**Project Description**

This case study describes two closely aligned efforts on the integration of precision prairie application with business and conservation planning. Many of the project partners are involved in both projects.

The projects are intended to assist private landowners meet their production and conservation goals while improving profitability and demonstrate the importance and effectiveness of voluntary conservation efforts.

In the Croplife Precision Prairie (CPP) Project, the Crop Life Foundation is partnering with the Iowa Soybean Association, Iowa State University, Iowa Agriculture Water Alliance (IAWA) and others to scale up pairing prairie strips with subfield scale profitability analysis. Key activities include technology development and outreach to farmers with an added focus on the design and management of prairie strips for integration with crop protection strategies to optimize production, while continuing to evaluate the effectiveness of this method in improving water quality and pollinator habitat.

The IAWA project, ‘Accelerating Habitat-Water Quality Conservation and Enhancing Agricultural Return on Investment’ (Ag-ROI), works with EFC Systems and their Profit Zone Manager platform (PZM) to determine which acres are consistently unprofitable and better suited for conservation practices such as prairie strips. Conservation planning and application of practices are then focused on these unprofitable areas. The project will include an evaluation of different methods of delivering these services.

**Problems and Opportunities**

While extensive agricultural production is an essential component of the Midwestern region's economy, an important contributor to the world’s food supply, there are recognized environmental concerns including soil erosion, water quality, and habitat loss for pollinators, other insects, and bird species associated with this scale of row crop production. Moreover, farmers are squeezed by ever higher input prices and periods where commodity prices fall below the cost of production. Emerging opportunities to address many of these concerns simultaneously include precision business planning to improve their return on investment (ROI) and strategic placement of zones of native prairie species.

Iowa State University has led development of Prairie strips technology as a practical, low-cost means of providing substantial reductions in soil erosion, improvements in water quality, and an expansion of pollinator and wildlife habitat. In this approach, narrow strips of native grasses and wildflowers are planted within row crops.

Subfield-scale profitability analysis enables farmers to determine the profitability of every acre in their fields to optimize their ROI. Taking unprofitable acres out of production and putting them into prairie strips releases capital that can be invested in the remaining parts of the field that more consistently generate revenue.

The CropLife Foundation and IAWA are coordinating efforts on the CPP and Ag-ROI projects to advance these approaches.

**Project Goals**

Overarching goals of both the CPP and Ag-ROI projects include improved water quality, pollinator habitat, and soil conservation while intensifying yields and increasing capacity for voluntary conservation in the Corn Belt.

The CPP project seeks to advance sustainable intensification on working landscapes by focusing on the most productive and profitable acres coupled with strategic placement of prairie strips in areas of lower profit potential. Displacing lower profit potential cropland with prairie may free-up resources helping farmers to optimize crop production on remaining cropland and maintain or improve soil quality such that agricultural yield goals can continue to be met.
The Ag-ROI project looks to change the paradigm for conservation discussions with producers by improving farm economics. This includes evaluating alternative methods of project delivery and supporting and developing the capabilities of private sector conservation planning resources.

**Measures of Success**

**CPP**
- Prairie STRIPS program now has 40 sites in Iowa and additional sites in Missouri, Michigan, and Wisconsin.
- Approximately $5M in prairie strips research funded at ISU.
- 32 peer-reviewed journal papers supporting prairie strips and a summary paper in top-tier scientific journal, PNAS.
- Conducted 5 CCA/TSP training sessions in Iowa in 2017 with a total of 62 attendees.

**Ag-ROI**
- Combined, ISA-EPS and Heartland Co-op reached 42 producers and conducted 18 PZM scenarios.
- ISA-EPS CCAs now able to conduct PZM analysis independently of EFC Systems.
- Reached approximately 850 farmers/landowners about project.
- Collaboration and financial support of two ISU CCA/TSP training sessions.

**Best Practices**

**CPP**
- Provocative and rock-solid data have been key to farmer/farmland owner interests in prairie strips.
- Farmer champions provide another kind of essential credibility.
- Soil conservation message particularly resonates with farmer audiences. Multiple, disproportionate benefits of prairie strips are also very appealing.

**Ag-ROI**
- Plan for a significant challenge in helping producers understand the economic opportunity associated with subfield profitability analysis such that they are motivated to fully engage and invest in the approach.
- Multiple contacts and strong relationships based on trust are required to conduct subfield profitability analysis and to link this with conservation planning and practice implementation.
- Private sector business models and structure change often, and potentially multiple times during project development and delivery. Projects including public-private partnerships need to be flexible and adaptable to these changes.
- Incorporate prairie strips as a distinct practice in EQIP based on the design standards established by the Prairie strips program at ISU (i.e., distinct from contour buffer strips and filter strips).
- Integrate economic tools including subfield economic analysis in conservation planning.
- Develop and conduct training for staff on subfield profitability analysis (awareness, not necessarily proficiency) and prairie strips as tools in conservation planning.

**Example Profitability Data**

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Project Summary
Gary Farrell brings 42 years of experience in the agricultural retail industry. As the President and CEO of Ag Enterprise Supply, Inc. in Cheney, Washington, the co-chair of the Washington State Soil Health Committee, a member of the Soil Health Institutes public policy committee, and a former Chairman of the Agricultural Retailers Association’s (ARA) Board of Directors, Mr. Farrell has seen how important America’s farm suppliers are in improving nutrient management and efficiency.

Because of this, he introduced the concept of creating a memorandum of understanding (MOU) between different agricultural retailers with the Natural Resources Conservation Service (NRCS) to improve collaboration between the federal agency tasked with improving conservation planning efforts and the farmers who implement them.

Washington’s unique climate and soil have allowed Mr. Farrell and his team to adjust variable rates of Nitrogen, Phosphorus, and Sulfur, direct seeding of cover crops (rather than conventional seeding methods), and rotation changes to improve soil conditions throughout their growing region in a relatively short amount of time. The focus on precision agriculture and the ability to utilize new ideas and methods are a perfect case study for agricultural retailers’ abilities to improve soil health and maximize nutrient efficiency for their farmer customers.

Problems and Opportunities
The biggest challenge has been changing the collective mindsets of farmers in the area. Whether their trepidation is practice-based, economics-based, or simply misinformation, it is difficult to convince a group of people to change the way things have always been done.

One local perception has been that there is not enough moisture in the area to support the planting of cover crops even though that has been proven to be false. Adoption of new methods are always tough but a lot has been learned over the past three years. Farmers have been successfully challenged to determine which cover crops work best locally and to make the economics work for them. Ag Enterprise Supply initially discovered that while there is a lot of information on soil health and cover crops, it was not collected in one location for their customers to access. They also fought the hard sale of making the economics work for their growers since the return on investment for cover crops that farmers have never planted is difficult to demonstrate. It took education and investments of time and money to show farmers that the return on investment is not only there in dollars and cents but also in long term soil health measurements.
Project Goals

The project goals were three-fold. The initial goal was to work with grower customers who have adopted yield monitoring technology to also determine realistic yield goals within the field zone. Ag Enterprise Supply also aimed to determine proper fertility rates based on these goals, while also taking into account varying efficiencies due to organic matter, Caution Exchange Capacity (CEC), and pH levels. Ultimately, they challenged customers to determine whether cover crops and alternative crops (flax, sunflowers, and canola) affected health and fertility requirements and goals.

Project Measures of Success

This project has been encouraged by the number of proposals and existing project reports that the Washington State Soil Health Committee has attained. When the Washington State Soil Health Committee put out their first request for proposals (for cover crops and soil health projects) they received six proposals. The second year they received eighteen proposals and last year they received twenty-eight. Of these proposals received, the committee was able to fund eight projects based on a 3-year life cycle. Success has also been realized by the number of growers who are actively trying to find ways to change their management systems to include cover crops with improved soil health as their ultimate goal.

Best Practices

Use technology to become efficient and cost effective. By saving money on nitrogen fertilizers, farmers can invest in micro-nutrients they had not previously been able to afford. This will increase productivity and crop quality and the results will lead to increased environmental benefits and financial gain for the farmers.

Farmers need to look at how they can adapt soil health practices into their current management system. For example, in dry areas, Mr. Farrell found that canola works well as a cover crop because it is also a cash crop, therefore improving both soil health and the farmers’ economic bottom line.

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NRCS and agricultural retailers walk a parallel path with the customer in the middle. To better serve their joint customers they need to interact more and better utilize each other’s resources. Find ways to open lines of communication so both parties can be aware of what the other is doing. Another issue that needs to be resolved is to streamline a way for Certified Crop Advisors (CCAs) to become certified as technical service providers.
The PA 4R Alliance was created in July 2012 as a volunteer organization and affiliate of the PennAg Industries Association in response to a Natural Resources Conservation Service (NRCS) subcommittee review of the PA 590 Nutrient Management conservation practice standard. The subcommittee identified a need for agribusinesses to work with farmers through a unified research and education strategy to expand the adoption of 4R Nutrient Stewardship principles in Pennsylvania to have a positive impact with respect to economic, social and environmental outcomes.

The Alliance was selected for a Pennsylvania NRCS Conservation Innovations Grant (CIG) in 2013 to accelerate adoption of nutrient stewardship practices by Pennsylvania farmers by establishing a common language and facilitating dialogue among agricultural stakeholders throughout the state. Since then, the PA 4R Alliance has continued to build trusting partnerships with a wide group of stakeholders, including government agencies, non-profit environmental groups, agribusinesses and farmers around nutrient management and improved water quality.

The Alliance has also developed numerous publications on 4R nutrient stewardship and has conducted extensive educational and outreach programs. Since concluding their CIG project in 2015, they have collaborated with new partners including The Nature Conservancy (TNC) and the Mid-Atlantic 4R Nutrient Stewardship Association to continue expanding their reach. In October of 2017, a new grant from the National Fish & Wildlife Foundation was received that will be used to support the agricultural community’s efforts to improve water quality in Delaware, Maryland, and Pennsylvania through an increase of 335,000 acres of practice implementation.

A Memorandum of Understanding was drafted in September of 2017 between the PA 4R Alliance and the NRCS to establish their mutual interests and agreement to cooperate in accelerating the adoption of nutrient stewardship principles.

Location: Pennsylvania

Problems and Opportunities

The mutual interest of the PA 4R Alliance and PA NRCS partnership is to improve crop productivity, reduce loss of nutrients to the environment and maintain a positive return on producers’ and taxpayers’ investments. This mission fostered an initial project to establish a common language to express sustainable crop management and nutrient stewardship across industry, government agencies, environmental stakeholders, consultants and farmers. Additionally, the initial project sought out opportunities to collectively deliver science-based systems that increase nutrient use efficiency as a means to achieve mutual interests.

Partnership Priorities

The PA 4R Alliance completed a discovery process in 2013 and formulated an action plan and set priorities around:

Research – Test in-season field specific nutrient use efficiency systems; research soil health and resilience; develop strategies to minimize stress; increase manure nutrient conservation including precision feeding,
bedding, solid liquid manure separation, storage and land application technology improvements, export, and manure to energy conversion.

Education and Outreach – Work with farmers, ag retailers, crop consultants, extension agents, industry representatives, non-profits and agency staff to establish a dialogue and further the adoption and understanding of 4R Nutrient Stewardship.

Data Collection and Quality – Develop a shared database for 4R and nutrient use efficiency research and demonstration, address misinformation and fill data gaps.

Communication – Address misinformation about the true cost and value of nutrients, especially manure nutrient sources. Share success stories, educate legislators about future regulatory impacts and need for certainty. Target conversations to each market segment from early adopters/champions (20% of the farming operations), to the basic and mid-level adoption operators (60% of the farming operations) and those with no adoption of 4R practices (20% of farming operations).

Initial Project Measures of Success
The purpose of the initial project was to translate The Fertilizer Institute’s 4R Nutrient Stewardship concepts into plain language familiar to Pennsylvania landscapes and farmers and to demonstrate 4R concepts in action. The two primary outreach products developed include a practical pocket guide for local farmers to implement 4R practices year-round called the “4waRd Thinking” brochure and a “How Do You do 4R on Your Farm?” fact sheet. This two-year project resulted in reaching 2,080 farmers, 238 NGO members, and 790 industry representatives through 35 outreach events supported by PennAg Industries, agribusiness, Penn State Extension, PA regulatory agencies and industry associations. As a result of this successful project, new partners, including The Nature Conservancy, have expressed interest in building on this project.

Best Practices

Actively listen
Keep an open mind. Listen to understand and seek to find common ground you can build on.

Begin at the beginning
Before selling advanced practices to a new customer, establish that they have mastered the basic ones. Do you test the soil? Calibrate application equipment? Keep records? Sample manure sources? Stabilize nitrogen?

Use plain language
While the 4R practices are science-based, use plain language to achieve buy-in and sell new ideas.

Make it relevant
Site and customer-specific information is key to earning trust and transforming a one-time encounter into a life-long relationship.

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Project Description

Multiple agencies working to improve irrigation practices in Northwest Florida partnered with the Replenish Project of the Coca-Cola Corporation to work with farmers to improve efficiency of irrigation water use and reduce costs, by demonstrating advanced irrigation technologies at a farm in Greenwood, Florida. The existing irrigation type was an electric fixed center pivot overhead irrigation system with a 288 wettable acre footprint. This system is 1,948 feet long with an end gun.

During the project, the system was fully automated with 6 zone controller kits, allowing the pivot to operate 42 zones of irrigation independently. The entire system is fully automated and wireless, allowing the farmer to determine the status of the pivot and to control the pivot remotely and the farmer to match irrigation precisely to a soils map of available water capacity. Using maps provided by a Mobile Irrigation Lab, the farmer can modify the irrigation prescription to more accurately apply water where needed, minimize runoff, and avoid irrigating non-production areas.

The area of the project is a karst terrain with increasing demand on the Floridian Aquifer. Soils are highly permeable resulting in the potential water quality impacts as a result of over-irrigation.

Project Goals

The goal was to reduce groundwater withdrawal as a direct result of increased irrigation efficiencies. The project aimed to utilize an innovative irrigation system retrofit to demonstrate the feasibility of irrigation efficiency enhancements and conduct a field day to encourage similar projects to surrounding producers. Groundwater withdrawal reductions were calculated as the volume of water that is not withdrawn for irrigation, as a result of implementing irrigation improvements. The water savings associated with irrigation improvements were estimated though field evaluations conducted by the Mobile Irrigation Laboratory (MIL), which is a partnership between the Florida Department of Agriculture and Consumer Services, the Natural Resources Conservation Service and Northwest Florida Water Management District.

Problems and Opportunities

Conventional center pivot irrigation systems typically operate at high pressure with impact sprinklers spraying water from the top of the pivot mainline. Retrofitting these traditional systems with spray-type sprinklers on drop hoses can generate considerable water and energy savings by applying water at a lower pressure more directly to the soil surface to reduce evaporation and wind drift losses and produce a uniform application of water droplets over the field.

Project Partners

Replenish Project
Coca-Cola Corporation
The Nature Conservancy
Jackson Soil and Water Conservation District
Florida Department of Agriculture and Consumer Services
NW Florida Mobile Irrigation Laboratory
Limno Tech

Partnership Dates
October 2015 to October 2016
Measures of Success

The MIL evaluated the performance of the irrigation system at the project farm before and after the upgrades were completed on the center pivot system. The water savings are calculated separately for implementation of the irrigation emitter retrofits and Variable Rate Irrigation.

Irrigation emitter retrofits:
- Net irrigation requirement (for cotton crop) = 9.46 inches
- Area under irrigation = 288 acres
- Pre-project (before emitter retrofits)
  - Distribution efficiency before emitter retrofits = 0.68
  - Total irrigation application before emitter retrofits = 14 inches = 333.9 acre-ft/yr
- Post-project (after emitter retrofits)
  - Distribution efficiency after emitter retrofits = 0.93
  - Total irrigation application after emitter retrofits: 10 inches = 244.1 acre-ft/yr
- Water Savings = pre-project irrigation volume – post-project irrigation volume
  = 333.9 acre-ft/yr – 244.1 acre-ft/yr = 89.8 acre-ft/yr = 29.24 million gals/yr

Variable Rate Irrigation (VRI):
The water savings associated with VRI are calculated as the volume of water that was not applied, as a result of using the VRI technology. This calculation considers the total water volume applied after implementing irrigation retrofit, which equals 10 inches per growing season. Areas affected by VRI and associated water savings are presented in Table 1 below.

Best Practices
- Utilize existing agency relationships to expedite new projects
- Incorporate time for development of contractual arrangements between participating partners
- Anticipate complications that may arise from undertaking irrigation projects on an operating farm.
- In this case, the success of the project was jeopardized by complications from the installations of a variable frequency drive motor on the irrigation well. Project timelines need to include flexibility for similar complications.
- Use field days with the participation of the cooperating grower to demonstrate the success of the project and viability for other area producers.

Table 1. Irrigation water savings associated with VRI

<table>
<thead>
<tr>
<th>Area</th>
<th>VRI Impact</th>
<th>Irrigation Avoided</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Acre-inch</td>
<td>Gallons</td>
</tr>
<tr>
<td>6 acres</td>
<td>Non-Crop Area (no irrigation)</td>
<td>60</td>
</tr>
<tr>
<td>16 acres</td>
<td>50% reduction</td>
<td>80</td>
</tr>
<tr>
<td>17 acres</td>
<td>30 reduction</td>
<td>51</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>191</td>
</tr>
</tbody>
</table>

Water savings due to VRI = 5,186,462 gallons/year

Total water savings = water savings due to emitter retrofits + water savings due to VRI

= 29.24 million gals/yr + 5.19 million gals/yr = 34.43 million gals/yr.

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Partnership Summary

In 2012, the Big Swamp Watershed was designated as a National Water Quality Initiative (NWQI) priority watershed by Natural Resources Conservation Service (NRCS) to improve water quality and aquatic habitats within impaired streams. The Big Swamp was one of four South Carolina watersheds selected because of high nutrient levels. Using funds from the Environmental Quality Incentives program (EQIP), NRCS provided financial and technical assistance to producers for implementing conservation practices such as cover crops, filter strips, nutrient management systems, and waste management systems.

As a County Extension Agent, Russell Duncan worked with NRCS and Clemson Cooperative Extension specialists to hold a workshop for Certified Crop Advisers (CCAs) on how to prepare comprehensive nutrient management plans (CNMPs). With a strong background in nutrient management and experience as a Certified Crop Adviser (CCA), County Extension Agent, and precision agriculture consultant, Mr. Duncan began CRD Agronomics because he recognized the opportunity to improve nutrient use efficiency through increased adoption of precision agriculture in eastern South Carolina and specifically in the Big Swamp watershed in Florence County. Since starting CRD Agronomics LLC, Mr. Duncan has collaborated closely with local NRCS District Conservationists to recruit farmers for CNMPs. This has been accomplished by holding local farmer meetings and inviting local NRCS District Conservationists to educate farmers on NRCS programs and initiatives. CCAs also participate in these meetings and assist farmers with the paperwork necessary for enrollment in EQIP.

Background

Big Swamp in Florence County is 38,163 acres and drains into the Lynches River. It contains 11,745 acres of ag land (30.77%) and is a blackwater system, characterized by naturally low dissolved oxygen levels. Contamination sources were determined to be wildlife, grazing livestock, and malfunctioning septic systems. The watershed is listed as a SCDHEC 319 water quality priority area.

Problems and Opportunities

The need for increased adoption of precision agriculture nutrient management stemmed primarily from phosphorus loading, since the Big Swamp Watershed is an old tobacco farming area and tobacco was a heavily fertilized crop for nitrogen, phosphorus, potassium, and lime. This presented the following opportunities:

- To reduce nutrient losses
- To more accurately address the nutrient needs of cropping systems
- To improve profitability of participating growers

Private-Public Partners

USDA-Natural Resources Conservation Service
Carolina Eastern Company
CRD Agronomics LLC

Project Dates

2012-2015

Partnering to Increase Agriculture Nutrient Management Adoption in Eastern South Carolina
• To increase adoption of practices that promote long-term economic and environmental sustainability

• To sign more farmers up for technical assistance and financial assistance for cover crops and advanced precision farming practices

Project Goals
This project was focused on reducing nutrient runoff into surface groundwater in eastern South Carolina by optimizing fertilizer use efficiency. A second social goal of the project was to overcome negative perceptions of retailers and their promotion of federal programs. Both goals were accomplished by introducing eligible producers to EQIP and encouraging them to sign up for conservation practice 590 (Nutrient Management Plans) and by conducting workshops to explain the partnership between retailers and the NRCS.

Project Measures of Success
• Success was measured by the number of new farmers that participated in planning and programs and by the quantities of conservation practices applied. It was further measured by the number of farmers who continued to implement the practices after funding eligibility was exhausted. Nutrient Management Plans were developed and implemented for approximately 15,000 acres of farmland as a result of this partnership. That represents about $150,000 of financial assistance. An additional benefit of the partnership was the ability to inform producers about the benefits of cover crops, which resulted in 16,000 acres of farmland with cover crops and $604,000 in financial assistance to producers.

• For producers, success was achieved through improved profitability, enhanced sustainability and better soil health.

• 90% of producers are continuing to use precision agriculture nutrient management practices after contracts are concluded.

Best Practices
• Joint meetings between CCAs and NRCS with farmers can result in a higher level of program participation and conservation practice adoption.

• Educate farmers on the value of working with a CCA who meets rigorous professional standards so that farmers trust and depend upon the advice and recommendations provided by CCAs.

• A continued partnership benefits both NRCS and CCAs since District Conservationists can work with CCAs to increase best management practices that optimize fertilizer use efficiency.

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Map from a phosphorus lab analysis highlighting how much phosphorus is on a client's fields in lbs/acre. The red areas show the farmer where not to add additional phosphorus.