Environment and Natural Resources Trust Fund

2026 Request for Proposal

General Information

Proposal ID: 2026-515

Proposal Title: Plant-Growth Promoting Microbes for Prairie Resilience and Restoration

Project Manager Information

Name: Jannell Bazurto

Organization: U of MN - College of Biological Sciences

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Project Basic Information

Project Summary: We will use stress-protective microbes from native Minnesotan plants to stimulate growth and improve the resilience of prominent prairie plants to support and enhance restoration efforts.

ENRTF Funds Requested: $356,000

Proposed Project Completion: June 30, 2029

LCCMR Funding 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.

The iconic beauty and value of prairie ecosystems in Minnesota are part of our natural heritage. This pristine resource, fueled by its extensive, deep root system, has profound positive impacts upon water quality, ground water supply, and soil health, while reducing soil erosion and flood risks, supporting biodiversity, including critical pollinators. Through these attributes, prairies promote the health of Minnesota's natural resources, including agricultural resources, and serve as a distinct attraction for nature enthusiasts and history-buffs alike. Unfortunately, prairies have been extensively diminished in the past two centuries, to slightly over 1% of the original estimated 18 million acres. This alarming decline has spurred various restoration efforts that have sought to increase the land area in Minnesota classified as native prairie and to connect existing prairies, which can improve their genetic diversity and long-term stability. In some cases, these efforts have been challenged by stressful environmental conditions. In particular, prairie productivity is profoundly impacted by drought stress, which can cause a lack of growth and die-off of above-ground biomass. Fortunately, restoration efforts can be bolstered by enhancing the resilience of prairie plants, ensuring these vital ecosystems continue to thrive and support Minnesota's rich natural resources.

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.

Microbes associated with plants, though invisible to the human eye, confer a remarkable variety of benefits on the plants they colonize. They enhance the availability of essential nutrients, produce hormones that promote growth, and provide protection against pathogens and environmental stressors. The plant growth-promoting microbes on the leaf surfaces, in particular, have gained increasing attention in recent years for their significant contributions to plant growth, development, and resilience. Plants under stress rely heavily on these microbes to survive and thrive. Methylotrophs, the predominant group on leaf surfaces, increase seed germination and production rates, dramatically stimulate leaf and root growth, and protect plants against a wide range of pathogens. Additionally, they are particularly good at protecting plants from drought stress, high soil salinity, and heavy metal contamination, which can arise from both natural (soil erosion) and human (industrial/agricultural) sources. Microbes thriving on plants in drought conditions are well-equipped to navigate such challenges and impart increased resilience through their introduction to plant surfaces. These beneficial organisms can be easily applied at the seed stage or by spraying leaves and stems with a suspension of cells during dry conditions, thereby enhancing microbial abundance and improving plant performance.

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?

The proposed work will leverage the qualities of microbial samples that demonstrate particularly positive outcomes for the plants they colonize to enhance the stress resilience and ultimately growth performance. These microbes will promote current prairie restoration efforts and directly serve as a valuable natural resource, as they are adept at handling drought conditions, native to Minnesota, and expected to thrive in a variety of stressful conditions encountered within the state. This approach can also be extended to other applications such as establishment of urban and rural prairie landscapes and improving growth and resilience of our many commercially important crops.

Activities and Milestones

Activity 1: Collect and identify prominent leaf-dwelling microbes from prairie plants at sites throughout Minnesota experiencing different levels of drought

Activity Budget: $128,387

Activity Description:
We will collaborate with University of Minnesota's extension educators who have expertise in prairie plant growth and members of the Minnesota Division of Natural Resources to identify ideal sites for gathering samples for this study. Sampling plant leaf tissue at the proposed scale is minimally invasive and should not impact the health of individual plants or the sample site; however, we will exercise additional care by seeking guidance from expert stakeholders. We will sample plants from prominent species that include grasses and flowering plants, which will allow us to: i) identify key leaf-colonizing microbial species present at each site, ii) acquire maximally diverse microbes to test for their ability to confer maximum plant resilience, and iii) provide a holistic view of the microbial landscape associated with prairie plants and drought regions.
To isolate the stress resilience-conferring methanol-consuming microbes for future plant applications, we will enrich for microbes that can grow directly on methanol. This nutrient is naturally released from plant leaves daily, making these microbes well-adapted to leaf surfaces. Overall, we aim to characterize plant leaf microbes from 15 distinct native prairie sites in Minnesota, across three drought states, to identify and cultivate important biological contributors to this vital ecosystem.

Activity Milestones:

Description	Approximate Completion Date
Determine five sampling sites for each of three drought status conditions	July 31, 2026
Sample the most prominent grasses and flowering plants to characterize and isolate leaf-dwelling microbes	August 31, 2026
Isolate DNA from and genetically characterize leaf microbe communities	December 31, 2026
Isolate and enrich for methanol-consuming microbes, characterize them genetically, and prepare them for long-term storage	July 31, 2027
Develop educational resources related to the project effort to share with K-12 educators	August 31, 2027

Activity 2: Characterize microbes that confer stress resilience to increase drought-stress resistance to key prairie plant species

Activity Budget: $132,658

Activity Description:
We predict that important plant-associated microbes will thrive on the surface of plant leaves, even under drought conditions, and confer benefits back to the plants during successful colonization. We will directly apply microbes with enhanced methanol utilization to key prairie plant species and evaluate their relative capacities to enhance plant performance and resilience, particularly in the face of drought and water stress. These microbes will be tested on prairie grasses, prairie wildflowers, and combinations of both together. Specifically, we will measure seed germination rates and overall plant growth (size and mass) in plants exposed to different watering regimes. These plant-microbe combinations will be evaluated under controlled greenhouse conditions that will allow us to isolate dryness as the primary plant stress factor and identify microbes that enable prairies plants to thrive, even under increased drought stress. The microbes that demonstrate the greatest capacity to improve plant growth and survival in conditions of limited water will be further characterized and cataloged as potential contributors to the rescue and enhancement of

prairie plant resilience, particularly in response to heightened drought conditions. The findings will be shared via peer-reviewed journals and outreach to relevant stakeholders, constituents, and educational institutions within the state.

Activity Milestones:

Description	Approximate Completion Date
Assess growth stimulation & drought resilience of selected microbes upon prominent prairie grasses	November 30, 2027
Assess growth stimulation & drought resilience of selected microbes upon prominent prairie flowering plants	March 31, 2028
Assess growth stimulation & drought resilience of selected microbes upon prairie grass and wildflower combinations	July 31, 2028
Isolate and genetically characterize leaf microbe communities that confer plant resilience	October 31, 2028
Dissemination of results and publish findings in a peer-reviewed journal	February 28, 2029

Activity 3: Partner with Minnesota citizens to initiate and maintain microbially supported prairie gardens to promote and strengthen our statewide natural resources

Activity Budget: $94,955

Activity Description:
To promote and strengthen our natural resources while fostering public appreciation for them, we will engage Minnesotans in citizen-science by running a booth weekly at the two largest farmers' markets in the Twin Cities to encourage individuals to plant their own prairie flora. We will provide seed packets that are untreated or have been treated with microbes identified as particularly beneficial for plant growth in the previous activities, along with a set of care instructions. Participants will be encouraged to track and report the growth of their prairie plants by capturing images over time. We will use citizen-generated data to track and compare the performance of differently treated plots to assess their long-term success in natural settings. Additionally, we aim to sample microbes from individual sites at both the beginning and end of the growing season to assess the microbial outcomes of microbial supplementation for prairie plants in local field sites. The planting of these prairie plants will beautify urban spaces, as we anticipate most participants will reside in the metropolitan area, increase residents' knowledge of prairie plants and their associated microbes, and impart a positive impact on local air, water, and soil quality by expanding prairie space in Minnesota.

Activity Milestones:

Description	Approximate Completion Date
Determine microbial stability to establish lifetime of microbially-treated seeds	March 31, 2028
Establish educational materials and resources required to distribute to citizen partners	April 30, 2028
Distribute materials to citizen scientists at local farmers' markets	May 31, 2028
Gather citizen growth data and sample local newly established prairie gardens	March 31, 2029
Iteration 2, analyze and present results to pertinent parties, potential educational and/or local publication	June 30, 2029

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 goal of the project is to identify natural and environmentally-friendly methods to support native plant health and restoration efforts. By isolating and characterizing microbes already associated with these plants, we can amplify their naturally-protective effects. Through this work, we will develop plant growth-supporting treatments that can be further investigated and harnessed for application to agriculturally relevant crops and other relevant ecosystems in Minnesota. We will seek funding for such ongoing efforts and additional work as needed through additional state and federal funding sources, such as the National Science Foundation and the United States Department of Agriculture.

Project Manager and Organization Qualifications

Project Manager Name: Jannell Bazurto

Job Title: Assistant Professor

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

Dr. Jannell Bazurto (Project Manager) received her PhD in the Microbial Doctoral Training Program from the University of Wisconsin in 2013. Prior to receiving her PhD, she worked in the private medical diagnostic industry for three years. Afterward, she spent five years as a postdcotoral fellow. She became an Assistant Professor in 2019 at the University of Minnesota in the Department of Plant and Microbial Biology whose mission is to contribute to the basic biological understanding of plants and microbes, environmental conservation, and agricultural productivity. Dr. Bazurto is also a member of the BioTechnology Institute and the Microbial and Plant Genomics Institute, which leverage cross-disciplinary biotechnological research and genomics-enabled science in microbes and plants, respectively, to innovate for the benefit of society. In addition to the many experimental and analytical resources available in the Bazurto lab, the University of Minnesota offers a range of shared facilities for research. This includes the Genomics Center for sequencing and specialized facilities for plant growth research, including state-of-the-art greenhouses equipped for various growth conditions and controlled environments, ensuring researchers have access to the necessary resources for effective plant research and development.

Dr. Bazurto's lab aims to fundamentally understand successful strategies that organisms use to survive, and even thrive on, toxic compounds and persist in high-stress environments, with an emphasis on leveraging these findings for the development of more resilient ecological, biotechnological and agricultural applications. Dr. Bazurto has over 20 years of experience in genetics and organismal physiology, the last nine of which have largely focused on plant-associated microbes that bestow a variety of benefits to plants, including stress resilience. Dr. Bazurto's work has been previously funded by the National Science Foundation, the United States Department of Agriculture, and National Institutes of Health, Minnesota's Discover, Research and InnoVation Economy.

Organization: U of MN - College of Biological Sciences

Organization Description:

The College of Biological Sciences (CBS) at the University of Minnesota is dedicated to advancing biological research and education, focusing on all levels of biological organization, from molecules to ecosystems. The college's mission is to deliver cutting-edge, internationally-recognized research and teaching, preparing students to innovate and shape the future of biology. CBS emphasizes the importance of collaborative research, fostering partnerships within the university and beyond to address pressing challenges in human health and environmental sustainability.

In addition to its strong academic programs, CBS actively engages with the community, promoting public understanding of biological sciences through outreach and educational initiatives. These efforts enhance student learning and contribute to societal well-being by translating complex biological concepts into practical solutions. For example, CBS

researchers work on topics such as sustainable agriculture, disease prevention, and ecological conservation, which directly benefit local and global communities. Moreover, the college provides resources and facilities that support hands-on learning, including greenhouses, laboratories, and field sites, ensuring that students gain valuable experience relevant to the world beyond University. Through its commitment to excellence in research and education, CBS plays a crucial role in shaping informed citizens and leaders who are equipped to tackle the biological challenges of our time.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
Research Scienstist		Design, conduct, and supervise experiments, manage undergraduate students, work with stakeholders and act as point person to manage experiments and assure that routine experimental procedures are properly performed. Assist with completion of project reports and lead efforts to complete peer-reviewed research papers related to the project and share results with the broader research community through presentations. These funds represent full-time support for on research scientist for three years of the grant period			26.79%	1.5		$143,430
Assistant Professor		Oversee all aspects of project, supervise researchers and trainees, plan monthly meeting with entire research group and quarterly meetings with broader group of stakeholders. These funds represent partial summer support for the lead Principal Investigator.			26.79%	0.24		$40,069
Graduate Student Researcher		Conduct laboratory and field experiments, train and educate undergraduate students in field and laboratory research. Write research papers related to project finding and share results with the broader research community through presentations. These funds represent support throughout the duration of the grant period of one graduate student at half-time.			44.72%	0.99		$85,501
Undergraduate Research Assistant		Establish and maintain plant growth, collect data, assist senior personnel and learn about laboratory and field research. These funds represent summer support and part-time support during the academic year for two undergrads throughout the duration of the grant period.			0%	2		$36,000
							Sub Total	**$305,000**
Contracts and Services								

University of Minnesota Plant Growth Facility	Internal services or fees (uncommon)	Rent greenhouse space to growth prairie plants under different treatments (0.0383/day/sqft, 72 experimental units, 2x2 foot plats for each unit)				0		$8,000
University of Minnesota Genomics Center	Internal services or fees (uncommon)	Costs to perform sequencing services for the identification and characterization of microbial communities and specific isolated microbes. In the first two years of the project, we anticipate two sequencing runs per year, at $3000 per each run. These estimates are consistent with previous expenses for similarly designed and scaled projects.				0		$12,000
							Sub Total	**$20,000**
Equipment, Tools, and Supplies								
	Tools and Supplies	Lab Supplies	Supplies to be purchased include all necessary reagents for microbial and plant growth experiments, including growth media, general laboratory chemicals and reagents, and safety materials ($750 per month total), preassembled kits for performing routine molecular biology tasks ($200 per kit), prairie plant seeds for propagation ($200), liquid nitrogen for strain and sample storage in ultra-low temperature conditions ($400 per year).					$27,000
							Sub Total	**$27,000**
Capital Expenditures								
							Sub Total	**-**
Acquisitions and Stewardship								
							Sub Total	**-**
Travel In Minnesota								

	Miles/ Meals/ Lodging	Car travel for 4-5 trips in year 1 (3-4 sampling sites each). Each trip will involve 2-3 people; the number of miles TBD (will depend on sites chosen). Analogous car travel at the end of year 2 is requested for 2-3 trips to report our findings to stakeholders.	To collect prairie plant leaf samples and obtain plant growth-promoting microbes during the year 1 and to disseminate our findings in year 2.					$3,800
							Sub Total	**$3,800**
Travel Outside Minnesota								
							Sub Total	**-**
Printing and Publication								
							Sub Total	**-**
Other Expenses								
		Farmer's Market Booth Rental Fees	To reserve a booth at local farmer's markets for citizen-science recruitment and educational outreach of Activity 3					$200
							Sub Total	**$200**
							Grand Total	**$356,000**

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				
In-Kind	University funds	Indirect costs for this proposal though not allowed, are listed as in-kind contribution of 54% MTDC which is the Federally Negotiated rate with the U of M. The indirect is proportionate to the awarded funds at a rate of 54% so if the award is reduced the F&A would be reduced	Secured	$177,313
Cash	University of MN	15% salary and fringe and unrecoverable indirect for PI as cost share	Secured	$27,768
			Non State Sub Total	**$205,081**
			Funds Total	**$205,081**

Total Project Cost: $561,081

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: 0769026f-86e.docx

Alternate Text for Visual Component

A prairie map of Minnesota depicts the historical range of natural prairies and current day prairie lands that remain. Additionally, there are three boxes, each of which visually depict one of the three Activities proposed in the proposal "Plant-growth promoting microbes for prairie resilience and restoration"....

Supplemental Attachments

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

Title	File
UMN Proposal Approval Letter	7b202e39-ccd.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?

Yes, Sponsored Projects Administration

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:

Elliot Skurich (University of Minnesota), Lori Nicol (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