Environment and Natural Resources Trust Fund

2026 Request for Proposal

General Information

Proposal ID: 2026-495

Proposal Title: Taking Action to Quantify Tradeoffs of Intermediate Wheatgrass

Project Manager Information

Name: Jeffrey Strock

Organization: U of MN - Southwest Research and Outreach Center

Office Telephone: (507) 752-7372

Email: jstrock@umn.edu

Project Basic Information

Project Summary: This project will measure plant, soil, and drainage components to anticipate adjustments to soil fertility requirements and water quality improvements or impairments associated with transition from IWG to row crops

ENRTF Funds Requested: $300,000

Proposed Project Completion: June 30, 2029

LCCMR Funding Category: Small Projects (G)

Secondary Category: Water (B)

Project Location

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

Region(s): 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.

Nutrient pollution degrades surface and groundwater quality. Nitrogen (N) and phosphorus (P) are critical to profitable agricultural production but when these nutrients leach from soils, they can create harmful algal blooms (HABs) affecting drinking water, public health, and recreation. Intermediate wheatgrass (IWG) is a perennial grain with multi-functional promise as a premium commercial crop with concomitant benefits for soil N and water retention. However, the ecological benefits of IWG for P retention are unclear, and phosphorus can respond in unexpected ways to conservation-oriented agricultural practices. For example, widespread adoption of conservation tillage practices throughout the Western Lake Erie Basin inadvertently increased dissolved P export and associated HABs in western Lake Erie. In 2022, Minnesota farmers harvested 35% of the U.S. Kernza® crop; Kernza® is the leading trademarked variety of IWG used in high-end baked goods, craft beers, and livestock fodder. Moreover, in 2023, Minnesota planted as much Kernza® acreage as all other Midwestern states combined. While preliminary data from MN show reduced N leaching from IWG compared to corn and soybean, dissolved P leaching is not reduced. Minnesota's demonstrated interest in IWG cultivation, coupled with potentially unanticipated P responses to this crop, warrant additional research into potential water quality.

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.

Incorporating IWG into Minnesota crop rotations requires 3 to 4 years of continuous IWG cover, followed by a transition to annual row crops. Soil and water quality improvements associated with IWG are largely attributed to the multi-year persistence of aboveground and belowground biomass. The unresolved question addressed by this project is whether these soil and water benefits from IWG persist following the transition from IWG back to annual crops. Particularly as the status of belowground roots changes dramatically following this transition— IWG roots can reach depths of 6 feet, , and those roots will decompose when annual crops replace IWG — we will characterize the changes in N and P allocation of above- and belowground biomass, soil, and drainage water in annual and mixed perennial-annual cropping systems before and after the transition period.

Specifically, we will: (1) measure above- and belowground biomass to quantify plant component nutrient uptake, export, and return to the soil, (2) characterize soil nutrient status and health attributes related to nutrient input, redistribution, retention, and cycling at multiple depths, (3) quantify monthly and annual N and P losses via soil drainage water under annual and perennial crops, and (4) communicate results to farmers and the public.

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?

Quantifying the relative magnitudes of agronomic and environmental benefits from perennial IWG versus annual crops will inform policy-making on IWG adoption to achieve commercial and ecological goals. Moreover, by identifying the degree to which potential ecological benefits of IWG cultivation persist following the transition back to annual crops, farmers, conservation professionals, and policy makers will be better positioned to anticipate unexpected soil and water quality responses during the post-transition period. This project's results will inform realistic expectations and policies for incorporating mixed annual-perennial crops, particularly related to soil N and P retention, redistribution, and loss across seasonal and hydrologic regimes.

Activities and Milestones

Activity 1: Infield characterization and synthesis of N and P in aboveground-belowground biomass, soil, and water from diverse cropping systems.

Activity Budget: $290,000

Activity Description:
This activity aims to expose potential improvements or impairments to soil and water quality associated with the transition from IWG into annual row crops. Generating data from plot-based experiments over three years, we will develop realistic expectations for mixed annual-perennial cropping systems.

Task 1: Above and belowground biomass will be collected at the same time and analyzed for N and P which will help advance knowledge of plant nutrient uptake, export, and return to the soil in plant residues. Research will be conducted on two tile drained experimental areas managed by the Southwest Research and Outreach Center (SWROC).
Deliverable 1: Root, shoot, and grain N and P data.

Task 2: Soil nutrient and soil health testing will be conducted to quantify distinct fractions of N and P, along with carbon and soil water to assess potential mechanisms contributing to N and P retention and loss from the soil.
Deliverable 2: Soil physical, chemical, biological, and ecological data.

Task 3. Drain flow and water quality data will be collected when sufficient flow occurs. All samples will be analyzed for NO3-N, total N, DRP, and dissolved organic Carbon.
Deliverable 3. Water quantity and quality data.

Activity Milestones:

Description	Approximate Completion Date
Demonstrate N and P distribution in above and belowground biomass	December 31, 2028
Demonstrate N and P distribution and retention in soil	December 31, 2028
Demonstrate N and P loss with drainage water	December 31, 2028
Synthesis of data and factors influencing N and P distribution, retention, and loss	June 30, 2029

Activity 2: Disseminate results to farmers and the public

Activity Budget: $10,000

Activity Description:
This activity aims to disseminate research results to farmers and the public.

Task 1: We will reach out to farmers to disseminate our results and receive their feedback through U of M's extension activities, such as webinars, blog posts, and field days. We will also conduct outreach activities to introduce our research to the public, including K-12 students, at various venues such as the Farm Fest, Minnesota State Fair, University on the Prairie, and/or at the State FFA convention.
Deliverable 1: Webinars, blog posts, field days, and other outreach events.

Task 2: We will present our results at the Minnesota Water Resources Conference. We will also produce scientific manuscripts in open-access journals.
Deliverable 2: Presentations and publications.

Activity Milestones:

Description	Approximate Completion Date
Conduct outreach activities	June 30, 2029
Publications and presentations	June 30, 2029

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Lucy Rose	University of Minnesota	Co-Investigator	Yes

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?

We will invite farmers, industries, agencies, and other interested parties to the field sites to show our experiments and share our results. The results will be disseminated to the public through open-access publications and conference presentations. If additional work is needed, funding from commodity groups and state and federal sources will be sought.

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 and located at the SWROC in the University of Minnesota. Dr. Strock's research activities are focused on diversified cropping systems/rotational complexity and agricultural drainage water management. He directs a field-based research program focused on soil 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 and land use 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. Dr. Strock has managed multiple projects related to the proposed subject.

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 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								
Lucy Rose		Co-lead, supervision, data and lab analysis, project reporting			36.6%	0.75		$78,495
1 graduate research assistant		Perform experiments, sample collection, data analysis, project reporting			23.2%	3		$173,950
1 field crew		Field operations, management, maintenance, sample collection			7.4%	3		$34,905
							Sub Total	**$287,350**
Contracts and Services								
							Sub Total	**-**
Equipment, Tools, and Supplies								
	Tools and Supplies	Materials for soil and plant collection and analysis	Necessary to measure nitrogen and phosphorus concentrations					$3,100
	Tools and Supplies	Materials for water sample collection and water quality analysis	Necessary to measure nitrogen and phosphorus concentrations					$3,100
	Tools and Supplies	Laboratory supplies and consumables	Various supplies and consumables are needed to collect and process samples (chemicals, glassware, plastic consumables, etc.)					$3,100
							Sub Total	**$9,300**
Capital Expenditures								
							Sub Total	**-**
Acquisitions and Stewardship								
							Sub Total	**-**

Travel In Minnesota								
	Miles/ Meals/ Lodging	A total of 3 trips (~900 miles) are planned (~300 miles/trip to visit SWROC from the University of Minnesota St. Paul campus at a rate of $0.70/mile.	Necessary to collect samples from the field site at SWROC					$600
	Conference Registration Miles/ Meals/ Lodging	Trips and registration fees to present our research results at a conference in MN ($300/person x 2 researchers)	To disseminate the results					$1,100
							Sub Total	**$1,700**
Travel Outside Minnesota								
							Sub Total	**-**
Printing and Publication								
	Publication	Open access publication fee	Necessary to make our results publicly available					$1,650
							Sub Total	**$1,650**
Other Expenses								
							Sub Total	**-**
							Grand Total	**$300,000**

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: $300,000

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: 7977fbd8-3fc.pdf

Alternate Text for Visual Component

Sampling scheme and expected N and P pools and fluxes in drainage water, soils, and vegetation before and after transition from IWG to corn in mixed annual-perennial cropping treatment plots. Arrow sizes indicate expected relative magnitudes of drainage water N and P concentrations and fluxes pre- and post-transition to corn....

Supplemental Attachments

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

Title	File
Authorization letter from the UMN Office of Sponsored Projects	7dad6395-c32.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:

Lucy Rose, University of Minnesota

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