A Framework for Promoting Diverse Perennial Circular Forage Systems for More Resilient Agricultural Landscapes: Developing Extension and Educational Tools for Resilience and Sustainability

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Abstract. The Resilience CAP Team seeks to use diverse, perennial, circular forage systems (DPCFS) to enhance biodiversity, improve soil and plant health, support ecosystem service, all towards achieving greater resilience to global change and improving the farm economy and quality of life. Our project will design a transdisciplinary framework that combines agronomic, ecological, economic, and sociological factors to achieve greater resilience and stability in agricultural systems through use of DPCFS. In this paper, we describe two of the project's six objectives. Objective 5 is our extension/outreach arm where we will develop extension media, activities, and actionable decision tools to communicate concepts about the benefits of DPCFS to all stakeholders including farmers, consumers, lenders, and policy makers. To this end, our Extension Team is developing an interactive network of farmers, researchers, and other stakeholders that use multidirectional communication to help reduce barriers to forage use in production systems. Our network will be supported by traditional print and face-to-face approaches, a website, online programming, interactive online decision tools, and social media. Objective 6 is our education arm, where we will develop educational materials on the importance of resilience, ecosystem services, and economic value of DPCFS and integrate the materials into K-12 and university curricula. The activities are designed to develop knowledge and skills associated with sustainable agriculture, with emphasis on DPCFS. Currently, we seek to have multi-institutional internship and graduate seminar programs throughout the year.

Overview

An overview of the Resilience CAP project is given elsewhere in these proceedings (Picasso and Williams, 2023). In short, the objective of the project is to build transformative agricultural systems based on three common features: diversity, perenniality, and circularity.

Extension Objective

Transformation of farming systems requires farmers to change their practices but one of the greatest challenges is the difficulty of reaching the farmers who might benefit most from a new approach to farm operations. Agricultural extension in the U.S. relies heavily on recruiting innovator farmers willing to adopt new practices and letting the innovators plant the seeds of change among their neighbors by providing practical examples of improved practices. Many of the practices needed to shift intensive agricultural systems towards a more sustainable or regenerative model are focused on ecosystem services which are difficult to quantify. Unfortunately, farmers often cannot afford the up-front expense of adopting new practices that provide better ecosystem services if those practices do not provide an immediate economic return that can be demonstrated to lenders. Therefore, it is essential to disseminate information about the benefits of ecosystem services among all stakeholders. Our Extension objective includes two sub-objectives: 5.1) design and implement online decision tools that can help farmers reduce risk in decision-making and estimate the return on investment of DPCFS practices that improve ecosystem services, and 5.2) develop extension outputs and activities to communicate concepts and project results to farmers, policy makers, and support industries.

Under Sub-objective 5.1, we are developing an online tool to provide farmers a means to determine which forage species are best suited to their particular growing conditions and this is described elsewhere in these proceedings (Hannaway, 2022). An additional online tool for predicting the value of ecosystem services in agricultural systems will be developed near the end of our grant period using the data collected from our agronomic research trials, life cycle analysis (Berti, 2023) and the Forage Data Hub (Ashworth and van Santen, 2023).

Sub-objective 5.2 is about developing a community of practice that includes farmers, support industries, policy makers, and consumers. Outputs include both typical and novel communication outputs, such as a project website, social media, newsletter, white papers, bulletins, videos, webinars, workshops, and field days. Key to our network is developing a network of practitioners that work directly with farmers and other stakeholders in the field. Completed activities include interviews with each collaborator overseeing farms in our Farm Pair network along with the extension agents/educators, graduate students, or other personnel assisting with this task. This information was used to develop a handbook for our internal team to use when working with the farm pairs. Initial efforts to recruit farmers revealed that many within conventional extension networks were extremely reluctant to offer farm-level production data even when anonymity was guaranteed. Therefore, we reassessed our recruitment approach to solicit participation from a wider group of farmers and explored means to encourage engagement.

Education Objective

The Education Team supports education efforts aimed at K-12 age groups (Sub-objective 6.1) and at college/university undergraduate and graduate students (Sub-objective 6.2). The emphasis in our approach for K-12 students is hands-on engagement with the relationship of DPCFS to ecosystem services, soil health, and resilience to climate change. The activities are designed to develop knowledge and skills associated with sustainable agriculture, with emphasis on DPCFS. The focus for University/College students is on the use of transdisciplinary approaches to understand the complexity of interactions among disciplines to address sustainability issues. The Team recognizes that investigators and institutions vary in their approaches to education, so we support all types of educational activities related to the project.

We have three activities for Sub-objective 6.1: K-12 education. First, we plan to inform and instruct high school teachers on DPCS, resilience, ecosystem services, and economic value. Second, we will develop and share curriculum materials for education of K-12 students. Third, we will work with local agricultural farm museum/parks for education of K-12 visitors.

We have five activities for Sub-objective 6.2: College/University education. First, we will create and share new courses and seminars that provide a comprehensive look at future agriculture employing sustainable practices. Second, we will prepare an edited volume for training and materials for agriculture courses for upper level undergraduate and graduate students. Third, we will develop a project-wide undergraduate internship program, including minority institutions. Fourth, we will partner with others to create community-based learning programs involving university students. Fifth, we will work with graduate students on the project to develop a Graduate Forum, to help with their professional development while also supporting the goals of the project.

Sub-objective 6.1 (K-12). Wyoming educators had discussions with local educators and teachers concerning possible demonstrations. The North Dakota team delivered five sessions for attendees to ‘Farm Camp 2022’ at Harvest Hope Farm. Graduate students taught 1) Llama-llama camp activity on the importance of worms for the soil, 2) importance of pollinators in food production and they built bees mason houses they took home, 3) soil health, including a demonstration of soil aggregation and importance of mycorrhizae. 4) importance of forages and differences between legumes and grasses, 5) importance of biodiversity of plants, insects and arthropods. The Wisconsin team delivered educational instruction to K-8 graders at a summer school field-based program on similar topics. They have also restored degraded land at a community garden site, using perennials to rebuild soil quality and fertility, to be used as a demonstration site. The Maryland team has created a BioBlitz teaching module for measuring biodiversity and is working on a DNA barcoding module to identify species in the landscape. In addition, MD created a preliminary education website for the grant, illustrating student-created science fair projects.

Sub-objective 6.2 (College/University). We developed a Graduate Forum which consists of 10 graduate students from across the country, with more to be added as the project grows. They have been asked to organize meetings on their own, to set their own agenda, and to determine their overall goals for the Forum. Individuals rotate through leadership positions, including Manager, Recorder, and Reflector. Among other activities, the Graduate Forum has been assigned the task of participating in the Annual Meeting in some way, determined by the group.

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References

Ashworth, A. and. van Santen, E. 2023. Forage Data Hub – a platform for sharing valuable datasets for resilience. *Proc. Internatl. Grassl. Congress*, Covington, KY, May 14-19, 2023. (in press)

Berti, M. 2023. Ecosystem services and life cycle assessment of perennial vs annual cropping systems. *Proc. Internatl. Grassl. Congress*, Covington, KY, May 14-19, 2023. (in press)

Hannaway, D. 2023. Developing forage species suitability maps using geospatial climate and soil factors. *Proc. Internatl. Grassl. Congress*, Covington, KY, May 14-19, 2023. (in press)

Krome, M., Finan, A., and Stevens, A. 2023. Socio-economic and policy barriers and incentives for diversifying and perennializing agricultural systems. *Proc. Internatl. Grassl. Congress*, Covington, KY, May 14-19, 2023. (in press)

Picasso, V., Berti, M., Cassida, K., Collier, S., Fang, D., Finan, A,. Krome, M., Hannaway, D., Lamp, W., Stevens, A., Williams, C.. 2022. Diverse perennial circular forage systems are needed to foster resilience, ecosystem services, and socioeconomic benefits in agricultural landscapes. *Grasslands Research* 1:123-130.

Picasso V., and Williams, C. 2023. A transdisciplinary approach to landscape transformation towards perennial, diverse, circular systems: why and how. *Proc. Internatl. Grassl. Congress*, Covington, KY, May 14-19, 2023. (in press)