Environment and Natural Resources Trust Fund

2027 Request for Proposal

General Information

Proposal ID: 2027-424

Proposal Title: Wide-Row Corn Systems for Water Quality and Farmer

Project Manager Information

Name: Samantha Wells

Organization: U of MN - College of Food, Agricultural and Natural Resource Sciences

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Project Basic Information

Project Summary: This project advances Regenerative Agriculture by integrating wide-row corn with forage crops to improve farm profitability and water quality, reducing nitrate leaching while supporting rural economies through sustainable livestock grazing.

ENRTF Funds Requested: $293,000

Proposed Project Completion: October 31, 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?
Region(s): Metro, Central, NW, SE, SW,

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

When will the work impact occur?
During the Project

Narrative

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

Minnesota's agriculture supports rural livelihoods but contributes to groundwater and surface-water nitrate contamination. Over 500,000 residents in southeastern Minnesota face nitrate-contaminated drinking water exceeding safe limits. Traditional best management practices focus on fertility timing, placement, and quantity, but often increase financial burdens on rural farming families. More intensive solutions require costly infrastructure and specialized supply chains, limiting farmer participation.

Solar Corridor Cropping Systems (SCCS) offer an alternative, integrating wide-row corn with forage crops to reduce nitrogen runoff while strengthening the economic resilience of family-owned beef and dairy operations. By producing high-quality forage alongside corn, SCCS allows farmers to offset yield reductions, lower input costs, and create additional revenue streams.

At the same time, digital tools, including AI-powered decision aids, are entering agricultural practice faster than farmers can evaluate them. Without hands-on experience questioning these tools, farmers risk adopting recommendations that conflict with local conditions or proven agronomic knowledge. This project addresses both challenges: it advances nitrogen management science through SCCS field trials while using the same field data to train farmers to critically evaluate digital tools, equipping producers to protect water quality and make informed management decisions in an increasingly digital agricultural landscape.

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.

This project advances water quality protection through Solar Corridor Cropping Systems (SCCS) research and equips farmers to critically evaluate the digital tools entering agricultural practice. Field trials at the Rosemount Research and Outreach Center (RROC) will evaluate how nitrogen placement (banded vs. broadcast) and timing (pre-plant vs. split application) influence corn yield, forage biomass, and nitrate leaching in SCCS. Deep soil sampling (0–90 cm) will track nitrate movement, and economic analysis will quantify the financial case for SCCS adoption across Minnesota's 20,000+ beef operations.

The field data generated by this research will also serve as the applied learning context for hands-on AI literacy workshops. Rather than delivering a prescriptive decision tool, this project teaches farmers to test and critically evaluate AI-generated recommendations using real agronomic data from SCCS trials and their own operations. Farmers learn to identify when AI output is unreliable, when human judgment must override tool recommendations, and how to ask effective questions of any digital system.

Findings will be shared through farmer-participatory demonstrations, a train-the-trainer program for UMN Extension educators, and AI literacy workshops integrated into field days. This approach delivers scalable conservation strategies while building the critical evaluation skills farmers need as digital tools

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?

This project will reduce nitrate leaching to protect groundwater and drinking water for rural and urban communities. Soil health improvements through interseeded forages will promote carbon sequestration and erosion control. The project supports Minnesota's farm economy by reducing input costs and diversifying income for 20,000+ beef operations. AI literacy workshops will strengthen producers' capacity to critically evaluate digital tools for conservation decisions. Trained Extension educators will sustain programming beyond the project period, and findings will guide evidence-based conservation policies ensuring long-term protection of Minnesota's natural resources.

Activities and Milestones

Activity 1: Aim 1: Optimize Nitrogen Management in Wide-Row Corn Systems

Activity Budget: $205,260

Activity Description:
This aim evaluates how nitrogen placement (banded vs. broadcast) and timing (pre-plant vs. split application) influence corn grain yield, forage biomass, and nitrate leaching in Solar Corridor Cropping Systems (SCCS). By examining resource trade-offs between corn and forage crops, we will identify nitrogen management strategies that balance productivity, water-quality protection, and economic feasibility.

In Year 1, field preparation will occur at the RROC, with baseline soil sampling to assess initial nitrogen levels. Research site management and data collection continue through Year 3. Nitrogen treatments will be applied, forages interseeded, and crop and forage growth monitored. Deep soil sampling (0–30 cm, 30–60 cm, 60–90 cm) will track nitrate movement and retention at key stages: pre-fertilization, post-harvest, during livestock grazing, and after spring thaw. In Year 3, a second year of data collection and analysis will ensure robust replication. Trials will conclude with final sampling, and results will be compiled into actionable nitrogen management recommendations for SCCS adoption.

Activity Milestones:

Description	Approximate Completion Date
Autumn field selection, baseline soil samples, and preparation before freeze-up	September 30, 2027
First growing season complete: data collected, analyzed, and reported	October 31, 2029
Second growing season complete: data collected, analyzed, and reported	October 31, 2030

Activity 2: Aim 2: Assess the Agronomic and Economic Viability of SCCS

Activity Budget: $29,323

Activity Description:
This aim will determine the economic feasibility of SCCS, focusing on cost savings from reduced wide-row corn yield losses, improved forage digestibility and tonnage, increased livestock weight gains, and lower feed storage costs. The analysis will provide farmers with financial insights into adopting SCCS as an alternative to conventional corn production, helping them make informed decisions.

In Year 1, economic models will be developed using historical SCCS trial data to estimate potential cost-benefit scenarios. Baseline cost structures for SCCS implementation will be outlined, laying the groundwork for future analysis.

Year 2 will mark the first year of data collection on yield, forage quality, and input costs from trials at the RROC. Livestock grazing impacts on feed costs and weight gains will be assessed, and economic modeling will incorporate real-world performance metrics to refine cost-benefit projections.

In Year 3, a second year of agronomic and financial data collection will ensure robust analysis. The final SCCS financial framework will be developed, detailing expected economic benefits, risk factors, and recommendations for widespread adoption.

Activity Milestones:

Description	Approximate Completion Date

Develop economic models using historical SCCS data; outline baseline cost structures	August 31, 2028
Collect yield, forage, and input cost data; assess livestock grazing impacts	September 30, 2029
Finalize SCCS financial framework with economic benefits and adoption recommendations	June 30, 2030

Activity 3: Aim 3: Integrated SCCS Outreach and Farmer AI Literacy Training

Activity Budget: $58,417

Activity Description:

This aim uses the agronomic data from Aim 1 and the economic models from Aim 2 as both the evidence base for SCCS adoption and the applied curriculum for farmer AI literacy training. The agronomic research is the content; AI literacy is the method of engagement. Rather than treating outreach and digital skills as separate activities, farmers learn to critically evaluate AI-generated recommendations by working directly with the nitrogen management data, forage quality results, and cost-benefit scenarios generated by this project.

In Year 1, the outreach framework will be developed in partnership with UMN Extension regional educators across southern and central Minnesota. Eight to ten Extension educators will be recruited to co-design demonstration protocols and farmer-facing materials reflecting the practical realities of beef and dairy operations. The PI will develop the AI literacy curriculum using SCCS field data as the context for applied learning. Workshop exercises will have farmers evaluate AI-generated recommendations about forage establishment timing, nitrogen placement scenarios from Aim 1 data, and economic assumptions from Aim 2 models against their own operation's numbers.

Year 2 will launch on-site demonstrations and field days at RROC and the UMN Field School for Agricultural Professionals, targeting 60–80

Activity Milestones:

Description	Approximate Completion Date
Develop integrated outreach and AI literacy curriculum; recruit Extension educator co-designers; prepare demonstration site logistics	January 31, 2028
Conduct on-station field days with integrated AI literacy workshops; publish preliminary SCCS adoption guides	July 31, 2029
Extension educators deliver independent SCCS and AI literacy workshops; publish final management guides and policy	June 30, 2030

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Samantha Wells, Ph.D.	University of Minnesota, Department of Agronomy and Plant Genetics	Principle Investigator and Co-Program Director: Dr. Wells will oversee research design, execution, and Extension/Outreach education efforts, focusing on expanding project objectives, mentoring underserved undergraduate researchers in the Experiential Learning for Agricultural Innovation (ELAI) Lab, coordinating field operations, analyzing data, and preparing educational materials and submitting final reports.	Yes
Alex Hard	University of Minnesota, Department of Agronomy and Plant Genetics	Technical Expert and Research Scientist: Mr. Hard will coordinate with the Agricultural Experiment Research and Outreach Center, ensuring the timely deployment and managment of all field-based objectives. Mr. Hard will lead the collection and processing of all samples and data and assist in developing quarterly and final progress reports.	Yes

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.
This project is designed so that research findings move from the trial plot to working farms through trained educators, engaged producers, and existing conservation infrastructure—not through publications alone.

Participation and awareness. Farmers participate directly in the research through structured field observations at RROC demonstrations, contributing data on forage establishment, weed pressure, and grazing behavior alongside research measurements. This participatory approach ensures that the communities who stand to benefit are engaged from Year 1, not informed after the fact.

Sharing results with resource managers. SCCS nitrogen management BMPs, the farmer decision guide, and economic feasibility analyses will be delivered to Soil and Water Conservation Districts, NRCS field offices, and state agency staff through policy briefings and printed management guides. These materials will provide conservation professionals with the evidence base to include SCCS in cost-share and incentive programs. Preliminary findings will be shared through UMN Extension publications beginning in Year 2, with final guides published in Year 3.
Longevity of products. The train-the-trainer model ensures that 8–10 Extension educators can deliver SCCS and AI literacy workshops independently in their counties after the project ends. All curriculum materials, adoption guides, and the nitrogen management decision guide will be hosted through UMN Extension's digital platforms for ongoing public access. Peer-reviewed publications will document research findings for the scientific community.

Promoting behavior change. Field days at RROC (4 per year) and the UMN Field School for Agricultural Professionals will provide hands-on demonstrations of SCCS practices. AI literacy workshops integrated into field days will equip farmers to critically evaluate digital tools for conservation decisions, reinforcing informed adoption of practices that protect water quality and soil health.

Accessible communication. Project outcomes will be communicated to Minnesotans through UMN Extension field day programming, county-level Extension workshops, grower meeting presentations, and UMN Extension digital media. All project signage, printed materials, publications, and electronic communications will acknowledge the Environment and Natural Resources Trust Fund using the ENRTF logo and attribution language per ENRTF Acknowledgment Guidelines.

Dissemination efforts are budgeted in Activity 3 ($58,646) and supported by the Outreach and Extension Materials line ($5,100).

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?

SCCS nitrogen management BMPs and the farmer decision guide will be published through UMN Extension and delivered to Soil and Water Conservation Districts for integration into cost-share and incentive programs. Trained Extension educators will continue delivering SCCS and AI literacy workshops in their counties, each reaching 50–100 producers annually through existing programming, sustaining outreach without additional funding. The AI literacy curriculum uses freely available tools and requires no ongoing technology investment. Future research will leverage federal funding (SARE, NRCS Conservation Innovation Grants) to expand SCCS adoption and validate results across additional Minnesota sites.

Project Manager and Organization Qualifications

Project Manager Name: Samantha Wells

Job Title: Associate Professor

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

Dr. Samantha Wells is an Associate Professor of Sustainable Cropping Systems in the Department of Agronomy and Plant Genetics at the University of Minnesota, where she leads an integrated research and extension program focused on cropping system design, experimental methods, and farmer-centered decision support. She holds a B.S. in Mathematics from UNC Asheville and a Ph.D. in Crop Science from North Carolina State University.

Dr. Wells brings more than $15 million in competitive grant funding to her record, spanning federal, state, and foundation sources, along with more than 60 peer-reviewed publications and the mentorship of more than 10 graduate students to degree completion. Her research expertise directly supports the proposed work: she has deep experience with intercropping systems, cover crop integration, and the agronomic trade-offs that shape profitability and environmental outcomes in row-crop systems. Her quantitative background in mathematics and experimental design equips her to rigorously evaluate system performance across the economic and water quality dimensions central to this project.

Dr. Wells is equally qualified to lead the outreach and AI literacy components. She has developed and piloted AI literacy curricula for agricultural audiences, with explicit attention to building farmer agency around evaluating and deploying AI tools rather than passive adoption. Her extension philosophy centers on the transfer of practical skills and critical thinking, ensuring that training outcomes persist beyond the workshop setting.

Her program sits at the intersection of production agriculture, ecological function, and rural economic resilience. She has managed complex, multi-objective projects involving research teams, farmer cooperators, and diverse stakeholders, and she understands the land-grant mission to translate systems-level science into durable on-farm practice.
Dr. Wells is well-positioned to lead this project to completion.

Organization: U of MN - College of Food, Agricultural and Natural Resource Sciences

Organization Description:

The University of Minnesota Department of Agronomy and Plant Genetics (APG), housed within the College of Food, Agricultural and Natural Resource Sciences, is the state's primary academic home for research, teaching, and extension in crop production, plant breeding, and agroecosystem management. Faculty programs address cropping system sustainability, soil health, water quality, climate adaptation, and rural economic viability. The department's extension

mission translates scientific findings into practice through field days, applied demonstrations, and statewide practitioner training. Grounded in the land-grant tradition, APG is committed to research that serves the public good and the long-term productivity of Minnesota agriculture. The department is supported by the University's sponsored projects offices, which provide pre- and post-award administration, ensuring fiscal oversight and compliance for externally funded work.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
Associate Professor/PI		Principal Investigator: Dr. Wells will oversee research design, execution, and Extension/Outreach education efforts, focusing on expanding project objectives, coordinating field operations, analyzing data, developing the AI literacy curriculum, preparing educational materials, and submitting final reports.			36.6%	24.9		$112,231
Research Scientist/Civil Servant		Technical Expert and Research Scientist (0.6FTE/year): Mr. Hard will coordinate with the Rosemount Research and Outreach Center, ensuring the timely deployment and management of all field-based objectives. Mr. Hard will lead the collection and processing of all samples and data and assist in developing quarterly and final progress reports.			32.3%	180		$160,778
							Sub Total	**$273,009**
Contracts and Services								
							Sub Total	**-**
Equipment, Tools, and Supplies								
	Tools and Supplies	Laboratory and Medical Supplies ($1,200): $400 per year for three years for nitrile gloves, disposable lab materials, sample drying trays, grinding tools for forage preparation, and containers for soil sample storage and shipment.	Maintaining sample integrity and ensuring reliable laboratory analysis of nitrate retention, soil health, and forage quality.					$1,200
	Tools and Supplies	General Operational Supplies ($3,000): $1,000 per year for three years for sample bags, labeling materials, flags, stakes, measuring tapes, and small tools such as hand augers and soil probes.	Establishing and maintaining experimental plots, enabling consistent data collection and reliable field assessments.					$3,000
	Tools and Supplies	Outreach and Extension Materials ($4,807): $1,623 per year for three years for printed handouts, outreach materials, demonstration plot signage, flags, and supplies for field days, AI literacy workshops, and farmer-led discussions.	Farmer education and engagement, equipping producers with practical, research-based strategies for SCCS implementation and AI literacy skills.					$4,871

							Sub Total	**$9,071**
Capital Equipment								
							Sub Total	**-**
Acquisitions and Stewardship								
							Sub Total	**-**
Travel In Minnesota								
	Miles/ Meals/ Lodging	Travel to Research Site ($1,512): 12 research trips per year to RROC. 58 miles per round trip. Mileage at $0.725/mile (GSA rate). $504/year x 3 years.	Field research, sample collection, and project management at RROC.					$1,512
	Miles/ Meals/ Lodging	Travel for Field Days and Grower Meetings ($888): 4 field day trips per year to RROC (60 mi RT, $168/yr) plus grower meeting travel ($128/yr for ~182 mi/yr). $296/year x 3 years.	Stakeholder engagement, research dissemination, farmer education, and AI literacy workshop delivery.					$888
							Sub Total	**$2,400**
Travel Outside Minnesota								
							Sub Total	**-**
Printing and Publication								
							Sub Total	**-**
Other Expenses								
		Field Operations, Site Rental, Field Preparation, and Harvesting ($2,400): $800/year x 3 years for site rental, seedbed preparation, fertilizer application, treatments, and harvesting at RROC.	Field trial establishment, maintenance, and harvest. Site rental covers research facility access, irrigation, and maintenance at RROC.					$2,400
		Soil, Crop, and Forage Laboratory Analysis ($6,120): $2,040/year x 3 years for soil nitrogen testing, corn nitrate analysis, and forage quality testing (crude protein, fiber, digestibility).	Third-party laboratory analysis providing key data for assessing nitrogen placement strategies, nitrate retention, crop yields, and forage quality under SCCS management.					$6,120

							Sub Total	**$8,520**
							Grand Total	**$293,000**

Classified Staff or Generally Ineligible Expenses

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

Non ENRTF Funds

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

Total Project Cost: $293,000

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: bdcd9e36-357.pdf

Alternate Text for Visual Component

Photo of Solar Corridor Cropping System at Kyle Dufrense farm....

Supplemental Attachments

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

Title	File
Board Resolution or Letter	d0a04e9e-ce1.pdf
Board of Regents and Letters of Support	992fb980-468.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:

Samantha Wells, UMN; Kelsey Grachek, Senior Grants and Contracts Officer, UMN; Sue Kilber, Pre-Award Coordinato, UMN Agronomy and Plant Genetics | Soil, Water, and Climate

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