Environment and Natural Resources Trust Fund

2026 Request for Proposal

General Information

Proposal ID: 2026-213

Proposal Title: Assessing Black Walnut for Climate Resilience in Minnesota

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 evaluate cold and drought tolerance mechanisms in black walnut to guide climate-adaptive planting and share findings through outreach and stakeholder engagement to support resilience in Minnesota.

ENRTF Funds Requested: $333,000

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?

Region(s): Metro, Central,

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.

Climate change poses threats to agriculture and forest stands throughout the state due to increasing drought severity and extreme winter temperature fluctuations. However, some native trees may offer adaptability to contribute to resilience in forest stands and statewide agricultural production. Black walnut (Juglans nigra) is one such valuable native species in Minnesota, contributing to forestry, agroforestry, ecosystem services, and emerging industries like syrup production. Despite its economic and ecological importance, characterization of stress tolerance limits could further inform effective climate-adaptive management strategies.

Black walnut appears adaptable to different regions in the state, however research could determine if cold tolerance strategies critical for survival in Minnesota's fluctuating winters are employed by the species, ultimately informing suitability under future climate predictions. Meanwhile, observations of established tree adaptability to sites with varying water availability suggest that black walnut may employ useful tolerance strategies to cope with drought. However, research-based evidence to inform managed plantings remains understudied.

This project addresses these knowledge gaps by evaluating cold tolerance across Minnesota and drought tolerance in controlled and real-world plantings. Findings will provide science-based guidance to foresters, land managers, and conservation planners on climate-resilient black walnut application, supporting Minnesota's efforts to integrate black walnut into resilient 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.

This project will build on purported adaptability in future climate models (e.g. UMN Extension's Climate-ready woodlands project) by assessing black walnut's resilience to climate stressors including: evaluating cold tolerance across multiple Minnesota regions as well as drought tolerance of container-grown plants under controlled conditions and mature specimens established in the landscape. The findings will provide science-based recommendations for specialty-crop producers, land managers, foresters, and conservation planners to select and manage black walnut for climate-resilient landscapes.

To evaluate cold tolerance, we will assess dormancy progression, deacclimation timing, and freeze-thaw responses in mature black walnut trees across three Minnesota climate regions. Bud and stem tissue sampling will occur from October to March for physiological and structural assessments, including differential thermal analysis, electrolyte leakage, and carbohydrate accumulation measurements, to determine regional adaptations to extreme winter conditions.

To assess drought tolerance, container-grown trees will be subjected to controlled drought treatments (well-watered, moderate, severe) over two years. Measurements will include leaf water potential, plant growth responses, osmotic adjustment, and predictive modeling used to determine resilience under prolonged drought stress.

Findings will be shared through Extension materials, decision-making tools, and stakeholder engagement, ensuring practical applications for climate-adaptive black walnut planting, management, and use in Minnesota.

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?

Black walnut is a species of critical importance for protecting Minnesota's natural environment and a natural resource that should be preserved for long-term food security. Strategically integrating this climate-resilient perennial tree into the landscape could enhance the state's natural resources by providing edible nuts, syrup, and timber, while also contributing to soil and water conservation. Evaluating its cold and drought tolerance will provide science-based recommendations for climate adaptation, reforestation, and sustainable land-use planning. Findings will guide science-based management strategies to ensure black walnut's ecological and economic benefits, promoting resilience in Minnesota's forests and agricultural systems.

Activities and Milestones

Activity 1: Investigating Cold Tolerance Mechanisms of Black Walnut Across Minnesota for Climate-Resilient Tree Management

Activity Budget: $112,402

Activity Description:
This study will assess cold tolerance mechanisms of black walnut across Minnesota by evaluating species capacity for entering and breaking dormancy as well as cold tolerance thresholds over three winters. We hypothesize that black walnut is capable of entering and remaining dormant during transitional seasons and during unseasonal warming, suggesting the species is adaptable to future predicted climate conditions. To test this, 10–15 mature trees will be sampled from different climate regions (north, metro, and south).
At each site, monthly tissue samples will be collected from October through March. Dormancy and deacclimation rates will be assessed by placing buds in controlled conditions and testing their ability to survive freezing. We will evaluate how plants respond to cold stress by measuring cell membrane damage through electrolyte leakage and assessing the accumulation of protective sugars that help prevent freezing damage. Additionally, bark thickness and the incidence of frost cracking will be observationally measured as indicators of structural adaptation.
Multi-year data analysis will compare regional adaptation trends, with findings informing predictive cold damage risk models and guiding climate-resilient tree selection and management for land-use planning. Results will be disseminated through Extension workshops and resources as well as scientific publications for practical applications.

Activity Milestones:

Description	Approximate Completion Date
Site selection, tree identification, and installation of environmental monitoring equipment	October 31, 2026
First winter of data collection completed	March 31, 2027
Second winter of data collection completed	March 31, 2028
Third winter of data collection completed	March 31, 2029
Final data analysis, publication of results (final report) and dissemination of findings	June 30, 2029

Activity 2: Uncovering Drought Tolerance Mechanisms of Black Walnut in Minnesota to Assess Climate Adaptation Potential

Activity Budget: $117,309

Activity Description:
This study will assess drought tolerance mechanisms of black walnut, focusing on a range of water deficits applied to container grown plants and predictive models for mature landscape trees. By evaluating plant response under controlled drought and mature trees exposed to natural conditions, we aim to determine potential and real-time response of black walnuts to drought in Minnesota.
We hypothesize that black walnut is capable of employing drought tolerance strategies during periods of water deficit and throughout prolonged exposure in the growing season (osmotic adjustment). We will test container-grown plants representing stock currently available to land managers in the state and established plants comprising Minnesota's black walnut genetics. Container grown plants will be exposed to three drought treatments (well-watered, moderate drought, severe drought), with 10–15 replicates. Soil moisture sensors will track dry-down cycles and traditional drought evaluation methods, including but not limited to determining actual and predicted leaf water potential, will be used to determine drought response strategies.
Findings will inform science-based recommendations for climate-resilient planting and management. Results will be disseminated through Extension workshops and resources as well as scientific publications for practical applications.

Activity Milestones:

Description	Approximate Completion Date
Procurement of nursery-sourced black walnut plants and establishment of controlled drought experiment	September 30, 2026
First-year drought study data collection completed	September 30, 2027
Second-year drought study data collection completed	September 30, 2028
Final data analysis, and synthesis of results in a peer-reviewed paper submitted for publication	December 31, 2028

Activity 3: Outreach and Knowledge Dissemination of the Potential Use of Black Walnut for Climate-Resilience

Activity Budget: $103,289

Activity Description:

This activity will translate findings from the cold and drought tolerance studies into actionable knowledge for Minnesota stakeholders. The objective is to increase awareness of the potential for using black walnut to bolster climate resilience, provide guidance on site suitability and adaptive management, as well as promote the tree in Minnesota landscapes, especially with changing environmental conditions.

To achieve this, Extension resources will be developed summarizing research findings and offering practical recommendations for planting and management. Findings will be shared through field days and workshops featuring demonstrations at the University of Minnesota Horticultural Research Center. Scientific dissemination will include peer-reviewed publications and conference presentations (funded externally), ensuring integration into broader land management discussions.

Outcomes will include increased adoption of climate-resilient black walnut planting strategies, improved access to research-based decision tools, and strengthened collaborations between researchers, policymakers, and industry stakeholders. The effectiveness of outreach will be evaluated through participant feedback, participation metrics, and engagement surveys to assess knowledge uptake and application. Findings will inform long-term strategies for integrating black walnut into climate-adaptive land management across Minnesota.

Activity Milestones:

Description	Approximate Completion Date
Development of outreach strategy, including identifying key stakeholders and communication platforms	December 31, 2026
Creation of extension resources based on initial research findings	December 31, 2027
First round of stakeholder engagement through workshops and field days	April 30, 2028
Second round of stakeholder engagement through workshops and field days	April 30, 2029
Dissemination of research findings through extension resources, peer-reviewed manuscripts, and final reports	June 30, 2029

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Herika Pessoa	University of Minnesota	Professional Research Scientist (R5; Co-PI): will manage the project, collect data, and develop reports as well as contribute to information dissemination.	Yes
Laura Irish-Hanson	University of Minnesota Extension (Horticulture)	Extension Educator: will provide expertise to translate research findings into digestible and accessible resources to be distributed through her existing network of green industry professionals as well as other Extension educators in other arenas.	Yes
Seth Wannemuehler	University of Minnesota	Post-doctoral Research Associate (Co-PI): will support the execution of the cold stress tolerance research as well as development of deliverables.	No
Neil Anderson	University of Minnesota	Professor (Co-PI): will advise throughout the the research project drawing on his vast experience working with perennial crops. Dr. Anderson will also contribute to the development of deliverables.	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 results of this project will be implemented through direct outreach efforts to agricultural producers, land managers, and foresters. Findings will be shared via workshops, Extension resources (externally funded), peer-reviewed publications (final reports), and collaboration with stakeholder networks, ensuring broad accessibility and practical application. This study directly supports Minnesota's climate resilience efforts by providing data-driven recommendations for black walnut cultivation in managed systems. No additional work is anticipated beyond the project timeline, as the research will generate actionable strategies that stakeholders can integrate into cultivation, conservation, reforestation, and strategic land-use planning efforts across the state.

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, 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								
Professional Research Scientist (R5)		Manages project, collects, analyzes, and presents data. [YR1: $98,489 (Salary: $72,100 ; Fringe: $26,389); YR2: $101,936 (Salary: $74,624; Fringe: $27,312); YR3: $105,503 (Salary: $77,235; Fringe: $28,268)]			36.6%	3		$305,928
Extension Educator		Translates information for broad public audiences (1% salary support for time). [YR1: $1,075 (Salary: $787 ; Fringe: $288); YR2: $1,113 (Salary: $815; Fringe: $298); YR3: $1,152 (Salary: $843; Fringe: $309)]			36.6%	0.03		$3,340
							Sub Total	**$309,268**
Contracts and Services								
							Sub Total	**-**
Equipment, Tools, and Supplies								
	Tools and Supplies	Soil moisture sensors, electrolyte leakage measuring tools, external temperature loggers, and temperature and relative humidity	Environmental sensors to document outdoor conditions in the field as well as research sensors used to mesasure electrolyte leakage (cold hardiness) as well as temperature and relative humidity in the laboratory during sample evaluation.(YR1: $375* 3 units); Electrolyte probe (Vernier Conductivity Probe) (YR1: $130), logger (Vernier) (YR1: $400), external temp sensors (ibuttons) [YR1: $1000 ($100/unit up to 10)], temp/RH sensor (onset) (YR1 $600)					$3,255
	Tools and Supplies	General consumable supplies used to support existing equipment necessary for completing the project.	chemical grade pure water ($100 annually); Y1: bare root black walnut plants-whips ($300) + falcon tubes & baggies ($300); Y2: vapor pressure					$1,985

			osmometer dessicant filter (x4) ($635), liquid nitrogen ($50), licor consumables ($200), compressed N2 gas ($200)					
							Sub Total	**$5,240**
Capital Expenditures								
							Sub Total	**-**
Acquisitions and Stewardship								
							Sub Total	**-**
Travel In Minnesota								
	Miles/ Meals/ Lodging	Victoria - Waseca 120 miles round trip; Victoria - Grand Rapids 400 miles round trip (1 of each trip annually). $0.70/mile	To scout specimens and manage field sites annually in subsequent years.					$1,092
							Sub Total	**$1,092**
Travel Outside Minnesota								
							Sub Total	**-**
Printing and Publication								
	Publication	Peer reviewed manuscript publications	Up to two peer reviewed manuscripts will be developed based on research findings (estimated at $2000 per publication in the journal HortScience)					$4,000
							Sub Total	**$4,000**
Other Expenses								
		Overnight shipping of tissue samples	To ship samples from field locations overnight back to research center for data collection ($100 per shipment *2 *6 months * 3 years)					$3,600

		Extension resource printing	Printing handouts and 1-page fliers of information generated by the project (YR3: $200)					$200
		Greenhouse space rental	Rental fee of greenhouse space (and associated supplies and services) as well as cooler space for overwintering plants. Annual fee = $4,800: greenhouse ($400/month * 12 months * 2 years)					$9,600
							Sub Total	**$13,400**
							Grand Total	**$333,000**

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: $333,000

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: 2ee1b62d-fb6.pdf

Alternate Text for Visual Component

Project logic model (pg 1) and example of outreach materials created by team to demonstrate and further highlight the value of black walnut research in Minnesota. Extension resource highlights a 1-pager front (pg 2) and back (pg 3) introducing syrup harvesting, one of many uses of black walnut in Minnesota....

Supplemental Attachments

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

Title	File
SPA Letter	a18e42b5-6a1.pdf
Letters of support	7d559e75-e93.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:

Herika Pessoa (Dept. of Hort. Sci.), Seth Wannemuehler (Dept. of Hort. Sci.), Dave La Fave (Dept. of Hort. Sci.), Sarah Hulke (Sponsored Projects Administration)

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