

Environment and Natural Resources Trust Fund

2026 Request for Proposal

General Information

Proposal ID: 2026-087

Proposal Title: Measuring Wind Erosion in Minnesota

Project Manager Information

Name: Grace Wilson Organization: U of MN - College of Food, Agricultural and Natural Resource Sciences Office Telephone: (612) 625-5200 Email: wils0674@umn.edu

Project Basic Information

Project Summary: Develop devices and protocols to measure wind erosion in Minnesota and take preliminary measurements of wind erosion

ENRTF Funds Requested: \$325,000

Proposed Project Completion: June 30, 2029

LCCMR Funding Category: Land (F)

Project Location

- What is the best scale for describing where your work will take place? Region(s): Central
- What is the best scale to describe the area impacted by your work? Statewide
- When will the work impact occur?

In the Future

Narrative

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

Farmers know that wind erosion can reduce the fertility of their fields by removing the most productive layer of soil. But wind erosion can also be a hazard to human safety, as occurred in 2023 in the state of Illinois, when wind-blown dust from farm fields reduced visibility on an area highway, resulting in a crash that involved 70 vehicles and killing 7 people. Despite its risks, wind erosion is poorly understood in Minnesota. There have been zero studies with published results measuring wind erosion anywhere in the state during its history. We need accurate measurements of wind erosion in order to fully understand its impact on agricultural productivity, and to make recommendations of land management practices to reduce its impact. This need is becoming more urgent—with weather conditions in Minnesota trending toward reduced snow cover and more variable precipitation, wind erosion is likely to increase. Current methods of measuring wind erosion are difficult to implement in active farm fields and don't allow for measurements on a daily basis. Better methods are needed to measure wind erosion in order to protect soil fertility and help protect against hazardous dust conditions.

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.

We need to be able to take daily (or sub-daily) measurements of wind erosion in order to fully understand the weather conditions that result in the greatest losses of topsoil from wind, and what land management practices best mitigate these losses. These measurements need to be able to be taken on Minnesota farm fields, while not interfering with farm management practices. In this research project we will achieve these goals by:

1) Developing new devices and protocols (including hardware and algorithms) that allow for cost-effective daily or sub-daily measurements of wind erosion in farm fields

2) Implementing these tools in the field, collecting preliminary wind erosion data and demonstrating their use for long-term data collection

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 allowing for accurate daily measurement of wind erosion in the state, results from this work will lead to a better understanding of what weather conditions and land management practices are most likely to generate significant wind erosion. The new tools developed here can be used in future studies to take accurate long-term measurement of wind erosion across the state considering different land management practices, soil types, and weather conditions. This information is needed by researchers, policy makers, and land managers to understand the impact of wind erosion on soil fertility loss and better predict dangerous wind erosion events.

Activities and Milestones

Activity 1: Development of wind erosion measurement devices

Activity Budget: \$179,269

Activity Description:

We will develop new devices and protocols that can be used to measure wind erosion in farm fields in Minnesota on daily or sub-daily times scales. Most wind erosion occurs on only a few days during the month, such as days with the highest wind speeds and little plant cover. Therefore, daily or sub-daily measurements are needed in order to obtain an accurate assessment of wind erosion. We will modify existing frameworks for sensors that can measure very small particles in the air to develop a new method for measuring wind erosion (larger particles in the air). Existing low-cost particulate matter sensors can detect particles up to 30 μ m. To extend this range, we will develop a machine vision-based, fast-response sensing system capable of measuring larger particles from 30 μ m to 100 μ m. This integrated system will be tested in the lab to assess its performance in sizing and counting particles across the full range in sizes.

Activity Milestones:

Description	Approximate Completion Date
Prototype device options	December 31, 2026
Test different prototypes and choose final design	June 30, 2027
Build 10 devices for field use	December 31, 2027

Activity 2: Measure wind erosion at test site

Activity Budget: \$145,731

Activity Description:

We will test the new devices in field conditions designed in Activity 1 by installing them at an experimental site paired with conventional wind erosion samplers (either the Modified Wilson and Cooke (MWAC) or Big Springs Number Eight (BNSE) samplers). (The conventional wind erosion samplers are designed to collect wind erosion data on a monthly basis.) We will place 2 of these samplers in an agricultural field, collocated with the new devices for an approximately 12-month period. This will allow us to assess the accuracy of the new devices in field conditions, considering different crop stages and weather conditions. Additionally, we may leverage partnerships with personnel working at the National Wind Erosion Network sites in North Dakota and Manitoba to install and run our devices at their sites, in order to collect additional data comparing the newly designed devices to traditional wind erosion collection methods.

Activity Milestones:

Description	Approximate Completion Date
Establish test field location and sampling protocol	January 31, 2028
Install conventional system and new devices in test field	March 31, 2028
Data analysis to assess accuracy of new devices	June 30, 2029

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Grace Wilson	University of Minnesota	Project manager	Yes
Jiayu Li	University of Miami	Consultant for design of measurement devices	No
Nick Webb	USDA	Consultant on wind erosion samplers	No

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?

The team will give open scientific presentations and publish scientific papers addressing the project objectives. We will also work with farmer organizations to discuss the project results. We expect to achieve the stated objectives of this project within the bounds of this grant timeline. Any additional work (such as longer-term measurement of wind erosion in the state) will be funded by separate grants after completion of the deliverables from this project.

Project Manager and Organization Qualifications

Project Manager Name: Grace Wilson

Job Title: Research Assistant Professor

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

Dr. Wilson received her M.S. degree in Applied Plant Sciences, and her Ph.D. in Land and Atmospheric Sciences, both from the University of Minnesota. Following completion of her Ph.D., Dr. Wilson worked to integrate wind erosion estimates into the Daily Erosion Project (a regional erosion model that currently only estimates water erosion) as part of a BWSR funded project geared toward developing tools to estimate total erosion in the state of Minnesota. Through that work, Dr. Wilson developed an understanding of the key processes driving wind erosion, and the current status of wind erosion measurements in Minnesota and the Midwest region. Her long-term research interests involve finding solutions to water and agricultural resources problems using methods that combine chemical, biological, and physical sciences. Previous grant funding has been awarded for research projects focused on water quality in agricultural and urban watersheds, including studying persistent organic pollutants resulting from structural fires.

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

Organization Description:

The College of Food, Agriculture, and Natural Resources Sciences (CFANS) at the University of Minnesota is dedicated to using science to find answers to the world's grand challenges and solve tomorrow's problems. The College includes twelve academic departments along with ten research and outreach centers, all representing a range of disciplines and research expertise. This breadth of expertise allows the College to tackle challenges in novel ways, including the Grand Challenge research and education investments program which specifically focuses on research geared towards water resources and uses.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineli	% Bene	# FTE	Class ified	\$ Amount
				gible	fits		Staff?	
Personnel								
Project Lead -		Oversee research, manage staff, project design,			36.6%	113.31		\$100,706
Principal		data analysis						
Investigator								
(Contract								
faculty)								
2 Researchers		device design and fabrication, lab tests of device			25.9%	2.25		\$198,464
		accuracy, establish field testing sites, manage undergraduate students						
Undergraduate		conduct tests of device accuracy, establish field			0%	0.24		\$7,998
students		test sites, and collect field data					Cub	¢207.100
							Sub	\$307,168
Contracts and							TOLAI	
Services								
Jervices							Sub	
							Total	_
Equipment,								
Tools, and								
Supplies	-							6740
	Tools and	supplies (e.g. steel tubes, bolts, nuts, etc)	for building 2 conventional wind					\$712
	Supplies		erosion samplers (MWAC samplers)					646.000
	Equipment	parts and tools (e.g. microscope objetives,	to design and create 10 sensor					\$16,920
		and components, cleatrical and course and	devices					
		and components, electrical enclosures and						
		nardware, mounting nardware for the field)					Sub	¢17 622
							Total	\$17,052
Canital							Total	
Expenditures								
-							Sub	-
							Total	
Acquisitions								
and Stewardship								
							Sub	-
							Total	

Travel In Minnesota						
	Miles/ Meals/ Lodging	approx 285 miles to drive to various test sites	test sensors and samplers			\$200
					Sub Total	\$200
Travel Outside Minnesota						
					Sub Total	-
Printing and Publication						
					Sub Total	-
Other Expenses						
					Sub Total	-
					Grand Total	\$325,000

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: \$325,000

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component File: <u>6561b883-c0c.pdf</u>

Alternate Text for Visual Component

A photo of a 70-vehicle accident caused by reduced visibility due to wind erosion. Also shown is text describing that new technologies are needed to measure wind erosion in MN in order to protect soil fertility and against hazards such as the accident shown in the photo...

Supplemental Attachments

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

Title	File
Approval to submit letter	8fd76b04-34c.pdf
Audit	b82bdf5f-b4a.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?

Yes

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

Yes

Do you wish to request reinvestment of any revenues into your project instead of returning revenue to the ENRTF? No

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?

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:

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