ASPs, with 4 farmer cooperators at 4 farm locations across PA. The state coordinator hosted 3 video conference meetings with this ASP cohort throughout the course of the project to orient them to the digital cover crop model, to plan field demonstration plot set up, and to discuss other related details of the project. Because each site was managed differently and each ASP had individual scenarios on their farms, additional questions were addressed one-on-one via phone or email on a case-by-case basis with each ASP. The calculator was used to estimate the appropriate legume to non-legume ratio for a cover crop mix tailored specifically to meet the nitrogen needs of each farm, which were determined by factors such as the amount of fall soil nitrate present, corn silage or grain would be harvested, or if manure was applied in spring and/or fall. At this time, the digital model was still fairly new and was not intuitive in its entry and output, therefore it was more appropriate for the state coordinator to enter the correct values and interpret outputs rather than having the ASP collaborate directly with the farmer to use the model. Each ASP/farmer pair was supplied with calculator outputs and reasoning for the mix chosen and the cover crop seeds needed to make the appropriate mixture and all necessary soil and plant-tissue tests were covered by the state project. All plot maintenance and sample and data collection was led by the ASP and farmer. A timeline of those activities was similar to what follows.

- Summer 2016. ASP identifies a farmer cooperator who produces cover crops in rotation with grain.
- Fall 2016. Enter site values into digital cover crop model - mostly estimated although actual values were preferred. (Soil samples would need to be collected prior to entering values into model).
- Fall 2016. State coordinator interprets digital model findings and purchases cover crop seed mix for ASP and farmer who plant the mix uniformly over a field in fall. Fall manure applied if applicable, soil samples collected and analyzed for nitrogen and soil organic matter.
- Spring 2017. At time of cover crop termination, ASP collects NDVI readings of the mature cover crop mix with a handheld Greenseeker sensor at the time of termination. This value is used to estimate how much N is supplied by the cover crop residue being returned to the soil and will be available to the following corn cash crop. ASP also collects soil samples, if not collected in fall, to determine soil organic matter levels that will mineralize.
- Spring 2017. Actual values are re-entered into the digital model including fall and spring GDD, soil organic matter levels, and spring cover crop biomass N, as determined by the Greenseeker sensor readings, to give an estimate of necessary fertilizer to be applied to the following corn crop.

- Late-Spring 2017. Plots are laid out and corn is planted in a uniform stand following the cover crop, with low, med, and high rates of N (as manure or fertilizer), as determined by the calculator.
- Early November 2017 (silage), Late November 2017 (corn grain south-eastern PA (warm)), mid-December (corn grain north-western PA (cool)), crops are harvested and samples for grain or biomass quality or additional soil tests are collected and analyzed.
- December 2017 state coordinator analyzes project results against the digital model recommendations and discusses results with a larger group of ASPs in preparation for winter farmer meetings and spring/summer field days.

An unusual growing season (hot and dry early, cold and wet late) delayed crop harvest substantially this year for both silage and grain crops and made it difficult adapt the calculator accordingly or to prepare any downscaled resources that were available by the end of the calendar year. Rain and inclement weather destroyed one ASPs field site entirely after grain was planted and another cooler, northern location has still not harvested corn grain in mid-December. Regardless, both ASPs gained experience using the calculator, the Greenseeker sensor, and have a better understanding of managing N with cover crop mixes. Two sites in southeastern PA however, performed very well and had valuable findings (described in Milestone 5). One digital support video about calculating the seeding rates of cover crop mixtures was prepared as an accessory digital resource, which is available on the Penn State Extension website.

Milestone #7

What beneficiaries do and learn:

5. 25 additional ag service providers receive information from state coordinator and participating service providers (4) about the experiences and lessons learned during the field test of the predictive computer model. Experiences, challenges, and final outcomes discovered at the demonstration plots will be discussed with this larger group at in-service extension meetings in order to prepare them to provide outreach to a larger group of cover crop producers. State coordinator will be available to answer questions and offer support for using the tools via phone calls to other service providers interested in using the predictive models for continued training of farmers.

Proposed number of agriculture service provider beneficiaries who will participate:

25

Actual number of farmer beneficiaries who participated:

28

Actual number of agriculture service provider beneficiaries who participated:

27

Proposed Completion Date:

September 30, 2017

Status:

Completed

Date Completed:

December 21, 2017

Accomplishments:

The digital model demonstrated to be a useful resource for determining the amount of N contributions supplied from a cover crop mixture to obtain maximum cash crop yields with reduced fertilizer applications. Input into the model is relatively easy to comprehend, but the output is more difficult to interpret and needs to be somewhat simplified to improve its utility for a larger group of ASPs and farmers. Future opportunities exist to continue to simplify and prepare supplemental materials that assist users to interpret the model and improve its overall utility as findings from this study established the importance of this tool.

A later corn harvest than expected reduced the amount of time available to present information as widely as anticipated to ASPs before the end of the year, but given the usefulness and importance for this digital resource, outreach will be continued heavily in 2018. In December 2017, results from the farm-based experiment using the digital model were presented to a total of 24 ASPs and 24 farmers. The ASP leading the two field demonstrations in southeastern PA presented the project findings at a winter soil health workshop in December to 24 farmers and 12 ASP participants. Project findings were also presented to 12 Extension ASPs in mid-December in preparation for their identifying the information they want to include in winter crops conferences, workshops, summer field days, and other farmer-based meetings that they will lead in 2018. Currently, information about this project has the potential to be incorporated by ASPs into at least 4 Extension workshops focused specifically on soil health, the Northeast Cover Crop Council meeting hosted in PA, and USDA-NRCS soil health meetings in 2018. Project findings are also scheduled to be presented at two research-based meetings focused on addressing soil health, cover crops, reduced-tillage in organic grain systems, and holistic agroecosystem management. Approximately 6 ASPs from those teams will incorporate use of the model in upcoming farm-based studies, outreach events, and future research studies. Furthermore, the former state coordinator (White) who developed the digital model, will serve as the new Nutrient Management Extension Specialist at Penn State and has a very active outreach agenda planned across the northeast and currently is scheduled for 4 farmer-based meetings. Having a strong focus nutrient management as an important aspect of soil health, the digital model will be the basis for many of his outreach and Extension programs working directly with ASPs and farmers.

Milestone #8

What beneficiaries do and learn:

Cover crop producers will learn about available digital resources for determining site-specific cover crop mixes and seeding rates developed from the predictive cover crop at traditionally scheduled regional field days (e.g., Farming for Success in Landisville, PA) or other producer targeted events (e.g., PA No-till alliance conference).

Proposed Completion Date:

September 30, 2017

Status:

Completed

Date Completed:

December 21, 2017

Accomplishments:

The model will be accessible and available for use on the Penn State Extension website. Currently, 1 Penn State Extension “Learn Now Video” about calculating cover crop seeding rates has been prepared as an accessory to the digital model and another one specifically describing the model is being prepared to help users navigate the tool. A complete renovation of the University Extension business model, website, and resources took place in 2017 making it challenging to create digital resources rapidly, but necessary support and a strong focus on developing digital resources will help to ensure that development of products like the digital model and associated advertising is strong. As described in Milestone 5 outreach at regional meetings, workshops and field days will include presentations about the model and its associated digital products.

Milestone Activities and Participation Summary

Educational activities conducted by the project team:

Activity	Year 1	Year 2	Year 3	Total
Consultations		1	32	33
Curricula, factsheets or educational tools			2	2
Published press articles, newsletters			2	2
Webinars, talks and presentations	5	6	15	26
Workshop / field days		6	4	10
Other educational activities: Soil health survey	1	15	1	17

Beneficiaries who participated in the project’s educational activities and events:

Audience	Year 1	Year 2	Year 3	Total Individuals
Extension	0	20	300	0
NRCS	0	240	257	0
Researchers	0	0	22	0

Nonprofit	0	15	81	0
Agency	0	100	105	0
Farmers / ranchers	0	595	276	0

PARTICIPATION SUMMARY:

900 Number of agricultural educator or service providers reached through education and outreach activities

Learning Outcomes

158 Agricultural service providers reported changes in knowledge, skills and/or attitudes as a result of their participation.

209 Farmers reported changes in knowledge, attitudes, skills and/or awareness as a result of their participation

23 Ag service providers intend to use knowledge, attitudes, skills and/or awareness learned through this project in their educational activities and services for farmers

Key areas in which the service providers (and farmers if indicated above) reported a change in knowledge, attitudes, skills and/or awareness::

Year 1 key areas of learning verified using post-event surveys

Characteristics of Soil Organic Matter

Methods to Measure Soil Organic Matter

Interpreting Results of Soil Organic Matter Measurements

Methods to Measure Soil Health

Year 2 Key areas of learning verified using post-event surveys

Characteristics of Soil Organic Matter on Soil

Soil Health Testing Tool Assessments

Soil Health impacts on Soil Physical Properties and Ag Management

Using Cover Crops to Build Soil Health

Interpreting a Soils Test

Year 3 Key areas of learning verified using post-event surveys

Cover Crop Species Impacts on Nitrogen Supply and Retention and Effects in Mixtures

Monitoring Nitrogen and Carbon Cycling in Crops and Soils

Impacts of Farm Management on Soil Health including Opportunities to Build Soil Health

Soil Health Lab Testing Opportunities, Limitations, and Alternatives

Performance Target Outcomes

PERFORMANCE TARGET OUTCOMES - SERVICE

PROVIDERS

Activities for farmers conducted by service providers:

Activity	Year 1	Year 2	Year 3	Total
Curricula, factsheets and other educational tools		2		2
Consultations		1	8	9
Online trainings		11		11
Published press, articles, newsletters		8	2	10
Webinars, talks and presentations		6	3	9
Workshops and field days	2	6	4	12
Soil Health Survey			1	1

14 Total number of agricultural service provider participants who used knowledge and skills learned through this project (or incorporated project materials) in their educational activities, services, information products and/or tools for farmers

309 Farmers reached through participant's programs

Total amount of production these farmers manage:

1890

Performance target outcome for service providers narrative:

Year 1 Narrative

2 extension educators used information from the soil health testing survey project in workshops that reached 64 farmers.

Year 2 Update. As the transition between Borrelli and White occurred in late 2015 into spring 2016, direct collaboration with ASPs and farmers was not as robust as it could have been. However, 6 ASPs used information generated from the Soil Health Survey during year 1 of the NE SARE State Program in presentations with ASPs and farmers. These presentations are included in the comprehensive summary described above in the Year 2 Milestones, which also includes presentations given by state coordinators. Those presentations specifically conducted and led by ASPs are separated out and listed here.

- 1 ASP presents information from soil survey at New England CCA Conference in Portsmouth, NH. 53 attendees (not considered in farmer count above)
- 1 ASP presents information from soil survey at 2 farmer field days in Pennsylvania
 - Newberg PA, 19 Farmer Participants
 - Womelsdorf, PA, 10 Farmer Participants

- 1 ASP presents information from soil survey at Cover Crops in Concord's Workshop, Portland, NY, 45 ASPs and 10 Farmer Participants
- 1 ASP presents information from soil survey at 2 separate workshops in North Carolina
 - NRCS Employee Training Meeting, 50 NRCS ASP Participants (not included in farmer counts above)
 - Extension Agent Training Meeting, 80 Extension Agents Participants (not included in farmer counts above)
- 1 ASP presented information from soil survey at Pasture Walk in Ulysses, PA, 6 Farmer Participants
- 1 ASP presented information about cover crops impacts on soil health and survey results in a Organic Vegetable Production for Beginners Meeting in Allentown PA, for 25 Farmer Participants
- 2 ASPs share Cover Crop Mixes factsheets with listserv audiences (users unknown)

Year 3 Update.

- 1 ASP conducted a soil health survey on 30 farms with farmer collaborators managing approximately 1000 acres of land. The ASP presented on-farm survey results to 138 Farmers, 83 ASPs and 30 Ag Professionals at 3 farmer-focused events and 1 professional conference, and also developed 2 magazine/newsletter articles featuring the information. Details in Year 3 Milestones above.
- 3 ASPs conducted on-farm demonstrations at 4 sites with farmer cooperators to test a digital resource that estimates cover crop seeding rates to manage soil nitrogen inputs. Personal interactions with farmers and ASPs took place at least 5 times per year to discuss the importance of seeding rates, selecting the right mix, the importance of nutrient management, the importance of soil and plant tissue testing, and the overall impacts on yield. The calculator is being prepared for further outreach in the future with a greater ASP and farmer cohort. The model itself will be a resource that will be supported by several accessory videos.
- 1 ASP leading the two field demonstrations for the digital decision tool in southeastern PA presented the project findings at a winter soil health workshop in December to 24 farmers and 12 ASP participants.
- Currently, information about this project has the potential to be incorporated by ASPs into at least 4 Extension workshops focused specifically on soil health, the Northeast Cover Crop Council meeting hosted in PA, and USDA-NRCS soil health meetings in 2018. Project findings are also scheduled to be presented at two research-based meetings focused on addressing soil health, cover crops, reduced-tillage in organic grain systems, and holistic agroecosystem management. Approximately 6 ASPs from those teams will incorporate use of the model in upcoming farm-based studies, outreach events, and future research studies.

Additional Project Outcomes

Number of grants applied for that built upon this project:

Year 1	Year 2	Year 3	Total
	2		2

1 New working collaboration

Additional Outcomes Narrative:

Year 1 Narrative

A group of faculty at Penn State who were inspired by recent soil health initiatives, including the soil health testing survey coordinated by the Pennsylvania State Program, applied for strategic reinvestment funding from the Penn State College of Agriculture to develop a soil health working group that would catalyze faculty research, teaching, and extension in the area of soil health. The working group received \$25,000 in funding to conduct planning retreats and stakeholders workshops.

Year 2 Update. As part of Penn State's College of Ag. Sciences Strategic Initiatives and Networks Program, 'Soil Health for One Health', the PA NE SARE coordinator (Borrelli) led a discussion about soil health in agriculture and the NE SARE State Program's involvement to a group of 15 graduate students in natural resource and agricultural sciences. This initiative also organized 2-day visits with national and international experts on soil health as part of the course including Bianca Mobius-Clune, Director NRCS Soil Health Division, Deborah Page-Dumroese, U.S. Forest Service, and Roger Schulte, Wageningen University, with Penn State graduate students, faculty, and service providers to discuss the future and implications of soil health research, testing methods, and its importance in ecosystem services.

In September 2016, a collaborative effort led by the Chesapeake Bay Foundation, that included members from Penn State Extension, NE SARE (Borrelli), Pennsylvania Association for Sust. Ag, PA No-Till Alliance members and farmers, 3 Conservation districts, and the NRCS partnered and developed a Regional Conservation Partnership Project (RCPP) grant from the NRCS to improve soil health in order to improve water quality, mainly in the Chesapeake Bay. The proposal seeks to help regional farmers implement and adopt different agricultural soil building practices and conservation practices on their farms that improve nutrient use in crops, balance in the soil, and reduced sediment and nutrient loading to water bodies. The goal is to adopt these practices on over 2000 new acres of land in 3 PA counties by 2019. Awards not yet announced.

In September 2016, NE SARE PA Coordinator (Borrelli) presented a lecture to 25 Undergraduate students and one primary school teacher about 'Addressing Sustainability in Agriculture' as an invited speaker. The state coordinator presented an overview and personal experience of what sustainable ag is and is not and various opportunities for employment following graduation.

This year a new PA NE SARE State Coordinator began and networking opportunities were abundant as she begun in her new role. New working collaborations directly related to the goals and milestones of this State Project are estimated below.

Success stories:

This project had a significant influence on the educational programming of one Extension agent who participated in the soil health survey. This individual developed an extensive outreach effort - to both farmers and other service providers.

He conducting a soil health survey on 30 farms with farmer collaborators in year 3 and has presented on-farm survey results to 138 Farmers, 83 ASPs and 30 Ag Professionals at 3 farmer-focused events and 1 professional conference, and also developed 2 magazine/newsletter articles. His activities are summarized here:

- Data-driven Farming and Citizen Science with FARMDATA. 2017. PASA Farming For the Future Conference. 22 Farmers and 21 ASP participants. On a scale of 1 to 5, Change in Knowledge increased 1.16 points and Likelihood to Make a Change increased to 2.89. The Program Overall was rated at 3.37.
- Tuscarora Organic Growers “Crop Improvement” Meeting. 2017. 23 Vegetable Farmers Participated in the event. No Evaluation Data was collected.
- PASA’s 3rd Annual Soil Health Conference. 2017. 93 Farmers and 62 ASP participants. On a scale of 1 to 5, Change in Knowledge increased by 0.51 points. The Program Overall was rated at 3.80.
- Setting and Exceeding Benchmarks for Soil Health. 2017. ASA-CSSA-SSSA Annual Meetings, Tampa, FL. 30 agricultural professional participants. No evaluation data available.
- Article: Setting and Exceeding Benchmarks for Soil Health. 2017. PASA e-newsletter.
- Article: Soil Health Journey at Spiral Path Farm. 2017. Organic Matters Magazine.
- Upcoming: Information from this study will be presented by the ASP and State Coordinator with participating farmer cooperators at one full-day and one half-day workshop at the PASA Farming for the Future Conference in February 2018. Expected attendance is 30 farmer participants per session.
 - Holistic Soil Health 101 - Wednesday 9:00 am to 5:00 pm
 - Developing Your Farm’s Soil Health Strategy - Thursday 9:00 am to 12:30 pm

SARE Outreach

Outreach about SARE:

Information about SARE grant programs and information resources was shared through the events and activities listed below.

Year 1 (2014-2015) SARE Outreach Activities

Event/Activity	Number of Contacts with:	
	Farmers	Ag. Professionals
PASA Farming for the Future Conference	1600	400
Pennsylvania Organic Farm Fest	100	100

Chatham University Sustainable Food System Grad Student Meeting		25
Penn State Rural Sociology Grad Student Meeting		20
Ag Progress Days	10,000	1,000

Year 2 (2015-2016) SARE Outreach Activities

(complete outreach activities table for Year 2; include additional description below table as needed)

Event/Activity	Number of Contacts with:	
	Farmers	Ag. Professionals
PASA Farming for the Future Conference	1600	300
Pennsylvania Certified Organic Farm Fest	200	50
Penn State Ag Progress Days	10,000	1,000
SUNY Cobleskill Lecture with undergrads		26
Soil Health for One Health Lecture PSU grad students		15
Conversations and farm visits for NE SARE grant applicants (Farmer and Partnership)	15	6

Year 3 SARE Event/Activity	# Contacts with	
	Farmers	Ag Service Providers
PA WAgN Conference	100	40
PASA Annual Conference	1500	500
Spring Sustainable Cropping System Symposium	0	110
PA Certified Organic FarmFest	20	30
BUGS Urban Farm Project site visit	1	2
Penn State Ag Progress Days	10,000	1,000
Conversations for NE SARE Grant Applicants	10	4

Received information about SARE grant programs and information resources:

Audience	Year 1	Year 2	Year 3	Total
Service providers	1545	1397	1686	4628
Farmers	11700	11415	11631	34746

Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the U.S. Department of Agriculture or SARE.



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