

PROJECT AND RESEARCH MANAGEMENT: INTEGRATING SYSTEMS, DATA, AND PEOPLE IN MULTIDISCIPLINARY WORK



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United States Department of Agriculture
National Institute of Food and Agriculture

Technical Report Series:
Observations and Recommendations of the
USDA-NIFA funded Climate and Corn-based
Cropping Systems Coordinated Agricultural Project

Volume 5 of 5

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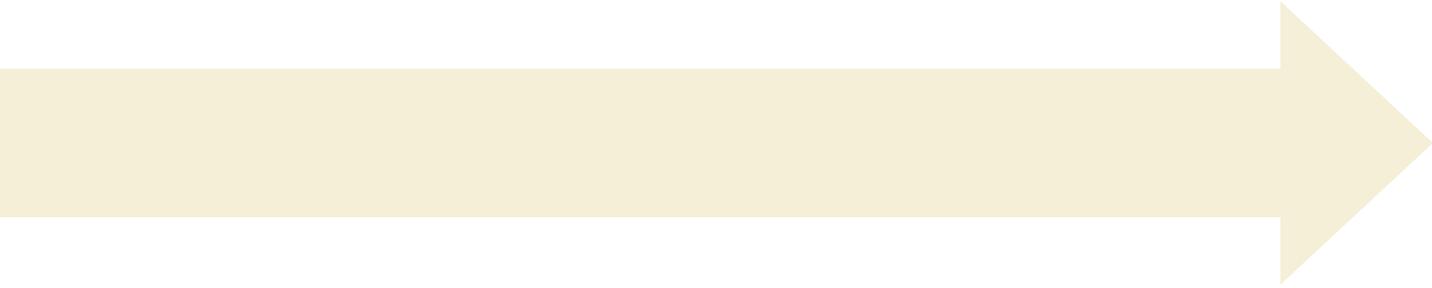
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EXECUTIVE SUMMARY

HIGHLIGHTS OF FINDINGS AND RECOMMENDATIONS

Local and national leaders and funding agencies are placing an emphasis on supporting multidisciplinary research and outreach to address the difficult, multifaceted challenges society faces. Teams comprised of many different disciplines and perspectives have the potential to more effectively respond to complex system challenges associated with agricultural production and agro-ecosystem functionality and health.

These teams are often large, diverse, and dispersed and managing them requires capacity to respond to both expected and unanticipated conditions. The dynamic nature of managing personnel and diverse work to achieve project goals is exacerbated by the large number of different institutions, disciplines, and expertise. These teams may be similar in size or larger than many academic departments on campuses, with the added challenge of disciplinary diversity and spatial dispersion. Managing these teams to achieve their potential requires project and data personnel who have high-level

management skills, scientific expertise, and personnel experience. Many team members are unfamiliar with large project teamwork and look to the project and research managers to help them accomplish the plan of work.

This technical report, *Project and Research Management: Integrating Systems, Data, and People in Multidisciplinary Work*, summarizes the experiential and technical knowledge in project and research management from the Sustainable Corn Coordinated Agricultural Project (CAP) team. This transdisciplinary team which spanned 9 states, 11 institutions, and 140 members was funded 2011-2017 by the United States Department of Agriculture, National Institute of Food and Agriculture (USDA-NIFA). The management infrastructure, processes, outcomes, lessons learned, and insights presented in this report will be particularly relevant to directors and managers of other long-term, multi-million dollar funded teams.

Highlights from the report include observations and recommendations related to:

- Skillsets to look for when hiring individuals for project and research management. Importance of identifying people with high-level experience in managing people, systems and corresponding workflows.
- Ways to structure project management and data systems to ensure they align with the team's goals to advance the science of the team and allow for deepening and expanding of research questions and hypothesis testing.
- Methods used to align systems for collecting, managing, storing, and retrieving project and research data to bring about maximum efficiency, productivity, and transparency internally and externally to stakeholders and the funder.
- Understanding team member workflows and their disciplinary scope of work to reduce and eliminate

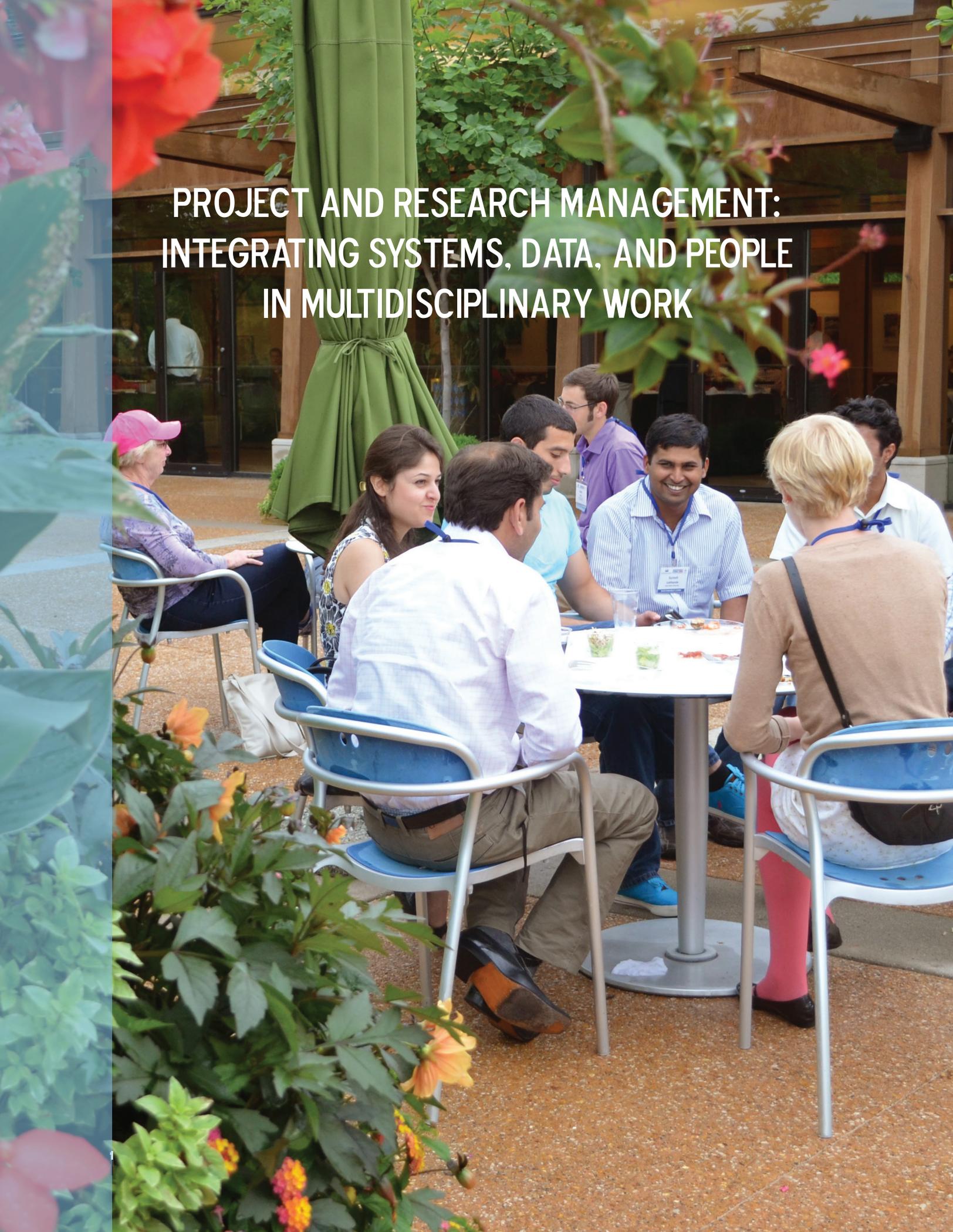
potential bottlenecks or pitfalls so each member can excel individually and as part of a group.

- Effective technical solutions that ensure available, high-quality data are accessible to all team members. These technologies can support the establishment of a flat organization where all team members are able to successfully complete their work and directly and indirectly support others efforts.
- Ways to equip researchers to upload, quality control, visualize, and use large data sets. Team members with outdated methods and skills may feel overwhelmed and need mentoring and learning opportunities to effectively deposit, access, and analyze large data.
- Investing in the time intensive work of managing data not only to accelerate the work of the team but also to make the large dataset available to future research efforts post-project. This amplifies funding agencies initial investment and becomes a resource future scientific endeavors can leverage.



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SECTION 1. INTRODUCTION

1.1 THE NEW NORM: SPATIALLY, TEMPORALLY, DISCIPLINARY COMPLEX TEAMS

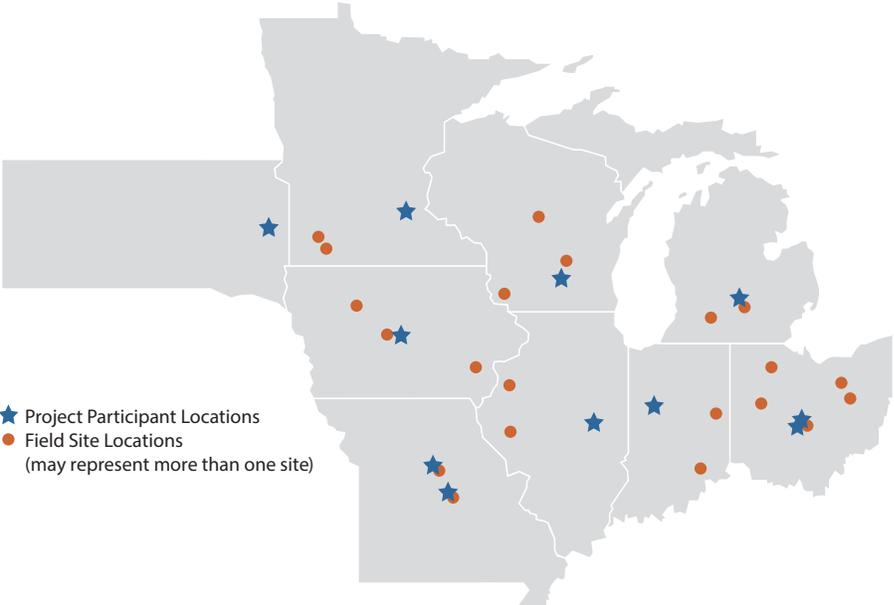
Large, diverse, and dispersed teams have the potential to substantially advance sciences that encompass unique systems relationships and behaviors. Teams comprised of different disciplines and perspectives expand the scope of knowledge and the research questions examined related to addressing complex problems. This diversity enables them to bring together a variety of theories, methods, data and analyses to view their work in new ways and explore innovative approaches. It is the potential benefit of this research that has led funding agencies to place an increased focus on supporting teams that bring together scientists, students, and educators to address multi-faceted scientific and societal challenges (Eigenbrode et al., 2014). However, these teams create unique management challenges due to the demands of managing personnel and work across different institutions, disciplines, and expertise.

These diverse teams are typically defined as multidisciplinary, interdisciplinary or transdisciplinary. Each has specific nuances within the literature of what these terms represent (Morton et al., 2015). They can differ based on the types and intensity of scientific, experiential, and local knowledge generation and integration; iterative feedback processes; and stakeholder involvement. **Managing these spatially, temporally, and disciplinarily complex teams requires project and data managers who have high-level management capacity, scientific expertise, and personnel experience.**

This technical report, *Project and Research Management: Integrating Systems, Data, and People in Multidisciplinary Work*, summarizes the experiential and technical knowledge in project and research management from the Climate and Corn-based Cropping Systems Coordinated Agricultural Project, aka Sustainable Corn CAP. This transdisciplinary team received funding in 2011 from the United States Department of Agriculture, National Institute

FIGURE 1 | Participating institutions involved in the Sustainable Corn CAP and the biophysical research site locations.

The 11 institutions comprising the project team included the following Land Grant Universities and USDA Agricultural Research Service (ARS): Iowa State University, Lincoln University, Michigan State University, The Ohio State University, Purdue University, South Dakota State University, University of Illinois, University of Minnesota, University of Missouri, University of Wisconsin, and USDA-ARS Columbus, Ohio.



of Food and Agriculture (USDA-NIFA) and was comprised of scientists, staff, postdoctoral research associates, graduate students, extension and outreach educators, and cooperating farmers. There were a total of 260 team members during the life of the project with generally 140 active at one time; this does not include undergraduate students or advisory board members. The project team and research sites spanned nine states in the upper Midwest including Iowa, Illinois, Indiana, Michigan, Minnesota, Missouri, Ohio, South Dakota, and Wisconsin (Figure 1).

The intent of this report is not only to present the Sustainable Corn CAP management infrastructure, processes, and outcomes, but also to offer lessons learned and insights of value to leaders and managers of other long-term, multi-million dollar funded teams seeking to navigate the management challenges.

Within academia, project and data management is viewed in a variety of ways and characterized by a range of diverse and eclectic responsibilities and expectations. Although the organizational management literature is extensive, very little of it has practical application to managing large academic teams with stakeholders where members voluntarily participate; and explicit chains of command and responsibility within the team are fuzzy at best and occasionally non-existent. The authors of this report believe management is critical to the success and functioning of a team and seek to offer our experiences to the broader academic community. **High performing, effective project and research managers serve as an essential organizational factor in managing the day-to-day details, and articulating the larger picture of what the whole team can and will accomplish.**

Although not the subject of this report, project directorship within academia seems to be more clearly

understood in its challenges and opportunities. However, support and guidance for directors beyond conceptual theories and ideas also is limited in how to functionally build and lead these large teams. A primer for project directors, *Leading Large Transdisciplinary Projects Addressing Social-Ecological Systems*, with Morton as a coauthor (Eigenbrode et al., 2017), will be posted to the USDA-NIFA research projects website in late 2017.

1.2 MANAGEMENT IN ACADEMIA

Project and research management within academia is quite variable in interpretation and expectations. It often is equated with coordination, which is necessary as these teams are highly complex and keeping everyone organized and going in a similar direction is a lot of work and should not be underestimated. However, project management is much more than coordination. These large project teams are similar in size or larger than many academic departments on campuses, with the added challenge of disciplinary diversity and spatial dispersion. Most team members will be new and unfamiliar to large project teamwork and thus, the path the project will take is uncharted for most and members will look toward the manager to help them accomplish the milestones proposed by the funded project.

Management of a large project team can be equated to a large downtown building being constructed in which individuals have specific tasks such as concrete, electrical, plumbing, framing, and so forth. The project manager ensures the work progresses in the right order, information is provided as necessary, pieces fit together in an optimum and efficient way, preemptive solutions are derived for problems unseen by the individuals, and



the project is completed on time. The project manager must be able to move the individuals from initiation to completion for the building to realize the potential which the architects and funders envisioned.

A similar scenario is true for multidisciplinary projects where individual academics are scattered across differing institutions with many having past experiences and research efforts focused almost entirely within their own discipline or institution. There can be the expectation and underlying belief that individual efforts of these faculty or principal investigators (PIs) will inherently self-manage and fit together. PIs, however, have a diverse and competing set of demands for their time and, despite their best intentions, cannot keep track of all the moving parts of these large projects very

well (or may not want to). Only a portion of a principal investigator's time will go towards this project, which means their energy and ability to invest in the team and what it accomplishes will vary. This is why the project manager does more than coordinate.

The PI can complete his or her scope of work but it may not be as well connected to other efforts, thereby falling short of what can help accomplish bigger goals and raise the team to the next level of excellence. In other words, the individual may be able to "check the box" in terms of task completion, but the outcome will lack synergy among other parts of the project and not ultimately be an effective use of the team's effort and allocated funding. A high performing manager enables the team to accomplish both task work and teamwork.

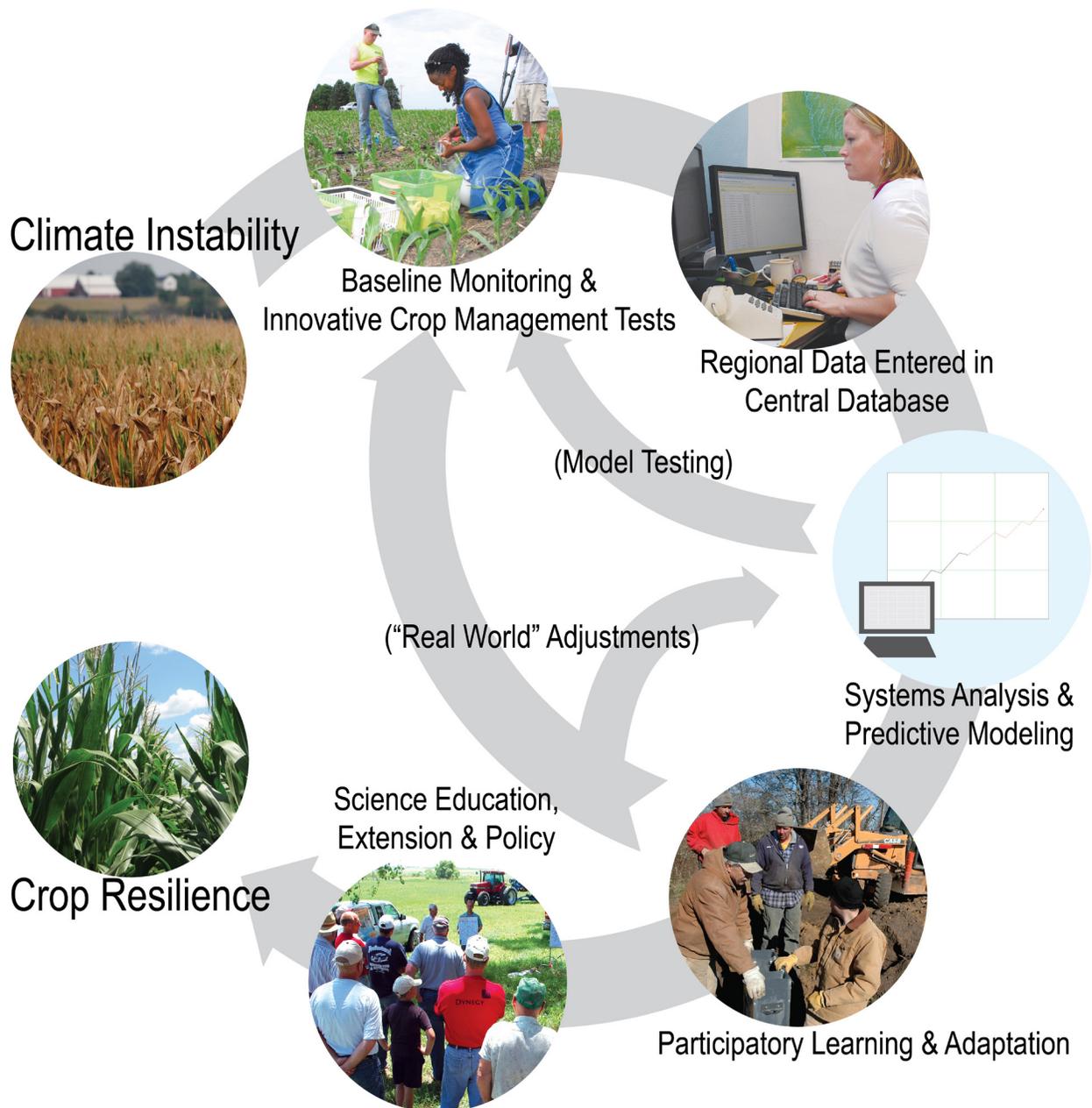


To obtain this synergy and system insights gained from listening to and learning from the diverse project members requires the frequent involvement of the PI with his or her colleagues under the guidance and feedback provided by the project manager.

The co-dependency and iterative nature among personnel and subgroups within a large project team can be seen in the schematic of the Sustainable Corn

CAP team, Figure 2. Figures like this often are included in proposals to reflect the dependency and need for communication and collaboration across the team. **Developing iterative, integrative science is extremely difficult and takes real intentionality among the project and research management, project director, leaders, and team members.** It cannot be achieved without the active engagement of all these partners.

FIGURE 2 | Example of the interconnectedness and dependency among the Objectives (subgroups) within the Sustainable Corn CAP transdisciplinary team.



1.3 MANAGEMENT AND DIRECTORSHIP BROADLY DEFINED

The roles of a project manager versus a project director (“leader”) can be broadly distinguished by their daily focus (Gallup, 1999). These two positions operate on a continuum where there is an overlapping complementarity of roles and duties that have flexibility and can vary with the unique skill sets of individuals in these positions. However, it is useful to frame the general scope of tasks, responsibilities and expectations as day-to-day “inward” and “outward” focused.

Great managers look inward

They must focus their primary energy toward each task and individual and the relationships among them, with attention to the differences in style, goals, needs and motivation of each person as they work to accomplish their part of the project. These differences are small and subtle, but paying attention will help individual members thrive, and enable the work of the team to go forward.



Great leaders (i.e. director) look outward

They must focus their primary energy toward broad patterns, finding connections, and gaps to position their team successfully. They must be visionaries, strategic thinkers, and activators.



“If the two roles are confused by expecting every manager to be a leader, or if they define “leader” as simply a more advanced form of “manager,” then the all-important “catalyst” role will soon be undervalued, poorly understood and poorly played.”

Gallup, 1999

“Every manager can learn to engage a team somewhat. But without the raw, natural talent to individualize; focus on each person’s needs and strengths; boldly review their team members; rally people around a cause; and execute efficient processes, the day-to-day experience will burn out both the manager and his or her team.”

Beck and Harter, 2014

Five traits of great managers:

1. Motivate every single individual to take action
2. Have the assertiveness to drive outcomes and the ability to overcome adversity and resistance
3. Create a culture of clear accountability
4. Build relationships that create trust, open dialogue, and full transparency
5. Make decisions based on productivity, not politics

Gallup, 2015

The relationship between the project manager and project director is critically important with each dependent on the success of the other. Mutual trust and extensive communication is key, with frequent conversations providing feedback between what is happening internally and externally to the team and potential impacts to the project. Together they must role model for their team tolerance and patience for differing views and approaches; and create listening and learning exchanges necessary for integrating new information and making concrete progress toward the project's milestones. The work of managing and directing the team is time and energy-consuming and their efforts must be closely connected and coordinated as the team evolves over time.

mistake, because although the research and educational components of the team are important, they will have difficulty succeeding without the right management in place. Narrowing the scope of research or education to assign funding to management personnel will be beneficial in the long term. Within academia, there continues to be a shift towards “soft-money” grant funded research with non-faculty positions funded by this soft-money. This places a challenge on hiring high-level management personnel with the necessary capacity and skills.

Based on the complexity of the team and funding level, additional support such as specialized staff, contract staff, and undergraduate students may be necessary to meet all management and administrative needs. Management personnel are not directly correlated to overall funding received due to gained efficiencies in scale, e.g., one project manager for a \$5 million project does not equal four project managers for a \$20 million project. This is true for research data managers as well, and largely depends on the heterogeneity of research data collected and methods used by team members.

Many of the roles and expectations of a project manager are transferable to research management personnel. In the Sustainable Corn CAP, the time and efforts of research management personnel were within the research objectives of the team, not on extension or education. The complexity of obtaining and managing research data required the ability to individualize, translate, and motivate individuals similarly as to that described above for the project manager.

1.4 CONNECTING PROJECT AND RESEARCH MANAGEMENT EFFORTS

Project and research management equally requires individuals who have experience managing people, systems, and the corresponding workflows. Having these individuals work together to connect in areas of crossover is extremely powerful for the team as a whole as it eliminates potential dual-reporting of efforts, limits loss of data and pertinent details, and aligns all management efforts within the team to the major goals and desired outcomes related to research. Understanding the workflows behind both project and research management is necessary to develop a system that is relatively seamless, and not overly cumbersome for personnel to operate within.

The Sustainable Corn CAP project and research management personnel worked in unison, with



Some exceptional individuals have skill sets that allow them to direct or manage a project although most individuals are specifically geared towards one or the other. Regardless, an individual would be very unlikely to fill both roles at the same time with these large teams. Clarity of the roles and responsibilities of the two positions need to be determined upfront for efficiency between the manager and director, as well as clarity for the team members.

If management roles within these teams are perceived as lower tier, it will be problematic when identifying and hiring personnel. These individuals will be tasked with managing multi-million dollar teams and associated research data that require a high-level of expertise and talent. The amount budgeted towards management often is determined at the end of proposal development once other components of the project are set. This can be a



communication across the members to ensure cohesive transfer of information when applicable and utilizing similar web platforms for ease of use by team members. Some basic examples of synergy between the two include:

Contact information and email list-serves maintained by the project manager and distributed out so correct personnel are reached when questions concerning data entry or edits arise.

Data management reviews progress reports submitted by PIs to cross-check status of data collection, synthesis, and potential challenges that may limit or delay entry of data into the database. The data team can adjust expectations and requests of the research personnel accordingly.

Project and research management personnel review the status of research data entered to-date per PI to determine if scope of work as outlined for that year has been fully completed.

Team member fatigue can be a real issue to be aware of due to time constraints and numerous demands beyond the funded project. Time is limited and most members only have the capacity to invest “x” amount, whatever that is. Therefore, ensuring their time is spent on advancing science and educational efforts is aided when the management lays out clear directions, is purposeful when requesting information, distributes data and information to all necessary individuals, and stays ahead of team members through strategic planning.

Team members will possess the disciplinary skills to carry out their research or educational efforts, but will not typically know what information is needed in the backend to connect all the pieces together. Management personnel can prompt individuals for these details when needed, or fill these in themselves based on what they know to be occurring within the various subgroups of the team. It is important for management personnel to get at this information using informal channels — side conversations, through Objective web meetings, subgroup meetings and so forth — to limit the requests made of team members when possible. When requests are made by management, having these stored on the internal website (see Section 2.4) is helpful to act as a central clearinghouse, versus corresponding via emails that could get lost over time.



By aligning the project and research infrastructure together, it helps simplify the experience for the user. Having one location the team member signs into and accesses information is extremely valuable. This helps develop patterns of behavior in team members, so they know exactly where to go to get what they need and don't

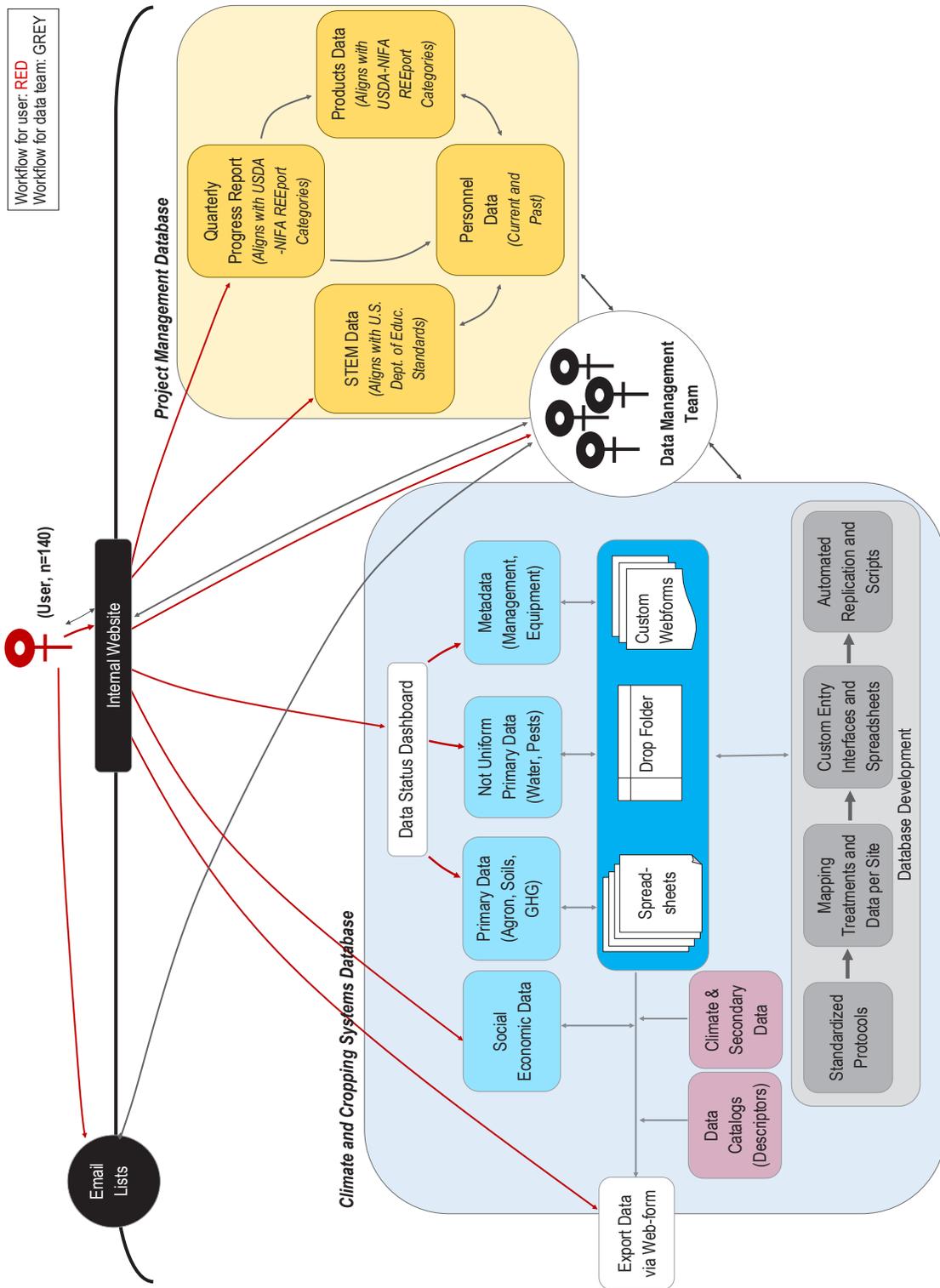


FIGURE 3 | Generalized workflow showing how project and research management systems were structured to work together in the Sustainable Corn CAP team with data and information transferring across.

Note the team member (user) is at top and all efforts are unidirectional, as reflected with the red arrows. The management team has efforts that are multidirectional as reflected with the grey arrows. Management personnel move and standardize data on the backend to simplify what is required of the user. Graphic from Herzmann et al., 2014.

become frustrated searching for information or entry forms. Because team members will have institutional pages they log into, it is best to add as few new webpages and web sign-ins as possible with these large teams. In Figure 3, the user only needed to sign-in to the main internal website, the various forms and data entry portals were then all linked from there. For example, the Sustainable Corn CAP team member was being directed across and within Google Site Google Drive, Google Apps, Smartsheet spreadsheets, Smartsheet reports, and Smartsheet web forms without complication because of the management personnel syncing the permissions and systems. The Google and Smartsheet tools will be described further in Sections 2 and 3.

1.5 REPORT OVERVIEW

Project management is described in Section 2 and includes the conceptual, technical, and personnel approach of the Sustainable Corn CAP. Similarly, research management follows in Section 3; an additional resource (Herzmann et al., 2014) is available

regarding the research database for the Sustainable Corn CAP, which describes major concepts and technical approach implemented.

This technical report, *Project and Research Management: Integrating Systems, Data, and People in Multidisciplinary Work*, is the fifth and final volume of a series published by the Sustainable Corn CAP. The intent of this volume is to summarize the data and systems management of the project and to be of value to project managers, project directors, research managers, administrators, and funding agencies. *Volumes 1 and 2* highlight the findings, implications, and recommendations from the biophysical and social economic research of the team. *Volume 3* focuses on building capacity for Land Grant University Extension services to address agricultural impacts of climate and adaptative management needs of stakeholders. *Volume 4* provides observations and recommendations related to the preparation of the next generation of scientists through educational efforts.





SECTION 2. PROJECT MANAGEMENT

Defining “good” project management can be difficult since much of what the manager does is not easily visible to team members or those external to the team. Each team is uniquely composed of a diversity of individuals with distinct expertise, goals and challenges. Thus, it is important to not apply a one-size-fits-all approach to expectations and responsibilities. Two measures of “good” management are the cohesiveness of the team as an organization, and its productivity over the life of the project.

High performance teams are aggressively and purposely managed to make it seem simple. Team members and their work are able to progress without bottlenecks due to appropriate processes, tools and communication in place. Successfully managed teams typically will garner attention for the team members because the science or education work is able to shine. Public attention to the team successes reaffirms the effectiveness of the project manager; but he/she needs to be willing to accept that often the spotlight is on an individual or the team rather than the manager, who behind the scenes enables these accomplishments to occur. Project management is long-term in nature, especially with multidisciplinary teams in which a large emphasis is to build capacity to conduct integrative and synergistic science. The manager is

working to increase the ability for this type of work, and carry it out on multiple fronts, including the individual, subgroup, team, and institution. Great management links the day-to-day tasks to accomplish longer-term goals. A successful project manager can be evaluated based on the body of work produced by the team, and whether progress towards the ultimate goals and vision of the team was consistent throughout the project life.

2.1 PROJECT MANAGER RESPONSIBILITIES

The responsibilities for project management within an academic setting are similar to outside academia in many cases and distinct in others, due to the nature of career advancement, methods of publishing science, and lack of team-focused work that has characterized academia in the past.

An individual hired into the role of a project manager does not necessarily need to come from a university setting. However, the manager must quickly learn and understand the Land Grant Universities (LGU) research, education, and extension missions that are distinct from

other academic institutions. It is nearly impossible to manage the work of a team well across these spheres if the manager does not have some directly applicable experience. It is highly beneficial for the manager to understand the integrated workflow of the team, and to be able to contribute managerial and scientific expertise to the objectives of the project.

Experience and knowledge of several of the following workflows within an academic setting are useful:

Research	Extension
Education	Personnel
Budgetary	Evaluation
Reporting	Hiring

It is recommended a project manager is hired who has a strong skillset in research, extension and/or education, and personnel management with an aptitude to learn the remaining areas of budgetary, evaluation, reporting, and hiring procedures.

A strong skillset in personal relations can be as simple as being able to recognize each team member in-person, knowing their name, and their specific work. In large teams, people often expect to not be known or seen for the work they do. However, a “flat” team makes everyone accountable and their work seen, properly acknowledged, and encouraged to be actively involved. A manager who forms individual relationships with each team member can build the strength of the team professionally and socially, while ensuring the quality of work and connectedness among the various parts.

It is beneficial for team members to sense the project manager is relatable and genuinely wants them to succeed. This can be demonstrated by the project manager being a good colleague in terms of completing work, responding to emails and phone calls, and providing solutions to obstacles the individual faces.

These complex teams are typically comprised of faculty, staff, graduate students, and postdoctoral associates. Thus, it is helpful for the project manager to relate to and understand the level of work expected of each individual. It can be difficult to estimate a reasonable length of time to complete specific tasks or predict challenges, without knowledge or understanding of what the task entails.

A manager who is able to produce work equal to the faculty members in terms of professionalism and quality is a huge asset to the project. Although the project manager cannot possibly know the entire team’s science, it is important to have a desire to understand it and represent it appropriately. A manager who is strong in a discipline is valuable to the team, as he/she will better understand the disciplinary perspectives and the challenges of connecting with other distinctly different disciplines.



The quality and quantity of work performed by the manager acts as a strong signal in the expectation of the quality and quantity of work performed by team members. Members who perform at a high capacity want to see their work summarized correctly and presented in a professional manner that represents their science and themselves well. People will typically rise to challenges with encouragement and support from others. When reasonable goals are set in front of people, they often are able and willing to go above-and-beyond if others are doing the same.

There are “grey areas” of work where no one is assigned responsibility and the team or subgroups must find processes to be sure this work is accomplished. Many of

these grey areas are the cross-objective integration efforts necessary to construct new paradigms or innovative findings. One role of the manager is to help the team and subtask groups move through these grey areas.

Dependent on the type of funding and scope of work, many PIs on the team will have responsibilities beyond research that include education or extension programming or training a graduate student who is involved in research. Thus, it is beneficial for the manager to understand the basics of formal and non-formal education within LGUs and how to support these efforts. An advanced degree is helpful because of first-hand experience of graduate school.

2.2 PROJECT OBJECTIVES

Early in the life of the Sustainable Corn CAP project, the whole team met monthly to discuss work and progress. As the team moved beyond implementation and start-up phase, it was necessary to meet more frequently within smaller subgroups that supported one of the main Objectives listed below or a crosscutting effort to discuss the data, synthesis, and programs in development. The project team was broken into six Objectives based on what was originally written in the proposal and aligned with the scope of work. Each Objective had one or more leaders who led the meetings and worked to coalesce and direct the individuals to collectively reach their goals.

OBJECTIVE 1
Standardization of Protocols and Methods

OBJECTIVE 2
Field Research Network

OBJECTIVE 3
Database, Modeling, and Systems Analysis

OBJECTIVE 4
Social-Economic

OBJECTIVE 5
Extension

OBJECTIVE 6
Education

Each team member had a dominant Objective they were a part of, due to their allocated funding as well as their interest areas. These smaller groups allowed more focused discussions related to their disciplinary fields of interest, which allowed them to have deeper conversations during these Objective meetings. The whole team meetings were broader and focused on connecting the efforts of the subgroups. It was beneficial to have the project manager attend most of the



meetings to support the Objective team leaders, answer questions that emerged as part of the discussion, track the Objective's progress, and look for areas of potential synergy with others.

Each Objective had milestones to complete which were developed for the proposal and then refined in Year 1. These milestones were on an annual basis, however the project manager reviewed these quarterly to determine if members were on track to meet the milestones. The milestones were structured to fall under each of the Objectives so it was clear who was responsible. See Figure 4 for an example of Year 2 milestones for Objective 1.

2.3 TEAM PERSONNEL

Many positions will need to be filled once the proposal is awarded, primarily graduate students and postdoctoral research associates. Principal investigators set out to select and hire candidates for these positions. During the life of the Sustainable Corn CAP project, there was an ongoing need to refill positions when individuals graduated or moved to a new position. This resulted in a continual churning of graduate students and postdoctoral staff throughout the project and orientation of new members accordingly. This was the responsibility of their hiring supervisor primarily, but the project manager came alongside to provide overarching details of the project.

Cropping Systems Coordinated Agricultural Project (CSCAP): Climate Change, Mitigation, and Adaptation in Corn-based Cropping Systems. USDA-NIFA Award No. 2011-68002-30190
 Project Director: Dr. Lois Wright Morton, Iowa State University

Task Name	Lead	Objective Team
Objective 1. Develop standardized methodologies and perform baseline monitoring of carbon, nitrogen, and water footprints at agricultural test sites across the Midwest.		
YEAR 2 MILESTONES		
Evaluate written standard protocols for agronomic indicators	Lauer, Kladivko, Scharf	1, 2
Evaluate protocols developed for in-season measurements: plant population, biomass (dry matter) for all crops; adjust as appropriate.		
Evaluate protocols developed for harvest measurements: grain moisture, grain yield, and grain total C & N for all crops; adjust as appropriate.		
Evaluate standard protocols for greenhouse gas data (CO₂, N₂O, and CH₄)	Castellano	1, 2
Evaluate protocol developed for GHG collection and adjust as appropriate.		
Sampling for data quality control.		
Check each PAS every 3 months for accuracy; recalibrate as necessary.		
Evaluate written standard protocols for soil data	Lal, Kladivko, Helmers	1, 2
Evaluate protocols developed for baseline carbon, nitrogen, pH, CEC, and texture measurements; adjust as appropriate.		
Evaluate protocol developed for baseline soil bulk density measurements; adjust as appropriate.		
Evaluate protocol developed for baseline soil water retention measurements; adjust as appropriate.		
Evaluate protocols developed for optional soil quality measurements of aggregation, penetration resistance, earthworms, and infiltration; adjust as appropriate.		
Evaluate protocols developed for soil moisture monitoring on selected plots; adjust as appropriate.		
Evaluate protocols developed for soil nitrate sampling on selected plots; adjust as appropriate.		
Evaluate written standard protocols for IPM measurements	Gassmann, Mueller, O'Neal	1, 2
Evaluate protocols developed for crop diseases; adjust as appropriate.		
Evaluate protocols developed for insects; adjust as appropriate.		
Evaluate protocols developed for weeds; adjust as appropriate.		
Train IPM USB colleagues in protocol collection since were not present in Y1.		
Evaluate written standard protocols for water and drainage measurements	Helmers	1, 2
Evaluate protocols developed for measuring drainage flow and collection of nitrate concentrations in drainflow.		
Evaluate method of collecting weather data; related to use of protocols, formatting and metadata.	Herzmann, Arritt	1, 2, 3
Evaluate protocols for processing, quality control, and formatting of raw data into the central database; adjust as appropriate.		
Complete the collection process for long term climate information from each of the field sites or from available data from nearby, long-term stations.		
Maintain and improve (as needed) raw weather data transmittal to the central database.		
Monitor data for quality control of data collection.		
Integrate with other outside weather data sources as needed.		

FIGURE 4 | Annual milestones break down complex tasks into manageable lists that are clear and identify who is accountable.

Here is an example from Year 2 of the Sustainable Corn CAP project for Objective 1. This document helped to bring about transparency between the Objectives and a timeline of completion so subgroups dependent on one another could plan accordingly when tasks would be completed.



<p>Questions? Lori Abendroth, Project Manager labend@iastate.edu 515.294.5692</p> <p>Home</p> <ul style="list-style-type: none"> ▶ Annual Meeting Info. ▶ Conference Calls, Dates & Notes ▼ Contact Information & STEM Form <ul style="list-style-type: none"> I'M NEW! - Now what? Email Lists STEM Reporting Team Personnel Evaluation ▶ External Communications Financial Information Photographs ▶ Presentations: Slides & Templates ▶ Project Identity (Logos, Templates, Letterhead) Project Proposal Narrative & Milestones Project Research Questions & Hypotheses ▶ Publications Reports ▶ FIELD DATABASE <ul style="list-style-type: none"> ▶ Objective 1 & 2. Field Research ▶ Objective 3. Systems Analysis & Predictive Modeling ▶ Objective 4. Socioeconomic Research ▶ Objective 5. Extension ▶ Objective 6. Education ▶ Next Generation Scientists' DC Meeting 	<h2>I'M NEW! - Now what?</h2> <p>Welcome! It is great to have you a member of our multi-state research, extension, and education team working to identify adaptive and mitigative strategies for corn-based cropping systems in the Midwest. The two primary hubs for team information are the external website (sustainablecorn.org) and the team's internal website (where you are now).</p> <p>Please go through the checklist below or provide this to your new employee/student:</p> <ul style="list-style-type: none"> • INTERNAL SITE ACCESS: <p>Access to the internal site is granted by Lori Abendroth or Daryl Herzmann. You can use either an institutional email address or a gmail email address as your log-in. Please note this internal website is only for team members as much of the information is unpublished or not for public use at this time.</p> • EMAIL LISTS: <p>Our team communicates often using email lists. New members can choose which list to subscribe to but we generally recommend the following:</p> <ul style="list-style-type: none"> ◦ Graduate student email list - all grad students are on this ◦ Objective specific email list - sign-up for whichever Objective(s) you identify with ◦ Whole team email list - sign-up to receive information sent to the team as a whole • STEM FORM: <p>All graduate students, undergraduate students, and postdocs need to fill out this form as we report our STEM efforts: https://www.smartsheet.com/b/publish?EQBCT=532a1f1fa7a34e039b6f6438eedde57a</p> • INTRO MATERIALS: <p>Request a packet of introductory materials from Lori; this packet will be the same that all team members received at our annual team meeting. If you prefer electronic copies then simply access the files housed there under MEETING MATERIALS.</p> • ASSESSMENT EVAL: <p>Complete the pre-assessment evaluation (required of all team members) to document your prior experience in team science and transdisciplinary work for our evaluation team. You will receive this via email within the first 3 months of your involvement with the team.</p> • WATCH THIS WEBINAR: <p>A great introduction to team science and what our team aims to accomplish is summarized in Dr. Colletti's webinar; please watch this.</p> • FAMILIARIZE YOURSELF WITH THIS WEBSITE: <p>You'll see the website is organized into whole team resources and Objective specific material. Tabs in the left sidebar with asterisks in front are project-wide resources and information. Please click on the various tabs and see what is all included and also review your Objective's tab to get up-to-speed.</p> • JOB POSTINGS, ETC FOR GRADUATE STUDENTS <p>Fellowship opportunities and job postings will be posted to the Graduate Student Hub. You can receive automatic notices when these are posted by subscribing in the upper right corner of that page (go to circle-wrench icon > SUBSCRIBE TO SITE CHANGES).</p> • GRADUATE STUDENT ROADMAP: <p>The roadmap is specifically designed to highlight the team's approach to equipping and helping graduate students become transdisciplinary scientists. Download and review the roadmap, identifying activities and opportunities that you have and have not yet done. Contact Lori or the graduate student leader with any questions.</p>
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FIGURE 5 | Welcome page on the internal website for new team members.

A link to the Sustainable Corn internal team website was included in the initial email sent by the project manager to new team members to ensure everyone received the same startup information.

CSCAP Sustainable Corn

[ENTER DATA](#)
[REVIEW & EDIT DATA](#)
[EXPORT & VISUALIZE DATA](#)
[PUBLICATION GUIDELINES](#)
[CITE COLLEAGUES](#)

Questions?
 Lori Abendroth, Project Manager
 labend@iastate.edu 515.294.5592

- Home**
- ▶ Annual Meeting Info.
- ▶ Conference Calls, Dates & Notes
- ▶ Contact Information & STEM Form Evaluation
- ▶ External Communications
- ▶ Financial Information
- ▶ Photographs
- ▶ Presentations: Slides & Templates
- ▶ Project Identity (Logos, Templates, Letterhead)
- ▶ Project Proposal, Narrative & Milestones
- ▶ Project Research Questions & Hypotheses
- ▶ Publications
- ▶ Reports
- ▶ FIELD DATABASE
- ▶ Objective 1 & 2. Field Research
- ▶ Objective 3. Systems Analysis & Predictive Modeling
- ▶ Objective 4. Socioeconomic Research
- ▶ Objective 5. Extension
- ▶ Objective 6. Education
- ▶ Next Generation Scientists' DC Meeting



2015 Team Photo
See full resolution version on Photographs page

COMMON QUESTIONS ABOUT THIS INTERNAL SITE

- 1. How do I best view this site?**
ANSWER: Any browser (Internet Explorer, Firefox, Google Chrome, etc) will work but [Google Chrome](#) provides the most seamless viewing and access.
- 2. Why can't I find the information I'm looking for?**
ANSWER: Project-wide resources are those at the top of the left sidebar. Objective specific information is listed below that. Still not sure where to look?! Pick the sidebar topic that best fits your area of interest and then check the subcategories.
- 3. How do I access Documents?**
ANSWER: Just click on the hyperlink!
The details (which are not really important): Most documents are housed within [Google Drive](#) and then hyperlinked to this internal site. You will see only a few documents are physically attached at the bottom of webpages; these do not show up in Google Drive.

This website houses work supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, under award number 2011-68002-30190, "Cropping Systems Coordinated Agricultural Project: Climate Change, Mitigation, and Adaptation in Corn-based Cropping Systems."

FIGURE 6 | Internal website organized with project-wide resources in the upper portion of the left side bar followed by Objective-specific content below.

Deadlines and pages of high interest were displayed along the header as yellow hyperlinks; these switched out frequently to align with what was most pressing at the time for the team.

When a new person was hired, the respective PI would alert the project manager. The new team member received a welcome email from the project manager with their PI copied on it. This email contained access information to the internal resources available, email lists they had been added to, and any next steps. The member also was directed to a page on the internal website for new personnel (Figure 5). Having the information housed there made orientation quicker for the manager.

The member could immediately access resources from the internal website and get up-to-speed with existing team member efforts. All materials were housed on the website to avoid any information gaps that could occur with people added mid-project. This included items such as meeting calendars, upcoming deadlines, Objective-specific information, presentation templates, past meeting recordings and notes, and past newsletters.

All personnel on the team were listed in the personnel directory for members to access. The data maintained on each individual is included in Appendix B. The start and end dates were included for each individual and when they transitioned off of the team, each member could decide whether they retained access to the internal resources. Several individuals remained as affiliates to the project and worked with colleagues on publishing the science of the team. The contact information for the team's advisory board also was provided on the internal website for members.

2.4 INFRASTRUCTURE

Project and research data were handled in a similar manner, with all of it managed in spreadsheets or relational databases. With a large, multi-year project such as the Sustainable Corn CAP, the amount of information

collected on even relatively minor details could become unwieldy if trying to manage in text documents. Many multidisciplinary teams are larger and more diverse than some university departments. The data generated by these large teams can be managed well when structured; this may not be as critical for short-term, small teams. With the information structured, it made organization, querying, editing, and exporting much easier. If a team member needed the information in a text file, this could be done with a few conversion steps.

With the Sustainable Corn CAP, the project data needed for reporting, evaluation, and tracking was substantial. Although setting up a highly structured format at the beginning took extra time, it saved significant time over the project life. The project data collected is included in Appendix B. Because the Sustainable Corn CAP team was one of the first transdisciplinary teams funded by the USDA-NIFA, there was an effort to collect and measure data that would allow evaluation of behavior change and team performance related to achieving these goals. Many of these data types may not be necessary for other teams.

Emphasis was placed on being systematic and intentional in getting information from team members. Almost all project data were entered through web forms. Obtaining the information needed in a timely manner from the team members was the most important goal. It was then cleaned and built out on the backend database to align with the overall structure and standardization as needed.

Team members will have worked within many institutional websites and reporting structures prior to joining a newly funded team. The new team adds another layer of sign-ins and knowledge of website construction and organization. A significant effort was made by project and research management personnel of the Sustainable Corn CAP to make the website intuitive and structured in a step-by-step format for ease of use. Most resources were not sent as attachments to emails, but instead as hyperlinks directing members to resources housed on the internal website. This was intentional to encourage members to access the website and become used to going to it for all information. It also reduced the amount of files and potentially different versions circulated among team members, and the possibility someone could miss key information.

A large research team benefits from having a dedicated virtual space to collect and organize project information. This was implemented as a Google Site for the Sustainable Corn CAP team (Figure 6), which allowed for WIKI style editing, shared files, and an access control list to restrict access. This internal website was curated primarily by the project manager with some advanced

users within the team also posting information; most team members used it to locate needed materials and access the research data entry forms.

2.5 COMMUNICATION

Communication among team members is critically important for building and maintaining a productive team and subgroups within it. Insufficient or inappropriate means of communication can lead to project inefficiencies or failures. Good communication is not a surefire means to success, but improves the team capacity to accomplish promised deliverables to funders.



Having the team set and agree to rules of engagement that highlight their commitment to respond to one another and act as a team sets the expectations upfront. Team members respond to one another, access information, and engage differently. Because of individual differences and preferences, the manager will find a mixed approach to communicating with members ranging from phone calls, in-person visits, virtual meetings, email (list-serves and individual emails), and an internal website will keep the work of the project running smoothly. The manager's role is not to contact individual members repeatedly to ensure their work is completed. All team members are expected to meet their mutually agreed upon scope of work. The responsibility ultimately lies with team members to be responsive, but the manager can help by repeating the same message through multiple channels.



Communication is varied and spans individual, small group, and large group interactions: one-on-one interactions with and among team members, Objective leaders, Objectives, and the whole team.

Managing this level of communication requires the manager to be extremely clear, consistent in messaging, responsive to questions as they emerge, and accessible so members do not feel as though they are bothering him/her.

2.5.1 Internal Communication

As discussed in the previous section, the internal website is a valuable resource to ensure all members have access to information and can use it as a collaborative platform. In addition to this website, there are other means to communicating and building relationships that will aid in developing a strong team. Some include:

- Traveling to each institution within first year to meet participating faculty, staff, and students. Understanding the research and seeing the facilities will aid in future interactions.

- Ensuring individuals are subscribed to the team and Objective-specific email lists.
- Sending out short, focused emails as needed to individuals or subgroups.
- Developing a way to communicate to the team such as a monthly newsletter (Figure 7). Frequency of email correspondence is a fine balance. There is a need to provide timely information and keep deadlines in front of the members. But some people also feel inundated with emails, and do not want to receive too many.

2.5.2 External Communication

The project manager (and director) has opportunities to represent the larger team at conferences and workshops. This will be of significant value to the work of the team and add value to the funding agency's investment. The manager can build relationships with other teams carrying out similar research or educational programs as well as potentially lead to future collaborations.

		CSCAP “RAIN” Resources, Action Items, and Notes MAY 2015 <i>A monthly newsletter highlighting our team's most current information and needs.</i>	
<p>Hi Team,</p> <p>Hope the closure of the spring semester and transition to summer is going well for you all.</p> <p>Thanks to Gabrielle Roesch-McNally for serving as the graduate representative this past year – you have done a terrific job. And welcome to our new graduate representative, Samuel Haruna from Lincoln University, who will serve for this final year of the project!</p> <p>Welcome to a new team member also! Natsuko Merrick, staff with Dr. Moore at The Ohio State University.</p> <p>Next meeting: We have cancelled the July team phone call because you will be working with your Objectives/workgroups this summer on recommendations. Therefore, the next time we will all communicate is at our annual meeting on Aug 3-4.</p> <p>This newsletter is online if you have problems viewing in your email.</p> <p>Lori</p>			
RESOURCES			
Organic Research Report		•	A new report has just been completed highlighting our team's organic research efforts brought about through industry partnerships and leveraging of CSCAP sites. This effort is led by Jeff Strock and Norm Fausey. This report can be found online under Special Reports .
Cite Your Colleagues!		•	Find a current listing of all refereed journals on the internal site so that you can cite other CSCAP members in your papers!
Undergraduate Students and Interns		•	Do you have new undergraduates working with you as part of the CSCAP team? If so, please make sure they fill out the STEM form which is required of all students who are paid from the CSCAP.
ACTION ITEMS			
MAY 19-20: Extension Team with U2U		•	The extension team is meeting with U2U on May 19-20 in Davenport, IA. Agenda and travel details are online . Contact Chad Ingels with questions.
JUNE 1: Register for Team Meeting		•	The agenda and registration for our team's final annual meeting are all online . All travel and hotel information are contained in the registration form. Registration deadline is June 1. Contact Lori Abendroth or Lori Oh with questions. You can verify we have received your registration by checking the Attendees list!
JUNE 15: Pls Complete Recommendation Template		•	All PIs received an email on 5/4 from Lori (and integration team) regarding the development of project wide recommendations. All PIs need to complete the recommendation template by June 15 and post to the internal website . Then work with your Objective/workgroup to develop group-based recommendations for presenting at the annual meeting.
JULY 5: Poster Abstract Deadline		•	Presenting a poster at the annual meeting? Great! Check out all details online including poster dimensions, templates, and instructions. Submit your poster abstract by July 5.
JULY 31 : Register for DC Meeting		•	Registration and details are all online for the DC meeting. Current and past graduate students and post docs have received an email invite about this meeting. You can verify we have received your registration by checking the Attendees list. Make sure to submit your registration and request for assistance on a research summary by July 31. Contact Gabrielle Roesch-McNally with questions.
NOTES			
<p>May 1, 2015 Meeting - Adobe recording available</p>			

FIGURE 7 | Monthly team newsletter, Resources, Action Items, and Notes (RAIN), of the Sustainable Corn CAP team.

The left column lists deadline and action item so team members could quickly scan and determine whether or not the content to the right was applicable. The Notes section is not shown here, but was a summary from the discussion during the monthly whole team meeting.

The project manager often will write or provide supporting text for external communication pieces. Being able to develop materials that can be used on an external website as well as in media, promotional pieces, and publications will garner attention to the project and the team members.

To highlight the work of the team as a whole, it is important to have templates available for use by individuals. Many team members will be young in their career, such as graduate students and postdoctoral associates. Their experience so far will be limited to any previous research work and to the methods and approach taught. This includes how to present their research such as posters and talks at societal conferences, team meetings, and in layman and technical writings. On the flip side, team members may be established in their career and familiar with preparing presentations and posters using

a certain template or design. Providing an example is an easy way for them to make a slight adaptation so it ties in with the larger team effort.

One strategy that helps to create a visually cohesive look is to develop presentation templates. Microsoft PowerPoint was the most consistently used program by Sustainable Corn CAP members; therefore templates were made in this program for project presentations (Figures 8 and 9). See Appendix C for examples of use by team members.

Branding is becoming more and more important as funders want to ensure they are recognized, and institutions seek recognition for their ability to obtain funding. Departments and colleges on university campuses have communication specialists to ensure the look is consistent and carried forward appropriately.

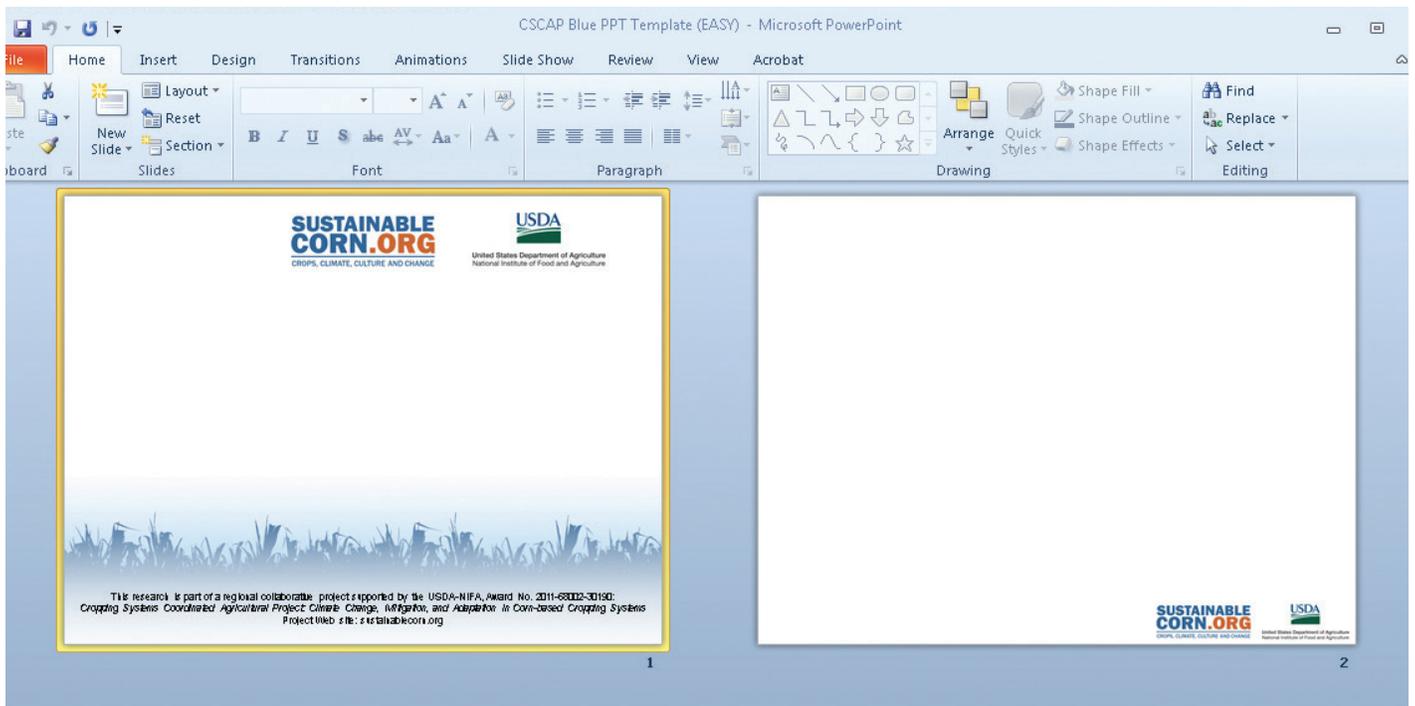


FIGURE 8 | Presentation template made in Microsoft PowerPoint for team members to adapt for their particular use.

The template includes logos on top of the slide for easy deletion and movement. Only a cover slide and an inside slide was provided with a white background, so as to not compete with other graphics or designs people wanted to use. Templates also were provided with these in the MASTER settings of Microsoft PowerPoint, but most team members were not accustomed to using the MASTER functionality.

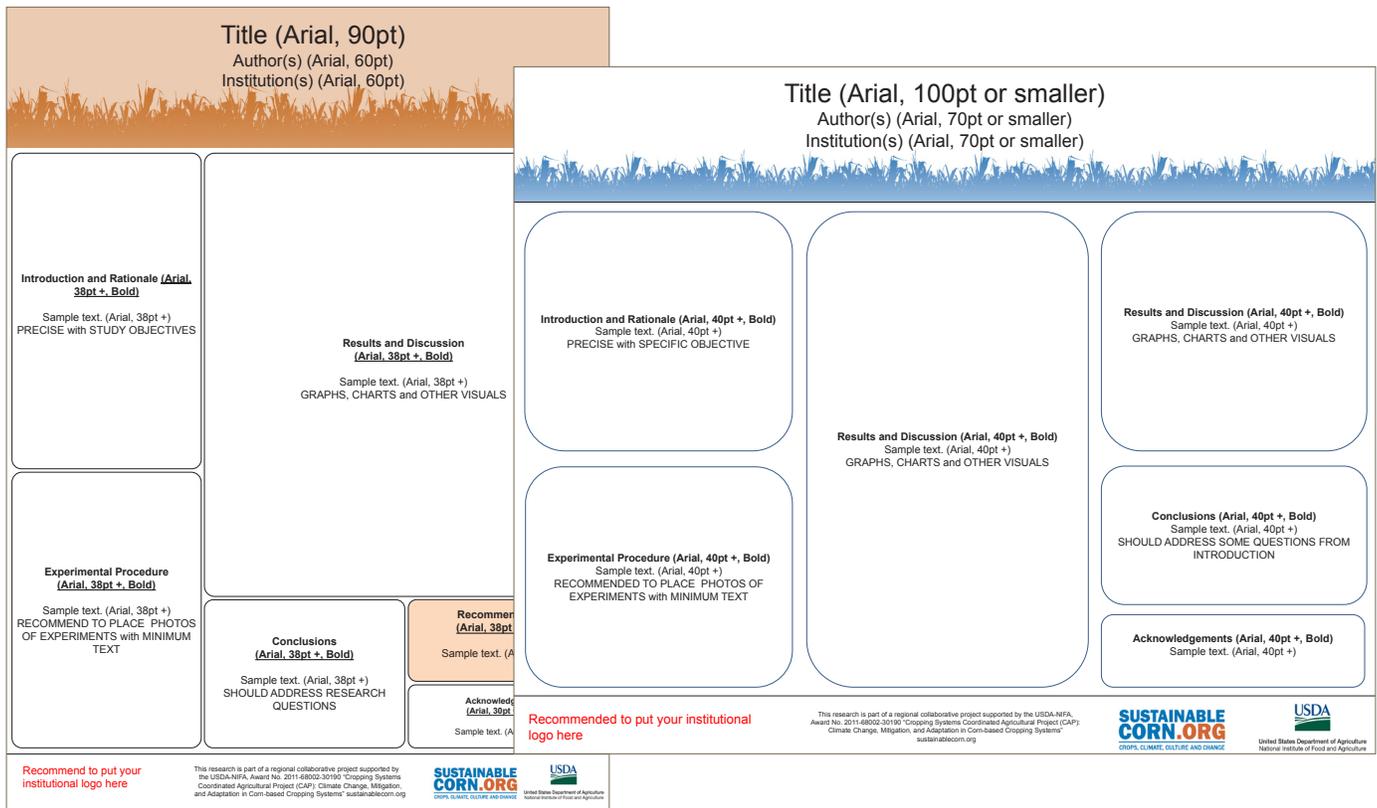


FIGURE 9 | Two examples of templates provided for poster presentations during the life of the project with differing dimensions and colors.

A simple white background was found to be the best approach, because it does not compete against what the team members want to do with graphic colors, photographs, etc.

However, these multi-state teams function outside of the responsibility of these communication specialists to a degree, because the team spans more than a particular department and university.

Once the Sustainable Corn CAP team was ready to start producing materials that would be posted online or in print, identity and trademark offices at all partner institutions were contacted (Appendix D). This was to give them awareness their institutional logos would be used to represent their faculty involvement in this multi-state project, and to request official authorization and direction in which logos should be used for print and web. These contacts resulted in multiple file types of the images being received along with their preferences. It also is important to include text that highlights the non-discriminatory status of the universities and USDA-NIFA; this can be acquired from the main institution.

The USDA-NIFA also has specific guidelines and text to include which is accessible at <https://nifa.usda.gov/resource/official-nifa-identifier>.

Once the logos were obtained from each university, these were posted on the internal team website (Appendix E) for use by team members. Many presentations are done by team members that are not known about until afterwards, so it is important to make things as available as possible to help members follow the guidelines and project identity.

2.6 MEETINGS

Meetings can advance the team significantly in a short amount of time if preparation and outcomes are set ahead. The management and leadership of the Sustainable Corn CAP team spent considerable time

preparing for meetings, whether virtual or in-person, to identify issues to discuss, action items, and any potential areas of conflict.

Determining how often the team meets can be set on a schedule, such as monthly or every other month, with adjustments based on unique conditions. For example, the Sustainable Corn CAP team had many members traveling to and collecting data in research plots during the summer months so Objectives 1 and 2 (field research emphasis) did not meet very often then. Finding a common time every month for the meeting, such as the fourth Tuesday, is helpful, especially if it can stay the same for most of the project life, since it becomes routine for members. Well-timed meetings will help the team move forward and not allow items to fall on the back burner.

2.6.1 Virtual Meetings

Virtual meetings held for the whole team, Objectives or subgroups can be more challenging than in-person meetings, but are critical for large, dispersed teams. An advantage of smaller teams (< 20) is that the whole group tends to work together more often, whereas in larger teams, such as the Sustainable Corn CAP, there must be smaller groups of people working on certain components separate from others. These groups need to complete their work while also simultaneously being mindful of other group efforts, and communicate often to keep everyone informed and connected. This requires exceptional communication and leadership within the group, as well as across groups.

Virtual meetings occurred throughout the life of the project and increased in frequency as the team advanced (Figure 10). It was necessary and helpful to have specific goals to keep meetings focused and meaningful. Engagement and accountability is more difficult with virtual meetings, so specific agenda topics and action items help.

It is recommended to have the manager attend most meetings to administer the virtual platform, thereby allowing leaders and members to focus on work-based efforts and discussions. This maximizes their time spent on the research or educational components of the team. Technology can be challenging for some individuals or seen as a diversion. There are technical challenges often related to sharing of documents, audio quality, accessibility, signing in, and more that are best addressed by someone very familiar with the technology platform. It can be unsettling to those not sure what to do and can get the group off-track quickly. With the manager attending most meetings, he/she also is able to find synergies among groups, answer immediate

questions that arise, support the leaders, and contribute expertise as applicable.

Technology is quickly evolving and improving for virtual meetings. Universities vary in the technology they carry and support; because of this, the technology used by the team will typically be that supported by the main award institution. For the Sustainable Corn CAP, this was Adobe Connect but other platforms are available. Having the meetings recorded was of benefit when team members had a conflict or wanted to listen again to meaningful conversations.

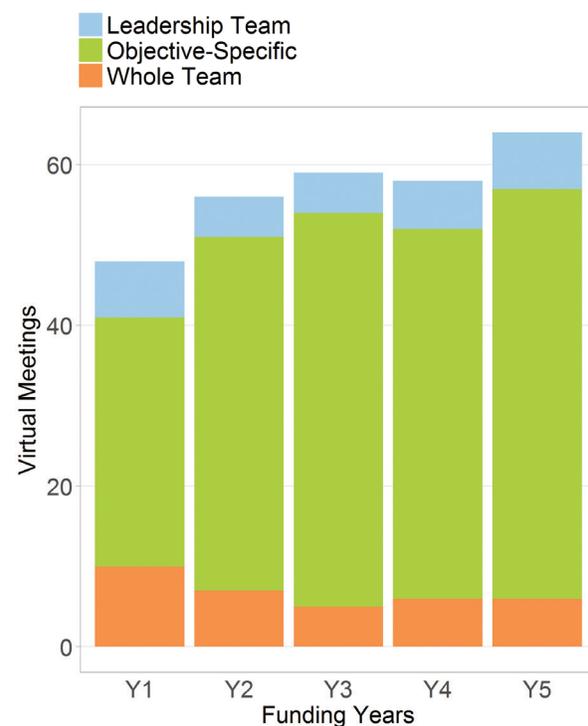


FIGURE 10 | Virtual meetings held yearly across the whole team, Objective-specific, and leadership team.

Overall, the frequency increased as the team progressed. There were additional virtual meetings not reflected in this overall count such as the annual meeting planning committee, yearly data review meetings between research management personnel and individual PIs, yearly review meetings between the project director and individual PIs, and those between just a few individuals on the team.

<p>Questions? Lori Abendroth, Project Manager labend@iastate.edu 515.294.5692</p> <p>Home</p> <ul style="list-style-type: none"> ▼ Annual Meeting Info. <ul style="list-style-type: none"> ▶ 2011 ▶ 2012 ▶ 2013 ▶ 2014 <li style="background-color: #f08080;">▶ 2015 <ul style="list-style-type: none"> Attendees Awards Evaluation Integration Meeting Materials (Handouts, Presentations, Posters) Poster Symposium ▶ Recommendations Registration 2016 Advisory Board (Semi-Annual) ▶ Conference Calls, Dates & Notes ▶ Contact Information & STEM Form Evaluation ▶ External Communications Financial Information Photographs ▶ Presentations: Slides & Templates ▶ Project Identity (Logos, Templates, Letterhead) Project Proposal Narrative & Milestones Project Research Questions & Hypotheses ▶ Publications Reports ▶ FIELD DATABASE ▶ Objective 1 & 2. Field Research ▶ Objective 3. Systems Analysis & Predictive 	<p>Annual Meeting Info. > 2015</p>  <p>Meeting Theme and Focus: From Synthesis to Recommendations</p> <p>WHEN: 2015 CSCAP Annual Meeting (full agenda via hyperlink and attached below) <i>Schedule overview:</i> Aug 2 (Sun): Travel day <i>*Dinner will be available at the Lied Lodge until 9 pm but is not part of the meeting package, so you will need to pay for it and then get reimbursed post-meeting.</i> Aug 3 (Mon): Full day from 8 am to 8 pm Aug 4 (Tues): Full day from 8 am to 8 pm Aug 5 (Wed): Travel home</p> <p>WHERE: Held at the Lied Lodge & Conference Center 2700 Sylvan Road Nebraska City, NE 68410 Conference website</p> <p>Airport Shuttle: Will transport from OMA to Lied Lodge (approx 50 minute drive)</p> <p>ISU Bus: Bus will depart ISU on Sun., Aug. 2 at approx. 4:00 pm CST and arrive at Lied Center by 8:00 pm CST. Bus will depart Wed., Aug. 5 at approx. 8:00 am CST and arrive at ISU by 12:00 pm CST. Lori Oh will send out an email prior to departure with details.</p> <p>WHAT: Book your travel, hotel, and complete the REGISTRATION FORM by June 1; all logistical details and links are contained in the form. Please solidify your travel plans and book hotel before completing the registration form.</p>
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FIGURE 11 | Main webpage for the annual meeting; a link to this page was included in email correspondence. This provided the overall details with directions to sub-pages, such as Registration and the Poster Symposium.

2.6.2 In-person Meetings

In addition to virtual meetings held throughout the year, a whole-team meeting was held annually for all team members. Prior to each annual team meeting, the Sustainable Corn CAP team members worked within their Objective teams on specific targets or work areas so they were ready to discuss in-person and maximize the time at the two-day meeting. Months and months of preparation for these annual meetings occurred, with time spent developing the agenda in line with the project's scope of work for the coming year, completing logistical and event planning tasks, guiding the preparatory work of the Objectives, and prepping speakers for content to be covered. It is important to note, however, this work always tied into overall project goals such as building knowledge of other disciplines, preparing data for synthesis at the meeting, publishing papers, and more.

For team members, their primary efforts were related to preparing their specific scientific or educational items.

Team members wanted to be successful in this and by providing information through email and on the internal web site helped ensure their questions were answered. For example, web entry forms allowed much of the standard information to be submitted and managed more efficiently than emailing back-and-forth. Examples of web entry forms and the internal website are included in the following figures (Figures 11, 12, 13).

A task list was useful in tracking progress on preparatory items for the annual meeting and helped ensure items were not forgotten, but also spaced out to not fully consume the manager's time over the months leading up to the meeting. From a timing standpoint, the items that needed to be addressed first had to do with actions that necessitated a response from or work by team members as well as those that required facilities planning. A generic list is provided here as an example of what the Sustainable Corn CAP began with each year, and then adapted as needed for the particular venue, team dynamics, and goals.

Logistics and Planning

- ✓ Develop contract with facility including hotel rooms, conference rooms, technology package
- ✓ Select food for meals and snacks
- ✓ Identify transport options (shuttle, train, bus) from the airport for members
- ✓ Make up site map and highlight various buildings (as needed), conference rooms, and small-group discussion rooms for members
- ✓ Once on-site, determine if the projection screen(s) are easily visible to all participants. Can add additional screens upfront or side TV screens to make it easier for those sitting in the back to stay engaged.

Invitations via email

- ✓ Send meeting “invite” to team members several months in advance with registration and hotel information
- ✓ Invite advisory board members and any guests with an agenda that highlights the portion of the meeting where their involvement is desired
- ✓ Invite speakers and poster presenters with specific details regarding technology, templates, and deadlines
- ✓ Send final meeting reminder and details to all participants one week prior to meeting

Agenda and Meeting Sessions

- ✓ Develop and finalize agenda: work, goals, and flow, including breaks (see Appendix F).
- ✓ Determine needs of subgroups prior to the meeting and during; prep appropriately. Base this off of prior workgroup efforts and goals from virtual and in-person meetings.
- ✓ Get presentations prior to the conference sessions to load into the virtual platform

Conference Handouts and Materials

- ✓ Order recognition plaques for graduate student poster competition
- ✓ Develop handouts that will be printed and put into folders
- ✓ Compile folders

Poster Symposium

- ✓ Determine which template and dimensions should be used for posters
- ✓ Determine location of poster symposium and arrangement
- ✓ Format abstracts for poster symposium handout (see Appendix I)
- ✓ Have push pins, binder clips, and hanging folders for handouts
- ✓ Request posters to post internally and externally

Internal Website

- ✓ Develop and maintain Registration page (see Figure 12).
- ✓ Develop and maintain Attendees page
 - ✓ Update registered attendee list on the internal site so team members can see who is coming
 - ✓ Cross-check team roster against registration and follow-up as needed with team members who have not registered
- ✓ Develop and maintain Poster Symposium page (see Figure 13).
- ✓ Develop and maintain Presentation page
- ✓ Develop and maintain Materials & Handouts page
- ✓ Develop and maintain Evaluation page

Presentations

- ✓ Provide guidance to speakers on length of time available, including questions, whether laptop is needed, and preparation on content as appropriate
- ✓ Ask presenter if materials need printed
- ✓ Make a podium sign with project name shown

Nametags

- ✓ Order nametags and lanyards
- ✓ Assign table seatings to encourage people to sit with those they don't necessarily know as well in the group. Put this table number on nametags.
- ✓ Develop and print nametags, include full name, institution, Objective, and position. Microsoft Publisher is a good tool for nametag creation.

Evaluation

- ✓ Develop evaluation to send out post-meeting
- ✓ Set up survey electronically in Google Forms, Survey Monkey, Qualtrics, etc.

Post-Conference

- ✓ Develop Awards page on internal website for recognitions received during the meeting
- ✓ Send out reminder to complete evaluation post-meeting
- ✓ Send post-meeting note to advisory board with progress and outcomes
- ✓ Make up packets and send to team members and advisory board members not in attendance
- ✓ Mail plaque, name plates, and instructions to poster winners
- ✓ Post all meeting materials (handouts, presentations, video links), plus photographs, on internal site

Annual Meeting Info. > 2015 >
Registration

Questions?
 Lori Abendroth, Project Manager
 labend@iastate.edu 515.294.5692

Home

- Annual Meeting Info.
 - 2011
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- FIELD DATABASE
- Objective 1 & 2. Field Research
- Objective 3. Systems Analysis & Predictive Modelling
- Objective 4. Socioeconomic Research
- Objective 5. Extension

CSCAP Annual Meeting Registration is online* again this year!
 You can complete the form in two places - below or open it in a [separate tab](#).
 *If useful, a [print version](#) of the registration form is available to aid in planning, but please submit the information online when ready.

Contact [Lori Oh](#) with questions on logistics and [Lori Abendroth](#) with overall questions. Once registered you can verify your registration has been received by checking the [Attendees list](#).



REGISTRATION DEADLINE: June 1, 2015
 HOTEL RESERVATION DEADLINE: June 1, 2015
 FLIGHT RESERVATION DEADLINE: June 1, 2015 (to avoid high prices)

Lied Lodge & Conference Center
 2700 Sylvan Road
 PO Box 817
 Nebraska City, NE 68410

* Required

Please book your flight, shuttle, and hotel room before submitting this registration form!

Attendee Information

First name *
 To appear on nametag

Last name *

FIGURE 12 | Registration page embedded within the internal website.

The full registration form used for the 2015 Sustainable Corn CAP team meeting is included in Appendix G.



Annual Meeting Info. > 2015 > Poster Symposium

2015 THEME: From Synthesis to Recommendations

The Poster Symposium will occur on **Monday, Aug. 3** prior to the team dinner. All of the posters submitted will have the abstract included in the packet of materials received by attendees.

TO PRESENT A POSTER AT THE CSCAP 2015 ANNUAL MEETING, FOLLOW THESE STEPS:

PRIOR TO THE MEETING:

- **Submit your Poster Abstract by July 5.** A Word version of the document is also attached below for your use in developing the abstract, but please submit the information online when ready.
- You can verify we've received your submission [here](#) - SUBMITTED will appear in the far right column.

GUIDELINES FOR POSTER CONTENT:

- Keep your text short, concise, and minimize the use of complete sentences
- Try to present data in graphical and visual formats
- Use good quality pictures
- Draw out key findings and recommendations from your research

GUIDELINES FOR POSTER LAYOUT:

- **Prepare your poster using the TEMPLATES** (download below). If you don't use the template, remember you need to keep the **logos** and **funding statement** on.
- Recommended poster dimensions are **30" W x 40" H**. Templates are currently set at these.
- **Special note:** the dimensions of your poster for our team's annual meeting can be different than the template. But if you want to use this poster also at the DC meeting, you must have your poster at 30"W x 40"H dimensions. Therefore by using the templates below, you ensure that your poster will work for both the annual meeting and the DC meeting.
- Graduate Students - there will be awards for the top 3 posters. Refer to this document for [developing an award winning poster](#).

AT THE MEETING:

- You will print your poster and bring it to Nebraska City. Push pins, binder clips, or velcro will be provided for you.
- Print your poster as an 8x11 handout and bring 20 copies with you. You will have a hanging folder next to your poster to put these in for people to take with them.
- You can put your poster up on Sunday evening after 8 pm or before 8 am on Monday morning.
- The Symposium is 2 hours in length. You will stand next to your poster for one of the two hours; this time slot will be assigned to you.
- After the meeting, e-mail a copy of your poster to [Suresh](#) or [Lori](#) so it can be posted to the internal and external websites.

<input type="checkbox"/>	2015 CSCAP Conference_Poster Symposium Abstract Submission.docx View Download	134k	v. 1	Jul 4, 2015, 6:21 PM	Suresh Lokhande
<input type="checkbox"/>	Orange Template Corn.pptx View Download	976k	v. 1	May 15, 2015, 3:16 PM	Suresh Lokhande

FIGURE 13 | Poster Symposium page on the internal website with details participants needed for making their posters, plus details pertaining to the day of the event.

2.7 REPORTING

Data that were collected for and about the project team are described in Appendix B. These data were determined to be of value based on reporting requirements by the funder, potential use by individual institutions, and from email requests received.

The U.S. Government Accountability Office (GAO) released a report in 2014 (GAO, 2014) that highlighted the need for USDA funded teams to have improved metrics of impacts for farmers. The National Academies also released a report that year identifying the need for traceability and performance indicators of teams funded by USDA (NRC, 2014). The Sustainable Corn CAP team worked to ensure recommended metrics were collected, as possible, for the internal and external audiences highlighted in the reports. Overall, the data collected were used in annual reports, executive summaries of yearly accomplishments and impacts, and in external pieces, including the website.

The transparency of team efforts, overall status, and completion of outputs to the funding agency and stakeholders highlights and advances the science of the team, while increasing exposure. The most important data to collect include:

- Team members (current, past, affiliates)
- Number of undergraduate and graduate students and postdoctoral research associates trained
- Training within STEM fields (women, minorities, international)
- Deliverables (outputs)
- Accomplishments and outcomes
- Leveraged funding
- Milestone completion

It is important to understand funding agency reporting needs and create systems that request and allow the

management of this data in near real-time. This allows for immediate transfer when requested or opportunities are presented. Aligning team entry forms with those used by federal agencies such as USDA and the U.S. Department of Education, as well as institutional guidelines, makes reporting efficient for everyone involved, from the PI to the federal agency.

Much of the data listed above were obtained through Quarterly Progress Reports (QPRs) written by PIs every three months, see Section 2.6.1. These reports were reviewed with content populated across the project management databases to maintain a current standing of information relative to the team's deliverables, personnel, STEM metrics, and Objectives milestones. Although reports were requested every three months, it was a short period of time to report on, which many PIs thought was easier to do than on an annual basis. The Sustainable Corn CAP made an effort to limit PI time spent on reporting so most of their efforts went to advancing the science and educational goals of the team.

2.7.1 Internal Quarterly Progress Reports

The principal investigators submitted QPRs using an online form (Figure 14). Each QPR entry included information about accomplishments, products, challenges or changes, personnel changes, leveraged

dollars, and miscellaneous notes from each PI and their respective group/lab during the given quarter. The Sustainable Corn CAP had over 700 QPRs submitted during the life of the project, which allowed management and leadership personnel to have a strong pulse on the work of the team, plus have current details when requested on short notice by the funding agency or administration, or to take advantage of promotional opportunities. Due to the size of the team, if PIs only reported once per year, it would be an all-consuming effort to get these processed, synthesized, and written in time for an annual report to the funder.

The Sustainable Corn CAP team was funded in 2011 and this equated to Year 1 or Y1. The quarters were based from the start of each funding year, which was March (i.e. Q1 = March, April, May; Q2 = June, July, August; Q3 = September, October, November; Q4 = December, January, February). The QPR entry form was designed based on the USDA REEreport manual (https://www.nifa.usda.gov/business/pdfs/reeport_user_manual_Apr2013.pdf) to ensure necessary information was collected for project transparency and reporting efforts.

The submitted QPRs were made available on the internal website in a non-editable form. This allowed team members to see the progress of others, potentially acquire information they needed, and increase accountability among members.



CSCAP Quarterly Progress Report

QPR for Dec. 1, 2015 to Feb. 29, 2016. Submit by Mar 15.

Principal Investigator

TELL US ABOUT YOUR EFFORTS & ACCOMPLISHMENTS

Accomplishments: WHAT DID YOU DO?

What did you do in terms of major activities relative to the milestones you listed?

Accomplishments: RESULTS & IMPACTS

What significant results, developments, or outcomes did you have? If something profound seems to have happened - put it here!

Accomplishments: OTHER

Did you collaborate with others or do work outside your specific Objective this past quarter? Explain these efforts.

TELL US ABOUT YOUR OUTPUTS

Products: PUBLICATIONS

Report all written products here including peer-reviewed articles, white papers, journal articles, conference proceedings, books, etc.

*NEW or IN PROGRESS publications: Include a complete citation (as much as possible).

*EXISTING publications: If you've already told us about a publication but have an update, simply include the title with the change in status/information.

Have a list of products in a document already? You can simply attach it via Attachments below.

Products: ACTIVITIES

Report all presentations (field days, conferences, and workshops), external partnerships, and consulting here.

Please include items such as location, title of your presentation, target audience, and an estimated number of participants.

Products: OTHER

Have you done something that doesn't seem to fit under the other Product categories? Include items here such as audio, video, curriculum, manuals, and websites.

USDA Acknowledgement*

When reporting our team products, we now need to articulate YES or NO whether USDA was acknowledged as the funding agency.

For all of your products you are reporting here, which had the USDA funding reference included?

Attachments

Upload lists of citations or outputs here if you have them in a separate document.

 Upload...

FINAL COMMENTS

Challenges or Changes

Describe major changes or problems you encountered and/or made adjustments for.

Personnel Changes

Did you have any personnel changes such as additions, graduations, professional development in this past quarter?

Leveraged Dollars

Did you receive other financial support, either from your institution or grant-based, in this past quarter? An estimate is sufficient.

Notes

Include any additional information and efforts here you think we should know about.

Send me a copy of my responses

Email address

Submit

FIGURE 14 | Entry form for Quarterly Progress Reports. It was an open-text submission form in which PIs stated their accomplishments, efforts, outputs, and challenges.

2.7.2 Continuation Proposal

The Sustainable Corn CAP received funds on a yearly basis which meant the project team needed to submit a continuation proposal at the end of each funding year. A Request for Application (RFA) was released to existing projects under the funding program with a request to submit a continuation proposal. This proposal was similar in length to the original proposal, and emphasize work that had been completed in the previous year, plus work planned for the coming year. The funding agency uses this to determine whether the project team has met requirements and can receive the next installment of funds. The many types of data described throughout Section 2 were collected to be used in the continuation proposal as well as the annual report.

The RFA outlined the information to include:

- Narrative text describing progress and accomplishments from past year and plan of work (POW) for coming year
- “Current & Pending” document for each PI that identifies percent time spent on all grants awarded
- Biographical sketches for each PI
- Budgetary POW for each subcontract as tied to the funds allocated
- Complete budgets for each subcontract

The Sustainable Corn CAP project manager, director, and leadership wrote the continuation proposals with limited involvement from the other PIs. This was agreed upon as the best approach as long as all PIs submitted their QPRs in a timely fashion. Once the continuation proposal was ready to submit, it was uploaded into an institutionally specific program, Cayuse in the case of Sustainable Corn CAP, and reviewed by university sponsored-programs staff. It was then uploaded to Grants.gov by their staff once it was approved internally. Understanding the review process and required time to work through all administrative channels of the institution and federal agency is beneficial, as it can easily take more than a few months.

2.7.3 Annual Report to Funding Agency

Although a continuation proposal may not be required given a particular funding agency’s requirements, an annual report is required. This report will follow a similar structure as a continuation proposal, with

significant overlap possible between the two. The team will be required to report their progress and accomplishments for the previous year as well as the plan of work for the coming year. The milestones (Section 2.2, Figure 4) for the team will serve as the primary benchmark as to whether the team is on track and has met expectations.

It is valuable to learn the funding agency reporting structure, guidelines, and deadlines. For the Sustainable Corn CAP team, the report was submitted within the USDA REEport web portal (<https://portal.nifa.usda.gov/>) and a manual was available outlining the step-by-step process and definitions of what to include.



2.7.4 STEM Data

Information regarding the team’s efforts in training the next generation of scientists and educators within the Science, Technology, Engineering, and Mathematics (STEM) fields is of national importance. Educating and training students and postdoctoral associates often is time intensive for PIs, and is of value to show the significant investment by a team towards this effort. The Sustainable Corn CAP team had a large number of students partially or fully employed each year (Figure 15); this data were also converted to months trained (Figure 16) to reflect the funding agency’s investment in this cadre of individuals, which would not have been possible without that investment. Information on the Sustainable Corn CAP efforts were requested multiple times within a year by USDA when certain press or promotions were being made. Information on gender,

race, and international status was always synthesized to total number of individuals under each category for the team. For example, in a Year 3 report by the Sustainable Corn CAP, the following text was included:

“To date, 61 undergraduate and 51 graduate students (25% minority; 39% women), and 14 post-doctoral researchers (65% minority, 15% women), representing a diverse set of expertise and specialties, have worked alongside other project members, to develop disciplinary rigor and a transdisciplinary approach to addressing complex scientific issues. Ten graduate students have completed their degree and moved into their career paths.”

Data were collected on all undergraduate students, graduate students, and postdoctoral research associates employed or affiliated with the Sustainable Corn CAP. Data were obtained through self-reporting by the individual using an online STEM form (Figure 17). The form was designed based on U.S. Department of Education standards and language (https://nces.ed.gov/ipeds/Section/collecting_re). All STEM data were kept confidential and only reported as requested to the funding agency with no personal identifiers made available externally.

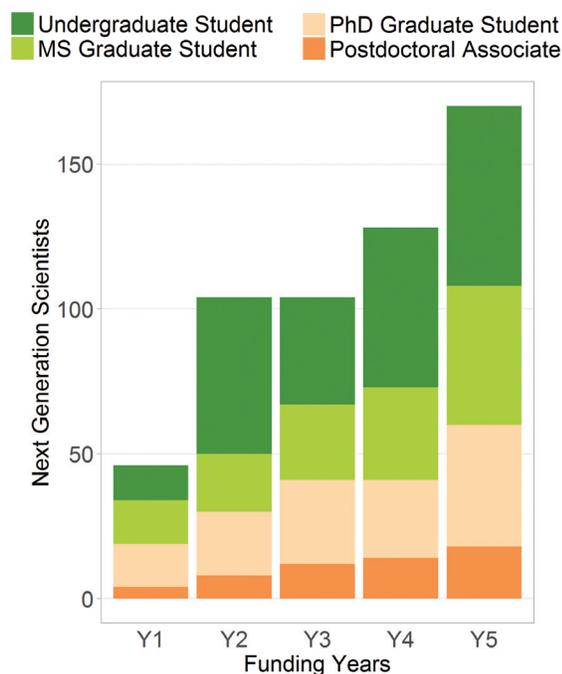


FIGURE 15 | Number of students and postdoctoral associates partially or fully employed each year of the Sustainable Corn CAP project.

Start and end dates were recorded for each individual; data were tabulated with individuals counted within a particular funding year regardless of number of months. Therefore, when examining on a yearly basis, this would overestimate the number of individuals.

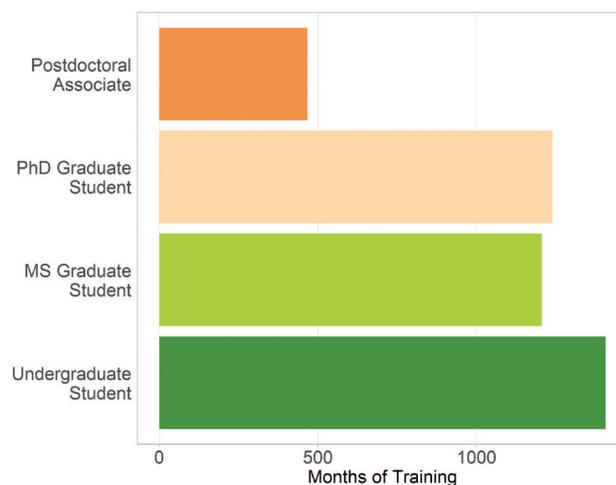


FIGURE 16 | Total investment in time of training students and postdoctoral associates by the Sustainable Corn CAP team.

As described in the caption of Figure 15, the start and end dates were recorded for each individual, allowing this to be calculated.



Personnel employed by or affiliated with the Sustainable Corn Project

The below information is requested from you to ensure we are transparent in terms of the number of employed undergraduate students, graduate students, and post-doctoral researchers who are a part of our team. We are also asked to provide a summary to our funding agency (USDA) about the individuals who are being trained within STEM (science, technology, engineering, and mathematics) areas due to the national need for these skill sets.

All information will be kept confidential and only reported as requested to our funding agency. No information, other than first and last names, will be posted on external websites.

The questions related to race and ethnicity are developed from the standards by the US Department of Education.

If you have any concerns or questions, please contact Lori Abendroth, Project Manager, at labend@iastate.edu or 515.294.5692. Thank you!

First Name *

Last Name *

Supervisor or Lab Group *

Select from the following options:

Position Title *

Select from the following options:

- Undergraduate Research Assistant
- Undergraduate Internship
- MS Graduate Student
- PhD Graduate Student
- Post Doctoral Researcher
- Visiting Scholar
- Other (explain in Comments below)

Employment Start Date *

Expected Ending Date of Employment

Make an educated guess if you are not certain!

Gender *

- Male
- Female

Ethnicity *

Are you Hispanic or Latino?

- Yes
- No

Race *

- American Indian or Alaska Native (including all Original Peoples of the Americas)
- Asian (including Indian subcontinent and Philippines)
- Black or African American (including Africa and Caribbean)
- Native Hawaiian or Other Pacific Islander (Original Peoples)
- White (including Middle Eastern)

Are you from a country other than the United States? *

Answer yes, if you would be considered as "International"

Discipline

Students: please enter the specific discipline you are studying, if declared.

Comments

Please enter explanatory information here if you answered "OTHER" above.

Submit

FIGURE 17 | Entry web form for new undergraduate and graduate students and postdoctoral research associates.

When new team members joined the Sustainable Corn CAP team, they would self-report STEM specific data.

2.7.5 Leveraged Funding

Funds that helped to extend the breadth and depth of work carried out by the Sustainable Corn CAP team members was recorded as leveraged funding (Figure 18). This was a helpful indicator to external partners of efforts by team members to acquire additional funds beyond the funding agency’s initial investment. It was a mutually beneficial partnership as others could partner with Sustainable Corn CAP members and receive high impact outputs for less financial investment because of the existing funds in place by USDA-NIFA. Leveraged funding included institutional in-kind support, industry support, and proposals. Examples include:

- Institutional tuition support for graduate students
- Industry support for addition of monitoring equipment at research sites
- State funds to expand surveying of local farmers related to practices tested
- Proposal that brought in additional data to the research database

Principal Investigators provided this information in their quarterly progress reports. Many proposals were submitted during the life of the project but only those

that were funded were counted as leveraged funding. Each type of leveraged funding was aligned with the funding years of the Sustainable Corn CAP, with multi-year funding distributed among applicable years.

The leveraged funding was reported to USDA in annual reports and executive summaries to showcase involvement and effort by project PIs to build out the initial investment by the agency into a broader scope of work. For example, text from Year 4 of the project was:

“Y4 leveraged dollars summed to over \$1.8 million, for a total of \$5.3 million leveraged dollars to-date. This includes support from the United Soybean Board, Minnesota Corn Growers Assoc., Iowa Dept. of Agriculture and Land Stewardship, Biological Agriculture Partners; grants from NOAA-SARP, USDA SARE, USDA-NRCS, Great Plains Climate Hub; and university institutional support.”

2.7.6 Measuring Productivity (Outputs)

Assessing the quantity of outputs from a project team is one indicator used by funding agencies to determine impact (Figure 19). Team productivity can be assessed as it relates to the scientific community, non-scientific community, and mixed audiences. The goal in quantifying outputs is to indirectly obtain a sense of knowledge built within the broader

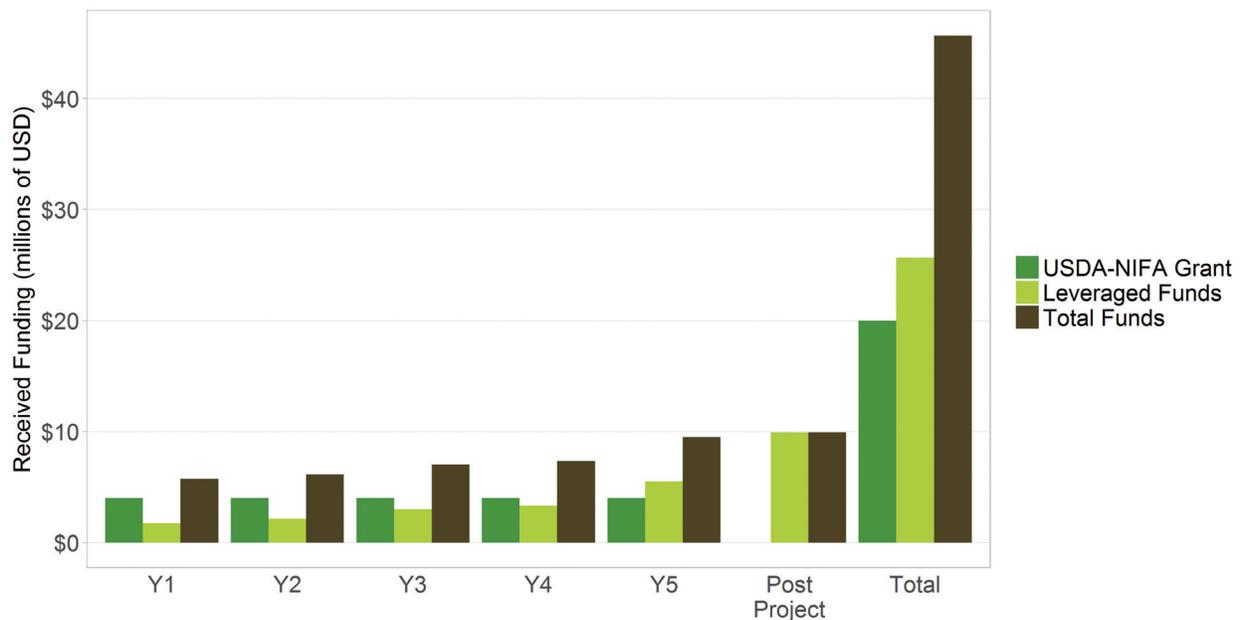


FIGURE 18 | Leveraged funding graphic provided in reports to convey team members’ efforts to acquire additional funds to build out the funder’s initial investment.

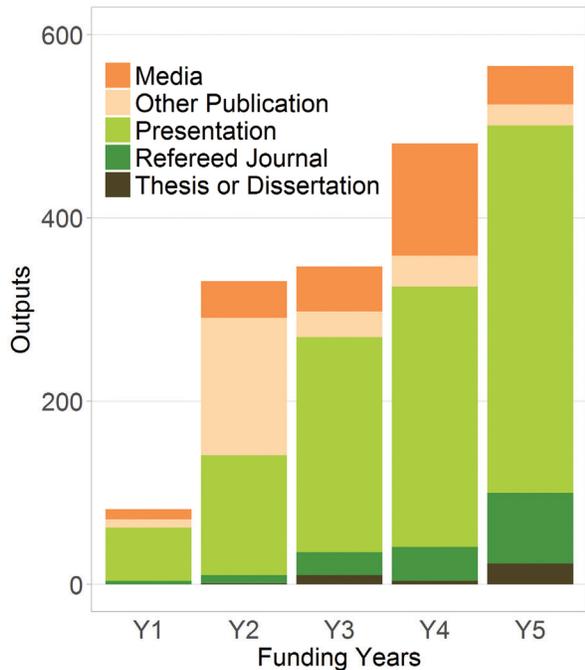


FIGURE 19 | Number of total outputs during the life of the Sustainable Corn CAP that acknowledged USDA-NIFA as the funding agency.

Additional outputs were recorded in the output database in cases where acknowledgment was not included due to error or inability to do so, such as in certain media pieces. These outputs are not included here and typically not reported to USDA; thereby resulting in an underestimate of total outputs by the project team. The categories shown here are summations across finer categories used in the database (Appendix B).

community as a result of the funded project team. The refereed journal has been of primary significance within the academic environment over the years (Figure 20), and beyond capturing the number of published articles, the journal impact factor and number of downloads also can be used to determine impact.

As multi-disciplinary teams become the new norm, the number of journal articles that have a diverse or large set of authors has increased dramatically. It may become more important over time to funding agencies and the general public to show the value of these large teams by capturing this dynamic and quality of work obtained through multi-disciplinary scholarship (Figure 21).

The Sustainable Corn CAP maintained this information in an output database that was manually populated with information reported in the quarterly progress reports (QPR). Significant structuring, cleaning, and populating was necessary to transform the QPR-submitted data into citation quality data. The structure and variables were determined based on the USDA REEport system for streamlined reporting and transparency to USDA.

See Appendix B for the complete listing of variables recorded in the output database. The number of outputs significantly grew as the project advanced (Figure 19), and often were in a state of flux as they moved from planning stage to submission and publication.

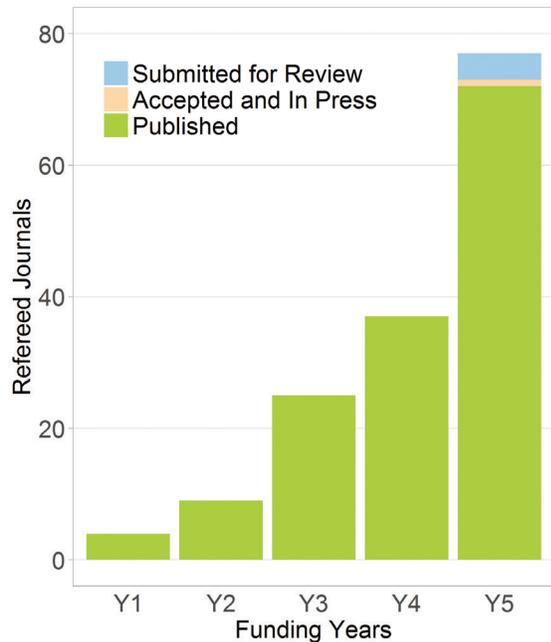


FIGURE 20 | Number of refereed journal articles published by the Sustainable Corn CAP during the life of the project.

Past reports such as GAO (2014) stated the productivity of large, multidisciplinary teams was not necessarily different than short-term teams. This conclusion is disputed by evidence such as this that shows an exponential increase in publications in later funding years.

The overarching types of outputs produced by the Sustainable Corn CAP team included:

- Refereed journal articles
- Graduate theses and dissertations
- Presentations made within a conference and extension setting
- Non-refereed publications including white papers, fact sheets, extension publications, reports, websites
- Media pieces including news releases, popular press, university press, radio or TV, blogs, videos

Publication guidelines (Appendix J) were developed at the beginning of the Sustainable Corn CAP team, which brought forth conversations about use of primary data in secondary modeling efforts, length of time for others to review publications, proper acknowledgement text to include, and more. All PIs voted on the publication guidelines that then were implemented as the standard

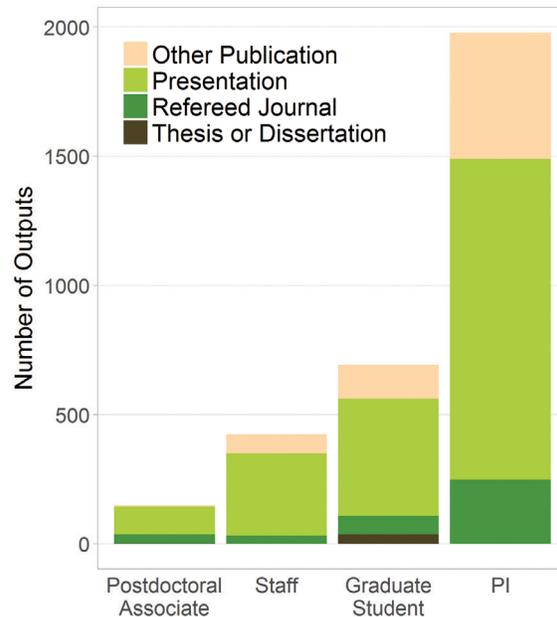


FIGURE 21 | All members of the Sustainable Corn CAP were actively involved in publishing and presenting the work of the team in various outlets.

The breakdown of authorship was determined for all outputs except for media, which is the reason it is not shown here. The number of outputs per position type reflect the importance of each team member to communicate the science of the team out.

for everyone to follow to reduce any co-authorship conflicts, as well as ensure the body of work was clearly recognizable to external parties.

2.7.7 Evaluation

Evaluation was conducted throughout the life of the Sustainable Corn CAP project. Evaluation was an important component in the original proposal with a focus on formative and summative evaluation. Formative evaluation tracked the processes and progress of the team throughout its life cycle and provided timely feedback for management and leadership to adjust programmatic goals and activities and operational processes. This especially helped to track and evaluate team efforts to practice transdisciplinary research, allowing management to target interventions to accelerate integration and transdisciplinary interactions. Summative evaluation documented the project accomplishments, achievement of milestones, and statistics of interest to funding agency and stakeholders and was especially valuable in annual and final reports to funders.

The type and amount of evaluation will vary based on funder requirements and interest by the team. There are different types of evaluation that can be conducted such as team member from team member assessment to assessment of program effectiveness to assessment of stakeholder behavior change.

The Sustainable Corn CAP worked with evaluation personnel to develop evaluation questions and metrics. These were administered primarily through Qualtrics

software (Figure 22), which was electronically delivered via email to participants. A pre- and post-assessment were conducted. Due to the churning nature of team members, keeping track of when an individual received an assessment was important. When too much time elapsed between starting or ending dates and the receipt of the survey response rates dropped. All team members, except undergraduate students, were assigned a unique ID for anonymity and participated in the evaluation processes.

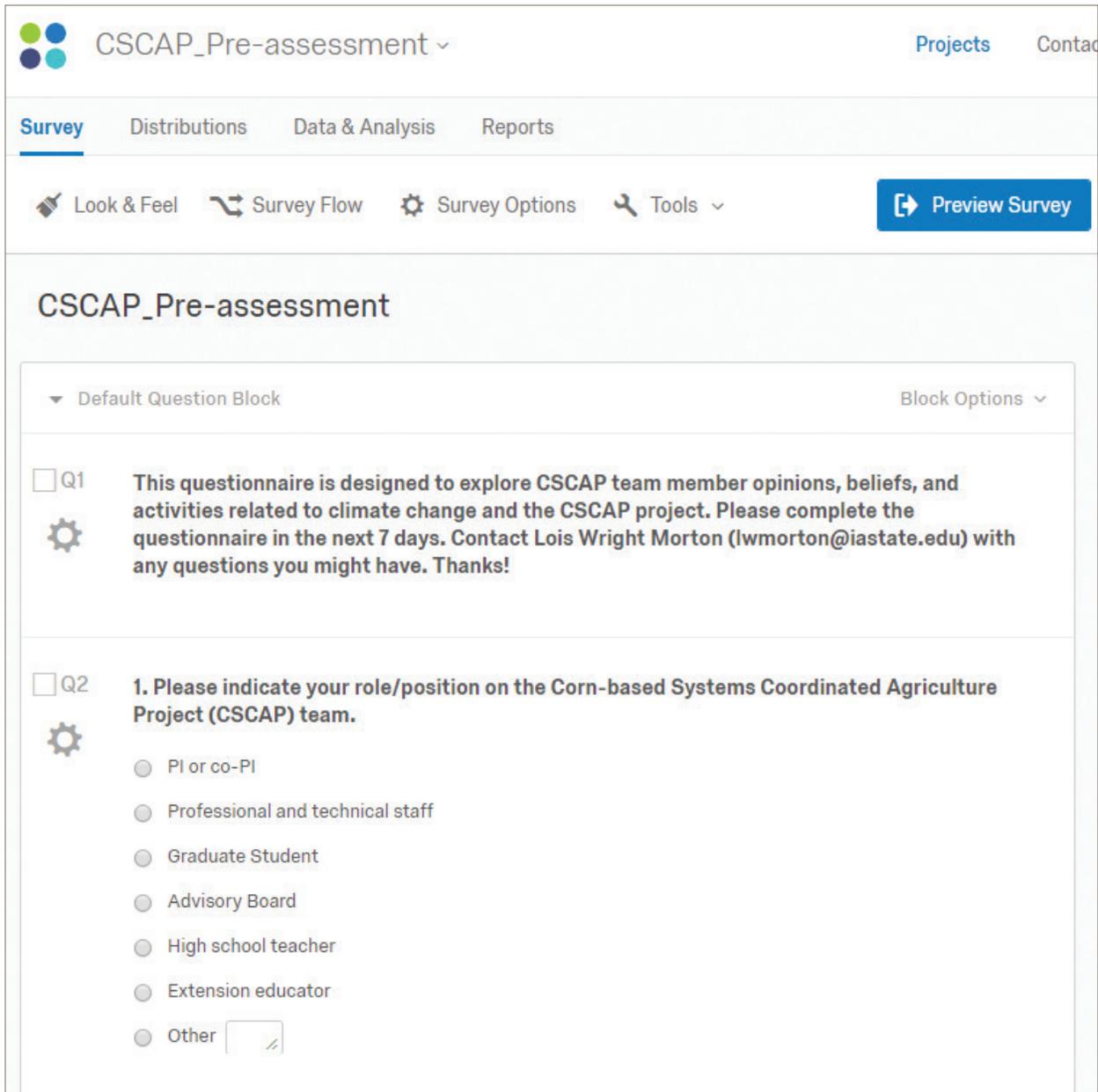


FIGURE 22 | Example of Qualtrics interface for setting up the survey questions followed by administration of the assessment to team members.

SECTION 3. RESEARCH MANAGEMENT



The change in research over the years towards multidisciplinary teams that are often distributed across universities is pushing the boundaries and capacity of traditional methods researchers have employed for storing, analyzing, and reusing data. It also has become standard within many disciplines and a requirement of funding agencies that the data be made available post-funding. Making data accessible and “open” after a certain period of time can be daunting to researchers in terms of preparation, but also presents a new way of doing research that may cause concern about data potentially being misinterpreted, misused, and out of their control.

In 2014, Wiley conducted a survey of global researchers (n=2250) to understand the motivations and hesitations researchers have in sharing data; see Table 1. The Sustainable Corn CAP team iteratively worked through many of these same concerns through formal discussions during whole team meetings as well as conversations between management and individual PIs. The technological platform chosen, tools developed, and methods of communication were intentionally designed to try and minimize the types of concerns listed in Table 1 as hesitations. There was variability among project members in the perceived value and hence, the motivation, to share data, but because the undergirding of the team’s success required it, it was a collective effort reinforced from multiple angles.

TABLE 1 | Researcher motivations and hesitations to publicly share their data (Wiley, 2014). More than one option could be selected under each header, Motivations and Hesitations.

Percent Respondents	Motivations
57%	Data sharing is standard practice within my research community
55%	To increase the impact and visibility of my research
50%	Public benefit
42%	Journal requirement
37%	Transparency and reuse
30%	Personal trust in the requester
25%	Discoverability and accessibility
23%	Funder requirement
18%	Institutional requirement
13%	Freedom of information request
13%	Preservation
2%	Other
Percent Respondents	Hesitations
42%	Intellectual property or confidentiality issues
36%	My funder/institution does not require data sharing
26%	I am concerned that my research will be scooped
26%	I am concerned about misinterpretation or misuse
23%	Ethical concerns
22%	I am concerned about being given proper citation credit or attribution
21%	I did not know where to share my data
20%	Insufficient time and/or resources
16%	I did not know how to share my data
12%	I don't think it is my responsibility
12%	I did not consider the data to be relevant
11%	Lack of funding
7%	Other

Although open-data creates new challenges, it also provides unique opportunities for research scientists, modelers, policymakers, and other stakeholders to tackle new questions in an efficient and transparent manner while offering an environment for multi-, inter- and transdisciplinary collaboration to thrive. To make the most of this opportunity, it is important to have in place sound, coherent and flexible data management practices that are user (i.e. team member) focused.

Scientists are familiar with managing their own data and storing it on individual storage devices accessible to a limited number of users involved in the data collection and research of the team. Managing data from a large

number of distributed research sites creates unique data management challenges that require a team mindset and determination, as well as a wide range of technical skills and knowledge.

The Sustainable Corn CAP team collected a suite of biophysical data variables in research field experiments to assess potential adaptive and mitigative strategies for corn-based cropping systems. Research sites varied in design, data collected, and disciplinary background of individuals involved; however, all sites had similar core data to collect and upload on a yearly basis. Social-economic research also was conducted including a survey of 5,000 farmers and 200 one-

hour, in-person farmer interviews. **The overarching goals for research management personnel were to create web applications that allowed the team to self-manage, decode disciplinary “languages” into data dictionaries for improved clarity among users, represent data collected at different frequencies, and allow for high customization and flexibility for research site variation.** The social-economic research data are not described further in this report, because it was minimally handled by the research management personnel due to only a small subset of users within the team, IRB (Institutional Review Board) standards for research involving humans, anonymity necessary, and inability to publish it post-project.

Teams will vary in whether they are leveraging an existing database or creating a new system. A repository may also be an option for some, although these tend to be static with limited interaction available from a user or manager standpoint. The goals of the team related to use of the data ultimately will determine the best database approach and personnel to hire; there are differing models of implementation possible. Consideration of overall project funding, existing infrastructure, use, and legacy is important.

The Sustainable Corn CAP did not have a centralized database prior to funding being awarded and therefore, took a two-pronged approach to research data management. This approach consisted of: 1) cloud resources and services for all user interactions and 2) local storage and traditional relational databases housed at Iowa State University. The systems were routinely synced with quality control and manipulation occurring at the database. The formulation of this approach was begun prior to the award date, when cloud technologies were in their nascent developmental stage. The local storage was done out of necessity due to lack of cloud functionality and concern the cloud may not be stable.

An important function of the research management approach was to avoid duplication and versioning of files common with such electronic collaboration systems as email. The goal in having the central database in the cloud was that it would be the authoritative source for entry and retrieval of data. The workflow of most team members was to enter, store, and email Microsoft Excel files. At the time of funding (2011), file synchronization and sharing services were not prevalent. The team selected online tools through Google because Google Sheets presented an attractive interface that felt much like a spreadsheet program, but was running in the cloud and on users’ local web browser.

The transparency the cloud provided aided in developing a “flat” experience for users, in which all had access to the same data. This also helped to self-govern the entry of data. Since the cloud served as the authoritative source of a given dataset, a simple inspection of it would reveal if the data were present. This transparency significantly reduced the complexity of having team members email others when they requested locally collected data. This transparency also aided quality control and provided insight into the frequency and approach data collectors have when editing data.

3.1 RESEARCH MANAGEMENT RESPONSIBILITIES

The primary responsibility of personnel within the research management scope of the project was to understand differing field research sites and data collection methodology. This knowledge allowed the design and development of data input interfaces and quality control to be performed with minimal investment from team members. Research personnel were able to successfully do this because of a collective background that spanned disciplines, technical expertise, personnel management, and computer science skills. These skills involved database technologies, using cloud services, and programming capabilities. Finding personnel with these skills and also a working knowledge of the sciences involved in the project can be challenging. Within the university environment, these individuals often are those who worked previously as a scientist and learned computing out of necessity to complete research work.



Research management personnel were seen by team members as the focal point and authoritative source for the standardization and quality issues that surfaced in



the Sustainable Corn CAP project. This was because of their role amassing data across the eight states and 35 research sites, coming from the more than 80 people collecting it.

Building data infrastructure, maintaining a large-scale network, and developing project-specific innovative tools, while regularly adopting existing platform to technological advancements and changes in software and cloud services, legitimizes a need for building human capacity within a project that can address these big data challenges. Nonetheless, technical skillsets of the data team personnel should be complemented by sound understanding of the science behind in order to successfully manage this multifaceted data.

The process of learning field site methodologies required attending most Objective virtual meetings, reviewing their emails, and visiting field sites to verify methods and metadata. With this knowledge in hand, understanding subtleties of submitted data were easier. There also was a feedback loop in this process as the data team could provide suggestions on more complete means to report collected data. For instance, a field site may only report a tillage operation being complete, but not record the soil depth of the tillage, which is important for modeling.

The Sustainable Corn CAP team developed standardized protocols (Kladivko et al., 2014) prior to the first year of research to standardize data collection methods. Research management personnel aligned with these methodologies and were able to design input interfaces, at times as simple as row-column spreadsheets, to capture the nuances of the data.

The process of learning also necessitated proactive engagement with the team members in-person and virtually. After team conference calls, research

management personnel would follow-up right away to comments made, data presented, or questions that surfaced related to collected data; this allowed clarification on both sides quickly. Email correspondence to the team members was effective for communicating data entry deadlines, new tools, and overall database information. Direct emails or phone calls, however, were valuable to communicate with members who were often in the field/laboratory or made errors in previous years to ensure correction.

Communication with team members also involved reminding and reinforcing project milestones and deadlines for upload or review of existing data. Even though these dates were set by project leadership, the research management personnel became the indirect enforcers as each PI would vary in completion, so clarification on what was missing was hugely beneficial. These personnel had the most visibility into and knowledge of the data progress, so it was a natural fit to take on this role. Questions related to methodology of a particular site or nuances in the reported values often were directed to research management personnel or jointly with the PI responsible.

Funding for research management will include the construction and management costs associated with support and quality control. The Sustainable Corn CAP research management personnel were not able to keep up at times with the demands of the team, as entry of data was occurring at the same time the interfaces were being built. The team had three personnel funded at half- to full-time. Key roles included a database administrator with programming expertise, a data manager who managed site data and interacted with team members providing support, and a data architect who understood the field research data and could construct data schema and appropriate interfaces.

3.2 INFRASTRUCTURE

Large collaborative projects need data management infrastructure to support the team's science. The challenge facing researchers seeking to collaborate in real-time across universities is that provided tools like centralized storage, identity management, and general software do not fully handle the complex needs of managing data. People with appropriate computational and communication skills can build the infrastructure. Having the systems structured and working in a way that aligns with the team's goals will help advance the science of the team, allow for expansion of research questions, and provide more efficient use of the team member's time.



Research data management systems are not commercially available software that can be purchased to support a collaborative data collection effort. The multi-institution nature of these projects also creates a licensing, user authentication, and networking challenge for resources that may not be available to local institutions. The Sustainable Corn CAP team's use of cloud tools (Google, Smartsheet), in conjunction with a local relational database, presented an appealing option as identity, files, and data could be managed centrally and accessed by all team members uniformly.

The first step was establishing the internal team website on Google Sites (Figure 23), allowing for



FIGURE 23 | Team members interacted with and accessed the research database through the internal website.

The left sidebar of the internal team website is shown here as it provided members with a step-by-step way to access the various components of the database.



the embedding and linking to research development interfaces developed in Google Sheets (later Google Drive) and Google Gadgets (later Google Apps Scripts). See Figure 24. Additional functionality was added with Smartsheet later in the project life for tracking reviews and edits needed of the data. Scripts written in Python were developed that interfaced with all of these cloud resources via published Application Program Interfaces (APIs). A downside to this approach was that the APIs were rapidly changing during this project period, and some application software had to be rewritten quickly to keep up with the changing cloud.

While Google Sheets provided spreadsheet-like interfaces to enter data into the cloud, other tools were

developed for more structured data, plus those too large to be managed by spreadsheets. Google Gadgets (Google Apps Scripts) were embedded into the internal Google Site to provide guided and structured dataset editing.

Each field data collection site was assigned a dedicated folder within the Google Drive, and was accessible to all project collaborators. These folders contained a hybrid mix of formatted data files and structured Google Sheets that were programmatically generated and later manipulated by scripts run by the research management personnel. An added benefit of the Google Drive was tracking of file versioning. When resources changed, the data team could track by whom it was done and what data changed. A script was developed that emailed research management personnel each day with a list of what resources in the cloud changed in the past 24 hours. The email would contain the time of the change, the resource changed and who made the change, allowing follow-up and review.

Even with these extensive cloud resources, traditional relational database software (PostgreSQL) was developed to support the team. Through the use of web service interfaces, the data stored in cloud project resources were synced with scripts to allow data providers and data users to manipulate data through customized interfaces. In general, team members did not directly interact with this local database; it was used to support data quality control, collation for synthesis work, and status reporting only by the research management personnel.

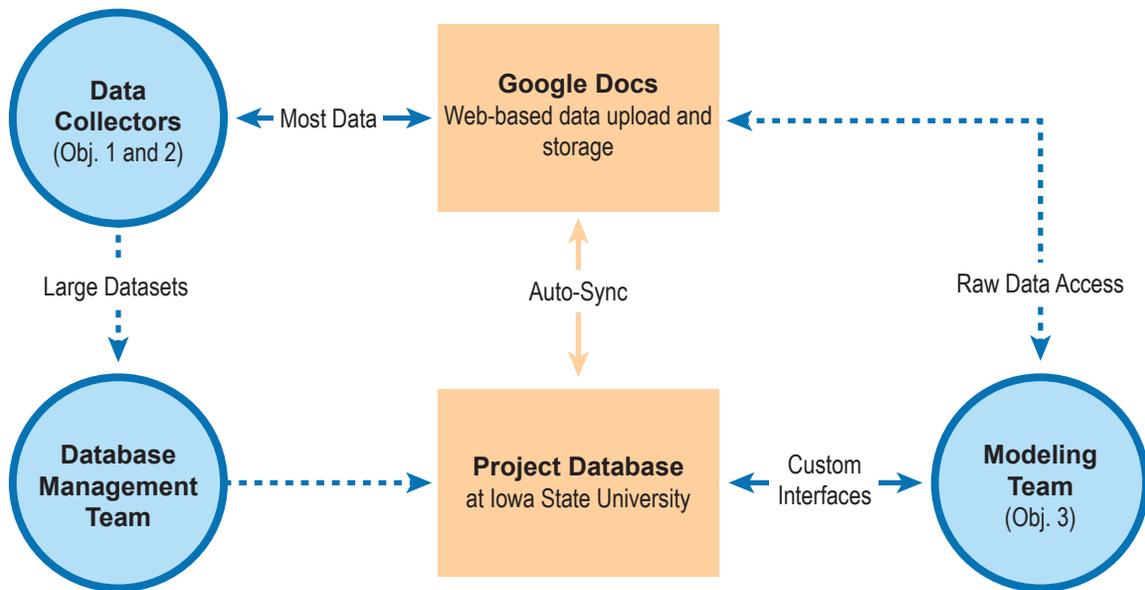


FIGURE 24 | Simplistic representation of data and metadata workflow including input and personnel involved.

See Figure 3 for an expanded workflow representing development and interactions between members and the system components.

Team members were expected to relate with the database through a set workflow:

- 1
 - a) Team members enter (or copy) most data into online Google Apps or spreadsheet.
 - b) For other datasets such as sensor data that are too large, it is sent or uploaded to the Google Docs (Drive) for manual processing by the data manager.

- 2

Data are processed, quality controlled, and reviewed by data management personnel from the database. Data are synchronized between the relational database and Google Apps.

- 3

Team members who wish to use the data may request it via downloadable webpage forms that materialize data from the database.

Having a transparent and live entry system for data provided for an immediate feedback and availability loop for data usage. Once data were entered into the cloud, team members could immediately start using the data and this usage often resulted in questions to the data team and subsequent feedback to field sites to help in the data curation process.

3.3 REPRESENTING TEAM RESEARCH

The Sustainable Corn CAP had a primary focus of collecting field data and then doing regional synthesis and modeling of that data. These efforts were to occur throughout the life of the project, which meant upload and use of data taking place after the first experimental year. The research management personnel were intimately involved in the entire process. This involvement was direct through on-site visits at the experimental sites (Figure 25) and one-on-one communication, but it also was indirect by gleaned information from previous publications and progress reports submitted by the PIs. For instance,

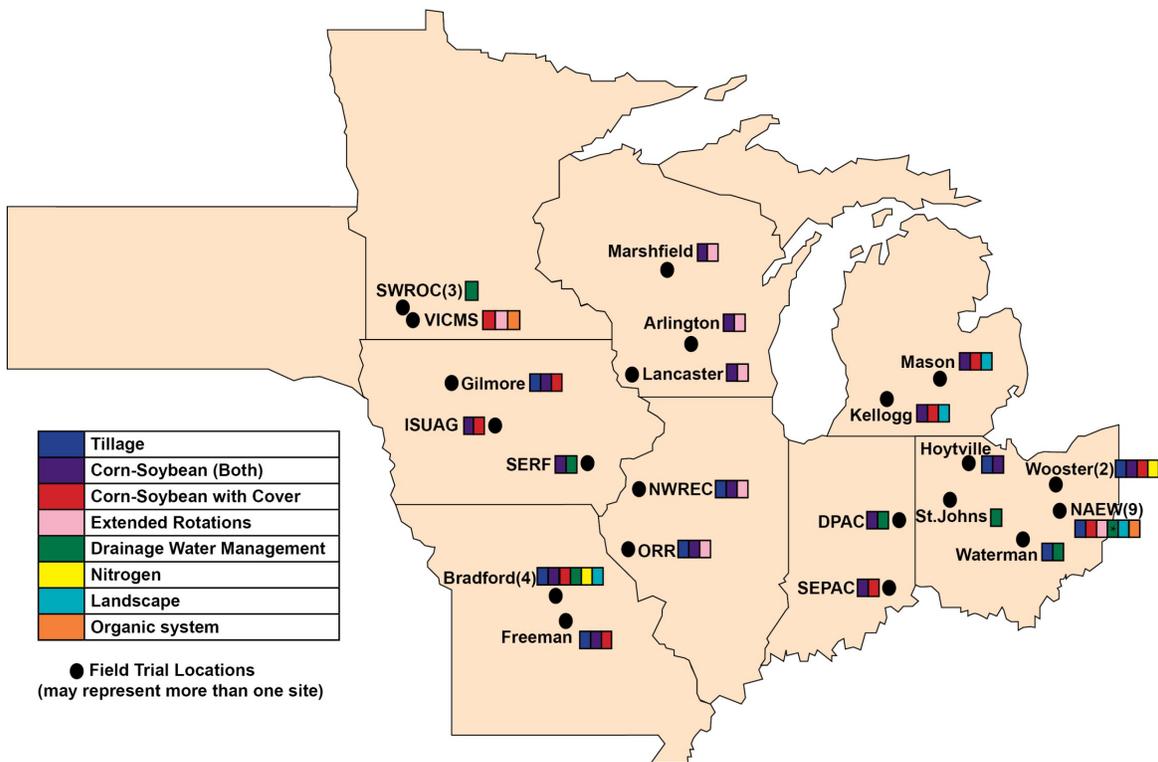


FIGURE 25 | Treatment categories across experimental research sites within the Sustainable Corn CAP project.



the quarterly progress reports submitted by PIs (Section 2.6.1) often noted dates of sampling and collection; this then was extracted and saved within the relational database.

The direct approach of visiting field sites was found to be very effective at obtaining needed site metadata (data that describes the site) and also building relationships with on-site personnel. Putting a human face to a series of electronic communications built friendly understanding between both groups and enforced the understanding that everybody was on the same team. These interactions helped to strengthen team cohesiveness, and show research management personnel were making every effort to lessen the burden on team members. The site visits also were useful to collect more basic metadata, like camera pictures, and pinpointing exact field boundaries of the experimental plots.

The site visits were very important in understanding the experimental design, landscape details, and small variances made with the standardized protocols (Kladivko et al., 2014). As with any scientific field, variation exists in sampling methodologies across principal investigators and institutions; therefore, an explicit requirement of the RFA from USDA was for the team to standardize sampling protocols. Some minor variations existed in following these protocols due to long standing local practices, equipment available, or lack of training in a particular measurement. Many of these variations were corrected or adjusted, once realized, to align as closely as possible in the team.

The data schema were designed by the research management personnel from the standardized protocols and methods developed by the team members. Data



types were further distinguished as “required” or “optional” within the protocols, as the team worked towards uniformity and transparency for the modeling efforts of what could be expected. Codifying these protocols into database schema was presented to the team in a set of Google Documents that identified each treatment and data variable as YES or NO for each experimental site. These sheets then could be proofed by team members. A Data Dictionary (described further in Section 3.6, Figure 33) also was developed in Smartsheet that described each variable, expected range, units, methodology, and description, which was especially valuable for secondary users of the data.

3.4 DATA ENTRY

The mechanisms that field site personnel use to collect and record data are diverse, and range from transcribing paper notes to advanced remotely sensed datasets from platforms like autonomous drones. The project resources, capabilities, and timing did not allow for software to be created facilitating this primary data collection. The lowest common denominator in most of these data collection cases was a spreadsheet. So it was a natural fit to utilize the Google Sheets tool, a spreadsheet interface storing data in the cloud, to support the reporting of data to the central database.

When the Sustainable Corn CAP team started data collection in the spring of 2011, the Google Sheets tool was unknown to most project collaborators. An initial bit of training was done to help team members with its usage. Some were initially concerned that uploading data into the cloud would mean outsiders could access it, so research management personnel explained how data were restricted via an access control list for only team members. In addition, publication guidelines (Appendix J) were in place so data originators would retain credit and editorial say over any subsequent publications.

The data entry sheets and tools were developed utilizing the knowledge gathered from the processes mentioned in the previous sections. These sheets were sometimes based off of pre-existing templates that had been used in previous projects by field sites. Team members entered data from their desktop based spreadsheets by copying and pasting into the cloud-based entry sheets and forms. This process resulted in some mixed results, due to software bugs and quirks with this workflow.

An important addition to the technical aspects related to entering data were the timelines employed. The Sustainable Corn CAP team found the greatest length of time between collection and online entry was in the

first year. Each subsequent year was generally quicker. This difference is important to note as it took more than a year upfront to get data entered by some site personnel. This was due primarily to the new workflow of the team related to the workflow typically done by the PI. It took significant efforts on everyone’s part to shift this and to upload data more quickly. Data deadlines were set each year and aligned with non-busy times of the year for team members. These deadlines helped establish a targeted focus and expectations.



3.4.1 Establishing Plot Identifiers

The research experiments overseen by research PIs were previously established in many cases and had existing plot identifiers. The research management personnel decided to align with these plot identifiers (ID) as the unique IDs, in particular to aid team members when uploading/copying data to the Google Sheets. It was expected team members had their data organized in numerical order by plot IDs, so having the online entry sheets in this same way would be beneficial.

The treatments and replications at each site were known by the research management personnel allowing Plot Identifier sheets to be constructed with a blank column highlighted in yellow that team members filled in (Figure 26). This step was only completed in the first year because the following years could be deduced by the research management personnel, based on the known treatments carried out. Entry spreadsheets were then automatically generated with these identifiers, helping the team members and also ensuring consistency across all data sets for that unique site ID.

SERF Helmers Plot Identifiers ☆

File Edit View Insert Format Data Tools Add-ons Help All changes saved in Drive

fx UniquelD

	A	B	D	E	H
1	UniquelD	Rep	Rotation	Drainage	PLOT ID
2	serf	1	[1] continuous corn	[4] Shallow drainage	1C
3	serf	1	[5] corn-SOYBEAN	[4] Shallow drainage	1N
4	serf	1	[4] CORN-soybean	[4] Shallow drainage	1S
5	serf	1	[1] continuous corn	[2] Conventional drainage ("free")	2C
6	serf	1	[5] corn-SOYBEAN	[2] Conventional drainage ("free")	2N
7	serf	1	[4] CORN-soybean	[2] Conventional drainage ("free")	2S
8	serf	1	[1] continuous corn	[3] Controlled drainage ("managed")	3C
9	serf	1	[4] CORN-soybean	[3] Controlled drainage ("managed")	3N
10	serf	1	[5] corn-SOYBEAN	[3] Controlled drainage ("managed")	3S
11	serf	1	[1] continuous corn	[1] No drainage	7C
12	serf	2	[5] corn-SOYBEAN	[3] Controlled drainage ("managed")	4N
13	serf	2	[4] CORN-soybean	[3] Controlled drainage ("managed")	4S
14	serf	2	[1] continuous corn	[3] Controlled drainage ("managed")	4C
15	serf	2	[4] CORN-soybean	[2] Conventional drainage ("free")	5N
16	serf	2	[5] corn-SOYBEAN	[2] Conventional drainage ("free")	5S
17	serf	2	[1] continuous corn	[2] Conventional drainage ("free")	5C
18	serf	2	[4] CORN-soybean	[4] Shallow drainage	6N
19	serf	2	[5] corn-SOYBEAN	[4] Shallow drainage	6S
20	serf	2	[1] continuous corn	[4] Shallow drainage	6C
21	serf	1	[5] corn-SOYBEAN	[1] No drainage	7N
22	serf	1	[4] CORN-soybean	[1] No drainage	7S
23	serf	2	[1] continuous corn	[1] No drainage	8C
24	serf	2	[4] CORN-soybean	[1] No drainage	8N
25	serf	2	[5] corn-SOYBEAN	[1] No drainage	8S

FIGURE 26 | Plot identifier sheet for the “SERF” research site led by PI Helmers at Iowa State University. Columns A to E were populated by research management personnel and the yellow column completed by Helmers staff.



3.4.2 Field Management Metadata

Data describing the year-to-year management details for each site were uploaded through a custom interface. Few standards exist specifically for management data and the importance of collecting certain data vary based on a disciplinary scientist's interest. Standardizing across all team members helped ensure the important metadata for modeling would exist. This interface was constructed because of the variation possible in this type of free-form data, to prompt members with a menu of options that then populated with drop-down lists and open text boxes to result in a more uniform set of data pertaining to land management, treatment application, and practices crucial for contextualization and interpretation of the measured data sets. Figure 27 shows the general interface before any research site or operation is selected by the user and Figure 28 is an example once the operation is selected.

Following the entry of data, this interface populates data into a web-enabled spreadsheet that can then be connected to the research data originating from the experimental site through the unique ID. This management data can be reviewed and edited by team members in real-time via the custom interface (Figure 29).

3.4.3 Experimental Data

Research data collected at the various experimental sites was entered primarily through Google Sheets (Figure 30). Although as mentioned previously, some files were too large and simply dropped into the folder housed on Google Drive for that site and manually ingested into the relational database locally storing all of the data.

Team members selected the overarching category for their data in the left sidebar (Figure 30). This was helpful to compartmentalize, because of many team members being responsible for only a subset of data; thereby simplifying the number of steps necessary for them. The blue text shown in Figure 30 are hyperlinks to the site-specific Google Sheets (Figure 31) for the team member to populate data into. The Google Sheet would have the plot identifiers included and the specific data types collected at that unique site as the column headings; team members would typically copy in their data from their desktop. Generally, a similar entry method was followed for all data types shown under ENTRY in the left sidebar of Figure 30.

Select Research Site:

Select Crop Year ¹. Enter information under all applicable tabs. Please click the "SUBMIT" button to save your edits for each tab you enter data for.

[1] Crop Year refers to all practices that occurred for the cash crop. For example, tillage in Nov 2014 should be entered under Crop Year 2015 because it is a field operation that was performed in preparation of the 2015 crop.

2011 Crop
2012 Crop
2013 Crop
2014 Crop
2015 Crop

Field Operations
Management
Pesticides
DWM
Site Map & GPS
Notes

Add to or edit previous Field Operations entries for :

Date	Operation	Cash Crop	Options	Last Edit By
No operations found for 2011				

Select Operation:

Operation Date:

Cash Crop Operation Applied To:

Comments:

FIGURE 27 | Management metadata entry interface before site or operation is selected.

2011 Crop	2012 Crop	2013 Crop	2014 Crop	2015 Crop
-----------	-----------	-----------	-----------	-----------

Field Operations	Management	Pesticides	DWM	Site Map & GPS	Notes
------------------	------------	------------	-----	----------------	-------

Add to or edit previous Field Operations entries for :

Date	Operation	Cash Crop	Options	Last Edit By
No operations found for 2011				

Clear Form for New Operation

Select Operation:

Fertilizer Date:

Cash Crop Operation Applied To:

Form of Fertilizer:

Which crop was this applied to:

Application Type:

What is the chemical formulation of the fertilizer applied? (example: urea, superphosphate, etc.)

Was a stabilizer (e.g. inhibitor or slow release) used?

If you apply a fertilizer blend (multiple sources), create a different entry for each product. Complete either Option A or B regarding this application.

Option A	Option B	Computed Formulation
<p>Use this side if you know the quantity applied per nutrient. Do not combine multiple applications though as we need to know the dates associated with each.</p> <p>Product Rate (lbs of product per acre): <input style="width: 50px;" type="text"/> Fertilizer Formulation (report in percent): <i>Example: 100 lbs/acre of 18-46-0 was applied. 100 should be entered as the product rate (above) with 18 in the %N box and 46 in the %P...</i></p>	<p>Fertilizer Formulation (report in pounds per acre):</p> <p><input style="width: 30px;" type="text"/> lbs N (Nitrogen) per acre</p> <p><input style="width: 30px;" type="text"/> lbs P₂O₅ per acre (Phosphate)</p> <p><input style="width: 30px;" type="text"/> lbs P (Phosphorus) per acre</p> <p><input style="width: 30px;" type="text"/> lbs K₂O (Potash) per acre</p> <p><input style="width: 30px;" type="text"/> lbs K (Potassium) per acre</p> <p><input style="width: 30px;" type="text"/> lbs S (Sulfur) per acre</p> <p><input style="width: 30px;" type="text"/> lbs Zn (Zinc) per acre</p>	<p>Computed Formulation</p> <p>This is the raw elemental data (units of lbs per acre) that are stored in the central project database. This listing should update in 'real-time' as you enter data within Option A or B.</p> <p>Nitrogen.....</p>

FIGURE 28 | Selection of synthetic fertilizer under the Operation dropdown results in the population of certain fields the team member is to complete.

Select Research Site: ▼

Select Crop Year ¹. Enter information under all applicable tabs. Please click the "SUBMIT" button to save your edits for each tab you enter data for.

[1] Crop Year refers to all practices that occurred for the cash crop. For example, tillage in Nov 2014 should be entered under Crop Year 2015 because it is a field operation that was performed in preparation of the 2015 crop.

2011 Crop	2012 Crop	2013 Crop	2014 Crop	2015 Crop	
Field Operations	Management	Pesticides	DWM	Site Map & GPS	Notes

Add to or edit previous Field Operations entries for :

Date	Operation	Cash Crop	Options	Last Edit By
Thu 16 Oct 2014	plant_rye-soy-res	corn	Edit Delete View	on Wed 23 Dec 2015
Thu 16 Oct 2014	plant_rye-corn-res	soybean	Edit Delete View	on Wed 23 Dec 2015
Mon 3 Nov 2014	tillage_chopstalks	soybean	Edit Delete View	unknown on Wed 14 Jan 2015
Mon 10 Nov 2014	tillage_chisel	corn	Edit Delete View	on Wed 23 Dec 2015
Mon 10 Nov 2014	tillage_chisel	soybean	Edit Delete View	on Wed 23 Dec 2015
Thu 16 Apr 2015	sample_soilnitrate	corn	Edit Delete View	based on QPR on Fri 15 Jan 2016
Thu 16 Apr 2015	sample_soilnitrate	soybean	Edit Delete View	based on QPR on Fri 15 Jan 2016
Fri 17 Apr 2015	termination_rye_corn	corn	Edit Delete View	on Wed 9 Mar 2016
Wed 29 Apr 2015	tillage_cultivate	corn	Edit Delete View	on Wed 23 Dec 2015
Wed 29 Apr 2015	tillage_cultivate	soybean	Edit Delete View	on Wed 23 Dec 2015
Thu 30 Apr 2015	plant_corn	corn	Edit Delete View	on Fri 22 Jul 2016
Tue 12 May 2015	sample_soilnitrate	corn	Edit Delete View	based on QPR on Fri 15 Jan 2016
Tue 12 May 2015	sample_soilnitrate	soybean	Edit Delete View	based on QPR on Fri 15 Jan 2016
Fri 15 May 2015	termination_rye_soy	soybean	Edit Delete View	on Tue 22 Dec 2015
Thu 28 May 2015	plant_soy	soybean	Edit Delete View	on Wed 23 Dec 2015
Mon 12 Oct 2015	harvest_soy	soybean	Edit Delete View	on Sun 27 Mar 2016
Tue 20 Oct 2015	harvest_corn	corn	Edit Delete View	on Sun 27 Mar 2016
Thu 22 Oct 2015	sample_soilnitrate	corn	Edit Delete View	based on QPR on Fri 15 Jan 2016
Thu 22 Oct 2015	sample_soilnitrate	soybean	Edit Delete View	based on QPR on Fri 15 Jan 2016
Fri 30 Oct 2015	sample_soilnitrate	corn	Edit Delete View	based on QPR on Fri 15 Jan 2016
Fri 30 Oct 2015	sample_soilnitrate	soybean	Edit Delete View	based on QPR on Fri 15 Jan 2016
Fri 26 Jun 2015	fertilizer_synthetic	corn	Edit Delete View	on Tue 22 Dec 2015

FIGURE 29 | Team members could review and edit the management metadata in real-time by viewing their site-specific data in the same interface.

Lead PI	Site Name	State	Soil Texture, pH, CEC, SOC, Total N	Bulk Density & Water Ret	Soil Nitrate
Helmers	GILMORE	IA	2015 Data	2015 Data	2015 Data
Helmers	SERF	IA	2015 Data	2015 Data	2015 Data
Helmers/Castellano	ISUAG.USB	IA	2014 Data	2014 Data	2015 Data
Sawyer	ISUAG	IA	2015 Data	2015 Data	2015 Data
Nafziger/Villamil	NWREC	IL	2015 Data	2015 Data	2011 Data
Nafziger/Villamil	ORR	IL	2015 Data	2015 Data	2012 Data
Kladivko	DPAC	IN	2015 Data	2015 Data	2015 Data
Kladivko	SEPAC	IN	2015 Data	2015 Data	2015 Data
Kravchenko	KELLOGG	MI	2015 Data	2015 Data	2015 Data
Kravchenko	MASON	MI	2015 Data	2015 Data	2015 Data
Strock	HICKS.B	MN	2015 Data	2015 Data	2015 Data
Strock	HICKS.G	MN	2015 Data	2015 Data	2015 Data
Strock	HICKS.P	MN	2015 Data	2015 Data	2015 Data

FIGURE 30 | Entry workflow for a team member entering soil data from a particular research site.

	H	K	L	M	N	O
1	PlotID	AGR1	AGR2	AGR4	AGR32	AGR33
2		[1] Corn final plant population	[2] Soybean final plant population	[4] Corn vegetative biomass at R6 (dry)	[32] Corn cob biomass at R6 (dry)	[33] Corn grain biomass at R6 (d
3		plants per hectare	plants per hectare	kg ha-1	kg ha-1	kg ha-1
4	1C	77987	n/a	did not collect	did not collect	9769.46
5	1N	n/a	277885	n/a	n/a	n/a
6	1S	79780	n/a	did not collect	did not collect	12864.91
7	2C	77091	n/a	did not collect	did not collect	11017.47
8	2N	n/a	314638	n/a	n/a	n/a
9	2S	79780	n/a	did not collect	did not collect	12610.18
10	3C	77987	n/a	did not collect	did not collect	did not collect
11	3N	82469	n/a	8638.65	1269.68	9691.23
12	3S	n/a	306570	n/a	n/a	n/a
13	4C	71712	n/a	did not collect	did not collect	11103.25
14	4N	n/a	300295	n/a	n/a	n/a

FIGURE 31 | Entry spreadsheet for agronomic data at the same site as illustrated in Figure 26.

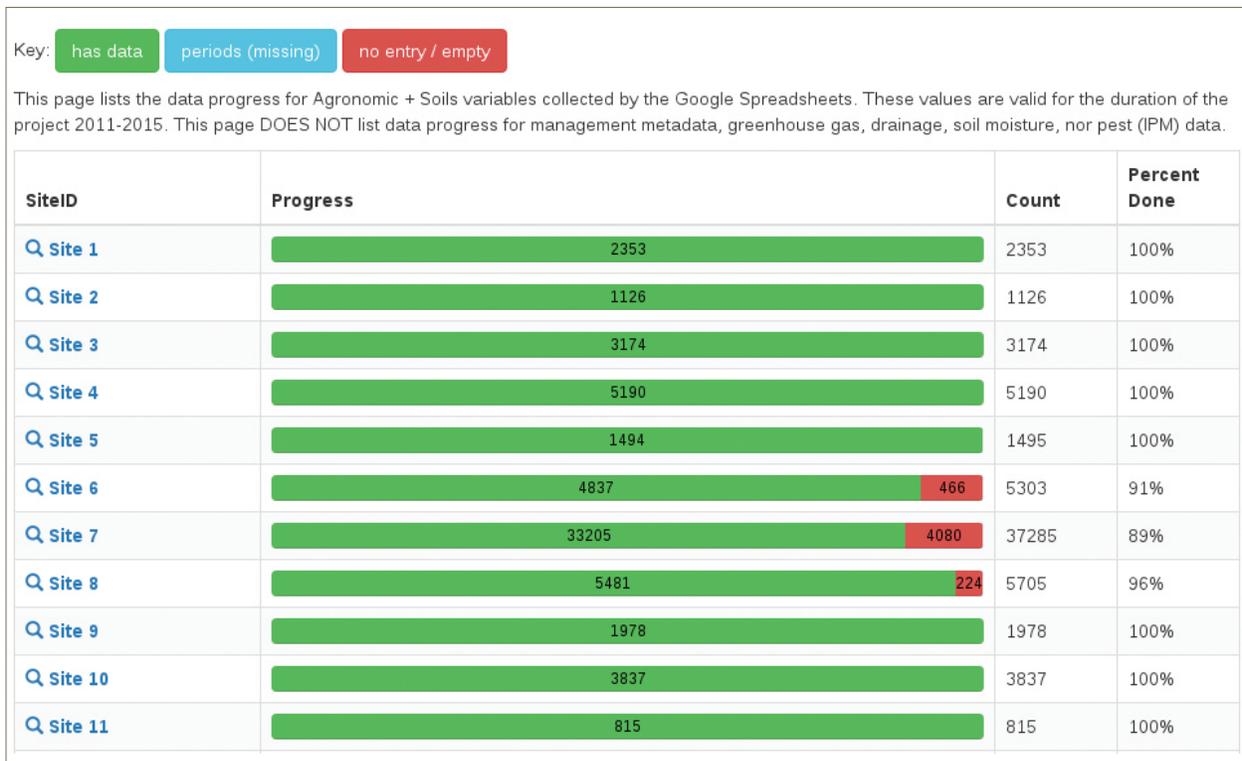


FIGURE 32 | Data dashboard for agronomic and soil data entered to-date.

Each site varied in the number of samples collected, which is reflected in the Count. Team members could select the magnifier icon to the left of the site name for a text file that identified which data were specifically missing and needed their attention.

3.4.4 Visualizing Data Completion

To aid in the transparency of data entered and available, colorized dashboards (Figure 32) were generated to show the overall data submission status. The “data dashboards” were delineated by research site and data type. They were available on-demand for team members to review and typically were shown during whole team meetings prior to and following data upload deadlines. Visually seeing the colors change from red to green was encouraging as a collective group to see progress made and also helped to reignite efforts to turn in the remaining red data. It also prompted conversations about delayed upload of data due to issues beyond the team member’s control such as delays in the laboratory analysis or environmental conditions that made sampling impossible. The upkeep of these dashboards was a logistical challenge, as not all were automated due to nuances of the data type.

3.5 QUALITY CONTROL

Producing high quality data obviously is an important aspect of any research project. The mechanisms

for quality control within a multi-institutional and multidisciplinary project are complex to establish and fully implement. Some practical and methodical approaches were taken to provide systematic review of the data within the Sustainable Corn CAP. While data quality ultimately was the responsibility of the PIs at each research site, the evaluation of the data and identification of areas that needed attention by the PI was largely done by research management personnel.

The systematic approach developed to address field site data quality was in the form of annual data reviews. Following the “data deadlines” as described in Section 3.5, the research management personnel would spend the next 1-2 months reviewing all the entered data for each site. Any missing or questionable data were itemized into bullet-style and actionable requests for the team members (Figure 33). These lists helped team members know exactly what was needed.

Once data were reviewed fully by research management personnel, a review would be held. This would typically be an hour-long web-based virtual meeting between

DONE	Growing Season	Overarching Data Category	Data Type	Edit/Review Needed	Additional comments by data team	Comments by site personnel	Hyperlink
✓	2011	Research Data	Agronomic	Please double check corn stalk nitrate sample that ranges from 122 to 1460 mg per kg across treatments.		Corn stalk nitrate values checked and confirmed to be correct. (A. Lagzdins)	https://docs.google.com
✓	2015	Research Data	Agronomic	Check that AGR2(soybean plant population), is correct because it ranges from 229121 to 356051 [Year 2012 to 2015.]		Soybean plant population values checked and confirmed to be correct. (A. Lagzdins)	https://docs.google.com
✓	2015	Research Data	Agronomic	Plot no. 14.1, AGR39(rye cover crop biomass in spring), collected seems to be off compare to the other two replication of the same treatment i. e. Plot # 17.1 & 19.3		Cover crop biomass values checked. Plots 14.1 and 4.2 of this treatment show similar biomass values, 642.8 and 597.1, respectively, Plots 17.1 and 19.3 also have similar values, 1012.4 and 1276.0, respectively. (A. Lagzdins)	https://docs.google.com
✓	2011	Research Data	Soil	Please enter data (or, if no data is available "did not collect") for the following columns: SOIL1(dry bulk density) (Just a few missing data points, enter "did not collect")		complete	https://docs.google.com
✓	2011	Research Data	Soil	Soil bulk density and water retention		15 bar coming soon	https://docs.google.com
✓	2011	Research Data	Soil	Look at bulk density and water retention-what is going on with the subsample labels used?	should we delete that column?		https://docs.google.com
✓	2013	Research Data	Soil	Please enter data for the Water retention at 15 bar. If no data is available enter "did not collect"	should we replace periods with "did not collect" at other tensions?	15 bar coming soon	https://docs.google.com
✓	2014	Research Data	Soil	Plot 22.1 - negative value (-0.01) is reported for infiltration rate in 2014.10.25. Check if		This is correct according to data collection. *There is some error associated with	https://docs.google.com

FIGURE 33 | Example of site edits needed across all data types and years for a particular site.

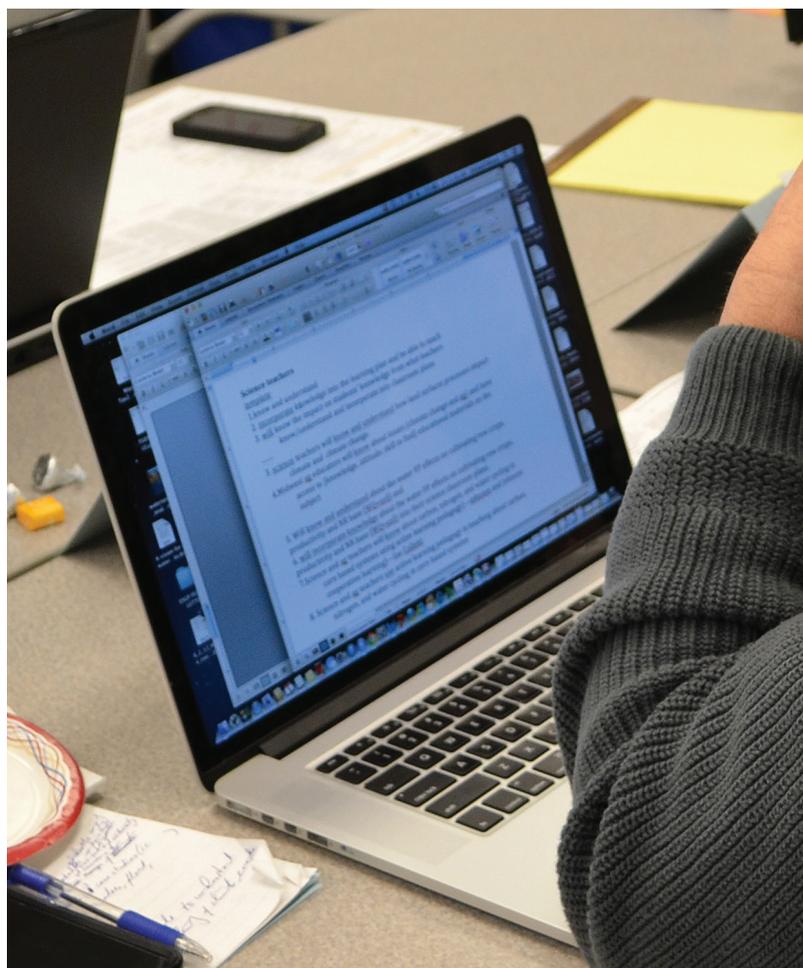
Each item was categorized based on the growing season, data category (research at plot level or management of the field), and the specific type of data (agronomic, soil, greenhouse gas, etc.). These were followed by space for research management personnel to explain what was needed and for team members to respond.

the research site personnel, including the PI, and the research data personnel. The meetings were recorded but only available to research management personnel for later reference as needed. Primary content discussed were overarching topics pertaining to the research for that year, challenges faced, and main data types that still needed some attention. Detailed edits needed were not discussed, as that was best addressed afterwards with team members going through the itemized lists and cross-checking their notes with it.

3.6 DATA EXPORT

The data entry transparency mentioned in previous sections allowed for team members to make ad-hoc data requests and manual downloads of the team's data for their usage. Download interfaces were constructed throughout the project life for certain variables (Figure 35) along with a comprehensive download toward the end of the project to provide a guided experience to receive project data on-demand (Figure 34). This download interface allowed the requesting user to limit the amount of data delivered by restricting to specified data variables, field sites, treatments and years. This interface also allowed for custom specification on how missing data should be denoted and also basic things like downloaded file format (Excel, csv, tab delimited).

When the team member selects to have it exported as an Excel spreadsheet, the download interface provided the file with auxiliary sheets of information to help make



Data [Refereed Journals](#) [Research Sites](#) [Theses and Dissertations](#)

CSCAP Data Download

Sites Treatments Agronomic Soil Year Final Options

Iowa

- GILMORE - Helmers
- ISU AEA Research Farms USB
- ISUAG - Sawyer
- SERF - Helmers

Illinois

- NWREC - Nafziger & Villamil
- ORR - Nafziger & Villamil

Indiana

- DPAC - Kladviko
- SEPAC - Kladviko

Michigan

- KELLOGG - Kravchenko
- MASON - Kravchenko

Minnesota

- HICKS.B - Strock
- HICKS.G - Strock
- HICKS.P - Strock

Missouri

- BRADFORD.A - Scharf
- BRADFORD.B1 - Scharf
- BRADFORD.B2 - Scharf
- BRADFORD.C - Scharf
- FREEMAN - Nkongolo

Ohio

- HOYTVILLE.LTR - Dick
- NAEW.WS109 - Fausey
- NAEW.WS111 - Fausey
- NAEW.WS113 - Fausey
- NAEW.WS118 - Fausey
- ST.JOHN.S - Fausey
- WATERMAN - Lal
- WOOSTER.CO.V - Dick
- WOOSTER.LTR - Dick

Wisconsin

- ARL - Lauer
- LAN - Lauer
- MAR - Lauer

FIGURE 34 | Data export tool allowing filtering and narrowing of data exported.

Select Research Site(s):

Select From List

- ARL [Arlington, WI] -- WI4961 MADISON DANE RGNL AP
- BRADFORD.A [Columbia, MO] -- MO1791 COLUMBIA RGNL AP
- BRADFORD.B1 [Columbia, MO] -- MO1791 COLUMBIA RGNL AP
- BRADFORD.B2 [Columbia, MO] -- MO1791 COLUMBIA RGNL AP

Select Time Period:

Year Month Day

Start: 2011 January 1

End: 2015 December 31

Select Data Variables:

Date and Julian Day are included automatically

- Model: Century
- Model: SALUS (using MERRA Solar Estimates)
- Computed: Growing Degree Days (base=50,max=86) [F]
- Computed: Growing Degree Days (base=40,max=86) [F]
- Variable: High Air Temperature [F]

Data Delimitation:

How shall the output values be seperated?

Comma

FIGURE 35 | Download interface for weather data from each research site.

sense of the information provided. These sheets would include the Data Dictionary lookup table of variable codes (Figure 37) with their associated units and meanings. It also would include a summary of the management metadata that described pertinent field operations.

Custom web-based visualizations also were developed to help support exploratory and screening analysis of the data (Figure 36). These visualizations were particularly helpful for the “big data” style datasets that often contained millions of data points. For the Sustainable Corn CAP team, this most often were sensors measuring

soil moisture as well as tile flow from drainage systems. The visualization tools also were designed to allow the export of data for future analysis at an aggregated scale. Additionally, an editing tool was added to the visualization to allow for team members to quality control the data when it obviously was due to a bad sensor or some other issue that had escaped previous inspection. This visualization tool was embraced by team members, but not widely used due to other intensive duties consuming team members’ day-to-day responsibilities.

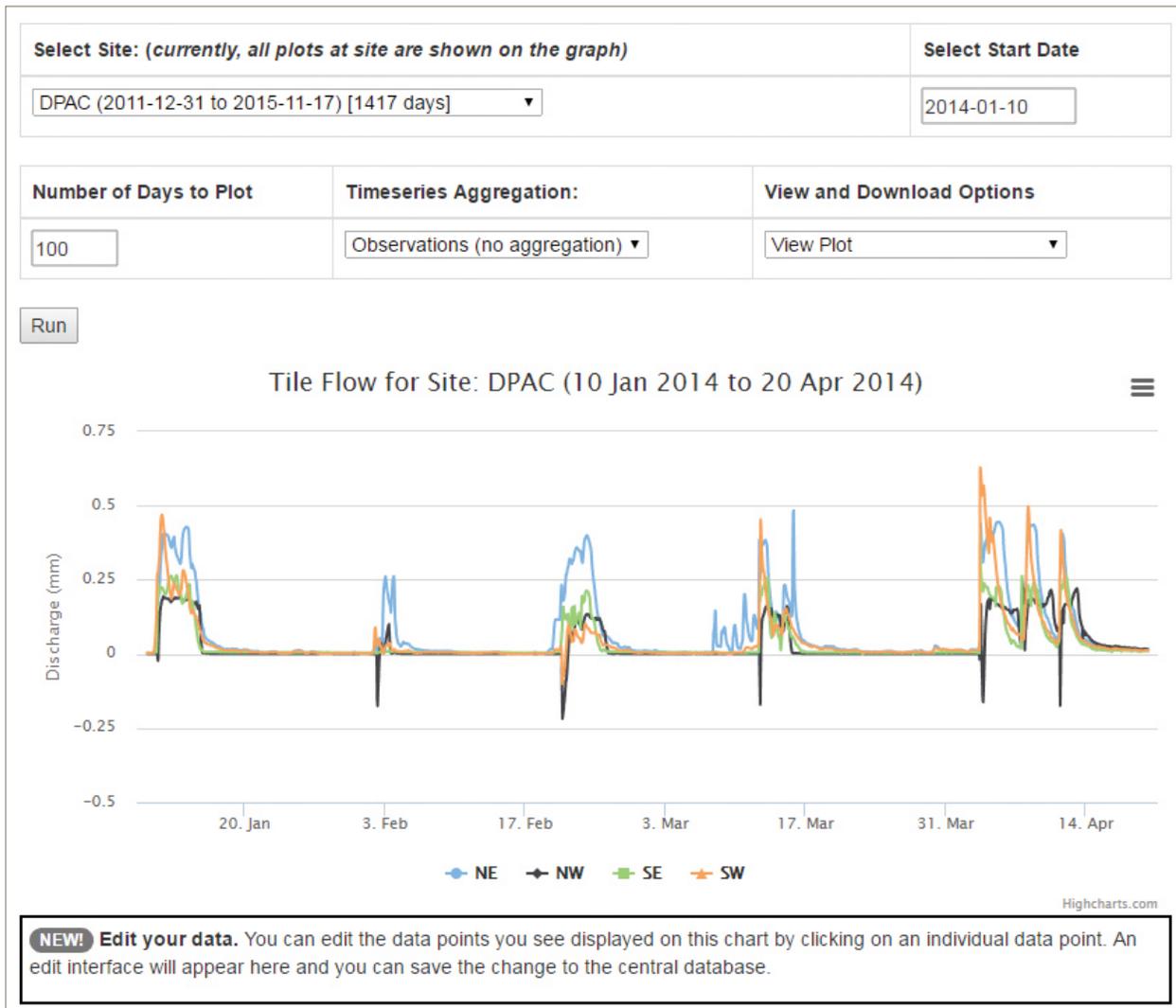


FIGURE 36 | Visualization tools for large data sets.

Team members could visualize and edit some data through tools such as this for drainage tile flow data. Sensor-based data collected on a reoccurring basis across a span of time become highly cumbersome for team members to work without plotting tools like this.

	Data Type	Scope (CSCAP Tab)	Code (Column Heading)	Short Description	Value Range	Units	Methodology (of CSCAP team)	CSCAP Team Required Status
24	Management	[1] Field Operations	plantrate	Numeric value of the planting rate per hectare (see plantrateunits for the units of this value)	1 to 500000	per ha		REQUIRED
25	Management	[1] Field Operations	plantrateunits	The planting rate units per hectare. "Seeds" are recorded most often for row crops while "lb" or "kg" is recorded for small grain crops.	seeds, kg	seeds or weight (lb or kg) per hectare		REQUIRED
26	Management	[1] Field Operations	plantryemethod	The method by which rye was planted	broadcast, drilled, other (specify in comments)	N/A		REQUIRED
27	Management	[1] Field Operations	productrate	Rate of synthetic fertilizer product applied	1 to 1000	kg per hectare		REQUIRED
28	Management	[1] Field Operations	stabilizer	Whether a stabilizer was applied with the synthetic fertilizer to delay or inhibit nitrification	Yes/No	N/A		OPTIONAL
29	Management	[1] Field Operations	stabilizername	Product name of the stabilizer used	N-Serve, Instinct, Agrotain, Agrotain Plus, ESN, Super U, Other	N/A		OPTIONAL
30	Management	[1] Field Operations	stabilizerused	Categorical type of stabilizer used	urease inhibitor, nitrification inhibitor, slow release, other	N/A		OPTIONAL
31	Management	[1] Field Operations	targetph	Target pH of the soil; this pH value is the determining factor in the rate applied	likely 6 or 7	unitless		OPTIONAL
32	Management	[1] Field Operations	terminatemethod	Methodology of terminating the previous rye or alfalfa crop prior to planting	herbicide, tillage, herbicide and tillage, crimping (rye only), other	N/A		OPTIONAL
33	Management	[2] Management	irrigation	Regarding whether irrigation was used at the site	Yes/No	N/A		REQUIRED
34	Management	[2] Management	irrigationamount	Total amount of irrigation water applied for the year	0 to 100	cm		OPTIONAL
35	Management	[2] Management	irrigationmethod	The method used to apply irrigation water	overhead, sprinkler, subsurface drip, flood (furrow/gravity)	N/A		OPTIONAL
36	Management	[2] Management	limeyear	Was lime applied to the site prior to 2011? If yes, year entered here.	No or year	yyyy		OPTIONAL
37	Management	[2] Management	notill	Status of whether the research site was managed using no-till	Yes/No	N/A		REQUIRED

FIGURE 37 | Example of data dictionary with management metadata of the Sustainable Corn CAP described with the variable code, short description, and expected values or text entered.

Each item was categorized based on the data type and the scope of data. These were followed by code names used for column headings in corresponding spreadsheets or database tables.

3.7 REUSE AND REDISTRIBUTION

Research data were not for public use during the life of the project so team members were able to properly collect, review, and publish their own findings based on the data. Research data were collected in the last year of funding (2015) and in total, the database was not finished until 2016, due to the significant amount of time to process and review these data.

The best practices when using and publishing from research data during the project by team members were agreed upon at the onset of the team, and outlined in the team's publication guidelines (Appendix J). Use of primary data had to be authorized by the data owners prior to publication, with a reasonable amount of time given to primary owners of data to publish in their respective journals. It was the role of the data owner to assure the data were of highest quality with no known errors or changes expected to occur, once it was

uploaded to the team database. Team members involved in regional syntheses and modeling efforts could access and initially work with the data contained in the database, but had to obtain PI agreement prior to publication.

The Sustainable Corn CAP team received federal funding and it was expected (but not required whereas later funded teams are) that research data be made publicly available at the completion of the project. It is generally agreed two years is an appropriate amount of time to complete publications post-funding. The team has a profile on the USDA National Ag Data Library (<https://www.nal.usda.gov/>) that provides a link to the database export tool housed at Iowa State University. The data will be of interest to the general public as well as agribusiness, farmers, scientists, and policymakers. Data dictionaries that document the standards, units, and explanations for the metadata, treatments, and measured data are included to help external users properly interpret the data and reuse it for additional hypotheses questions not examined by the Sustainable Corn CAP team.



SECTION 4. CONCLUSION

The lessons learned and methods employed by the Sustainable Corn CAP in project and research management have the potential to serve other large, multidisciplinary teams. This report highlights some of the conceptual and theoretical approaches for accomplishing large-team success and presents observations and recommendations associated with day-to-day management and operations of a large transdisciplinary team.

Each team member comes to the project with established workflows and ways of approaching their work that are unique and different. Management approaches that seek to meet each person where he/she is at and deliver solutions enable them to thrive and harmonize their efforts with others. This ultimately benefits the entire team. Project and research management personnel efforts to align with and communicate using multiple channels provide support to team members as they focus on succeeding within their specific scientific and educational goals.

Aligning the systems used in managing data and information across project and research management provides strong benefits for the team members. Although a greater amount of time upfront is required to setup the systems and workflow, well-thought out and managed systems allow information and data to flow across personnel more effortlessly and provide maximum efficiency, effectiveness and transparency in the long run.

The Sustainable Corn CAP team utilized a hybrid model with cloud technologies and a traditional relational database. There are technical nuances when working with third-party cloud software that are rapidly being developed, modified, and improved. The benefits of

leveraging these new technologies have far outweighed minor frustrations, and allowed the Sustainable Corn CAP team to have a fairly robust and functional system running very quickly.

The team's management approach and database have provided structural and collaborative advantages for team members and working groups. The team's overall approach has resulted in tangible benefits and outcomes, including the following:

Expedited discovery of relevant project data through integrated search capacity provided by the cloud platform.

Minimal loss of data and supporting information due to centralized storage and metadata assigned to data.

Improved transparency and reproducibility of findings as data are centrally located for all team members.

Increased speed and mobilization of the team and subgroups working to address the large-scope questions initially set out by the team.

Real time capacity to retrieve project management data for routine funder reports, unexpected funder requests, and developing educational and outreach publications for project stakeholders and other audiences.

SECTION 5. SUPPORTING PUBLICATIONS

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Appendix A

Abbreviations and acronyms used in this report

API	Application Programming Interface
ID	Identifier
LGU	Land Grant University
PIs	Principal Investigators
POW	Plan of Work
QPR	Quarterly Progress Report
REeport	The Research, Extension, and Education Project Online Reporting Tool
RFA	Request for Application
STEM	Science, Technology, Engineering, and Mathematics
USDA NIFA	United States Department of Agriculture, National Institute of Food and Agriculture

Appendix B

Sustainable Corn Project Management Data Dictionary

Scope (Management Tab)	Code (column heading)	Description	Value Range
Personnel	Status	Status of the team member	4 categories: Current, Past, Affiliate, Removed
Personnel	Supervisor or Lab Group	Name of the PI(s) who the individual reports to. These are typically single PIs but co-PIs occur some cases	PI last names (removed here to save space)
Personnel	Leadership Team Member	Is the person a member of the CSCAP leadership team?	Yes or No
Personnel	General Position	General position title	12 categories: Admin, Admin/PI, Affiliate, Extension Educator, Grad Student, Grad Student (USB), PI, PI (USB), PI/Adv Board, Post Doc, Staff, Staff/Grad Student
Personnel	OBJ 1 & 2	Is the person affiliated with Objective 1&2? (Some individuals have multiple affiliations)	Yes or No
Personnel	OBJ 1 & 2_IPM	Is the person affiliated with Objective 1&2 IPM? (Some individuals have multiple affiliations)	Yes or No
Personnel	OBJ 3	Is the person affiliated with Objective 3? (Some individuals have multiple affiliations)	Yes or No
Personnel	OBJ 4	Is the person affiliated with Objective 4? (Some individuals have multiple affiliations)	Yes or No
Personnel	OBJ 5	Is the person affiliated with Objective 5? (Some individuals have multiple affiliations)	Yes or No
Personnel	OBJ 6	Is the person affiliated with Objective 6? (Some individuals have multiple affiliations)	Yes or No
Personnel	First Name	Team member's first name	Open text
Personnel	Last Name	Team member's last name	Open text
Personnel	Institution	Name of employing institution; slight variation from those included as partner institutions	Iowa State University, Lincoln University, Lincoln University - University of Missouri, Michigan State University, Minnesota, National Council for Science and the Environment, USDA-ARS - Columbus, Ohio Ag Res & Dev Center (OARDC), Purdue University, South Dakota State University, The Ohio State University, USDA-NIFA, University of Illinois, University of Minnesota, University of Missouri, University of Wisconsin
Personnel	Position Title	Job title	Open text
Personnel	Dept.	Department within the institution	Open text
Personnel	Street Address	Mailing street address	Open text
Personnel	City	City name	Open text
Personnel	State	Abbreviated state name	Open text
Personnel	Zip code	Zip code	Open text
Personnel	Email	Institutional email address	Open text
Personnel	Secondary email	Other email address	Open text
Personnel	Primary phone	Phone number (preferred landline or cell)	xxx.xxx.xxxx
Personnel	Secondary phone	Phone number (secondary landline or cell)	xxx.xxx.xxxx
Personnel	Cell phone	Phone number (cell)	xxx.xxx.xxxx
Personnel	Employment Start Date	First day of employment period	yyyy.mm.dd
Personnel	Employment End Date	Last day of employment period	yyyy.mm.dd
Personnel	No of months (month's start to month's end)	Total number of months employed with CSCAP	For example: 20
Personnel	Explain new position	New position title and institution details (past personnel only)	For example: SDSU faculty position as an Assistant Professor
Personnel	Comments	Information not reported elsewhere	Open text populated by Operations team

Scope (Management Tab)	Code (column heading)	Description	Value Range
STEM	Supervisor or Lab Group	Principal Investigator the individual is supervised by.	PI last names (removed here to save space)
STEM	First Name	Team member's first name	Open text
STEM	Last Name	Team member's last name	Open text
STEM	Institution	Name of the partner institutions associated with the project	11 institutions: Iowa State University, Lincoln University, Michigan State University, Purdue University, South Dakota State University, The Ohio State University, University of Illinois, University of Minnesota, University of Missouri, University of Wisconsin, USDA-ARS – Columbus. Few exceptions exist of other institutions through partnerships.
STEM	Position Title	Job title	7 categories: Undergraduate Research Assistant, Undergraduate Internship, MS Graduate Student, PhD Graduate Student, Post Doctoral Researcher Visiting Scholar, Other
STEM	Employment Start Date	First day of employment period	yyyy.mm.dd
STEM	Expected Ending Date of Employment	Expected last day of employment period	yyyy.mm.dd (Management corrects as necessary when it is different from that originally submitted)
STEM	No of months (month's start to month's end)	Total number of months employed with CSCAP	For example: 20
STEM	Gender	Sex of individual	Male or Female
STEM	Ethnicity	Whether individual is of Hispanic or Latino ethnicity	Yes or No
STEM	Race	Description of individual's race	5 categories: American Indian or Alaska Native (including all Original Peoples of the Americas), Asian (including Indian subcontinent and Philippines), Black or African American (including Africa and Caribbean), Native Hawaiian or Other Pacific Islander (Original Peoples), White (including Middle Eastern)
STEM	Minority Status	Whether individual is considered a minority in the US	Yes or No (Management populates this based on answers to other questions)
STEM	International Student	Whether individual is from a country other than the United States	Yes or No
STEM	Discipline	Specific discipline the student is studying, if declared	Open text
STEM	Comments	Explanatory information	Open text added by individual and/or populated by Management
Outputs	Obj	Lead Objective for output	1&2, 1&2 - IPM, 3, 4, 5, 6, Project Note: Many efforts are multi-Objective but for categorization purposes, the Objective of the first author is selected here.
Outputs	Institution	CSCAP partner institutions which is lead for the output	11 institutions: Iowa State University, Lincoln University, Michigan State University, Purdue University, South Dakota State University, The Ohio State University, University of Illinois, University of Minnesota, University of Missouri, University of Wisconsin, USDA-ARS – Columbus
Outputs	Type of Output/ Product	Type of material the entry describes	23 categories: Refereed Journal, White Paper/Fact Sheet, MS Thesis, PhD Dissertation, Book, Book Chapter, Presentation (Conference), Presentation (Extension/Outreach), Extension Publication, Education Camp/Workshop, Education Curriculum/Module, Education Webinar, Teaching (Formal Education), Website, Proposal, Survey, Promotional/Project Report, Media_Blog, Media_Popular Press, Media_Univ Press, Media_Radio/TV, Media_Video, Media_News Release
Outputs	Status	Status of the output	9 categories: Not Started, In Preparation, Submitted for Review, Accepted/In Press, Complete, Media in Production, Need to Finalize/Post, On-Going, Withdrew
Outputs	Open Access	Availability of refereed journal to non-paying members of journal.	Yes, No, N/A
Outputs	Author(s)	Full listing of author(s) involved with the given output in citation structure.	Open text For example: Anex, R., M. Castellano, M. Helmers, P. Scharf, and J. Stroock.
Outputs	Year	Year of output	2011 to 2016 For example: 2014.

Scope (Management Tab)	Code (column heading)	Description	Value Range
Outputs	Funding Year	Funding year of output	Y1, Y2, Y3, Y4, Y5 Y1= March 1, 2011 to February 28, 2012 Y2= March 1, 2012 to February 29, 2013 Y3= March 1, 2013 to February 28, 2014 Y4= March 1, 2014 to February 28, 2015 Y5= March 1, 2015 to February 29, 2016
Outputs	USDA Acknowledgement	Identifies whether the output acknowledges USDA funding	Yes or No
Outputs	Title	Full title of given output	Open text For example 1: Model-based environmental analysis of N-sensor-based variable rate corn fertilization. For example 2: Effects of a cereal rye (<i>Secale Cereale</i> L.) cover crop on soil properties and crop productivity in southeast Indiana.
Outputs	Journal or Source	Location (source) of where this output is found, in citation structure	Open text For example 1: Journal of Soil and Water Conservation. For example 2: CSCAP Annual Conference, Poster Symposium. Wooster, OH. Aug. 7-9, 2012
Outputs	Journal Source Abbreviated	Refereed journal name abbreviation obtained from: http://cassi.cas.org/no-result.jsp	For example: Agron. J. (Abbreviation for Agronomy Journal)
Outputs	Vol.	Volume number; only entered for refereed journal, extension publication, book, and conference proceedings	For example: 3:
Outputs	Pg No.	Page number(s), as applicable	For example: 23-31.
Outputs	Online Source	Web link or doi (for referred journals) for the given output	For example 1: http://sustainablecorn.org/Publications/Posters.html For example 2: http://dx.doi.org/10.1007/s11270-013-1677-z
Outputs	Journal Impact Factor	Impact factor for refereed journal. This is trademarked, source for Journal Impact Factors (JIF) can be accessed through Web of Science.	For example: 1.722
Outputs	Meeting Attendance	Size of audience for a given presentation (applicable for output types: Presentation (Conference), Presentation (Extension/Outreach), Education Camp/Workshop and Teaching (Formal Education).	For example: 120
Outputs	Other_Proposal Funded	Status of whether grant proposal was funded	Yes, No, N/A
Outputs	Other_# Total Authors	Number of authors who contributed to output	For example: 3
Outputs	Other_# CSCAP PI's Authors	Number of PI's who contributed to output	For example: 2
Outputs	Other_# CSCAP Grad Authors	Number of graduate students who contributed to output	For example: 1
Outputs	Other_# CSCAP Postdocs Authors	Number of postdoctoral researchers who contributed to output	For example: 2
Outputs	Other_# CSCAP Staff Authors	Number of staff members who contributed to output	For example: 1
Outputs	Abstract	Technical summary of the publication. Only for refereed journals; no other outputs have an abstract.	Open text. Text ranges from 200 to 300 words typically in length.
Quarterly Progress Report	Reporting Period	QPR Year and Quarter (YxQx)	20 quarters: Y1Q1, Y1Q2, Y1Q3, Y1Q4, Y2Q1, Y2Q2, Y2Q3, Y2Q4, Y3Q1, Y3Q2, Y3Q3, Y3Q4, Y4Q1, Y4Q2, Y4Q3, Y4Q4, Y5Q1, Y5Q2, Y5Q3, Y5Q4
Quarterly Progress Report	Submission Date	Date and time the QPR was submitted	Calendar date as mm/dd/yy and time in central standard time; automatically populated. For example: 11/19/13 11:20 AM
Quarterly Progress Report	Principal Investigator	Last name of the PI(s) submitting the QPR	PI last names (removed here to save space)

Scope (Management Tab)	Code (column heading)	Description	Value Range
Quarterly Progress Report	Institution	Name of the partner institution reporting	11 institutions: Iowa State University, Lincoln University, Michigan State University, Purdue University, South Dakota State University, The Ohio State University, University of Illinois, University of Minnesota, University of Missouri, University of Wisconsin, USDA-ARS – Columbus
Quarterly Progress Report	Year Milestones	Team milestones reporting on; based on respective year's milestones as documented on internal website.	For example: 3A, 3C, 3Z (number is aligned with Objective number with letter specific to a milestone)
Quarterly Progress Report	Accomplishments: WHAT DID YOU DO?	Description about activities completed relative to the milestones listed; includes experimentation details, data collection, management and analysis.	Open text For example: Completed soil sampling for topsoil depth and total organic carbon at three farm sites in Iowa. Performed statistical analysis of topsoil depth and total organic carbon versus yield for a total of seven sites.
Quarterly Progress Report	Accomplishments: RESULTS & IMPACTS	Description of significant results, developments, or outcomes relative to milestones listed.	Open text For example: Jerry Hatfield, Director of the NLAE, reported that USDA Secretary Vilsack is very impressed with the CSCAP survey and will be sharing our Statistical Atlas with President Obama.
Quarterly Progress Report	Accomplishments: OTHER	Description of collaborations with others or work completed outside their specific Objective.	Open text For example: Yes, we are continuing our collaboration with Objective 3. We met with Cathy Kling's team and Gabrielle Roesch in particular is working with them to integrate our survey and qualitative data with their modeling.
Quarterly Progress Report	Products: PUBLICATIONS	Report of all written products including peer-reviewed articles, white papers, journal articles, conference proceedings, books, etc.	Open text For example: Haruna, S.I. and N.V. Nkongolo. (2014). Spatial and fractal characterization of soil chemical properties and nutrients across depths in a clay-loam soil. Communications in Soil Science and Plant Analysis, 45 (17): 2305-2318. http://dx.doi.org/10.1080/00103624.2014.932371
Quarterly Progress Report	Products: ACTIVITIES	Report of all presentations (field days, conferences, and workshops), external partnerships, and consulting.	Open text For example: Presentation at the Southeast Research Farm field day on June 26, 2014. The results from the drainage water management project were presented at this event (~80 attendees).
Quarterly Progress Report	Products: OTHER	Products that do not fit into other categories, such as audio, video, curriculum, manuals, and websites.	Open text For example: CSCAP-U2U survey referenced in NatGeo Blog (http://newswatch.nationalgeographic.com/2014/05/01/wetlands-do-triple-duty-in-a-changing-climate/)
Quarterly Progress Report	USDA Acknowledgement	Identifying whether the reported product(s) include recognition of USDA funding.	Open text For example: The manuscript to be published in the special issue of the Journal of Soil and Water Conservation included the proper acknowledgement of support by USDA.
Quarterly Progress Report	Challenges or Changes	Description of major changes or problems encountered and/or made adjustments for; typically related to experimentation, data collection, and personnel needs	Open text For example: Challenges include typical weather interruptions of field activities, such as planned rye control timing, corn and soybean planting, nitrogen application, and herbicide application.
Quarterly Progress Report	Personnel Changes	Description of personnel changes such as additions, graduations, and professional development	Open text For example: Dr. Yiannis Panagopoulos, a postdoc we hired to work on CSCAP SWAT simulations, has arrived and will begin work on June 1.
Quarterly Progress Report	Leveraged Dollars	Financial support (beyond the CSCAP) that was received either from their institution or grant-based; in-part because of their involvement with the CSCAP	Open text For example: We receive \$20,330 from Indiana Soybean Alliance for our proposal "Reducing Nutrient Losses from Tile-Drained Cropland Using Drainage Water Management", which will fund phosphorus analysis and additional data collection at the DPAC site.
Quarterly Progress Report	Notes	Comments or information that was not reported elsewhere	Open text
Meeting Attendance	Status	Status of the team member	5 categories: Current, Past, Affiliate-Active, Affiliate-Not Active, Removed

Scope (Management Tab)	Code (column heading)	Description	Value Range
Meeting Attendance	Lab/Group	Name of the PI(s) who the individual reports to. These are typically single PIs but co-PIs occur in some cases	PI last names (removed here to save space)
Meeting Attendance	Leadership Team Member	Is the person a member of the CSCAP leadership team?	Yes or No
Meeting Attendance	PI	Is the person a PI?	Yes or No
Meeting Attendance	First Name	Team member's first name	Open text
Meeting Attendance	Last Name	Team member's last name	Open text
Meeting Attendance	Attendance	Attendance information for virtual and in-person meetings with name of meeting and date used as column header: yyyy.mm.dd_meeting type	For example: Objective 3 held a meeting (2011.12.18_obj3) and team members were recorded as 0, 1, or NA to represent did not attend, attend, or not applicable.
Meeting List, Type, Duration	Meeting Name	Name of the meeting describing date, objective(s) and subgroup.	Format: xxxx.xx.xx_objx -or- xxxx.xx.xx_objx_subgroup For example: 2016.04.29_obj1&2_dwm
Meeting List, Type, Duration	Meeting Type	Method of carrying out the meeting	3 options: In-Person, Virtual (Phone, Adobe), Mix (In-Person, Virtual)
Meeting List, Type, Duration	Recording Available	If meeting was virtual, designation regarding whether a recording is available.	Yes or No
Meeting List, Type, Duration	Duration (hours:minutes:seconds)	Length of the meeting in hours:minutes:seconds format	Format: xx:xx:xx For example: 01:56:02
Meeting List, Type, Duration	Duration (minutes)	Length of the meeting in minutes format	Format: xx:xx For example: 71:65
Meeting List, Type, Duration	Recording Saved to P drive	Internal check with departmental share drive (P drive) and whether the recording has been downloaded in vlc or mp4 format.	Yes or No
Meeting List, Type, Duration	Logged in Meeting Attendance SS	Whether the attendees of the meeting have been logged in "Meeting Attendance" database.	Yes, No (Data Not Exist), or Do Not Collect (DNC)
Meeting List, Type, Duration	Transcribed	Designation whether the meeting has been transcribed.	Yes or No
Assessment Status	ID	Unique ID number assigned by Management; used across all evaluations	Four-digit number. For example: 1234
Assessment Status	FirstName	Team member's first name	Open text
Assessment Status	LastName	Team member's last name	Open text
Assessment Status	Email	Institutional email address	Open text
Assessment Status	Email to be used for post	This email address is for post assessment and will differ because institutional address may no longer be active	Open text
Assessment Status	Current, Past or Do Not Assess (DNA)	Status of individual which guides evaluation to be administered	Current, past, past/affiliate, DNA, removed
Assessment Status	PRE_STATUS	Status of the pre-assessment for the individual	COMPLETE or DNC (did not complete)
Assessment Status	PRE_YEAR COMPLETED	Pre-assessment completed year	2011, 2012, 2013, 2014, 2015, N/A
Assessment Status	MID_STATUS	Status of the mid-assessment for the individual	COMPLETE or DNC (did not complete)
Assessment Status	MID_YEAR COMPLETED	Mid-assessment completed year	2013 or N/A
Assessment Status	POST_STATUS	Status of the post-assessment for the individual	COMPLETE, DNC or blank ()
Assessment Status	POST_YEAR COMPLETED	Post-assessment completed year	2013, 2014, 2015, 2016, N/A

Appendix C

Four examples of posters from the 2015 annual team meeting that were subsequently presented at the Next Generation Scientist Workshop in Washington, DC. Although the presenter has had full freedom regarding the content in the center, the header and footer were encouraged to remain unchanged to meet funder requirements for credit and retain a visual identity that aligned with others on the team.

Effects of Drainage on Crop Yield, Drainage Volume, Nitrate Loss, Water Table, and Planting Date in Southeastern Iowa

Linda R Schott, Matthew Helmers, Carl Pederson, Anis Lagzdins
Iowa State University

Introduction and Rationale

Subsurface drainage removes excess water from agricultural land, especially during the rainy spring months when the timeliness of field operations are important. In Iowa, to qualify for crop insurance, corn must be planted between April 11-May 31. During this planting window (PW), soil volumetric water content must be less than field capacity, and the water table must be below 30 cm for improved timeliness.

The objective of the study was to determine the impact of shallow drainage (SD), controlled drainage (CD), conventional drainage (CD), and no drainage (ND) on crop yields, subsurface drainage volumes and nitrate loss, as well as drainage impact on planting date.

Experimental Procedure

This research was conducted at the Iowa State University Southeast Research Farm (SERF) located near Crawfordville, Iowa. Each plot is planted to half in a corn and half in soybeans every year. There are two replicates for each drainage treatment.

Com Planting Dates

Due to personnel limitations, all drainage sites are planted on the same day and soil conditions are the same for all drainage treatments, leading to a delay after optimal conditions for some treatments.

Table 1. SERF planting dates

Year	Planting Date	Soil Conditions
2010	18 April 2012	No delay
2011	19 May 2013	Wet soil conditions in ND, SD
2012	13 May 2014	Cool soil temperatures in all

Results and Discussion

Table 2. Average treatment results from 2007-2014 Rows out yield with the same later soy equivalent (P<0.05)

Flow (mm)	CD	CD	CD	ND
NO ₃ -N Loss (kg ha ⁻¹)	30.1a	17.8b	15.8b	45
NO ₃ -N Concentration (mg kg ⁻¹)	31.4a	16.7b	19.1b	49
Corn Yield (Mg ha ⁻¹)	10.2b	10.0b	12.7a	48
Corn Yield (Mg ha ⁻¹)	11.5a	10.6b	10.7ab	40
Soy Yield (Mg ha ⁻¹)	3.6a	3.5a	3.5a	3.2b

CD and SD plots reduced flow by 45 and 51%, respectively. CD and SD reduced N loss by 49 and 42%, respectively. SD increased NO₃-N concentrations, but CD had no impact when compared to CD.

Corn yields at CD plots were reduced, probably due to lack of management in wet years. Drainage increased soy yields.

Planting Date

Figure 2. Examples of (a) soil temperature and (b) soil volumetric water content during 2013 planting window (PW) with a 12.2 cm vertical distance between plots. Plots were drained by wet soil conditions during drainage treatments.

Figure 3. Number of hours water table is within 30 cm of ground surface during PW. Rows out yield with the same later soy equivalent (P<0.05).

Year	CD	CD	CD	ND
2010	206	30	0	674a
2011	40	0	0	60a
2012	226	236	336	192a
2013	70	220	182a	524a
2014	0b	38	73b	291a
Average	130b	110	50b	305a

Drainage did not significantly (P<0.05) impact volumetric water content (VWC) at 10 cm in any year 2012-2014, but ND had higher VWC during dry down periods. No soil temperature differences between drainage treatments regardless of year. ND had significantly (P<0.05) reduced availability due to the high number of hours the water table was within 30 cm of the ground surface and, on average, SD also reduced VWC.

Conclusions & Recommendations

- Since SD and CD reduce nitrate loads, both can be recommended to farmers as part of the nutrient reduction strategy.
- Drainage increased yields during wet years.
- Drainage increased availability in the spring, potentially allowing earlier planting.
- SD and CD shouldn't be recommended to decrease NO₃-N concentrations.

Cereal Rye (*Secale cereale* L.) Cover Crop Effects on Cash Crops and Soil Properties in Southeastern Indiana

Trevor J. Frank¹, Joseph D. Rorick², and Eileen J. Kladivko¹
¹Agronomy Dept., ²Purdue University, West Lafayette, IN

Introduction

Cover crops may help increase resiliency to climate stresses and improve soil health and crop productivity in the Midwest.

Site established in 2011 at the Southeast Purdue Agricultural Center (SEPAC) in Butlerville, IN.

No-till corn-soybean rotation with and without cereal rye cover crop.

Randomized complete block design with four blocks and sixteen plots total.

Objectives

- Measure soil aggregation over time and compare rye vs. no rye treatments.
- Assess dry matter production and nitrogen (N) uptake of cereal rye above-ground biomass and compare rye vs. no rye treatments.

Experimental Procedure

Cereal rye at termination before corn or soy beans cover before soybeans (SB) or 2010-14-17. Rye grown longer before soybeans because of slow growth response greater and improvements, and to see a fine spatial resolution, crop yield, soil organic carbon and nitrogen loading across the Midwest US. Within the framework of CCRAP Objective 3, we also aimed to identify the best adaptation and mitigation strategies to projected climate variability and change using different climate and management scenarios.

Results and Discussion

Spring Cereal Rye Dry Matter

Soil Cereal Rye Nitrogen Content

In 2014, before soybean treatments had less weed and rye biomass than before corn treatments due to extra biomass growth when sampled on same date.

Much greater biomass was accumulated when allowed to grow two weeks longer before soybean than before corn (years 2013-2015).

No significant cover crop effect on either corn or soybean yields.

Small corn yield difference existed between plots before cover crop implemented in fall of 2011.

Weather stress impacted 2011 and 2012 yields.

Conclusions

Cereal rye increased soil aggregate stability in the upper soil profile compared to no cover treatments.

Rye accumulated more dry matter and scavenged additional N when grown longer before soybeans.

Cash crop yields generally unaffected by cover treatment during first four years of this study.

Recommendations

Allow cereal rye to grow longer for more biomass accumulation and scavenging of N.

Persistence and persistence on-farm benefits accrue over long term.

Acknowledgements

Thanks to SEPAC staff, the Sustainable Corn Team, Holland Hausman, and undergraduate student workers.

Increased Risk of Insect Injury to Corn with Rye Cover

Mike W. Dunbar, Aaron J. Gassmann, Matthew E. O'Neal
Department of Entomology, Iowa State University

Introduction

A rye cover crop can be beneficial. Reducing field input and soil runoff. Suppressing weed populations. Creating habitat for predatory insects.

All management strategies involve risk. Including the planting of a rye cover crop.

Planting corn following a rye cover crop risks injury from true armyworm (TAW). TAW overwinter on grasses during spring. TAW preferentially attracted to rye. TAW larvae consume corn after rye is destroyed.

Objective

Determine if a rye cover crop affects colonization and injury by TAW.

Materials & Methods

Sampled cornfields

2014: Rye cover = 10, No cover = 8

2015: Rye cover = 8, No cover = 5

Fields sampled weekly, Mid-April through late June.

Data Collected

- Sampled adult TAW with species-specific sex pheromone traps.
- Measured TAW larval abundance & corn injury.
- Sampled within a 6m x 1.8m frame. Sampled from edge to interior of each field (Edge, 20m, 40m, 60m, 80m).
- Collected larvae & incidence of corn injury.

Results & Discussion

TAW Adults

No significant difference between TAW captured from cornfields in 2014 (F = 0.04, P = 0.84), 2015 (F = 0.04, P = 0.84), or 2016 (F = 0.04, P = 0.84). Significantly more adults captured in cornfields with rye cover in 2015 (F = 6.97, P = 0.01).

TAW Larvae

Significantly more TAW larvae found in cornfields with rye cover in 2014 (Z = 2.99, P = 0.003), and in 2015 (Z = 4.15, P < 0.0001).

TAW Larvae & Corn Injury Throughout Cornfields

Significantly more TAW larvae (Z = 4.57, P < 0.0001) and corn injury (Z = 6.17, P < 0.0001) throughout cornfields with rye cover.

Conclusions

Adult TAW were found in all cornfields, regardless of the presence of rye cover. Significantly more TAW larvae within and throughout cornfields with rye cover. Significantly more plants injured within and throughout cornfields with rye cover.

Recommendations

Farmers planting corn following a rye cover crop should regularly scout fields for TAW, and apply a toxic insecticide as needed.

CLIMATE VARIABILITY, MANAGEMENT PRACTICES AND CORN YIELD IN THE MIDWEST US: ADAPTATION AND MITIGATION STRATEGIES TO CLIMATE CHANGE

Dumont, B., Basso, B.
Michigan State University, East Lansing, MI, USA

INTRODUCTION

To assess and evaluate the impact of the complex interactions occurring between soil, climate, management and genotypes on yields and environmental outcomes, a systems approach is required. In this study, we developed a methodology to simulate, at a fine spatial resolution, crop yield, soil organic carbon and nitrogen loading across the Midwest US. Within the framework of CCRAP Objective 3, we also aimed to identify the best adaptation and mitigation strategies to projected climate variability and change using different climate and management scenarios.

RESULTS

Corn yield are expected to decrease with climate under RCP 2.6 (mean value for Midwest under RCP 2.6) to 40% (RCP 6.3). This decrease is steady across the management scenarios.

N₂O leaching is expected to increase under climate change, but can be greatly decreased by including cover crop and extended rotation.

Projected SOC decrease under climate change is expected to be mitigated under scenario SCA-SC7.

MATERIAL AND METHOD

Management scenarios

Seven management scenarios were defined, with increasing complexity and progressive integration of sustainable practices.

Climate change scenarios

Projected climate change scenarios (RCP 2.6, RCP6.3) were simulated considering seasonal modifications around the baseline (1979-2013).

Soil and climatic databases

The SSURGO (Soil Survey Geographic) data of nine Midwest states (IA, IL, IN, MI, MN, MO, OH, SD, WI) were extracted to parameterize soil characteristics at the fine spatial scale. The NCEP-NARR (North American Regional Reanalysis) weather files were analyzed to account for the driving climatic variables at the county level.

Crop model and state specific crop management

The information collected by the USDA National Agricultural Statistics Service (<http://www.nass.usda.gov/>) was used to define state specific management literature. The SALUS soil-crop model (<http://salusmodel.psu.edu/>) System Approach to Land Use Sustainability) was used to simulate crop growth and soil changes over the Midwest US.

CONCLUSIONS

Corn yield are expected to decrease across the Midwest, with slight increase in MI and WI. The impacts of climate change and management practices on corn yield vary greatly from one state/soil to another, with opposite effects between them.

The gain in SOC and the reduction in N₂O leaching when using improved management are greater under RCP 2.6 compared to R6, and even higher under RCP6.

RECOMMENDATIONS

Additional research, cover crops, extended rotation have a great impacts on mitigating and reducing N₂O leaching and SOC losses, but not sufficient to reverse the negative effects on yield caused by climate change.

The negative impact of increasing temperature and more frequent extreme events, such as flooding and drought, can be mitigated using adaptive in-season management strategies, new genetics, and variable rate application of agronomic inputs.

Appendix D

Example letter sent to Purdue University for authorization and clarification on logos to use by the team. This also was done for extension logos at each university as these are typically different from the main university logo and also may have a different person or office to approve the use.



May 3, 2012

David Wilson
Director Trademark Licensing - Purdue University
Office of Advancement
Lawshe Hall, Room 318
2200 169th Street
Hammond, IN 46323-2094

Dear Mr. Wilson,

I am writing to request use of your institution's logo as part of a multi-state, USDA-funded project which includes Purdue University.

The Climate and Corn-based Cropping Systems CAP (CSCAP) is a transdisciplinary partnership among 11 institutions, including: Iowa State University, Lincoln University, Michigan State University, The Ohio State University, Purdue University, South Dakota State University, the University of Illinois, the University of Minnesota, the University of Missouri, the University of Wisconsin, USDA Agriculture Research Service and USDA National Institute of Food and Agriculture (USDA-NIFA).

This five-year project, which began in 2011, assesses the environmental, economic and social impacts of long-term climate variability on corn-based cropping systems. The project focuses on ways to encourage resilient decision-making, maintain yields and reduce environmental impact.

We are seeking authorization to use your institution's logo to document your university's involvement in this USDA-funded project. We request authorization for print and electronic use and seek clarification on what logo is preferred for these publications. Materials will include printed annual reports, extension fact sheets, education modules, research technical reports; these materials will be uploaded to the team's external website. Please include any specific requirements you may have regarding size, placement, etc.

We would like to begin incorporating logos into reports in the next two weeks, so a timely reply is appreciated. Please feel free to contact me by phone or email to discuss further and address any questions you may have.

Best regards,

A handwritten signature in blue ink that reads "Lori J. Abendroth".

Lori J. Abendroth
Project Manager
Climate Change, Mitigation, and Adaptation in Corn-based Cropping Systems CAP
Iowa State University
labend@iastate.edu | 515.294.5692

Appendix E

Institutional, Sustainable Corn, and USDA-NIFA logos made available on the team's internal website.

<p>Questions? Lori Abendroth, Project Manager labend@iastate.edu 515.294.5692</p> <ul style="list-style-type: none"> Home ▶ Annual Meeting Info. ▶ Conference Calls, Dates & Notes ▶ Contact Information & STEM Form Evaluation ▶ External Communications Financial Information Photographs ▶ Presentations: Slides & Templates ▼ Project Identity (Logos, Templates, Letterhead) <li style="background-color: #f0f0f0;">Logos Project Proposal Narrative & Milestones Project Research Questions & Hypotheses ▶ Publications Reports ▶ FIELD DATABASE ▶ Objective 1 & 2. Field Research ▶ Objective 3. Systems Analysis & Predictive Modeling ▶ Objective 4. Socioeconomic Research ▶ Objective 5. Extension ▶ Objective 6. Education ▶ Next Generation Scientists' DC Meeting 	<p>Project Identity (Logos, Templates, Letterhead) ></p> <h2>Logos</h2> <p>The sustainablecorn.org logo and the USDA logo are available in black/white and color. Use the color logo for all print material when possible (unless the document featuring the logo will only be printed in greyscale, then use black/white). Always retain logo proportions; avoid logo stretching or enlarging to a size greater than 100% to minimize image pixilation.</p> <p>To download any of the logos, click on the link and then select FILE > DOWNLOAD.</p> <h3>USDA-NIFA Logos</h3> <ul style="list-style-type: none"> • NIFA Centered (color) • NIFA Centered (black) • NIFA Horizontal (color) • NIFA Horizontal (black) • NIFA Vertical (color) • NIFA Vertical (black) <h3>Sustainablecorn.org Logos</h3> <ul style="list-style-type: none"> • Sustainablecorn - print use (color) • Sustainablecorn - digital use (color) • Sustainablecorn (black and grey) <h3>QR Codes</h3> <p>These are the matrix barcodes that are readable by smartphones, etc. Use these on posters or presentations as someone can be immediately directed to our team's website by scanning it. Two sizes exist: MEDIUM or LARGE</p> <h3>Institutional Logos</h3> <p>We have received authorization to use your institution's logo in our team's print and electronic materials. Your licensing/trademark office has told us which ones they want to see on our materials. For a few of your institutions, they gave us many versions to use, which are not all included here. EPS (vector-based) versions of the logo are available for large logo needs. Contact Lynn or Lori if you need the web or vector-based versions.</p> <ul style="list-style-type: none"> • Purdue University - extension version (grey or color) non-extension version • Lincoln University - cooperative extension color extension version color extension version b/w extension version_College of Ag & Natural Science non-extension version • Michigan State University - extension version non-extension version - with or without helmet • South Dakota State University - extension version extension gray non-extension version - center or center full or wide • The Ohio State University - OSU has no extension version non-extension version (portrait or landscape) • University of Illinois - extension version (portrait or landscape) non-extension version (portrait or landscape) • University of Minnesota - extension version non-extension version (maroon or black) • University of Missouri - extension version (color or b/w) non-extension version (b/w or color) • University of Wisconsin - extension version (color or b/w) non-extension version (wide or stacked versions) • Iowa State University - extension version - (b/w or color) non-extension version (b/w or color) • USDA-ARS (Ohio sites) - color b/w <h3>Corn Landscape</h3> <p>This is the corn used for handouts and powerpoints - BLUE and ORANGE available. Resize or crop as needed to fit your media but try to retain the general look of it so it ties in well with our other materials. Ask Lynn or Lori if you have questions on use of this.</p>
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Appendix F

Agenda for the team's annual meeting with overall vision and goals presented upfront, followed by team "platforms" and the breakdown of what will be discussed each day. The agenda for most years was a couple pages, while in 2015 it also included detailed breakout sessions.

SUSTAINABLE CORN.ORG From Synthesis to Recommendations
CSCAP 2015 Annual Meeting
August 3 and 4
Lied Lodge, Nebraska City, NE
CROPS, CLIMATE, CULTURE AND CHANGE



YEAR 5 MEETING GOAL:

Synthesize findings to construct initial set of recommendations that are integrated and systems focused. Recommendations will address productivity and environmental (ecological) outcomes in managing corn-based systems as fully as possible. These recommendations will then continue to be vetted and built out as further research data and analyses are performed in Y5 and beyond. The work at this meeting will get us through the most intensive period of synthesizing and connecting all of our work together.

It will be challenging but also incredibly rewarding! We have the capacity to do this.

Recommendations will span: scientific, programmatic, educational, and methodological

To accomplish these goals we will work across:

Disciplines - Objectives - Platforms - Scale (field to region) - Stakeholder Audience



Climate and Corn-based Cropping Systems Coordinated Agricultural Project (CSCAP)
sustainablecorn.org
USDA-NIFA Award No. 2011-68002-30190

CSCAP PLATFORMS



CARBON: Increase the retention of soil carbon to improve soil quality and sustainability within corn-based cropping systems.



NITROGEN: Limit the loss of nitrogen during seasonal peaks observed within Midwestern corn-based cropping systems that have naturally rich soils and fertilizer applied.



WATER: Stabilize soil and nutrients during periods of saturated and flooded conditions while improving water availability and efficiency for crop use during moisture stress conditions.



STAKEHOLDERS: Knowledge exchange and transfer of findings through science-driven, experiential learning opportunities to prepare and educate farmers and teachers.



SYSTEMS: Build human-natural system resilience by integrating productivity and environmental goals through field, farm, watershed and landscape scale management.

IPM
Human Dimensions
Climate
Carbon
Nitrogen
Water

MONDAY, AUG 3, 2015

All sessions today are held in Rosehow unless noted

Time	Activity	Presenter
6:30 - 7:45 am	Breakfast, <i>Timber Dining Room</i>	
7:15 - 8	Registration in front of Marcotte Room	
8 - 8:30	Welcome and kickoff Year 5 action items Accomplishing project legacy outcomes Post CAPs and USDA vision	Lois Wright Morton Michael Bowers
RECOMMENDATIONS FROM SCIENTIFIC RESEARCH		
8:30 - 10	Overall integration process	Lori Abendroth
	<i>Drainage water management</i>	Jane Frankenberger, Laura Bowling
	<i>Cover crops</i>	Eileen Kladyko, Andrea Basche
	<i>Tillage</i>	Rick Cruise, Bruno Basso, Rob Anex
	<i>Extended crop rotations</i>	Joe Lauer, Emerson Natziger
10	Break	
10:15 - 12	<i>Greenhouse gas</i>	Mike Castellano, Rob Anex
	<i>Nitrogen rate and timing</i>	Warren Dick, Ben Duval
	<i>Soil quality index (SQI)</i>	Rattan Lal
	<i>Pests</i>	Matt O'Neal
	<i>Climate change and yield</i>	Dennis Todley, Bruno Basso
	<i>Social economic</i>	J. Arbuckle
	<i>Landscape soil-water</i>	Phil Gassman
12 - 1 pm	Lunch, <i>Timber Dining Room</i>	
1 - 2:30	INTEGRATION ACTIVITY 1. Development of platform-specific recommendations at different spatial scales. Table discussions	
2:30 - 3:15	Break and team photo outside!	Lynn Laws
3:15 - 4:15	INTEGRATION ACTIVITY 2. Connecting platform-specific recommendations to form systems recommendations. Group discussions: Field synthesis group, <i>Rosenow</i> Watershed synthesis group, <i>Rosenow D</i> Regional synthesis group, <i>Terrace</i> Climate & social synthesis group, <i>Marcotte</i>	
4:15 - 4:30	Operations update	
4:30 - 6:30	Poster symposium with appetizers, <i>Steinhart</i>	
6:30 - 8	Dinner, <i>Timber Dining Room</i>	

Climate and Corn-based Cropping Systems Coordinated Agricultural Project (CSCAP)
www.sustainablecorn.org
 USDA-NIFA Award No. 2011-68002-30190

TUESDAY, AUG 4, 2015

All sessions today are held in the Rosenow unless noted

Time	Activity	Presenter
6:30 - 7:45 am	Breakfast, Timber Dining Room	
8 - 12	BREAKOUT BY ROLES See next pages for detailed schedules	
As determined	Take a break mid-morning as your group chooses	
	[1] Principal Investigators, Terrace	
	[2] Grad students and postdocs, Rosenow	
	[3] Extension Educators, Mercotte	
12 - 1 pm	Working Lunch, Buffet downstairs	
	RECOMMENDATIONS IMPACTING CAPACITY BUILDING	
1 - 1:20	Management capacity <ul style="list-style-type: none"> Project data, structure Research data, structure 	Lori Abendroth Daryl Herzmann
1:20 - 1:45	Extension legacy <ul style="list-style-type: none"> Regional capacity building for extension Distribution of materials via Extension online stores 	Chad Ingels Lynn Laws
1:45 - 2	Educational recommendations for teachers	Dennis Today
2 - 2:45	INTEGRATION ACTIVITY 3. Reporting out systems recommendations from small groups.	
2:45 - 3:15	Break and priority ranking	
3:15 - 4	INTEGRATION ACTIVITY 4. Compile all recommendations. Group discussion.	
4 - 5	OBJECTIVE SESSIONS	
	Obj. 1 & 2, <i>Rosenow</i>	Eileen Kladviko, Matt Helmers, Joe Lauer
	Obj. 3, <i>Terrace</i>	Rob Anex
	Obj. 4, <i>Executive Board Room</i>	J. Arbuckle
	Obj. 5, <i>Marcotte</i>	Chad Ingels
	Obj. 6, <i>Rosenow D</i>	Dennis Today
5 - 6	ACTION STEPS: Final 6 months! Objectives report back to team and collectively identify gaps, plan workgroups, and next steps	Leaders, Lois, and Lori
6:30 - 8	Team dinner and presentation "It's about science", Steinhart	Lois Wright Morton
8 - 9	Integration team (only) debriefing and follow-up plans, Executive Board Room	

Climate and Com-based Cropping Systems, Coordinated Agricultural Project (CSCAP)

www.sustainablecorn.org
USDA-NIFA Award No. 2011-68002-30190

Tuesday Breakouts: Ask Lori Abendroth if unsure which breakout to attend.

Groups will follow these schedules as closely as possible to allow for individuals attending multiple sessions.

TUESDAY MORNING BREAKOUT 1

WHO SHOULD ATTEND: Principal investigators

Schedule and Goals

- 8 am **Data: status, storage, and legacy, Lois, Lori Abendroth and Peter Arbuckle**
1) Key dates: Feb 2016 & Feb 2017
2) How pieces fit together: CSCAP, National Ag Library (NAL), AgMIP, PubAg
3) National Ag Library, Peter Arbuckle, Knowledge Services Division, NAL
4) CSCAP data to NAL: umbrella, clusters, and citations
5) Institutional capacity and consortium
- 9:30 **USDA no cost extension guidelines, Y6 proposal and budget allocations, Lois and Lori Oh**
- 10 **Accomplishing project goals and legacy** (writing the NCE request)
1) Y6 accomplishments and Y6 activities based on deliverables (data prep and NAL archival, publications, Extension, Education)
2) Opportunities for Y6 aligned with project goals, resources
- 12 pm Grab lunch and come back to continue discussions

Be back in main room for 1 pm session!



TUESDAY MORNING BREAKOUT 3

WHO SHOULD ATTEND: Extension educators

Schedule and Goals

- 8 "Lessons learned: Building capacity for extension to address climate change needs of stakeholders" white paper, *Chad Ingels and Lynn Laws*
- Discuss entire paper, make via Cloud, and identify any gaps or text needed.
 - Finalize all edits and paper focus with individuals selected to follow-up on items as needed.

- 9:30 **Extension online store, Lynn Laws**
- Demonstrate live stores to-date (ISU) and what products exist currently.
 - Educators determine what other state based information (CSCAP or non-CSCAP) should also be posted and draft email for Lynn to communicate to state-based store personnel.

- 10 **Follow up from May UZU-CSCAP Davenport meeting**
- Plans and dates for extending UZU tools to your audiences
 - Plans for sharing the "lessons learned" paper with your Extension ANR director and other administrators
 - Update on workgroup product development

10:30 Roadmap for Y6 to develop Extension products from CSCAP research recommendations

- SARE professional development grant extended until Dec 2016
- Interest in SARE grant proposal writing for 2017-programmatic and/or professional development

11 Thematic workgroup products

- Break into workgroups and write/develop content together. Need laptops and videos/cameras if want to shoot any footage.
- Goal is to get materials wrapped up and sent to Emily for layout.

Other extension updates

12 pm Grab lunch and come back to continue working in your groups

Be back in main room for 1 pm session!



TUESDAY MORNING BREAKOUT 2

WHO SHOULD ATTEND: Graduate students, post-doctoral associates, and education team members*

Schedule and Goals

8 am **DC overview, Gabrielle Roesch-McNally**
Logistics, attendees registered, program booklet, poster symposium

8:15 **DC program booklet, Suresh Lokhande**

8:30 **Role and presence in DC, Joe Colletti and Sophia Megill**

- 1) Role as ambassadors of CSCAP and their institution
- 2) Each institution has own policy and practices in talking with their elected officials/staff
- 3) Federal lobby laws
- 4) How to take your science and talk to DC policy wonks and an interactive opportunity to role play presenting your science to DC staff

10 **Tri Societies webinar and training, Andrea Basche**

- 1) A basic introduction to policy and the legislative process
- 2) How science and research fit into the overall process
- 3) How scientists can best communicate and engage with legislators

11:50 Give Lynn your research summary and graphics on USB flash drive

12 pm Grab lunch and come back for working lunch

12:15 **Staying connected and legacy of next generation (students and postdocs) cohort, Samuel Haruna**

Be back in main room for 1 pm session!

**Attend as much as possible*

Appendix G

CSCAP 2015 Annual Conference Registration

REGISTRATION DEADLINE: June 1, 2015
HOTEL RESERVATION DEADLINE: June 1, 2015
FLIGHT RESERVATION DEADLINE: June 1, 2015 (to avoid high prices)

Lied Lodge & Conference Center
2700 Sylvan Road
PO Box 817
Nebraska City, NE 68410

* Required

Please book your flight, shuttle, and hotel room before submitting this registration form!

Attendee Information

First name *

To appear on nametag

Last name *

To appear on nametag

Organization *

To appear on nametag. Please enter your CSCAP-participating organization or institution.

E-mail address *

Do you plan to submit a poster for the CSCAP poster session? *

Select "yes" if you will be the presenting author or primary contact. Those who select "yes" will receive an e-mail later with instructions for abstract submission (due July 5). If unsure at this time, select "yes."

Yes

No

Travel Information

FLIGHT RESERVATION DEADLINE: June 1, 2015

If you are unable to find a flight for under \$600, contact Lori Oh (lorioh@iastate.edu)

Fly into Omaha Eppley Airfield (OMA).

SHUTTLE TO/FROM LIED LODGE:
Please book your shuttle ahead of time.
By calling 1-800-546-5433
Online - <http://goo.gl/akVwdL>

How will you travel to the conference? *

*NOTE ABOUT ISU BUS: Bus will depart ISU on Sun., Aug. 2 at approx. 4:00 pm CST and arrive at Lied Center by 8:00 pm CST. Bus will depart Wed., Aug. 5 at approx. 8:00 am CST and arrive at ISU by 12:00 pm CST.

- Airplane
- Automobile
- *ISU Bus (option only for Iowa State University members)

What day and time is your estimated arrival to Lied Center? *

- Sunday Evening
- Other:

What day and time is your expected departure? *

- Wednesday Morning
- Other:

Cell phone number

This is not required but may be helpful for us to have during travel

Lodging/Meal Information

HOTEL RESERVATION DEADLINE: June 1, 2015

ATTENDEES ARE RESPONSIBLE FOR MAKING THEIR OWN HOTEL RESERVATIONS!

Lied Lodge & Conference Center
2700 Sylvan Road
PO Box 817
Nebraska City, NE 68410

To Reserve by Phone:
Call 800-546-5433 and ask to make a reservation under the CSCAP Climate and Corn-based Cropping block.

To Reserve Online:
Go to <https://reservations.liedlodge.org/ll/> and in the special rate box select Group/Block and enter 1508IOWAST.

Double-check that your rate is \$93 per night (single occupancy). This equates to \$279 for 3 nights before taxes are applied. If you have a roommate (double occupancy), it will be \$103 per night. This equates to \$309 for 3 nights before taxes are applied.

Will you have a roommate? *

If Yes, please enter name of the roommate

Any dietary restrictions?

If applicable, detail any dietary restrictions below.

SUBMIT and you are registered for the CSCAP annual team meeting!

Your registration will be saved automatically in our online system. If you want to have a print-out of this form, please print (CTRL + P) before submitting as it will not be possible afterwards. Contact Lori Abendroth with any questions or changes you need to make. Thanks!

Appendix H

Poster submission form with title, authors, and abstract. This information would be printed in a booklet for meeting participants (Appendix I), and provided as a follow-up document of poster presentations.

CSCAP Poster Abstract Submission

ABSTRACT SUBMISSION DEADLINE: July 05, 2015.

Questions?!? Email Lori Abendroth (labend@iastate.edu) or Suresh Lokhande (lokhande@iastate.edu) or call (515.294.2074)

* Required

Title *

AUTHORS AND INSTITUTIONS

Please include all names followed by institutions in the next 2 boxes.

Example:

Lori J. Abendroth¹, John T. Smith¹, and Susie A. Johnson²

1 Iowa State University

2 Purdue University

Author List *

Include all authors here. Insert an asterisk after the presenting author.

Author Institutions *

Note which institution goes with each author by using a number (see example above). It will not be possible to superscript the numbers in this web form but we will do this for you before it is printed.

ABSTRACT AND KEYWORDS

Abstract *

300 word maximum. Most formatting (such as superscript, italics, etc.) is not retained in this form but we will edit appropriately before it is printed for the meeting.

Keywords *

In ~5 words, tell us what your poster is about. This will help to categorize your poster. Example: Corn, No-tillage, photosynthesis, germination.

Handouts available

There will be hanging folders next to each poster allowing presenters to bring handouts with them for people to take. I recommend you make 20 copies of your poster on 8 x 11 paper and bring with you to put into this folder.

SUBMIT YOUR ABSTRACT!

Your poster information will be saved automatically in our online system. If you want to have a print-out of this form, please print (CTRL P) before submitting as it will not be possible afterwards. Contact Lori Abendroth or Suresh Lokhande with any questions or changes you need to make. Thanks!

Submit

Appendix I

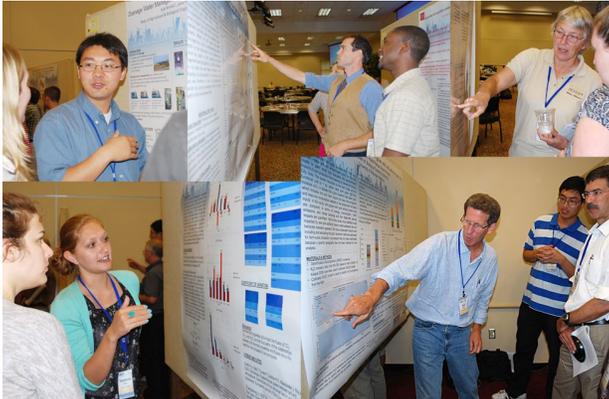
Poster Symposium booklet (pages 1-3 shown from 17 pages total) handed out at the annual meeting to all participants. The information contained here was uploaded by the presenters using the poster submission form (Appendix H). The numbers preceding each poster were assigned so posters were grouped topically around the room and people knew where to set up their posters on their own.

The symposiums were typically two hours in length, which often meant people were not able to get to all posters of interest and discuss. Having the booklet with abstracts helped to increase knowledge among team members of the work being carried out, as well as encouragement for the poster presenters to write a strong abstract.

2015 CSCAP Annual Meeting

POSTER SYMPOSIUM

From Synthesis to Recommendations



SUSTAINABLE CORN.ORG
CROPS, CLIMATE, CULTURE AND CHANGE

USDA
United States Department of Agriculture
National Institute of Food and Agriculture

Monday, August 3, 2015
4:30 to 6:30 pm
Lied Lodge, Nebraska City, NE

Please refer to this publication as: From Synthesis to Integration [Poster Symposium]. 2015. CSCAP Annual Meeting, August 3-4, 2015, Nebraska City, NE. Cropping Systems Coordinated Project (CAP): Climate Change, Mitigation, and Adaptation in Corn-based Cropping Systems. Pub. No. CSCAP-0186-2015.

For specific abstract please refer to it as: (Authors). (Abstract title). 2015. *In* From Synthesis to Integration [Poster Symposium]. 2015. CSCAP Annual Meeting, August 3-4, 2015, Nebraska City, NE. Cropping Systems Coordinated Project (CAP): Climate Change, Mitigation, and Adaptation in Corn-based Cropping Systems. Pub. No. CSCAP-0186-2015.

The research presented here is part of a regional collaborative project supported by the USDA-NIFA, Award No. 2011-68002-30190 "Cropping Systems Coordinated Agricultural Project (CAP): Climate Change, Mitigation, and Adaptation in Corn-based Cropping Systems."

An asterisk (*) denotes the presenting author

1. Effects of Drainage on Crop Yield, Soil Water Content, Drainage Volume, Nitrate Loss, and Planting Date in Southeastern Iowa

Linda R Schott*, Carl Pederson and Matthew Helmers
Iowa State University, Ames, IA

Subsurface drainage removes excess water from agricultural land, especially during the rainy spring months when the timeliness of field operations, such as planting, are important. The objective of this study was to determine the impact of shallow drainage, controlled drainage, conventional drainage, and no drainage on crop yields, depth to water table, soil water content, subsurface drainage volumes, and nitrate loss through subsurface drainage. The optimal planting date was also investigated using temperature and moisture data in order to determine if drainage may have impacted this. This research was conducted at the Iowa State University Southeast Research Farm near Crawfordsville, Iowa. The site consists of eight plots with two replicates for each of the four treatments. Each plot had half of the plot planted in beans and half in corn, and the halves were rotated every year in accordance with a typical corn-soy rotation. While there were no significant yield differences in either corn or soybeans between the management types, in years with high rainfall, there was a yield reduction in both corn and soybean yields in the undrained plots. The undrained plots also tended to have a water table closer to the soil surface, which can impact field operations. The minimal yield differences could be due to suboptimal planting dates since all the plots are planted at the same time due to personnel limitations, which is dependent on when the wettest plot becomes optimal. In every year, the conventionally drained plots lost both the highest volume of subsurface water and the most nitrate. This study highlights the importance of drainage water management for maintaining crop yields and reducing nitrate export. With increasing concern on nitrate loss downstream, this study highlighted that controlled and shallow drainage have the potential to significantly reduce nitrate export.

2. Drainage Water Management Effect on Water Table Recession Rate

Samaneh Saadat*, Jane R. Frankenberger, Laura C. Bowling and Kyle Brooks
Purdue University, West Lafayette, IN

Drainage water management is being promoted to decrease nitrate loads from subsurface drainage, but questions remain about optimal operation strategies. One unanswered question is whether the outlet should be lowered prior to or directly after a rainfall event to reduce the amount of time that water table is at a level that would be detrimental to either trafficability or crop yield. This question was addressed using water table recession rates from two pairs of managed and conventionally drained fields located in Indiana over a period of 9 years from 2006 to 2014. The significance of relationship between paired observations and the effect of management was determined by paired watershed approach using the analysis of variance (ANOVA) and covariance (ANCOVA). Raising the outlet decreased rate of water table recession by 4 to 10 mm/h, increasing the time needed for the water table level to fall from the surface to 60 cm depth by approximately 26 to 38 hours.

3. Assessing Yield Impact of Drainage Water Management Based on Soil Moisture

Caroline Hughes^{1*}; Laura Bowling¹; Jeffery Strock²; Jane Frankenberger¹; Lu Zhang²; Lindsay Pease³; Linda Schott⁴; Norm Fausey⁵; Matthew Helmers² and Eileen Kladvik¹

¹Purdue University, West Lafayette, IN

²University of Minnesota, Lamberton, MN

³The Ohio State University, Columbus, OH

⁴Iowa State University, Ames, IA

⁵Soil Drainage Research Unit, USDA-ARS, Columbus OH

Drainage water management gives farmers an opportunity to control water leaving agricultural fields, which is potentially beneficial to crop yield if moisture is retained in the soil during critical growth phases. Soil moisture content has been monitored at four Midwestern sites in fields with conventional drainage and controlled drainage between 2011 and 2014. This data is being compared against a moisture stress threshold to determine the hours of moisture deficit that corn crops face in each growth stage and the magnitude of those deficits. Stress caused by both deficit and excess soil moisture were quantified in this way; a statistical analysis yielded no significant difference in stress between managed and free-draining fields. However, both excess in soil moisture and total stress are correlated with grain yield, suggesting that it is important to manage drainage water to prevent excess moisture stress from occurring.

Appendix J



**Climate and Corn-based Cropping Systems CAP
Team Publication Guidelines
Agreed upon at Annual Meeting, November 2011
Addendum approved, March 2014
Minor adjustments made afterwards by Project Operations to clarify formatting issues, etc.**

**This document and other project-based templates and materials are at:
<https://sites.google.com/site/sustainablecorn/publications>**

Guidelines developed by the CSCAP Publications Committee: Lois Wright Morton, Eileen Kladivko, Dennis Today, Cathy Kling, and Lori Abendroth

OVERVIEW

Guidelines developed for research, extension, and education publications developed by CSCAP faculty, staff, and students. Recommendations for proper citation, credit, and acknowledgement vary based on type of publication and complexity. Recommendations are given for each category of publication; exceptions and variations are possible but should be brought to the committee prior to publication for verification. Contact Lori Abendroth (labend@iastate.edu) with questions; she will forward to the committee as necessary or address herself.

These guidelines apply to publications derived from CSCAP data secured on a password protected central database. One exception to these guidelines is the socio-economic survey data jointly funded and collected in conjunction with U2U, a USDA-NIFA standard climate grant. These survey data will be secured on the password protected site of each group and used under the same guidelines as stated in this document.

Guidelines are developed for five types of team output:

- 1 – Refereed Journal Articles and Technical Reports
- 2 - Education and Extension Curricula and Publications
- 3 – Presentations: Field, Conferences, and Societal Meetings
- 4 – Theses and Dissertations
- 5 – Media: Videos, Web Site, Etc.

CATEGORY 1: Refereed Journal Articles and Technical Reports

- [1.] Using field/primary data from state level sites
 - [a] List lead author and coauthor(s) as recommended by journal.
 - [b] Include personnel only directly involved with field/primary research.
 - [c] Include Acknowledgement option [1].
 - [d] Include this statement at the end of Acknowledgement option [1] also: "Research data and supporting metadata are stored in the team's centralized Climate and Cropping Systems database."

- [2.] Combining field/primary data from 2 or more states' scope of work
 - [a] List lead author and coauthor(s) as typically done per respective journal.
 - [b] Include personnel only directly involved with field/primary research.
 - [c] Include Acknowledgement option [1].
 - [d] Include this statement at the end of Acknowledgement option [1] also: "Research data and supporting metadata are stored in the team's centralized Climate and Cropping Systems database."

- [3.] Using primary data for secondary analysis (e.g. modeling and/or survey analyses)
 - [a] List lead author and coauthor(s) as typically done per respective journal.
 - [b] Next, include PI's whose field research/primary data comprise the dataset used for analysis and/or modeling. Include PI names in alphabetical order. This may or may not include all PI's* on CSCAP dependent on which field sites/primary data are used in the paper.
**PI needs to decide whether a staff or student should be listed instead of themselves based on time spent on respective dataset.*
 - [c] Agreement form (page 6) must be initiated prior to publication by the first author with a copy submitted to the CSCAP operations team. It is recommended that secondary users initially consult with data owners prior to analysis for clear communication and agreement.
 - [d] Include Acknowledgement option [2].
 - [e] Include this statement at the end of Acknowledgement option [2] also: "Research data and supporting metadata were accessed from the team's centralized Climate and Cropping Systems database."

CATEGORY 2: Education and Extension Curricula & Publications (Peer Review or Not Peer Review)

- [1.] State-based publication
 - [a] List lead author and coauthor(s).
 - [b] Include Acknowledgement option [3].
 - [c] Include Publication number as described on page 5, if possible.
 - [d] Include institution logo as primary logo at page header.
 - [e] Include the Sustainablecorn.org logo at the page footer.
 - [f] Include the USDA logo next to the CSCAP logo at the page footer.
 - [g] Include disclaimer on bottom of last page (see page 5).

- [2.] Publication from 2 or more states' scope of work
 - [a] List lead author and coauthor(s) as typically done.
 - [b] Include Acknowledgement option [3].
 - [c] Include Publication number as described on page 5, if possible.
 - [d] Include multiple institution logos if desired.
 - [e] Include the Sustainablecorn.org logo as primary logo at page header or footer.
 - [f] Include the USDA logo next to the CSCAP logo at page header or footer.
 - [g] Include disclaimer on bottom of last page (see page 5).

CATEGORY 3: Presentations: Field, Conferences, and Societal Meetings

- [1.] Individual PI or state-based
 - [a] Use standardized PowerPoint (PPT) or poster template if possible, provided by CSCAP operations. If not using the standardized version, please adhere to points [c, d, e, f] listed here.
 - [b] List lead author and coauthor(s) as typically done.
 - [c] Include Acknowledgement [1] on last slide or bottom of poster.
 - [d] Include institution logo at the top left of poster or in the bottom left of PPT slide.
 - [e] Include the Sustainablecorn.org logo at the top right of poster or in the bottom right of PPT slide.
 - [f] Include the USDA logo next to the CSCAP logo at the top right of poster or in the bottom right of PPT slide.

- [2.] Group presentations and/or using multi-state data in presentation
 - [a] Use standardized PowerPoint (PPT) or poster template if possible, provided by CSCAP operations. If not using the standardized version, please adhere to points [c, d, e, f] listed here.
 - [b] List lead author and coauthor(s) as typically done.
 - [c] Include Acknowledgement [1] on last slide or bottom of poster.
 - [d] Include multiple institution logos, if desired, at the top left of poster or in the bottom left of PPT slide.
 - [e] Include the Sustainablecorn.org logo at the top right of poster or in the bottom right of PPT slide.
 - [f] Include the USDA logo next to the CSCAP logo at the top right of poster or in the bottom right of PPT slide.

CATEGORY 4: Theses and Dissertations

- [1.] Research on individual component of CSCAP, within state scope of work.
 - [a] List student and committee as typically done.
 - [b] Include Acknowledgement option [1].
 - [c] If part of the thesis or dissertation is published in a refereed journal, follow the respective guidelines (see CATEGORY 1).

- [2.] Research using CSCAP data for secondary analyses (e.g. modeling and/or survey analyses), within or across state's scope of work.
 - [a] List student and committee as typically done.
 - [b] In the Acknowledgement section or Materials & Methods, include PI's who conducted field research/survey collection that comprise the dataset used for analyses and/or modeling. Include PI names in alphabetical order. This may or may not include all PI's on CSCAP dependent on which primary data are used in paper.
 - [c] Include Acknowledgement option [2].
 - [d] If part of the thesis or dissertation is published in a refereed journal, follow the respective guidelines (see CATEGORY 1).

CATEGORY 5: Media: Videos, Web site, etc.

[1.] Individual PI

- [a] List presenter as typically done, by title and institution.
- [b] Include institution logo where appropriate.
- [c] Reference the funding source when speaking or at the bottom of webpages; e.g. use Acknowledgment [1].
- [d] Include the Sustainablecorn.org logo.
- [e] Include the USDA logo.

ACKNOWLEDGEMENT TEXT

All publications will include a reference to the funding agencies* and scope of CSCAP in the Acknowledgements section. Insert one of the following text options based on type of publication.

**If funding beyond the USDA-NIFA grant was acquired, insert acknowledgement to additional agencies/sources next to or following the CSCAP reference.*

[1] This research is part of a regional collaborative project supported by the USDA-NIFA, Award No. 2011-68002-30190, "Cropping Systems Coordinated Agricultural Project: Climate Change, Mitigation, and Adaptation in Corn-based Cropping Systems." Project Web site: sustainablecorn.org.

[If space exists, also include:]

The 11 institutions comprising the project team include the following Land Grant Universities and USDA Agricultural Research Service (ARS): Iowa State University, Lincoln University, Michigan State University, The Ohio State University, Purdue University, South Dakota State University, University of Illinois, University of Minnesota, University of Missouri, University of Wisconsin, and USDA-ARS Columbus, Ohio.

[2] This research is part of a regional collaborative project supported by the USDA-NIFA, Award No. 2011-68002-30190, "Cropping Systems Coordinated Agricultural Project: Climate Change, Mitigation, and Adaptation in Corn-based Cropping Systems." The dataset used in this paper was derived from field research experiments conducted by *name 1, name 2, ..., name X* (listed in alphabetical order) as part of the Cropping Systems CAP. Project Web site: sustainablecorn.org.

[If space exists, also include:]

The 11 institutions comprising the project team include the following Land Grant Universities and USDA Agricultural Research Service (ARS): Iowa State University, Lincoln University, Michigan State University, The Ohio State University, Purdue University, South Dakota State University, University of Illinois, University of Minnesota, University of Missouri, University of Wisconsin, and USDA-ARS Columbus, Ohio.

[3] The information contained within this *[insert: publication/module/etc.]* is based on extensive scientific research conducted at sites across the Midwest. This regional collaborative project is supported by the USDA-NIFA, Award No. 2011-68002-30190, "Cropping Systems Coordinated Agricultural Project: Climate Change, Mitigation, and Adaptation in Corn-based Cropping Systems." Project Web site: sustainablecorn.org.

[If space exists, also include:]

The 11 institutions comprising the project team include the following Land Grant Universities and USDA Agricultural Research Service (ARS): Iowa State University, Lincoln University, Michigan State University, The Ohio State University, Purdue University, South Dakota State University, University of Illinois, University of Minnesota, University of Missouri, University of Wisconsin, and USDA-ARS Columbus, Ohio.

IDENTIFICATION AND FORMALITY ISSUES

Publication Number

Many of the publications produced by CSCAP personnel will have the capability and need for a reference number. The following structure will be inserted at the bottom right corner of the publication. Contact Lori Abendroth (labend@iastate.edu) for reference number.

Publication numbers will be set as: CSCAP-Number of publication in system-Year-State or Region

Example, the first CSCAP publication produced for an Iowa audience is: CSCAP-0001-2011-IA

Logos, Style, and Templates

It is recommended that all affiliated publications and materials utilize standard publication guidelines whenever possible to remain consistent with the project's visual identity and style.

General guidelines:

- Font: Arial, 11 point
- Spacing: Single-spaced, paragraphs separated by line breaks
- Colors: Based primarily off those listed as part of the visual identity (orange and blue)

Logos are available in black/white or color. Use color logo for all print and web material when possible. Attain high resolution version of logos from CSCAP internal site.

Resources are available on the internal site to help meet identity and style guidelines:
<https://sites.google.com/site/sustainablecorn/publications>

Disclaimer for University Produced Materials

This is the most recent statement (as of 22 Nov 2011 via the USDA). You may use this or another version provided by your University. This is included here as a reference, if needed.

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The Cropping Systems Coordinated Agricultural Project (CSCAP): Climate Change, Mitigation, and Adaptation in Corn-based Cropping Systems is a multi-faceted, complex project aimed at answering questions important to researchers, policy makers, and citizens. To provide results and recommendations to others, we must work cooperatively in sharing and publishing data. Primary data, whether collected in field research plots, surveys, or landowner meetings, are needed for secondary analysis, e.g. crop, climate, and societal analyses and modeling.

Use of primary data must be authorized by the data owners prior to publication. A reasonable amount of time must be given to primary owners of data to publish in their respective journals. It is expected secondary users of the data will know their journal's stipulations regarding the disclosure of the dataset at time of publishing. This is an important clarification so that any published work on modeling does not unknowingly disqualify future publications of the dataset from occurring.

It is the role of the data owner to assure the data is of highest quality with no known errors or changes expected to occur once it is uploaded to the team database. Secondary users may access and initially work with data contained in the database but must obtain PI agreement prior to publication.

We affirm that it is highly desirable the owners of data be given an opportunity to review and comment on all publications that utilize their data. The primary data owners will improve the quality of analyses and the papers that describe them by providing insights into the quality and meaning of the data, the nature of the physical systems that they represent, and proper and correct use of the data.

Toward this end, data owners should be given a period of at least twenty-one (21) days to review and comment on publications that utilize their data prior to journal submission. In some circumstances this may not be possible, such as use of data in special submissions that have a firm deadline, but such circumstances should be rare exceptions. Ordinary journal submissions should be made only after review by the data owners and a discussion between the analysts and data owners of any comments resulting from the review. Owners of primary data are not, however, invested with the power to veto or delay a submission through inaction. It is expected that all members of the team will work together in a collaborative and supportive way, resulting in a large number of publications of superior quality.

Authorship of primary data owners should be as outlined in Category 1, point 3 (page 2); in which data owners should be listed alphabetically following authors of the paper. Authors using datasets benefitting from compilation, visualization, interpretation, analysis, or synthesis performed by the data team should consider including data team members as authors as appropriate.

I have discussed this publication with all involved data owners and have followed the guidelines as stated in this document for my specific type of publication.

Title of Publication: _____

Publisher: _____

Lead Author of Publication: _____ Date _____

I agree to use of the data, which was collected by myself and/or my team, for use in the lead author's publication. My name, or someone on my team, will be included in the author list for this publication.

Note: This form is designed for electronic signatures; simply click within each box to sign.

Data Owners:		
Printed Name	Signature	Date
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U.S. Department of Agriculture

The Climate and Corn-based Cropping Systems CAP (Sustainable Corn CAP) is a USDA-NIFA supported program, Award No. 2011-68002-30190. It is a transdisciplinary partnership among 11 institutions creating new science and educational opportunities. The Sustainable Corn CAP seeks to increase resilience and adaptability of Midwest agriculture to more volatile weather patterns by identifying farmer practices and policies that increase sustainability while meeting crop demand.



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