



Environment and Natural Resources Trust Fund

2027 Request for Proposal

General Information

Proposal ID: 2027-299

Proposal Title: Field to Future: Agroecological Cropping Systems for Resilience

Project Manager Information

Name: Jeffrey Strock

Organization: U of MN - Southwest Research and Outreach Center

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Project Basic Information

Project Summary: Data synthesis from a statewide network of long-term experiments will provide a roadmap for solving critical local and regional challenges: food security, climate resilience, economic stability, and environmental quality.

ENRTF Funds Requested: \$274,000

Proposed Project Completion: June 30, 2030

LCCMR Funding Category: Small Projects (G)

Secondary Category: Resiliency (A)

Project Location

What is the best scale for describing where your work will take place?

Statewide

What is the best scale to describe the area impacted by your work?

Statewide

When will the work impact occur?

During the Project and In the Future

Narrative

Describe the opportunity or problem your proposal seeks to address. Include any relevant background information.

Minnesota's 16 million acres of corn-soybean production form the backbone of the state's agricultural economy and supports rural communities. Farmers face mounting pressure from volatile weather, declining soil health, and uncertain long-term profitability. Deploying the wrong cropping system carries real consequences: eroded soil can take decades to recover; a single poor year, in a low-resilience system, can erase years of profitability. Ensuring stakeholders have access to research-based guidance on which systems deliver stable yields, protect soil resources, and remain profitable under various stressors is therefore not just a scientific priority, but a critical need for the state's economy and natural resources.

The University of Minnesota's Long-Term Agricultural Research Network (MN-LTARN) addresses these limitations by utilizing a coordinated, three-site approach across diverse agroecosystems. By implementing identical management across different geographies, MN-LTARN enhances the transferability of results and bridges the gap between small-plot precision and field-scale variability. To further amplify this impact, MN-LTARN experiments will be coupled with the USDA-ARS Long-Term Agroecosystem Research (LTAR) network in Minnesota, integrating local/regional findings into a statewide framework. This synergy facilitates cross-site data synthesis and interdisciplinary collaboration, ensuring that local management strategies contribute to solutions for sustainable food production and environmental security for Minnesotans.

What is your proposed solution to the problem or opportunity discussed above? Introduce us to the work you are seeking funding to do. You will be asked to expand on this proposed solution in Activities & Milestones.

To maximize the impact of this synergy, the MN-LTARN and USDA-ARS LTAR networks will focus on coupling these experiments for a robust, cross-site data synthesis that translates Minnesota's findings into broader, regional-scale systems.

The Postdoctoral associate will synthesize data from the MN-LTARN and USDA-ARS LTAR sites, specifically contrasting annual row-crop systems (e.g., corn-soybean) against rotationally diverse and perennial systems. This work will result in two important outcomes. The first outcome will focus on resiliency and stability of cropping systems including: Corn-Soybean; Corn-Soybean+cover crop; Corn-Soybean-Wheat; Corn-Alfalfa; and Perennial grass-based polyculture. The synthesis will also integrate an economic trade-off assessment that identifies which system(s) optimize the balance between production stability, profitability, and environmental conditions. The second outcome will focus on integrating soil organic carbon (SOC) data across the networks to quantify carbon dynamics. This synthesis will compare more diverse against less diverse systems. The analysis will demonstrate how land management practices shape long-term carbon accrual or loss across diverse Minnesota landscapes. These outcomes will be the basis for public engagement and education programming among stakeholders across Minnesota.

What are the specific project outcomes as they relate to the public purpose of protection, conservation, preservation, and enhancement of the state's natural resources?

By combining research data from state (MN-LTARN) and federal (USDA-ARS LTAR) long-term agricultural networks, project outcomes will advance protection of Minnesota's natural resources in several practical ways: protecting water resources through reduced erosion and nutrient leaching from more rotationally diverse systems; enhancing carbon sequestration from more rotationally diverse systems that include continuous living covers and deeper rooted crops; supporting risk mitigation through identifying cropping systems more resilient to climate shocks (drought and excess water); and economic trade-off assessment that helps policymakers, farmers, and landowners prioritize cropping systems that enhance ecosystem services, productivity, and profitability.

Activities and Milestones

Activity 1: Synthesis of longitudinal data from long-term experiments addressing agricultural resiliency, sustainability and productivity, economic profitability, and environmental quality.

Activity Budget: \$265,000

Activity Description:

This activity aims to synthesize research results from multiple long-term experiments in Minnesota for farmers, policymakers, agricultural industry, state and federal agencies, the public, and researchers interested in rotationally diverse cropping systems.

Task 1: Stability indices will be used to compare interannual variability between systems. This analysis will evaluate more rotationally diverse systems against less rotationally diverse systems to balance and assess risk associated with climate volatility. The synthesis will also integrate a systematic evaluation of costs, benefits, and risks associated with choosing one alternative over another. This work will help producers navigate the trade-offs between short-term yield and long-term risk mitigation.

Deliverable 1: Yield Stability and Economic Trade-offs of rotationally diverse cropping systems

Task 2: The Postdoctoral associate will harmonize soil organic carbon (SOC) data across the networks to quantify carbon dynamics. By comparing more diverse against less diverse systems, the associate will demonstrate how management-mediated interactions influence long-term carbon accrual/loss across diverse Minnesota geographies.

Deliverable 2: Carbon Dynamics of rotationally diverse cropping systems.

Activity Milestones:

Description	Approximate Completion Date
Yield Stability and Economic Trade-offs activity complete	December 31, 2028
Carbon Dynamics activity complete	June 30, 2030

Activity 2: Public engagement field tour exploring cropping systems that enhance system resiliency, ensure long-term stability, drive productivity, profitability, and environmental sustainability.

Activity Budget: \$9,000

Activity Description:

This activity aims to synthesize and disseminate research results to farmers, policymakers, the agricultural industry, and state and federal agencies, and the public.

Task: Our primary public engagement activity will be a triennial rotating field tour at five different long-term sites across Minnesota. Hosting responsibilities will cycle through locations over a three-year period. Sites will take a turn as the primary venue host once every three years, allowing for a diverse showcase of regional research, practices, and localized weather and soil conditions. In some years, two sites will be highlighted, for example, the UMN site at Lamberton and ARS site near Morris. These events will target a diverse audience consisting of producers, agencies, and agricultural industry leaders. We will coordinate with the University of Minnesota Extension to manage promotion, registration, and other logistics. Extension will also assist in impact tracking through evaluations that measure participants' perceptions and willingness to adopt conservation or management practices shown during the field tours.

Deliverable: Field tours and other outreach events.

Activity Milestones:

Description	Approximate Completion Date
Conduct field tour(s)	August 31, 2027
Conduct field tour(s)	August 31, 2028
Conduct field tour(s)	August 31, 2029

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Gregg Johnson	University of Minnesota	Co-PI, data curation, project reporting with expertise in annual and perennial cropping systems with a focus on maximizing productivity, efficiency, and ecosystem services.	No
Axel Garcia y Garcia	University of Minnesota	Co-PI, specialist at the intersection of agronomy, data science, and environmental modeling	No
Jacob Jungers	University of Minnesota	Co-PI, expertise in improving the profitability and sustainability of cropping systems relying on the principles of plant ecology, field experimentation, and statistical modeling,	No
Brent Dalzell	USDA-Agricultural Research Service	Co-PI, expertise in issues related to soil and water quality in agricultural landscapes. USDA-ARS scientific research agency contact for Minnesota USDA-ARS long-term research sites and data.	No

Dissemination

Describe your plans for dissemination, presentation, documentation, or sharing of data, results, samples, physical collections, and other products and how they will follow ENRTF Acknowledgement Requirements and Guidelines.

Oversight of project data management tasks will come from the Project PI, Strock, as well as coordination with Co-PI's. The data, reports and publications generated under this proposal will be made available under the University of Minnesota University Digital Conservancy (UDC). The UDC will provide long-term access to data resources. Within UDC we will use DRUM for digital archiving and open access to project information to the general public and scientific community. The DRUM provides a place to share, publish and preserve digital data for long-term access and future use.

We will use various methods and channels to connect with stakeholders and local communities. We will organize field days at our research sites, as described in detail in Activity 2, and invite farmers, conservation professionals, and NGO's as well as members of state and local units of government. We will organize one stakeholder focus group meeting per year with the goal of sharing research information and gathering in-depth qualitative insights, opinions, and perspectives from stakeholders that have an interest in our project. We will also share findings from this project at the annual Minnesota Water Resources Conference (> 900 attendees) and the University of Minnesota Ag Research Update series (250 attendees). We will present research and outcomes in the University of Minnesota tent at Farm Fest. Farm Fest is a three-day annual event that attracts > 25,000 visitors and provides an excellent opportunity to promote innovation in agriculture and networking opportunities with farmers, landowners, agribusiness and conservation professionals as well as members of state and local units of government. Project fact sheets will be generated and annually updated to share with outreach/extension channel partners. Collected data and analysis results will be shared at webinars and professional conferences to share research results with members of the research community.

Long-Term Implementation and Funding

Describe how the results will be implemented and how any ongoing effort will be funded. If not already addressed as part of the project, how will findings, results, and products developed be implemented after project completion? If additional work is needed, how will this work be funded?

To maximize the adoption of rotationally diverse cropping systems, we will leverage partnerships with the Minnesota Department of Agriculture and the Board of Water and Soil Resources. These existing partnerships will be enhanced by a new collaboration with the Land Stewardship Project, utilizing their expertise in on-farm research and farmer education to drive transformational change. Integrating these networks will help move research findings into practice. While

current funding is provided by the USDA-ARS and the University of Minnesota, we will pursue additional support from state and federal agencies, commodity groups, and private foundations to sustain research efforts.

Project Manager and Organization Qualifications

Project Manager Name: Jeffrey Strock

Job Title: Professor

Provide description of the project manager's qualifications to manage the proposed project.

Dr. Strock is a Professor in the Department of Soil, Water and Climate at the University of Minnesota. He is an expert in soil-water relations. Dr. Strock's research activities are focused on the study of agricultural hydrology of rotationally complex/diversified cropping systems and agricultural drainage water management. He directs a field-based research program focused on vadose zone hydrology, agricultural drainage, crop response to water, and understanding nutrient (nitrogen and phosphorus) mobility, uptake, storage, transformation, and losses in agricultural systems. More specifically, he seeks to understand how variations in climate, land use, and rotational complexity drive physical, chemical, biological, and ecological water dynamics and nutrient cycling in agricultural landscapes. Dr. Strock's approach strongly relies on plot and field-scale experiments, and statistical models to characterize mechanisms, processes, and solutions that result in productive, profitable, sustainable, and resilient agricultural systems.

Organization: U of MN - Southwest Research and Outreach Center

Organization Description:

The UMN is the primary research and graduate teaching institution in the state. In the Department of Soil, Water, and Climate, we seek to improve and protect the quality of soil, water, and air resources in natural and managed ecosystems, through research, teaching, and extension. The Southwest Research and Outreach Center (SWROC) is part of CFANS and represents the Colleges and University's mission to respond to the needs of all Minnesotans. The SWROC provides research, training, and university-industry interaction in the areas of water quality and sustainable cropping systems.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
Personnel								
Postdoctoral Research Associate		Post-Doctoral Associate will collaborate with PI and co-PI's evaluating and analyzing research data. The individual will also participate in preparing and presenting data to PI's, research professionals, and other audiences. The Post-Doctoral Associate will also author or co-author, or otherwise collaborate with PI's on reports, conference presentations, and peer-reviewed publications.			26.1%	3		\$265,398
							Sub Total	\$265,398
Contracts and Services								
							Sub Total	-
Equipment, Tools, and Supplies								
							Sub Total	-
Capital Equipment								
							Sub Total	-
Acquisitions and Stewardship								
							Sub Total	-
Travel In Minnesota								
	Miles/ Meals/ Lodging	Funds are requested for mileage expenses at \$0.725 per mile to travel to tour sites for two days per year in years 1 through 3.	Funds are requested for mileage expenses to travel to experimental sites to plan and carry out field tour activities in years 1 through 3					\$1,102
							Sub Total	\$1,102

Travel Outside Minnesota								
							Sub Total	-
Printing and Publication								
							Sub Total	-
Other Expenses								
		On-site field tour expenses	Funds are requested to cover costs associated with planning and carrying out field tours at the experimental locations. Cost will include, among other things, portable toilets and temporary shelters (tent and chairs).					\$7,500
							Sub Total	\$7,500
							Grand Total	\$274,000

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
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Non ENRTF Funds

Category	Specific Source	Use	Status	Amount
State				
			State Sub Total	-
Non-State				
			Non State Sub Total	-
			Funds Total	-

Total Project Cost: \$274,000

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: [fd851f90-46c.pdf](#)

Alternate Text for Visual Component

This visual features a map of Minnesota showing lines of latitude to pinpoint locations. It highlights five research sites: three University of Minnesota locations situated along the 44°N and 47°N lines, and two USDA-ARS sites between 45°N and 46°N. Each site includes a corresponding reference image....

Supplemental Attachments

Capital Project Questionnaire, Budget Supplements, Support Letter, Photos, Media, Other

Title	File
FP00014693 Strock LCCMR	ab952489-d58.pdf

Administrative Use

Does your project include restoration or acquisition of land rights?

No

Do you understand that travel expenses are only approved if they follow the "Commissioner's Plan" promulgated by the Commissioner of Management of Budget or, for University of Minnesota projects, the University of Minnesota plan?

Yes, I understand the UMN Policy on travel applies.

Does your project have potential for royalties, copyrights, patents, sale of products and assets, or revenue generation?

No

Do you understand and acknowledge IP and revenue-return and sharing requirements in 116P.10?

N/A

Do you wish to request reinvestment of any revenues into your project instead of returning revenue to the ENRTF?

N/A

Does your project include original, hypothesis-driven research?

Yes

Does the organization have a fiscal agent for this project?

No

Does your project include the pre-design, design, construction, or renovation of a building, trail, campground, or other fixed capital asset costing \$10,000 or more or large-scale stream or wetland restoration?

No

Do you propose using an appropriation from the Environment and Natural Resources Trust Fund to conduct a project that provides children's services (as defined in Minnesota Statutes section 299C.61 Subd.7 as "the provision of care, treatment, education, training, instruction, or recreation to children")?

No

Provide the name(s) and organization(s) of additional individuals assisting in the completion of this proposal:

Kelsey Grachek, University of Minnesota, Sponsored Projects Administration

Do you understand that a named service contract does not constitute a funder-designated subrecipient or approval of a sole-source contract? In other words, a service contract entity is only approved if it has been selected according to the contracting rules identified in state law and policy for organizations that receive ENRTF funds through direct appropriations, or in the DNR's reimbursement manual for non-state organizations. These rules may include competitive bidding and prevailing wage requirements

N/A