Environment and Natural Resources Trust Fund

2026 Request for Proposal

General Information

Proposal ID: 2026-157

Proposal Title: Evaluating Climate-Ready Native Shrubs for Resilient Managed Landscapes

Project Manager Information

Name: Brandon Miller

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

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Project Basic Information

Project Summary: This project will assess underutilized native shrubs from Minnesota to determine their suitability for use in challenging settings to improve overall landscape resiliency in the face of a changing climate.

ENRTF Funds Requested: $239,000

Proposed Project Completion: June 30, 2029

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

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.

Managed green spaces are landscapes that utilize plants to provide environmental, social, and aesthetic benefits. Taking many shapes, they manifest as home landscapes, roadside plantings, parks, and green infrastructure like rain gardens. These ecological oases are highly valued for the benefits they provide in the built environment but are often characterized by harsh conditions that limit the success of vegetation, including irregular water cycles, degraded soils, and increased temperatures. Progressively more extreme and variable climate conditions are intensifying these challenges, making managed landscapes a critical front for climate adaptation. In Minnesota, many managed plant assemblages lack the biodiversity and adaptability necessary to endure shifting conditions, threatening their ability to deliver essential ecosystem services and subsequent benefits to local residents. The decline of American elms and ash trees underscores the risks and costs of limited plant species diversity. There is a pressing demand for adaptable plants capable of thriving in unpredictable conditions. While some native species show promise for these environments, they remain understudied. Expanding the plant palette for managed landscapes requires quantitative data on the performance of native species in these settings. This research would address a crucial knowledge gap and enhance the resilience and long-term sustainability of Minnesota landscapes.

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.

Woody plants offer a natural solution for climate adaptation in managed landscapes. Adding diversity and texture to a landscape, woody plants, like trees and shrubs, enrich human experiences with their environment. Beyond their physical and mental health benefits, woody plants provide essential ecosystem services– managing stormwater, reducing erosion and wind, and maintaining complex ecological networks. Incorporating woody plants transforms managed landscapes into multifunctional spaces that strengthen community resilience. Minnesota native shrubs represent a significant opportunity to expand woody plant diversity in managed green spaces. Native willows, for example, are vastly underutilized. Despite the state having over 20 native willow species, some highly adaptable, commercial application is largely limited to non-native varieties like dappled willow (Salix integra ‘Hakuro-Nishiki’) and purple osier willow (Salix purpurea). Integrating adaptable native species into managed landscapes not only enhances biodiversity but also restores critical habitat for other native wildlife in human-dominated environments. However, performance testing is fundamental to the successful introduction of underutilized species. Without proper research, resources may be wasted on plants that cannot withstand challenging conditions. Confidently selecting species that will thrive indefinitely allows landscape managers to sustain resilient plant communities in Minnesota and preserve their ecological benefits.

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 research aims to identify climate-adaptable shrubs for greenspace application with the goal of enhancing Minnesota’s environmental quality while simultaneously preserving state-native flora in managed settings. Performance testing in greenhouse, field, and landscape conditions will generate quantitative context-specific data on the capacity for native species to thrive in challenging environments and deliver ecosystem services. A focus on soil moisture tolerances will illuminate potential benefits for stormwater management. Prioritizing underutilized species will fill gaps in knowledge and expand plant options for harsh sites. This work seeks to provide data-driven recommendations to statewide stakeholders, supporting climate adaptation and resilience in Minnesota communities.

Activities and Milestones

Activity 1: Identify a diverse set of potentially climate-adaptable native shrub species fit for implementation in Minnesota managed landscapes.

Activity Budget: $47,299

Activity Description:
Taxa will be selected based on their perceived ecological adaptive capacity, input from green industry professionals, and information from public garden collections, curators of germplasm repositories and University of Minnesota Extension's climate-ready woodlands project. This process will promote informed selection of species likely to be climate-adaptable based on ecological principles and first-hand accounts. Species will comprise a diverse array of plant families to promote biodiversity in managed plant communities. Species may include but are not limited to prairie willow (Salix humilis), sweetfern (Comptonia peregrina), round-leaved dogwood (Cornus rugosa), buttonbush (Cephalanthus occidentalis), and bush honeysuckle (Diervilla lonicera). Selected shrub species demonstrate adaptability in their natural habitats, but are underutilized in managed landscapes. Prairie willow, sweetfern, and round-leaved dogwood are noted for growth in disturbed or variable environments, including roadside ditches and transitional forest edges. Buttonbush, a common shoreline shrub, has shown broader adaptability in preliminary drought trials than previously assumed from site-association assumptions. Bush honeysuckle has an expansive native range and is also characterized by an ability to colonize altered or disturbed habitats. While preliminary information supports the adaptability of these species, formal research is limited. The list generated from this process will be utilized for greenhouse, field, and landscape trials.

Activity Milestones:

Description	Approximate Completion Date
Identify all taxa for inclusion	July 31, 2026
Obtain plant material	August 31, 2026
Establish stock plants in the greenhouse with obtained plant material	October 31, 2026

Activity 2: Assess performance potential of the selected set of shrubs in a controlled greenhouse environment.

Activity Budget: $61,876

Activity Description:
Greenhouse trials will facilitate a controlled assessment of plant adaptive responses to water stress. Experiments will use one-year-old stock plants, cultivated at the University of Minnesota Plant Growth Facilities through early spring, with trials commencing in early summer. Plants will be subjected to varying degrees of inundation and drought, then assessed on their growth and ability to photosynthesize. Informed by Peterson & Graves (2013), three treatments of inundation (containers in saucers of water that saturate the entire root zone, the lowest 7.5cm, or the lowest 3.5cm) and three of drought (irrigation when containers reach 5%, 19%, and 20% soil moisture) will be applied. Prior to treatment, one plant from each group will be selected as the control and measured. Repeatedly throughout the first month, root zone moisture measurements, photosynthesis measurements (LI-6400 photosynthesis system), stem length and diameter, and surface area of leaves (LI-COR 3100 leaf area meter) will be collected. At the end of the experimental period, root and shoot dry mass will be recorded. These measurements will illustrate species responses to drought and flooding, showing whether they can continue to grow and photosynthesize in challenging conditions. Controlled greenhouse trials thereby represent one method to assess potential climate-adaptability.

Activity Milestones:

Description	Approximate Completion Date
Cultivate/grow stock plants to 6" container sizes	May 31, 2027
Execute greenhouse trials	July 31, 2027
Create deliverables and disseminate results to stakeholders	May 31, 2029

Activity 3: Assess performance potential of the selected set of shrubs in a controlled outdoor environment.

Activity Budget: $83,340

Activity Description:
For field trials, species of interest will be planted in a uniform outdoor setting at the Horticultural Research Center in Chaska, MN. To assess plant adaptive responses in a controlled outdoor setting, data will be collected on growth attributes, ability to photosynthesize, and predicted drought tolerance. Growth metrics will include plant volume, subjective appeal (rating from 1-5), chlorophyll content, and leaf dimensions. Photosynthesis will be measured using the same methodology as greenhouse trials. Routine measurement at the beginning, middle, and end of each growing season will help characterize these understudied taxa and demonstrate their responses to different conditions. In late spring and in late summer, predicted drought tolerance will be assessed using the methodology recommended by Miller & Bassuk (2022). By collecting and processing leaf disks with a 5600 Vapor Pressure Osmometer, we can calculate leaf turgor loss points (using methods from Sjöman et al. 2015 and Bartlett et al. 2012). Low turgor loss points are associated with drought tolerance and a maintained ability to photosynthesize during drought. These measurements will thereby reveal whether the selected species have the ability to continue to thrive and deliver ecosystem services during drought conditions.

Activity Milestones:

Description	Approximate Completion Date
Establish field plots	May 31, 2027
Collect data on photosynthesis and growth attributes- beginning of the growing season	June 30, 2028
Collect data on predicted drought tolerance- beginning of the growing season	June 30, 2028
Collect data on photosynthesis and growth attributes- middle of the growing season	July 31, 2028
Collect data on photosynthesis and growth attributes- end of the growing season	August 31, 2028
Collect data on predicted drought tolerance- end of the growing season	August 31, 2028
Create deliverables and disseminate results to stakeholders	May 31, 2029

Activity 4: Assess performance potential of the selected set of shrubs in realistic managed settings.

Activity Budget: $46,485

Activity Description:
Landscape trials will take place in managed landscapes throughout Minnesota. Sites will be selected in collaboration with green industry professionals, including landscape architects certified by the Minnesota Department of Transportation. Potential sites include rain gardens, bioswales, roadsides, parks, and other green infrastructure settings. Plant locations will be mapped using ArcGIS and site characteristics– including soil moisture, light exposure, pH, and soil compaction– will be recorded at the start of each growing season. Data on plant performance will include the same metrics utilized in field trials (plant volume, subjective overall appeal, chlorophyll content, leaf dimensions, and leaf area) and will be collected at the beginning, middle, and end of each growing season. These data will provide species- and locality-specific data to assist green industry stakeholders in their plant selection decisions. The landscape trials are an essential component of this work because they operate outside of a controlled setting and will be used to assess

plant abilities to thrive in the milieu of multiple different stressors. This work will also provide a framework for further long-term monitoring of taxa to ensure their sustainability in these landscapes.

Activity Milestones:

Description	Approximate Completion Date
Confirm trial locations with green industry stakeholders	October 31, 2026
Cultivate/grow stock plants to #1 gallon container sizes	May 31, 2027
Install plants in trial locations	June 30, 2027
Collect data on plant performance- beginning of the growing season	June 30, 2028
Collect data on plant performance- middle of the growing season	July 31, 2028
Collect data on plant performance- end of the growing season	August 31, 2028
Create deliverables and disseminate results to stakeholders	May 31, 2029

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Hazel Schrader	University of Minnesota-College of Food, Agricultural, and Natural Resource Sciences	Graduate Research Assistant	Yes
Luther Overholt	City of Edina Parks and Recreation Department	City Forester	No
Carol Zoff	Minnesota Department of Transportation	Supervisor of the Environmental Planning and Design Unit	No
Brianna Lovato	University of Minnesota - Horticulture Research Center	Research Plot Technician	Yes
Daniel Gullickson	Minnesota Department of Transportation	Supervisor for the Roadside Vegetation Management Unit- Specifically Blowing Snow Control Shared Services	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?

This project will culminate in public and academic resources, including plants left in place for long-term landscape trialing, all mapped using ArcGIS. Results will be presented via Extension field-day demonstrations, at industry gatherings, and at academic conferences (funded externally). Information will be distributed to green industry and public stakeholders using UMN Extension webpages, including Yard & Garden. Project success and achievement will be measured by the development of at least one peer-reviewed research publication in an open-access scientific journal as well as a published dissertation in the UMN digital repository, serving as the final report for the project.

Project Manager and Organization Qualifications

Project Manager Name: Brandon Miller

Job Title: Assistant Professor/State Extension Specialist/Curator of Plant Collections

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

Dr. Brandon Miller is an Assistant Professor in the Department of Horticultural Science at the University of Minnesota. He serves as a State Extension Specialist and as Curator of Plant Collections at the Minnesota Landscape Arboretum. His research and Extension programs are extramurally funded and he is experienced in managing a research team and grant-funded projects. Dr. Miller is experienced in the specific qualifications pertinent to this proposed plant resiliency project: controlled stress physiology experiments, field trialing, real-world implementation of plant evaluation with green industry stakeholders, graduate student advising, and distributing findings to public stakeholders via Extension programming.

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

Organization Description:
This project will operate through the University of Minnesota Department of Horticultural Science, in particular in the Resilient Landscape Horticulture Research and Extension Program, a lab group with the core focus of developing resilient landscapes in Minnesota.

The College of Food, Agricultural and Natural Resources Sciences (CFANS) comprises twelve academic departments as well as ten research and outreach centers, in addition to the Minnesota Landscape Arboretum, the Bell Museum, and a variety of interdisciplinary centers.

The University of Minnesota Landscape Arboretum, founded in 1958, is a 1,200-acre premier northern garden that includes 28 specialty gardens, 45 plant and tree collections, 18 model landscapes and natural areas, and an extensive collection of cold hardy plants. The mission of the Arboretum is to welcome, inform and inspire all through outstanding displays, protected natural areas, horticultural research, and education. Its vision is to be the premier northern landscape arboretum, welcoming all to enjoy, learn from, and connect with nature.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
Graduate Research Assistant		To set up experiments, conduct research, analyze data, compile results, and support dissemination of findings. [YR1: $39,794 (Salary: $32,300; Fringe: $7,494); YR2: $41,187 (Salary: $33,431; Fringe: $7,756); YR3: $44,739 (Salary: $36,314; Fringe: $8,425)]			23.2%	1.5		$125,720
Research Plot Technician		To maintain the field plots and support greenhouse plant management. Coverage is 25% time for 9 months/yr (only works March-Nov). [YR1: $12,414 (Salary: $9,383; Fringe: $3,031); YR2: $12,849 (Salary: $9,712; Fringe: $3,137); YR3: $13,299 (Salary: $10,052; Fringe: $3,247)]			32.3%	0.54		$38,562
							Sub Total	**$164,282**
Contracts and Services								
							Sub Total	-
Equipment, Tools, and Supplies								
	Tools and Supplies	Environmental data sensors (temp./RH/light quality)	Acquisition of sensors to be deployed in the field to track temperature (ibuttons), as well as sensors for use documenting temperature and relative humidity (Onset), and photosynthetically active radiation (Apogee Quantum) in greenhouse experiments.					$4,433
	Tools and Supplies	Supplies - Plant Material	Purchase of established Minnesota-grown plants (#1 gallon or larger) for field evaluations and real-world trials to measure suitability and plant growth responses.					$5,000
	Tools and Supplies	Supplies - General	$500 annually for general supplies as needed to complete project work.					$1,500

							Sub Total	**$10,933**
Capital Expenditures								
							Sub Total	**-**
Acquisitions and Stewardship								
							Sub Total	**-**
Travel In Minnesota								
	Miles/ Meals/ Lodging	100 miles ($0.70/mile) annually (3 years) for one GRA student.	Mileage to support GRA student to visit research sites for experiment setup and data collection.					$210
							Sub Total	**$210**
Travel Outside Minnesota								
							Sub Total	**-**
Printing and Publication								
	Publication	Peer reviewed manuscript publications	Up to three peer reviewed manuscripts will be developed based on research findings (estimated at $2000 per publication in the journal HortScience)					$6,000
							Sub Total	**$6,000**
Other Expenses								
		Graduate Research Assistant Tuition	Built into the GRA appointment, this fee covers the tuition portion [YR1: $19,094; YR2: $19,667; YR3 (Adv. Status): $3,214]					$41,975
		Greenhouse and Cooler Rental Fee	Rental fee of greenhouse space (and associated supplies and services) as well as cooler space for overwintering plants. Annual fee = $5,200: greenhouse ($400/month * 12 months)					$15,600

			& cooler space ($100/month * 4 months)					
							Sub Total	**$57,575**
							Grand Total	**$239,000**

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: $239,000

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: b21c5790-7b3.pdf

Alternate Text for Visual Component

This logic model visually breaks down the situation (context), inputs, activities, outputs, and outcomes of the proposed research project....

Supplemental Attachments

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

Title	File
SPA Resolution Letter	47afdf07-d36.pdf
Support Letters	89d1c89a-618.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?

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:

Hazel Schrader (UMN Dept. of Hort. Sci.); Dave La Fave (UMN Dept. of Hort. Sci.); Sarah Hulke (UMN SPA)

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