



Quarterly Progress Report

**Regenerating America's Working Landscapes
to Enhance Natural Resources and Public Goods
through Perennial Groundcover**

Report No. 12 | May 1, 2024 - Jul. 31, 2024

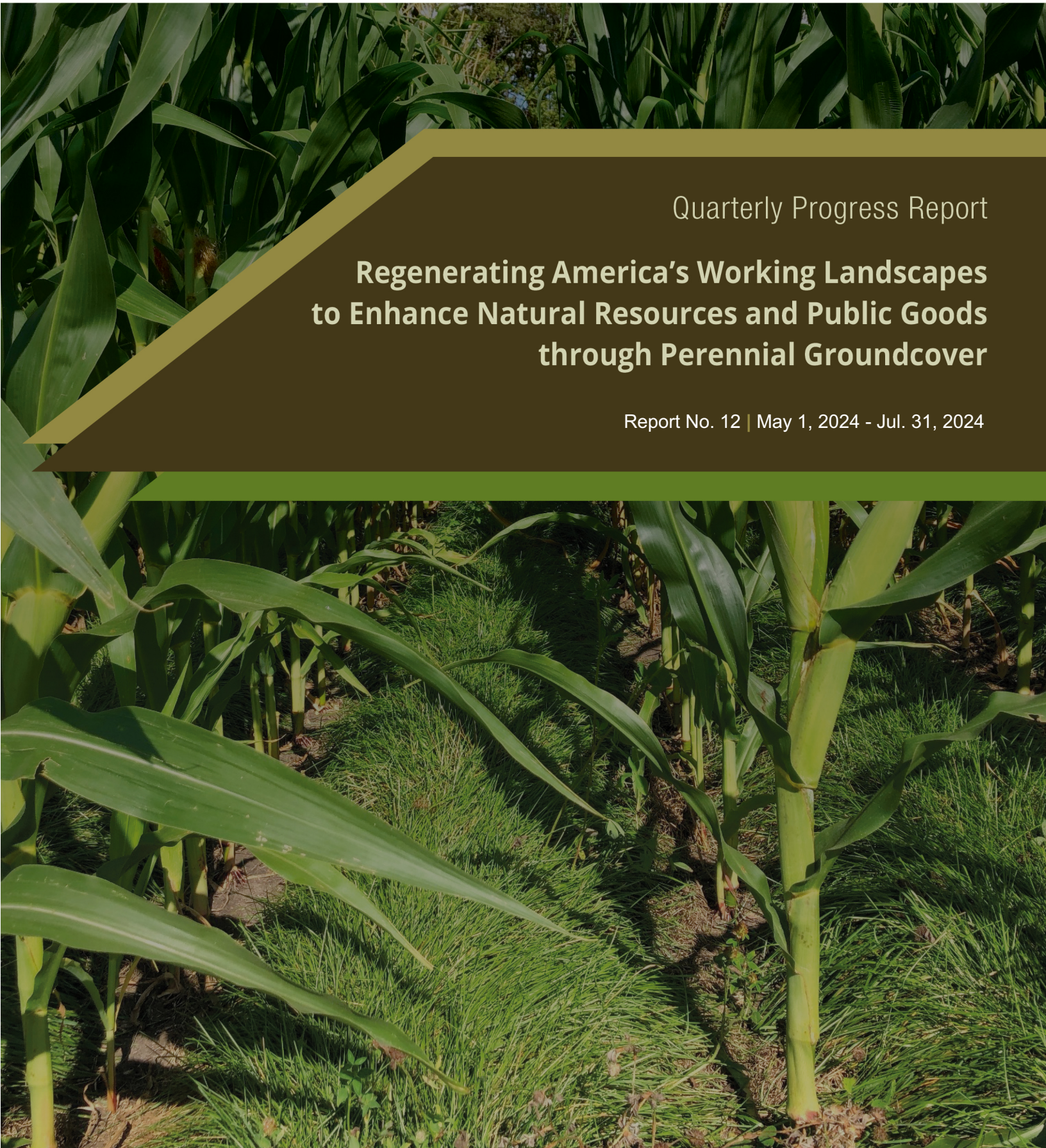


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For more information, visit www.regenpgc.org

ACKNOWLEDGMENT

Regenerating America's Working Landscapes to Enhance Natural Resources and Public Goods through Perennial Groundcover (RegenPGC) is supported by Agriculture and Food Research Initiative Competitive Grant No. 2021-68012-35923 from the USDA National Institute of Food and Agriculture. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the U.S. Department of Agriculture.

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ABSTRACT

Achieving the SAS program goal of transforming the US agricultural system to sustainably increase production by 40% requires large-scale production agriculture across multiple crops to profoundly change its bare-soil winter-fallow practices. These conventional practices negatively impact soil health and natural resources conservation – the pillars of agricultural systems sustainability. A scalable solution to this challenge is the implementation of perennial groundcover (PGC) cropping systems, which use an ecologically complementary, permanent groundcover in fields where annual cash crops are grown. This transformative approach to large-scale agricultural production increases the duration and extent of groundcover on cropland, enhancing resiliency and improving the quality of water, air, and soil. Working closely with farmers, NGOs, and industry stakeholders, this project will develop and refine PGC approaches enabling high-yielding row-crop production while improving soil and water quality, providing large increases in the availability of lignocellulosic feedstocks, and preserving or increasing farm income. This project will develop best management practices for growing crops and suppressing weeds with PGC, develop improved crop and groundcover genetics, develop appropriate soil and nutrient management practices, quantify the environmental impacts, and determine the policy and socioeconomic implications of adoption of PGC approaches. Knowledge gained through this project will be used to educate a new generation of undergraduate and graduate students who recognize the opportunities to enhance agriculture using perennial groundcovers. We will provide a multi-pronged extension effort using a combination of hands-on field days, farmer meetings, and online resources to educate practitioners about the opportunities and challenges of the system.

Regenerating America's Working Landscapes to Enhance Natural Resources and Public Goods through Perennial Groundcover (RegenPGC)

AFRI Competitive Grant No. 2021-68012-35923

Year 3 – 4thnd Quarter Project Activities

April 1, 2024 – July 31, 2024

PROJECT ADMINISTRATION AND GOVERNANCE

1. Actual Accomplishments

- **Meetings**

PD Raman attended the 2024 SAS CAP Meeting at the University of Wisconsin-Madison (UW-Madison) campus, along with Deputy Director Kinzel and Ph.D. candidate Gabriele Myers.

PD Raman attended and or hosted the following project meetings:

- Theme Leader Meetings – Ad hoc (averaging 1 per week)
- Deputy Director meetings – Weekly
- Data Management – Monthly
- Budget Updates – Monthly
- All CoPd Meetings – Quarterly
- Meetings with Objective Leaders – Ad hoc (two or three per quarter)
- Meetings with the External Evaluator to discuss strategy, results, logic models – Ad hoc
- Stakeholder Advisory Board Meetings – We hosted a virtual meeting (June 17, 2024) to introduce a new member (POET), brief the board on recent project highlights, and discuss plans for the Year 3 Annual Meeting.

- **Educational Activities**

- Successfully mentored Philip E. Rockson to completion of his M.S. degree in Agricultural and Biosystems Engineering (ABE) at Iowa State University (ISU) (co-

- mentored by Extension Theme Leader Daniel Andersen). Rockson will continue his graduate education at ISU.
- Successfully mentored Gabrielle M. Myers to completion of her Ph.D. degree in ABE at ISU (co-mentored by Ext. Theme Leader Daniel Andersen).
 - Participated in the Research Experience for Undergraduates (REU) / Research Experience for Teachers (RET) summer 2024 welcome events.
 - Gave a focused talk on the RegenPGC vision and progress to REU/RET participants.
 - Held bi-weekly meetings with an ISU first-year engineering student honors student who continued working on small-scale erosion experiments with graduate student Oluwatuyi Olowoyeye (Ecosystem Services and Modeling Objective).
 - Attended and participated in several RegenPGC Graduate Student Community meetings.
 - Led a 2-day RegenPGC grad student tour (10 total students) of The Land Institute. (TLI)
- **Outreach Activities**
 - Speaker at ISU Graduate College *Emerging Leader Academy* (4 h session with ~ 12 graduate students).
 - Keynote speaker at ISU College of Agriculture and Life Sciences *Open Academy Team Science Conference*.
 - **Project Leadership**
 - Continued working with the team to better articulate PGC (i) instance, (ii) intensity, and (iii) context.
 - Continued to work with the team on re-budgets where appropriate.

2. Plans for Next Quarter

Successfully conduct a Year 3 Annual meeting and continue progress on many items listed above.

THEME 1. RESEARCH AND DEVELOPMENT

The cross-cutting Research and Development Theme focuses on establishing organizational structures for data management and modes of communication among the research teams and individual participants – the foundation of integrated research. **Brandon Schlautman** (The Land Institute) leads this theme.

1. Planned Activities

- Collaborate with an ISU graduate student and Corteva staff to curate data from on-farm research trials in preparation for the October 2024 annual meeting at the University of Missouri-Columbia (MU).
- Apply appropriate planned PGC suppression practices to the network of small-plot trials in Iowa, Nebraska, Kansas, and Kentucky.
- Use large publicly available crop image datasets for corn and grass+clover mixtures to refine the PGC machine learning image model further.

2. Actual Accomplishments

- Selection of a core meta-data ontology to be collected for all on-farm and small-plot research trials within the RegenPGC framework. Identified an ISU graduate student willing to manage communications and data collection among farmers and researchers. Improved framework in AirTable for managing collected meta-data.
- Many new trials (e.g., Ames, IA) and new locations (e.g., University of Kentucky) were established this growing season. All PGC trials were suppressed using a previously developed methodology (i.e., Liberty herbicide), but new suppression timings and rates were tested at some locations.
- A refined machine learning algorithm was developed using expanded publicly available crop image datasets, including pictures of corn and grass+clover images.
- These datasets were augmented with PGC images collected from trials in 2022 and 2023. The algorithm was applied to suppression trials in Kentucky and PGC variety trials in Ames, IA.

3. Explanation of Variance

None noted.

4. Plans for Next Quarter

- Continue to focus on the flowing activities:

- Data Management
- Characterizing PGC quality.
- Moving PGC establishment and suppression practices up the technology readiness scale.
- RegenPGC research cross-cutting research

5. Publications, Presentations, Stakeholder Engagement, Proposals Submitted

• Publications

Meyering, Bryce B. (2024). *Machine Learning algorithms for image-based data acquisition of perennial groundcover establishment, cover, and quality in agricultural research trials*. [Master's Thesis, Georgia Tech University].

• Stakeholder Engagement

- Follow-up discussions with POET about pilot PGC projects.
- Conversations with *Pheasants Forever* about perennial cover crops potentially creating habitats for insects necessary in young gamebird diets.

THEME 2. EXTENSION

This cross-cutting theme extends the project's reach by developing a robust platform to share science-based knowledge, existing and potential commercial opportunities, and policy recommendations to an expanded set of stakeholders. **Dan Andersen** (Iowa State University) leads this theme.

Our comprehensive extension education efforts, which are geared towards ensuring and strengthening PGC adoption, target five stakeholder groups:

- Extension educators
- Farmers
- Technical service providers and crop advisers
- The scientific community
- The general public

1. Planned Activities

- Develop a draft protocol for demonstrating no-till planting row units and what will be measured to help ensure success, encourage project collaboration, and work to find collators for demonstration next spring (Q2).
- Publish online on-farm soil health assay documentation and develop a “citizen science” data-sharing platform. Expand the list of assays developed and create a Google Form for sharing results (Q1).
- Develop an on-farm test protocol to help farmers evaluate how to set up trials on their farms (Q2).

2. Actual Accomplishments

- Fall field day at Nashua, Iowa, with local farmers (42 attendees) showing the perennial groundcover crops with discussions on opportunities and challenges of implementing. We also discussion of soil health.
- Fall Ames Field Day with 15 participants on perennial ground cover. I was videotaping to turn field day into a virtual experience.

3. Explanation of Variance

None noted.

4. Plans for Next Quarter

- Develop a perennial ground cover module for the *Crop Advantage* series in Iowa.
- Develop a draft protocol for demonstrating no-till planting row units and what will be measured to help ensure success, encourage project collaboration, and work to find collators for demonstration next spring (Q2).
- Publish an on-farm trial guide.
- Virtual Field Day in the spring to show soil temperature and soil moisture in control vs perennial ground cover strips.

5. Publications, Presentations, Stakeholder Engagement, Submitted Proposals

• Presentations

- On June 13, 2024, the Blackhawk Iowa Southwest Conservation District sponsored a perennial ground cover where field day speakers presented information about the

Kentucky Bluegrass (KBG) establishment and management, and future ground cover research goals.

- On July 24, 2024, RegenPGC held a field day in Corning, Iowa, at perennial ground cover sites, where we reported initial results on yield and held a water quality demonstration. Also held Applicator Certification training to demonstrate soil health improvements and discuss impacts on nutrient movement and nitrogen use efficiency.

THEME 3. EDUCATION

The cross-cutting Education Theme coordinates educational efforts impacting students from pre-college to undergraduate and graduate students at multiple institutions. The aim of each of the educational programs is tuned to the audience. The Educational Theme Coordinator and the project Objective Leaders will ensure that these programs are not siloed and provide rich cross-disciplinary training and engagement opportunities for undergraduate and graduate students to meet the workforce education and training requirements to adopt PGC production systems successfully.

Ken Moore (ISU) leads this theme, and **Maureen Griffin** (ISU, focused on the REU and RET programs), **Dennis Miller** (independent contractor, focus on FFA), and **Maya Hayslett** (ISU, focus on 4H) serve as collaborators.

1. Instructional Development (Moore)

Development of instructional materials will continue. Modules will be shared in the Teams directory as they are finalized.

A. Planned Activities

Instructional development. (Moore) Development of instructional materials will continue. Modules will be shared in the Teams directory as they are finalized.

B. Actual Accomplishments

Development of instructional materials related to the science and practice behind PGC systems to be used at all levels of instruction is ongoing.

C. Explanation of Variance

No variance was encountered.

D. Plans for Next Quarter

Development of instructional materials will continue. Modules will be shared in the Teams directory as they are finalized.

2. Research Experience for Undergraduates Program (Griffin)

Undergraduate interns will participate in coordinated summer research experiences.

A. Planned Activities

The program kicks off with participants arriving on campus, settling into apartments, and starting summer learning with Griffin and Hall, the professional development team. The REU students will meet their mentors on June 11th for field and lab work. They will be joined by the RET participants on June 19, 2024, for three days of professional learning with the entire cohort of 24 educators. Plans to complete the Intercultural Development Inventory (IDI) and engage in learning sessions with our DEI lead, Theresa Cooper, are scheduled. A summer events calendar is attached. Highlights include a talk by Will Richardson early on, focusing on reshaping the school experience for modern times. Mid-summer Mark Windschitl, professor of science teaching and learning at the University of Washington, will connect the REU students' research skills to future classroom teaching, particularly on the topic of climate change education.

B. Actual Accomplishments

This summer, the REU program included University of South Florida and Wartburg College participants. The cohort featured a rising senior and a rising sophomore, majoring in elementary education and secondary biology, respectively. Both students completed an eight-week research experience in the labs of Drs. Raman and Fei. In the labs, an effort was made to support the development of our graduate students' leadership skills, as we emphasized the importance of mentor/mentee relationships and organized weekly meetings with structured conversations. Due to the RegenPGC REU program's popularity and success, we expanded the REU cohort with support from an NSF EPSCoR-funded grant, adding three more REU participants, which enriched the summer experience for all involved.

Additionally, three RET participants joined the RegenPGC research project. (see summary below). Post-program surveys and focus groups are still in progress, with results scheduled to be presented at the annual meeting in October. All planned events were successfully executed, and based on anecdotal evidence, the summer program was highly successful across all metrics. (See the RET webpage at <https://www.regenpgc.org/theme-3-education/2023-ret-reu-programs/>. See the RET summer cohort poster and final reflections at <https://boec.biotech.iastate.edu/2024-ret->

[participants/](#). Plans are being made for participants to stay connected throughout the academic year individually and as a group.

C. Explanation of Variance

We completed all planned activities.

D. Plans for Next Quarter

Our commitment to maintaining ongoing connections with the REU students will be realized through several communication avenues. A prominent one is our monthly meeting, scheduled for the second Tuesday of each month (SToM), during which a speaker from the summer program will share insights and lead discussions with the group. Additionally, REU students have the option to engage with Griffin every other week in virtual one-on-one meetings. Griffin's guidance is designed to assist them as they embark on education courses, practicum experiences, and student teaching endeavors. Among our participants, we are providing supplementary support to two seniors. They will be awarded a \$500.00 mini-grant to further their educational journeys, aiding their student teaching in the upcoming fall and spring terms. To maintain a sense of unity and continued learning, we have planned a virtual learning day on November 9th. This event will bridge the REU students with the RET participants and their mentors.

Moreover, we plan to incorporate the REUs' summer experience at the RegenPGC annual meeting, slated for October. Finally, Griffin will work to consolidate the post-program survey information provided by REU mentors and participants and cooperate with our external evaluator, Heather Dantzker, to consolidate the post-program focus group data. All data is used to improve programming, the participant and mentoring experience, and overall satisfaction with the program goals.

3. Undergraduate Internship Program (Moore)

This program was again discontinued due to insufficient interest by undergraduate students working in project co-director labs.

4. Research Experience for Teachers Program

The RET program is aimed at middle and high school teachers working with underrepresented students. We will recruit and encourage future post-secondary students interested in developing sustainable agricultural systems.

A. Planned Activities

The program kicks off with participants arriving on campus, settling into apartments, and starting summer learning with Griffin and Hall, the professional development team. The

RETs will meet their mentors on June 21st for field and lab work. They will be joined by students on June 19, 2024, for three days of professional learning with the entire cohort of 24 educators. Plans to complete the Intercultural Development Inventory (IDI) and engage in learning sessions with our DEI lead, Dr. Theresa Cooper, are scheduled. A summer events calendar is attached. Highlights include a talk by Will Richardson early on, focusing on reshaping the school experience for modern times. Mid-summer Mark Windschitl, professor of science teaching and learning at the University of Washington, will connect REU students' research skills to future classroom teaching, particularly on the topic of climate change education.

B. Actual Accomplishments

Three local teachers—a high school math teacher, an elementary math and science teacher, and an elementary special education teacher—participated in the Regen RET program this summer as part of a larger cohort of 19 teachers. They shared inspiring reflections on their experience: “I am motivated to create lessons that integrate environmental themes into mathematical problem-solving activities. I want my students to understand the real-world relevance of math.” Another teacher remarked, “This program has given me a glimpse into the world of science through the eyes of a researcher. Research is a dynamic, constantly evolving field involving encountering errors, repeating experiments, and engaging in continuous learning.” These teachers had a six-week research experience and were provided weekly professional development to support returning their research to the classroom. All planned events were successfully executed, and based on anecdotal evidence, the summer program was highly successful across all metrics. The link to a website featuring participants is [here](#). The link to the RET summer cohort poster and final reflections are [here](#). Plans are being made for participants to stay connected throughout the academic year individually and as a group.

C. Explanation of Variance

No variance was encountered.

D. Plans for Next Quarter

As the new school year commences, Griffin will actively engage REU students bi-weekly, providing coaching and mentorship to individuals. Alongside this, the RETs will be involved in the "Second Tuesday of the Month" (SToM) gatherings and are set to participate in a virtual learning day in November alongside the REU students. To facilitate the integration of their summer research experiences into their classrooms, each RET has been awarded a mini-grant of \$500.00 through the RegenPGC funds, and the Office of Biotechnology is offering an additional \$500.00 for a total of \$1,000.00 investment in the teachers. This funding aims to support the transition of their new

learning back to their educational environments. Moreover, each RET will be invited to share their summer experiences at the RegenPGC annual meeting, set to take place in October, alongside their counterparts from the REU program. Our collaboration with the Diversity, Equity, and Inclusion (DEI) coordinator will persist throughout the academic year. This collaborative effort aims to heighten awareness and implement strategies that foster more equitable classroom environments, catering to all students' diverse needs. In line with this, we remain committed to encouraging researchers' involvement in classrooms. By doing so, we hope to share the concepts of sustainable agriculture, underscore the significance of data-driven agricultural stories, and promote the design of experiments that serve as the basis for scientific inquiry. Finally, Griffin will work to consolidate the RET post-program survey information provided by mentors and participants and cooperate with our external evaluator, Heather Dantzker, to consolidate the post-program focus group data. All data is used to improve programming, the participant and mentoring experience, and overall satisfaction with the program goals.

5. Graduate Student Community (Moore)

Build a community of graduate students engaged in topics broader than their research.

A. Planned Activities

The graduate student community will not meet regularly over the summer as students are actively engaged in their research projects. However, they will get together for social events, and a picnic is scheduled for late June. Some students will participate in field days, while others will participate in K-12 activities over the summer.

B. Actual Accomplishments

The graduate student community did not meet regularly over the summer as students have been actively engaged in their research projects. A Graduate Student Community Picnic was held at Emma McCarty Lee Park on June 20th. The event was organized by Rickiel Franklin, who demonstrated his Brazilian grill master skills. Nearly all locally-based students attended and had a good time (See Photo 1).

C. Explanation of Variance

No variance was encountered.

D. Plans for Next Quarter

The graduate student community plans to resume a weekly seminar schedule this fall semester, which will be folded into the project-wide RegenPGC Café. Each week, a different student will present a seminar on the research they are conducting as part of the

project. Special professional development workshops and other activities will be organized on an ad hoc basis.



Photo 1. RegenPGC Graduate Education Community Summer 2024 Barbeque.

E. Explanation of Variance

No variance was encountered.

F. Plans for Next Quarter

The graduate student community plans to resume a weekly seminar schedule this fall semester, which will be folded into the project-wide RegenPGC Café. Each week, a different student will present a seminar on the research they are conducting as part of the project. Special professional development workshops and other activities will be organized on an ad hoc basis.

Table 1. RegenPGC Fall 2024 Seminar Series.

Date	Speaker	Title
Aug. 30	Cyndi Bartel (ISU CoPd)	Evaluation of Kentucky Bluegrass-Based Perennial Groundcover Implementations in Large-Scale Midwestern US Corn Production Systems
Sep. 6	Memis Bilgici (ISU Grad Student)	Maize Management x Environment and Genotypes Interaction under PGC
Sep. 13	Hallie Sandeen (UK Grad Student)	Perennial Groundcover Species and Management Strategies for Continuous Corn Production
Sep. 20	Prathyusha Cheguri (ISU Grad Student)	A Sustainable Approach to Enhance Ecosystem Services by Interplanting Summer Dormant Grasses with Maize
Sep. 27	Jack Moran (ISU Grad Student)	A Sustainable Approach to Enhance Ecosystem Services by Interplanting Summer Dormant Grasses with Maize
Oct. 4	Rickiel Franklin (ISU Grad Student)	Light Competition in Maize and Perennial Ground Cover Intercropping: The Shade Avoidance Strategy
Oct. 11	Philip Rockson (ISU Grad Student)	Communicating Time and Labor Demands of Cropping Systems
Oct. 18	Kiera Searcy (ISU Grad Student)	Weed Management Strategies for Establishing KBG as a Perennial Cover Crop
Nov. 1	Amina Moro (ISU Grad Student)	Effect of PGC Proximity to Corn Growth, Development and Yield
Nov. 22	Oluwatuyi Olowoyeye (ISU Grad Student)	Towards Ecosystem Service Modeling in a Perennial Groundcover System
Dec. 6	Jacob Miller-Klugesherz (KU Grad Student)	Community Capitals, Conservation Agriculture, & Groundcover Adoption in the U.S. Corn-Belt

6. FFA and 4H Programs (Hayslett, Miller)

This program develops PGC crop production systems curricula for FFA high school students and 4H K-12 participants.

A. Planned Activities

Piloting of a day camp curriculum will be done at three locations over the summer. Revisions to lesson plans will continue with a goal of publishing by the end of the year. Initially, the citizen science program was scheduled to start this summer. Due to low

enrollment, this program will be canceled. We will consider starting the program again next year with a targeted group of youth instead of advertising statewide.

B. Actual Accomplishments

The youth day camp was piloted with a group of 5-6th graders in Shelby County. This was a six-hour program that combined lessons from the Water Connects Us All curriculum as well as the new RegenPGC lessons. The pilot feedback will be used to improve the day camp curriculum. (Miller) A flyer was developed to inform Agriculture Teachers/FFA Advisors about the curriculum materials that have been developed. Copies of the flyer were printed, and a copy was placed in each of the 263 instructor's folders at the State FFA Convention. The materials were loaded onto a flash drive and taken to the FFA Director. The FFA Director then loaded the materials onto the FFA webpage so all instructors could access them. The FFA Director is trying to make it possible to track which instructors download the materials.

C. Explanation of Variance

Two additional day camp pilots were canceled due to low enrollment.

D. Plans for Next Quarter

Youth programs are scheduled for September 4 in O'Brien County and September 10 in Floyd County. These programs are a collaboration with county ISUEO and 4-H programs. They will reach over 200 high school aged students with hands-on activities to inform them of the benefits of perennial groundcover, including the concept of perennial groundcover. Revisions to lesson plans will continue with a goal of publishing by the end of the year. Discussion will continue on the possibility of trying a citizen science project with a targeted audience next year.

E. Publications, Presentations, Stakeholder Engagement, and Proposals Submitted

Stakeholder Engagement

A Perennial Groundcover Youth Day Camp for 5-6 graders was held in Shelby County, Iowa (June 11, 2024).

THEME 4. COMMERCIALIZATION

Our goals are to:

- Work with Project Director Raj Raman and Deputy Director Anne Kinzel to engage stakeholders by establishing a Stakeholder Advisory Board (SAB) and a Farmer/Landowner Advisory Group (FLAG).
- Establish on-farm trials and conduct field days with producers to gain input and advice on how to make PGC approaches more practical, reliable, and profitable.
- Engage ag sector commercial entities in research partnerships and further identification of investment and development opportunities.

Sara Lira (Corteva Agrisciences) leads this theme.

1. Planned Activities

- Continue engaging with on-farm cooperators.
- Continue sequencing project for *Poa bulbosa*.
- Continue data collection in on-farm and research trials.
- Continue ongoing summarizing soil and plant data collected for growers.

2. Actual Accomplishments

- Continued engaging with on-farm cooperators.
- Continued sequencing project for *Poa bulbosa*.
- Hired a part-time agronomist (Brent Wilson, Corteva).
- Data collection continues as an ongoing activity, but we are caught up on milestones.
- Research sites are being managed.

3. Explanation of Variance

None noted.

4. Plans for Next Quarter

- Continue working with cooperators to collect yield and practice information.
- Continue data collection in on-farm and research trials.
- Continue summarizing soil and plant data collected to date for growers for 2024 and beyond planning.

5. Publications, Presentations, Stakeholder Engagement, and Proposals Submitted)

None to this quarter.

OBJECTIVE 1. CROP ECOLOGY & MANAGEMENT

This Objective focuses on developing and testing best management practices for cash crop establishment in PGC systems and managing the transition from current practices. Objective 1 will improve PGC economics by tuning and integrating groundcover and cash crop management, thereby reducing risk. The primary goal is to elucidate key mechanisms related to a) cash crop and perennial ground cover interference (PGC), b) early cash crop growth and development in PGC systems, and c) pest dynamics.

Erin Haramoto (University of Kentucky) and **Scott Flynn** (Corteva Agrisciences) lead this Objective. Collaborators are **Lucas Borrás** (Corteva Agrisciences), **Susana Goggi** (ISU), **Ken Moore** (ISU) and **Jose Rotundo** (Corteva Agrisciences).

1. Planned Activities

- **Kentucky**
 - Hallie Sandeen (Graduate Student) will submit a grant proposal to Southern SARE (May 2024).
 - Plant corn and spray pre-emergence herbicides in all trials. All trials except Kiera Searcy's (Graduate Student) corn herbicide trial will receive a blanket application of the same product and rate. Searcy's corn herbicide trial will receive different pre-emergence herbicide treatments.
 - Take plot and overhead photos to estimate the degree of suppression.
 - Collect grass biomass samples prior to corn canopy closure.
 - Collect corn plant samples at the V3 stage to measure height, internode distance, and root and shoot biomass.
 - Measure insect herbivory at V3.
 - Assess corn stand and plant development.
 - Implement an additional trial on the number of suppression applications that PGC can tolerate.

- **Iowa**
 - Corn will be planted in the remainder of PGC experiments.
 - Chemical suppression treatments will be applied at appropriate timing in PGC plots.
 - Nitrogen fertilizer will be banded over corn rows.
 - Herbicides will be banded over corn rows to reduce weed competition in most PGC experiments. This is an expansion of successful weed control observed in one experiment last year.
 - Data collection will begin on all plots, including plant height, date of emergence, biomass of PGC, soil water content, and many other measurements.
 - Field tours will begin in June for various groups interested in PGC.
 - Assessments will be made on continuing research on some experiments without a principal research graduate student assigned to them because of the weak performance of treatments. Data will be taken on plots before abandonment to sort out any valuable information for future research.

2. Actual accomplishments

- **Kentucky**
 - Hallie Sandeen submitted a grant proposal to the Southern SARE graduate student research proposal program (May 2024).
 - In May 2024, corn was planted into all trials. Pre-emergence herbicides were also applied. All trials except Kiera Searcy's corn herbicide trial received a blanket application of Storen. Kiera Searcy's corn herbicide trial receives different pre-emergence herbicide treatments.
 - Students continued with plot and overhead photos to estimate the degree of suppression. Students also worked with Bo Meyering to develop protocols that quantify the degree of suppression.
 - Grass biomass was collected prior to the corn canopy closure
 - Students collected corn plant samples at the V3 stage to measure height, internode distance, and root and shoot biomass. Students also measured insect herbivory and assessed corn stand and plant development (height, growth stage, SPAD readings).

- We implemented an additional trial on the number of suppression applications that PGC can tolerate.
- Trials were irrigated through June and July as very dry conditions stressed corn.
- Weeds were counted, and POST herbicides were applied to the corn herbicide trial. Other trials did not need POST herbicide application as weed pressure was very low.
- Students presented at the *University of Kentucky Pest Management Field Day*.
- **Iowa**
 - Corn was planted in the remainder of the PGC experiments.
 - Chemical suppression treatments were applied at appropriate timing in PGC plots. Suppression chemicals were used at higher rates than in previous years in some experiments based on the experience of other researchers with promising results.
 - Nitrogen fertilizer was banded over corn rows per experiment protocols.
 - Herbicides were banded over corn rows to reduce weed competition in most PGC experiments. This resulted in decent residual weed control in tilled strips.
 - Data collection began on all plots, including light reflectance, plant height, date of emergence, biomass of PGC, soil water content, and many other measurements.
 - Assessments were made on continuing research on some experiments. Two experiments were discontinued because of the weak performance of treatments. However, visual observations were noted on promising characteristics in these experiments for future consideration of new experiments.

3. Explanation of Variance

- Kentucky experienced extremely hot and dry conditions during June and July. The grass in all trials was not suppressed as we expected, leading to increased competition with the corn. Irrigation was applied starting in late June. Hopefully this was sufficient so plots will have harvestable yield.
- No field days were held during the May – July period in Iowa.

4. Plans for Next Quarter

- **Kentucky**
 - **August**

- Continued monitoring of corn development in all trials
- Students start fall classes
- **Early to mid-September**
 - The second year of student trials focused on PGC establishment (PGC species and PGC herbicide) will be planted into perennial grasses.
 - Pre-emergence herbicides will be applied to the PGC herbicide trial as per treatment protocols.
 - Additional Kentucky bluegrass will be planted for use in summer 2025 experiments.
 - All newly planted grasses will be irrigated as needed.
- **Late September**
 - Students will measure the proportion of plants in each plot that produce a viable ear. Students will also assess stalk rot.
 - Students will monitor grass emergence in newly planted experiments. When the grass starts to emerge, students will begin taking overhead photos to quantify the groundcover development.
- **Mid-October**
 - Corn will be harvested in all plots.
 - Using the grid approach, students will continue with overhead photos of new grass and quantify groundcover produced by grass and weeds.
- **Late October**
 - Students and co-PD Haramoto will attend the annual RegenPGC project meeting in Missouri. Students will give presentations on their research findings to date.
 - Students hold committee meetings.
- **Iowa**
 - We will travel to ISU for a RegenPGC Field Day on August 14, 2024, to review current plot work.
 - Data collection will continue as appropriate by study.

- New grass seedings will be made to accommodate research conducted in the Year 1 PGC establishment.
- Appropriate plots will be harvested with a plot combine, and grain yield will be determined.
- Some experiments will be hand-harvested, and individual plant grain yield will be determined.
- Data will be analyzed in preparation for grad student presentations at national professional meetings in November.
- The second year of a study looking at the seeding rate and ratio of single or binary combinations of KBG and perennial ryegrass will be seeded.
- ISU Co-PD's, collaborators, and graduate students will attend the annual RegenPGC project meeting in Columbia, Missouri.

5. Publications, Presentations, Stakeholder Engagement, Submitted Proposals, and

- **Presentations**

Sandeen, Hallie & Searcy, Kiera. (2024, June 27). *Overview of perennial groundcover projects in Kentucky*. [Field Day presentation]. University of Kentucky Pest Management Field Day, Princeton, KY., United States. 80 attendees.

- **Proposals**

Sandeen, Hallie. *Evaluating perennial grass species and spring management for permanent groundcover in annual cropping systems*. Submitted to Southern SARE Graduate Student Grant Program, May 10, 2024.

OBJECTIVE 2. PLANT BREEDING & GENETICS

This Objective focuses on PGC cropping system optimization by screening for superior groundcovers and maize hybrids that minimize competition as each occupies its own temporal or spatial niche. This can enhance PGC's economic viability through yield improvement and reduced management requirements while increasing ecosystem impacts via reduced chemical inputs. Our work will also enable the design of novel breeding strategies and the development of dedicated breeding programs for PGC hybrids and varieties.

Shuizhang Fei (ISU) and **Thomas Lübberstedt** (ISU) lead this Objective, and **Brandon Schlautman** (TLI) and **Sara Lira** (Corteva Agriscience) serve as collaborators.

Shuizhang Fei Group

1. Field Trials

Field trials evaluating the compatibility of various PGC species with corn are ongoing. The following is a list of active trials:

- This field trial evaluates the suitability of 4 *Poa* species, including 10 KBG cultivars or cultivar blends, one Radix Hybrid Bulbosa cv. PB55, a blend of Sandberg bluegrass, cv. 'Vale' and cv 'Hanford' and two cultivars of rough bluegrass ('Havana' and a naturalized population) entered its 2nd year with maize hybrid P1185 planted. Data on ground coverage and red/far red ratio of reflective lights of PGC are being continuously collected. Maize seedling count, plant height and staging, and leaf chlorophyll content are measured.
- The field trial evaluating the compatibility of five cultivars of Sandberg bluegrass with maize and the field trial evaluating the compatibility of 10 warm-season plant species with maize also entered their second year. Maize F1 hybrid P1185 was planted. Data on ground coverage and red/far red ratio of reflective lights of PGC are continuously being collected. Maize seedling count, plant height and staging, and leaf chlorophyll content are measured.
- The split-plot field experiment investigating the effect of species/cultivar and suppression method on the persistence of PGC and their impacts on maize growth and development entered its first full year. Grass-free tillage zones were created, and maize hybrid P1185 was planted. Species/Cultivars include KBG (*P. pratensis*, cv. 'Milagro'), tall fescue (*Festuca arundinaceae*, 'FNKY,' a dwarf cultivar, and 'Chisolm,' a summer-dormant cultivar), Sandberg bluegrass (*P. secunda*, cv. 'High Plains' and 'Vale,' both summer dormant), Radix Hybrid Bulbosa (cv. 'PB343', a summer dormant cultivar), hard fescue (*F. ovina*, cv. 'Tenacity') and creeping red fescue (*F. rubra* cv. 'Boreal'). The main plot looks at suppression methods, i.e., no suppression or suppression with the herbicide "Liberty," but no suppression was applied this year due to the young age of the PGC. The split plot is for species/cultivar, and a no grass control is replicated four times. No data is being collected.
- Space plant trials of *Poa bulbosa* with 81 accessions and *P. secunda* with 154 accessions are ongoing. Data on key agronomic traits, including the onset and release of summer dormancy, tillering capacity, disease incidence, leaf genetic color, and persistence, are being collected.
- Two additional observational field trials are also being conducted: a) *Poa bulbosa* cultivar evaluation trial with 20 entries was established on September 7, 2022. Data on the

percentage of ground coverage, genetic color, and summer dormancy duration are being collected; b) an observation trial evaluating the summer dormancy in tall fescue ('Chisolm,' 'FNKY'), orchardgrass ('Suma-Dorm'), *Poa secunda* ('Vale' and 'High Plains'), *Poa trivialis* ('Havana') and *Poa bulbosa* ('PB343') was established on September 13, 2023. This is a non-replicated trial with a 20 x 22.5 ft plot size.

Observations were made on summer dormancy and winter injuries. We found no freezing injuries to any entries being tested. Surprisingly, neither the Chisolm tall fescue nor the Summa-Dorm orchardgrass, two cultivars known to exhibit summer dormancy in other regions, showed any signs of summer dormancy in our location, suggesting the relatively cool, wet summer prevented summer dormancy in these two cultivars.

2. Germplasm Collection

The PI Fei collected more than 50 unique *Poa bulbosa* from the wild in Washington, Oregon, and Idaho in late June 2024. Additional plants were collected by colleagues in the states of Utah and Montana. These collections are currently being characterized for subsequent breeding and genetics studies.

3. Genome Sequencing

Genomic sequencing for *Poa bulbosa* was performed by Corteva Agriscience on a USDA GRIN accession. Genome assembly and genome analysis will be performed soon. A finished reference genome is a valuable resource for genetic analysis of summer dormancy and germplasm improvement in *Poa bulbosa*.

4. Growth Chamber Studies

- **Study of reproductive mode in *Poa bulbosa*:** We have determined photothermal conditions that induce true flower formation. With this information, we have successfully obtained true hybrid seed instead of the usual bulbils expanded the research to include more accessions to generate publishable results. These results will help us to improve the species through traditional plant breeding. We are studying the dormancy behaviors of bulbils and true seeds.
- **Vernalization requirement in *Poa secunda*:** We are currently studying the vernalization requirement in three commercially available *Poa secunda* cultivars ('Vale,' 'High Plains,' and 'MT-1') and their winter hardiness.

5. Plans for Next Quarter

Active research and data collection in all field trials will continue throughout the rest of the summer.

We will work with Corteva to sequence the genome of another *Poa bulbosa* entry and sequence the genome of a genotype of the *Poa secunda* cultivar, ‘High Plains.’

6. Student Advising

Table 2. Dr. Shuizhang Fei - Graduate Student Advising & Undergraduate Student Education

Name	Degree Program and Major	Year Started
Prathyusha Cheguri	Ph.D., Genetics & Genomics	Fall 2022
Bandana Bhusal	Ph.D., Bioinformatics & Computational Biology	Summer 2023
Vipul Kumar	Ph.D., Plant Breeding	Fall 2023

7. Publications, Presentations, Stakeholder Engagement, and Submitted Proposals

None this quarter.

Lübberstedt Group

1. Research Report

A. Genotype x Management Interactions with Experimental Hybrids

We conducted a comparative study involving 52 experimental hybrids derived from the BS39-DH lines from ISU alongside two hybrid checks from Corteva in the 2023 and 2024 growing seasons. The experiment was carried out in a Lattice design (6X9) in the project in both perennial groundcover (PGC) and conventional locations across three different environments in Iowa (IA), Nebraska (NE), and Kansas (KS). Within NE and KS, two distinct types of PGCs were used: grasses and clover. During the study, we collected five ear cobs in Iowa (IA), Nebraska (NE), and Kansas (KS) for image analysis in each central two rows of four rows of plots and put them in the dryer rooms. All locations were harvested in collaboration with Dr. Brandon Schlautman and Dr. Sara Lira. For 2024, we established a new PGC (*Poa bulbosa*) site in IA in collaboration with Roger Hintz.

We visited the 3 locations in Iowa (IA), Nebraska (NE), and Kansas (KS), comparing PGC versus conventional methods. We collected and scored some measurements such as stand count and cover crops coverage percentage. We measured Ames (IA) locations early stage of maize plant height, leaf area, and so on to make a correlation with the growth chambers study. We found that positive correlation and statically significant result between PGC corn and the growth chambers study.

Please find the link <https://boec.biotech.iastate.edu/past-projects/>.

We collected flowering dates of maize (Conventional, KBG-PGC, and *Poa bulbosa*-PGC) in Ames, IA. We will measure and score late-stage maize traits such as plant height, ear height, chlorophyll content, leaf angle, etc.

B. Growth Chamber Studies

In our Growth Chambers Study for ERA Corteva Hybrids (27 hybrids from 1920 to 2023), we researched the impact of low red (R/FR) ratio light versus white light on ERA hybrids using growth chambers. Our findings revealed that light conditions significantly influence key phenotypic traits such as stomata (size, density, and width), plant height, leaf area, stem diameter, root length, chlorophyll content, anthocyanin color on the stem, and dry biomass. We found a statistically significant difference between the R/FR ratio of light and white in all traits we measured.

2. Student Advising

Memis Bilgici completed the Special Topic class. Additionally, we are actively working on the growth chamber study result for ERA hybrids and review paper and data analysis collected this year.

For the RET/REU summer research program, Meggan Lint completed her research experience program in Dr. Lübberstedt’s lab for six weeks on July 26, 2024. *Comparative Analysis of Growth and Development in Maize under Shade (Low Red Far Red Ratio) Light and White Light Conditions Under Perennial Ground Cover Crop (PGC)*

(<https://www.regenpgc.org/wp-content/uploads/2024/08/Mikayla-SampsonPagan-poster-2024.pdf>)

Dr. Elnaz Ebrahimi (ISU) will contribute at one month/year.

Table 3. Dr. Thomas Lübberstedt - Graduate Student Advising & Undergraduate Student Education

Name	Degree Program and Major	Year Started
Memis Bilgici	Ph.D., Plant Breeding	Fall 2022
Leticia Prada de Miranda	Visiting Ph.D. Student	Fall 2023 (-10/2024)
Yu-Ru Chen	Post-Doc	12/2023-12/2025
Diego Caixeta	Visiting Ph.D. Student	Spring 2024 (-8/2024)

3. Publications, Presentations, Stakeholder Engagement, and Submitted Proposals

None this quarter.

OBJECTIVE 3. SOIL HEALTH & NUTRIENT MANAGEMENT

Objective 3 focuses on understanding how and quantifying the degree to which different PGC approaches impact soil health and nutrient use/loss. Because soil health drives crop productivity and environmental impacts, this knowledge is crucial to better managing PGC systems and characterizing the indirect economic benefits associated with PGC, which inform policy and deployment. **Marshall McDaniel** (Iowa State University) and **Morgan Davis** (University of Missouri-Columbia) lead this Objective. Daniel Andersen (Iowa State University) serves as a collaborator.

1. Project Planning

We will focus on methods and materials, as well as data analysis.

2. Preliminary Results and Outputs

- Graduate student Max Eness will continue working on his M.S. thesis; he plans to finish and defend by April 2025.
- Project collaborator Patrick Galland, postdoc Cole Dutter, CoPds Shuizhang Fei, Ken Moore, and Marshall McDaniel are working on a publication on KBG varieties and *Poa bulbosa* effects on crop yield and soil water/nutrients. The manuscript will be submitted by December 2024.
- Dutter, Eness, and McDaniel are working on an intensive soil/root sampling manuscript from our June 2023 sampling. The manuscript will be submitted by December 2024.
- Dutter and many others on the RegenPGC team, especially CoPds Sara Lira and Brandon Schlautman, are working on solidifying a 2-3 year dataset from on-farm trials. This will be submitted by May 2025.

3. Explanation of Variance

No variance occurred.

4. Plans for Next Quarter

- Continue work on the objectives stated above.

1. Publications, Presentations, Stakeholder Engagement, Submitted Proposals/Funded Grants

None this quarter.

OBJECTIVE 4. ECOSYSTEM SERVICES AND MODELING

This Objective focuses on quantifying the provision of ecosystem services derived from

PGC implementation. We consider a wide range of ecosystem services, including improved water quality, flood and drought mitigation, protection from soil erosion, carbon sequestration, and biofuel feedstock and/or fodder provision. Quantification is crucial to incentivize farmers for ecosystem services. **Amy Kaleita-Forbes** (ISU) and **Rob Anex** (University of Wisconsin-Madison) lead this Objective. Additional participants are **Randy Clark** (Corteva Agrisciences) and graduate student **Oluwatuyi S. Olowoyeye** (ISU)

1. Quantify Decreased Flood Risk and Improved Drought Resiliency Compared to Conventional Cropping Systems

A. Planned Activities

- Design an indoor rainfall simulation study to estimate runoff from PGC and other ground covers.
- Establish trays for this purpose with different land covers in the greenhouse.

B. Actual Accomplishments

- Different varieties of *Radix Poa Bulbosa* were planted in the greenhouse, but they did not survive. We will repeat the attempt.
- Setting up EPIC models to run data from the 2023 rainfall simulation summer experiment.

C. Explanation of Variance

None noted.

D. Plans for Next Quarter

If covers are established in the experimental trays, begin indoor rainfall simulation experiments.

E. Publications, Presentations, Stakeholder Engagement, Submitted Proposals

- Olowoyeye, Oluwatuyi S., Kaleita, Amy. (2024, July 27-31). *Investigating Ecosystem Services in Perennial Groundcover (PGC) Systems through Rain Simulator Experiments and Modeling* [Oral Presentation]. ASABE Annual International Meeting, Anaheim, CA, United States.

- Olowoyeye, Olowatuyi S. (2024, June 20). *Save Soil with Next-Gen Landcover* [Video Lightning Talk]. Top Ten FFAR Fellowship Lightning Talks. YouTube. <https://youtu.be/357SGkPQIFc?feature=shared>.

2. Quantify PGC Impacts on Water Quality

A. Planned Activities

- Monitor observed erosion at Sorenson Field plots using mesh pads.
- Analyze the resulting data to check the treatment effect of PGC compared to other management practices.

B. Actual Accomplishments

- Collection of data from the erosion pad field plots.
- Laboratory drying of erosion pads to determine the sediment mass.
- Data processing started for data recorded in the Lab.

C. Explanation of Variance

Erosion pad collection is ongoing, and no analysis has been done yet.

D. Plans for Next Quarter

- Complete work on erosion pad data collections
- Analyze the data to check the treatment effect of PGC compared to other management practices.
- Continue calibration of the EPIC model with available data on erosion and runoff.

3. Quantify PGC Ecosystem Service Sustainability Indicators and Compare them with Conventional Systems

A. Planned Activities

- Recruit a new student to work on the project.
- Evaluate experimental data available this fall and develop a modeling plan.

B. Actual Accomplishments

- Efforts to recruit a new graduate student to replace Kailia Topping working on PGC modeling, have so far been unsuccessful. New advertisements have been placed to recruit a new student this fall.
- We held discussions with crop modeling experts to decide if we should continue using the STICS model. No decision has been made.
- We are still reviewing the experimental data that are now becoming available to determine which are most complete and useful for evaluating the impact of PGC on soil moisture available to corn.

C. Explanation of Variance

None noted.

D. Plans for Next Quarter

Continue efforts to recruit a new student to work on the project.

4. Quantify the Limits on PGC Maize Stover Removal

A. Planned Activities

We had not planned to undertake activities during this quarter.

B. Actual Accomplishments

No activities were undertaken this quarter.

C. Plans for Next Quarter

Explore modeling opportunities using GREET.

OBJECTIVE 5: SOCIOECONOMIC IMPACTS AND POLICY

This Objective evaluates the conditions under which the proposed practices are economically sustainable for farmers and input suppliers in the PGC supply chain and wellbeing-enhancing for farmers and consumers. It integrates them by considering how PGC fits into existing policy frameworks. Functionally, the Objective synthesizes information from other Objectives and quantifies the overall value proposition for various versions of PGC. **Cornelia Flora** (Kansas State University) and **Keri Jacobs** (University of Missouri-Columbia) lead this Objective, and **Amani E. Elobeid** (ISU) and **Cynthia A. Bartel** (ISU) serve as collaborators.

Our overall team direction focuses on continuing data discussion and working toward finalizing the data, then communicating it to the Data Management Team.

1. Evaluate the Economic Feasibility of PGC Systems for Maize and Soybean Producers

A. Planned Activities

- Rework the enterprise publication and submit it to *Sustainability* – an invited submission
- Build cover crop adoption maps with correlations with known barriers/drivers.

B. Actual Accomplishments

- *Anticipatory Technoeconomic Evaluation of Kentucky Bluegrass-Based Perennial Groundcover Implementations in Large Scale Midwestern US Corn Production Systems* was submitted as an invited paper to Sustainability MDPI on June 18, 2024, for the special edition *Agronomic Strategies and Crop Resilience in the Face of Climate Change*. The paper utilizes an enterprise budget framework to detail and compare the expected cost and revenue of establishing and maintaining PGC in row crop systems with standard continuous corn, including stover production but excluding ecosystem services.

C. We submitted an abstract (July 9, 2024), which was accepted to the *2024 ASA, CSSA, and SSSA International Annual Meeting*. We will give an oral presentation.

D. Explanation of Variance

None noted.

E. Plans for Next Quarter

We will next quantify the economic incentives for ecosystem services that an optimized PGC system can deliver over standard continuous corn. The enterprise budget format used for our technoeconomic evaluation could not incorporate the on- and off-farm value of the environmental and natural resources benefits. We will use the *USDA Natural Resources Inventory* and National Centers for Environmental Information raw data to map variables associated with PGC adoption.

2. Evaluate the Market and Aggregate Welfare Effects of PGC Approaches.

A. Planned Activities

Continue with activities planned

B. Actual Accomplishments

- Updated the modeling system with the most recent agricultural supply, utilization, and prices.
- Incorporated PGC costs in the cost of production model and completed a preliminary model run using the PGC costs (work in progress).
- Developed the structure of the cellulosic module in the model.

C. Explanation of Variance

None noted.

D. Plans for Next Quarter

- The model will be ready to incorporate different yield scenarios based on management practices determined by the other objectives.
- Fine-tune and run the cellulosic module in the model.

3. Identify the Socioeconomic Barriers and Potential Facilitators to PGC Adoption

A. Planned Activities

Run analyses on CCF, Conservation ag, and PGC, and write up the results.

B. Actual Accomplishments

- Continued developing the 3C dataverse: community capitals, cover crops, and conservation agriculture, and ran certain descriptive and inferential statistics (https://ksuemailprod-my.sharepoint.com/:x/g/personal/tree11_ksu_edu/ETPb8WNmG8BIjQTrTYORLSwBdzQj8YOqYMhzSQi-_uG2NQ?rttime=Fni9M96L3Eg)

C. Plans for Next Quarter

Continue to Run analyses on CCF, Conservation ag, and PGC, and write up results.

D. Explanation of Variance

None noted.

4. Explore the Role of Input Supply Agribusinesses in the PGC Supply Chain.

A. Planned Activities

Run analyses Continue collecting data to augment agribusiness demographic and other data for analyses.

B. Actual Accomplishments

There is no additional progress to report this quarter.

C. Plans for Next Quarter

Utilize spatial mapping and analysis to understand what role cooperative agribusiness concentration and locations play in conservation-type practices directly or indirectly in farm-level production decisions.

5. Publications, Presentations, Stakeholder Engagement, Submitted Proposals

• Presentations

Bartel, Cyndi. (2024, June 13). *Perennial Groundcover – Enterprise Budget & Policy*. Natural Resources Conservation Service Conservation Innovation Grants Informational Farmer Facing Meeting. ~50 attendees.

PROJECT EVALUATION

Dr. Heather Dantzker is the RegenPGC External Evaluator. PD Raman and Deputy Director Kinzel meet with Dr. Dantzker regularly to review her work and plan future evaluation activities. Our goal is to use these activities to fine-tune the performance of the RegenPGC team.

1. Planned Activities

A. RegenPGC – Overall Project Activities

- Qualitative analysis and initial report out of findings from graduate student interviews to project leadership
- Participate in RegenPGC leadership calls (Co-PD and SAB)
- Data analysis to track project progress and milestones with an updated logic model
- Plan additional evaluation and reporting activities through YR4Q2, including the project annual meeting, in collaboration with project PD and Deputy PD based on findings

B. Regen PGC – Education Theme Focus

- Continue to meet in monthly planning meetings with Education theme leaders.
- Schedule and conduct individual one-hour interviews with RegenPGC-affiliated graduate students.
- Schedule and conduct individual debriefings as part of Intercultural Development Inventory (IDI) programming with the RegenPGC graduate student cohort (in conjunction with qualitative interviews), including review of individual IDI assessment results and facilitation of reflective discussions with each student.

2. Actual Accomplishments

A. RegenPGC – Overall Project Activities

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3. Explanation of Variance

None noted.

4. Plans for Next Quarter

Report out on data collection and IDI activities will be happening in Year 4 -Q1 as part of the External Evaluator's preparation for and presentation at the Annual Meeting.

5. Publications, Presentations, Stakeholder Engagement, and Proposals Submitted

None this quarter.



The long-term goal of this project is to develop and de-risk a transformative method for increasing groundcover on working landscapes, thereby realizing urgently-needed environmental benefits. Our vision is to develop a perennial cover-cropping system that requires less labor, provides equal or more ecosystem benefits, and increases resiliency while having an overall economic profile that is equivalent to, or better than conventional row-crop practices.

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