



# Environment and Natural Resources Trust Fund

2027 Request for Proposal

## General Information

**Proposal ID:** 2027-112

**Proposal Title:** Maximizing Lowland Conifer Ecosystem Services - Phase III

## Project Manager Information

**Name:** Marcella Windmuller-Campione

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

**Office Telephone:** (847) 772-5458

**Email:** mwind@umn.edu

## Project Basic Information

**Project Summary:** Eastern larch has been decimated by the native eastern larch beetle. We want to know what defenses trees have, if and which trees are regenerating and how wildlife are responding.

**ENRTF Funds Requested:** \$575,000

**Proposed Project Completion:** June 30, 2030

**LCCMR Funding Category:** Resiliency (A)

## Project Location

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

Region(s): NE, NW, Central,

**What is the best scale to describe the area impacted by your work?**

Region(s): Central, NE, NW,

**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.**

At the time of European settlement, land survey records indicated eastern larch was the most numerous tree species in Minnesota. By the early 2000s eastern larch represented only 4% of its historic distribution. Over the last 26 years, eastern larch has experienced additional widespread mortality from eastern larch beetle (ELB), a native insect. This ongoing ELB outbreak is the longest and largest in Minnesota's recorded history. Eastern larch forest communities play critical roles within carbon cycling, provide habitat for numerous species of greatest conservation need, are recreational destinations, and are part of the forest economy.

MN DNR and UMN received federal funding to quantify regeneration in eastern larch forests impacted by ELB in 2022 and 2023. We observed that many areas were regenerating. However, this was a one time sampling. We do not know whether that regeneration has persisted and transitioned into saplings. We do not know how large trees are defending themselves. We do not know how wildlife species are responding to structural changes, nor how canopy loss may be influencing peatland hydrology. Without this information, managers are left uncertain whether eastern larch systems are recovering naturally or whether targeted intervention is needed to prevent long term ecosystem transformation.

### **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.**

In collaboration with the Minnesota DNR, NRRI, and University of Minnesota Departments of Forest Resources and Entomology, with support from regional lowland conifer management partners, we propose a holistic effort to quantify ecological impacts of ELB across eastern larch forest communities. This work builds on our peatland research program and expands the original network of 48 study sites established in earlier project phases, extending our understanding of how ELB driven forest change reshapes vegetation, hydrology, and wildlife communities.

First, we will resample vegetation plots established in 2022 and 2023 to determine whether regeneration is recruiting or whether mortality signals a need for restoration. Second, we will evaluate defensive traits of surviving overstory trees. Because several defenses are heritable, surviving trees may shape the defensive capacity of regenerating stands. Third, we will establish wildlife monitoring to measure bird and small mammal responses to ELB driven canopy loss and structural change, linking forest conditions to habitat suitability for species of conservation concern. Finally, we will install hydrologic wells on selected plots to compare water table dynamics with wells established during earlier lowland conifer project phases. Together components will determine whether peatland forests are regenerating, reorganizing, or declining and inform management.

### **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?**

Project outcomes will identify eastern larch forests that are regenerating and those failing to recover following ELB disturbance, allowing managers to prioritize limited restoration resources where intervention is needed. Evaluating defensive traits of surviving trees will improve understanding of resistance and future susceptibility, informing strategies that promote resilient regeneration. Wildlife and hydrologic monitoring will clarify how ELB driven canopy loss affects habitat quality and ecosystem function. Together, these outcomes provide science based guidance to support regeneration where recovery is occurring and restoration where it is not, enabling proactive stewardship of one of Minnesota's most carbon rich and wildlife important ecosystems.

## Activities and Milestones

### Activity 1: Remeasurement of Forest Vegetation Impacted by Eastern Larch Beetle

**Activity Budget:** \$200,000

**Activity Description:**

We will remeasure over 100 permanent vegetation plots established in 2022 and 2023 within eastern larch peatland forests impacted by ELB. This represents the first opportunity to quantify early forest responses to ELB across a replicated peatland monitoring network. We will quantify overstory mortality, recruitment, and structural change following the outbreak. Importantly, the remeasurement will determine whether previously observed regeneration has successfully transitioned into sapling and small tree recruitment or whether early cohort mortality indicates regeneration failure.

We will use standard forest inventory sampling for the overstory and regeneration layers to quantify tree survival, recruitment into size classes, stem density, basal area, and canopy closure. Structural changes in overstory and midstory layers will be measured to evaluate forest trajectory following beetle driven mortality. We will also measure the understory vegetation to evaluate shifts in plant community composition within the Ecological Classification System (ECS).

Data analysis will compare current conditions to baseline measurements to determine whether sites are trending toward recovery, compositional shift, or the loss of forest cover. Results will provide direct evidence of whether natural regeneration alone is sufficient or whether silvicultural or restoration interventions are warranted.

**Activity Milestones:**

Description	Approximate Completion Date
Conduct first growing season measurement of permanently sampled plots	September 30, 2028
Conduct second growing season measurement of permanently sampled plots	September 30, 2029
Analysis and comparison of vegetation data from 2022-23 to 2028-29	December 31, 2029
Identification of forests not meeting minimum regeneration standards	March 31, 2030
Development of management recommendations for ELB impacted forests	June 30, 2030

### Activity 2: Quantifying Eastern Larch Tree Defenses to Eastern Larch Beetle

**Activity Budget:** \$80,000

**Activity Description:**

Eastern larch possess an arsenal of natural defenses that—until the most recent outbreak—were effective ELB deterrents. Sticky resins comprised of toxic compounds expel burrowing beetles and poison their offspring. Unfortunately, we are unable to proactively manage eastern larch with these defensive traits in mind because our understanding of the tree's defense remains limited. For example, it is unclear how the current outbreak has altered the defensive profiles of surviving eastern larch populations. Also unknown is what causes a tree's defensive capacity to become compromised under changing environmental conditions. .

To gain insight into eastern larch defenses as they relate to ELB resistance, we will quantify defensive traits of surviving trees from a subset of vegetation plots. We will leverage plots with varying proportions of ELB-caused mortality to determine how defensive profiles vary in response to the current outbreak. In other words, how does the defensive capacity of a stand change after ELB comes through, and what does this suggest for eastern larch forests in the future? Defenses will be measured alongside physiological tree traits related to vigor (e.g., tree growth and water content) to gain additional insight into when and why eastern larch become susceptible to ELB.

**Activity Milestones:**

Description	Approximate Completion Date
Field sampling of a minimum of 25 eastern larch trees for tree defenses and physiology	October 31, 2028
Chemical analysis of defenses	June 30, 2030

### Activity 3: Evaluation of Wildlife Habitat Use and Diversity in Lowland Conifer Ecosystems

**Activity Budget:** \$200,000

**Activity Description:**

We will continue monitoring and quantify wildlife responses to ELB driven forest change through integrated bird and small mammal monitoring across our existing network of 48 long term peatland study sites and associated experimental peatland harvest areas that provide a unique research network for evaluating disturbance driven forest change.

Bird communities will be assessed using standardized point count surveys across vegetation plots to estimate species richness, abundance, and community composition relative to forest structure and canopy loss, building on previous wildlife surveys conducted across this peatland research network. Special emphasis will be placed on species of greatest conservation need associated with peatland and larch systems, including peatland specialists such as Boreal Chickadee, Canada Jay, and Connecticut Warbler.

Small mammal communities will be monitored using live trapping grids to assess species composition, abundance, and habitat associations within intact, harvested, and ELB affected stands to evaluate how structural change influences prey communities and ecosystem function

Wildlife data will be linked directly to measured vegetation structure and regeneration status to determine how forest trajectory influences habitat quality. This activity will identify whether beetle impacted forests are maintaining habitat function, temporarily enhancing structural heterogeneity, or losing suitability for key species within the broader context

**Activity Milestones:**

Description	Approximate Completion Date
Identify ELB survey locations for birds and small mammals	April 30, 2028
Conduct first year of small mammal and bird surveys	November 30, 2028
Conduct second year of small mammal and bird surveys	November 30, 2029
Complete data QA/QC and preliminary analysis of wildlife data	December 31, 2029
Wildlife community responses to ELB driven forest change analyzed	May 31, 2030

### Activity 4: Long-term monitoring of Hydrology in Lowland Conifer Ecosystems

**Activity Budget:** \$95,000

**Activity Description:**

We will continue to monitor wells that were established in the lowland conifer Phase 1 and maintained in Phase 2. This will represent one of the longest running hydrologic data across the different lowland conifer ecosystems in the state.

We originally established these wells in healthy eastern larch stands. Establishing new wells in ELB mortality forests would allow for direct comparison between intact and beetle impacted forest conditions. Understanding hydrologic change is critical because peatland water balance governs tree regeneration, carbon storage, and long term ecosystem resilience. We will establish a minimum of 6 wells in ELB mortality stands. These wells will be directly compared to wells established and maintained during earlier project phases to evaluate temporal shifts in peatland hydrology. Water table depth will be monitored across seasons to determine whether canopy loss alters evapotranspiration rates, soil moisture regimes, or surface water dynamics that regulate peatland forest regeneration and stability. Hydrologic data will be integrated with vegetation and wildlife findings to determine whether eastern larch decline is altering peatland ecosystem services, including climate regulation and water storage and long term peatland stability.

**Activity Milestones:**

<b>Description</b>	<b>Approximate Completion Date</b>
A minimum of 6 hydrologic wells installed in ELB mortality stands across peatland study sites	July 31, 2028
Season 1 water table monitoring completed across intact and ELB impacted stands	October 31, 2028
Season 2 water table monitoring completed across intact and ELB impacted stands	October 31, 2029
Hydrologic trends integrated with vegetation and wildlife data to assess peatland respons	March 31, 2030

## Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Alexis Grinde	Natural Resources Research Institute (NRRI)	Lead on Activities 3	Yes
Shealyn Malone	Department of Entomology - University of Minnesota	Lead on Activity 2	Yes

## Dissemination

**Describe your plans for dissemination, presentation, documentation, or sharing of data, results, samples, physical collections, and other products and how they will follow ENRTF Acknowledgement Requirements and Guidelines.**

Project results will be actively disseminated to scientists, land managers, and the public through multiple communication pathways. The project team regularly shares results at state meetings focusing on management which include the Research Review (100+ managers) hosted every January, statewide forestry and wildlife meetings, and special topic workshops focused on lowland conifer management. These venues provide direct opportunities to translate research results into management guidance for state, federal, tribal, and private land managers. Scientific findings will also be disseminated through peer-reviewed publications. We will also develop a minimum of two peer review publications focused on ELB impacts on peatland forest dynamics, wildlife responses, and hydrologic change. Because Minnesota represents the leading U.S. authority on peatland forest management, these publications will contribute to broader knowledge used by other states and boreal regions, including Canada.

Project data, methods, and documentation will be archived and made available through institutional repositories consistent with University of Minnesota data management practices. All project presentations, publications, and public materials will follow ENRTF acknowledgement requirements and guidelines, including appropriate recognition of ENRTF support.

## 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 was developed collaboratively with state and federal managers and continues to receive strong management interest and support. Initial work was funded by the US Forest Service Forest Health Protection program and the Minnesota DNR Division of Forestry, and results from Phases 1 and 2 have already informed management guidance such as Forestry for Minnesota Birds. Findings from this project will similarly be incorporated into forest planning, restoration prioritization, and peatland management decisions. After the funding period, monitoring and analysis will continue through complementary grants from federal agencies, partners, and research programs administered through the University of Minnesota.

## Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
Maximizing Lowland Conifer Ecosystem Services: Phase 2	M.L. 2023, , Chp. 60, Art. 2, Sec. 2, Subd. 03m	\$482,000

Can Increased Tree Diversity Increase Community Diversity?	M.L. 2024, , Chp. 83, Art. , Sec. 2, Subd. 08c	\$415,000
--	--	-----------

## Project Manager and Organization Qualifications

**Project Manager Name:** Marcella Windmuller-Campione

**Job Title:** Associate Professor

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

Dr. Marcella Windmuller-Campione received her B.S. and M.S. in Forestry from Michigan Technological University and a PhD in Ecology from Utah State. She was hired to the UMN in 2015 and since then has been working on silviculture and applied forest management in Minnesota and the surrounding forest ecosystems. She has successfully managed over \$7 million in grant funding and has graduated over 25 graduate students. The focus of her work is exploring forest dynamics and forest management through science-management partnerships to maintain resilient, sustainable forest ecosystems.

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

**Organization Description:**

The mission of the Department of Forest Resources housed within the College of Food, Agricultural and Natural Resource Science is to advance the science and management of forests and related natural resources by developing solutions to important problems affecting these resources; training the next generation of forest and natural resource scholars and practitioners; and informing the broad public on the economic and ecological importance of forests and natural resources and how they enrich our quality of life.

## Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
<b>Personnel</b>								
PI Faculty/ M. Windmuller-Campione		Lead for overall project and Activities 1, 2 & 4			36.6%	0.12		\$26,890
Co-PI, Scientist/ A. Grinde		Lead on Activity 3 and co-lead on activity 4			36.6%	0.12		\$25,457
Researcher 5		Conduct sampling and analysis for Activity 1 & 4			36.6%	1.74		\$193,531
Post-Doctoral Researcher		Sampling and Analysis for Activity 2			26.1%	1		\$79,442
Researcher 4		Sampling and analysis related to Activity 3			32.3%	0.24		\$23,937
Researcher 6		Sampling and analysis for Activity 3			32.3%	0.15		\$16,683
Researcher 5		Sampling and analysis for Activity 3			32.3%	0.21		\$20,542
Researcher 2		Sampling and analysis for Activity 3			32.3%	0.36		\$27,107
Civil Service Position		Banding and trapping of animals for Activity 3			32.3%	0.03		\$1,049
Graduate Student		Collection of data for Activity 3 and writing of research			24.2%	0.18		\$13,526
Undergraduate Wildlife Tech		Collection of data for Activity 3			0%	0.15		\$5,495
Two Undergrad Forestry Field Techs		Collection of data for Activity 1, 2, and 4			0%	1.95		\$48,960
Bird bander		Assistant with banding and tracking birds for Activity 2			32.3%	0.15		\$11,916
							<b>Sub Total</b>	<b>\$494,535</b>
<b>Contracts and Services</b>								
							<b>Sub Total</b>	<b>-</b>
<b>Equipment, Tools, and Supplies</b>								

	Equipment	Trail cameras (qty= 10 @ 200 ea.), SD cards and batteries (500), buckets and flashing (500).	Counting and measuring bird numbers and diversity					\$3,000
	Equipment	ARU (qty 4 @ \$800 ea.) batteries and SD cards (500) = 3700.	Recording birds to monitor and measure use					\$3,700
	Equipment	Sherman traps (qty 20 * 37.00 ea) and bait (100)	Trapping of small mammsl					\$840
	Tools and Supplies	Disposal supplies for sampling which include flagging, write-in-the-rain paper, pencils, clip-boards, bug spray, and field safety kits	To be able to sample lowland conifer ecosystems safely					\$1,500
	Tools and Supplies	Lab cost to analyze tree defenses	Equipment and machine time to run tests on tree resin					\$4,000
	Equipment	Forestry equipment to measure trees - loggers tape (\$75/unit - 3 needed), 3 hysometers (\$125/unit - 3 needed), compass (\$25)	Equipment needed to measure height, diameter, and location of trees					\$700
	Equipment	PVC (6) (\$150), data loggers (6 @ \$450/unit), cement (\$100), string and other supplies (\$75)	To install and monitor hydrology through the installation of wells					\$2,725
							<b>Sub Total</b>	<b>\$16,465</b>
<b>Capital Equipment</b>								
							<b>Sub Total</b>	<b>-</b>
<b>Acquisitions and Stewardship</b>								
							<b>Sub Total</b>	<b>-</b>
<b>Travel In Minnesota</b>								
	Miles/ Meals/ Lodging	This represents 50 days of travel each season (150 days total) estimated at per diem of \$50/day, room rental rates of \$50/day per person, and vehicle rental rates budgeted through the UMN	This is a field intensive project that requires sampling at multiple times in the year and in difficult and remote locations. This includes needed to rent vehicles that are 4x4 (greater cost) due to road conditions during the spring when bird and hydrology monitoring occurs.					\$64,000
							<b>Sub Total</b>	<b>\$64,000</b>
<b>Travel Outside Minnesota</b>								
							<b>Sub Total</b>	<b>-</b>

<b>Printing and Publication</b>								
							<b>Sub Total</b>	-
<b>Other Expenses</b>								
							<b>Sub Total</b>	-
							<b>Grand Total</b>	<b>\$575,000</b>

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
<b>State</b>				
In-Kind	Unrecovered F&A	University support of research	Secured	\$310,499
			<b>State Sub Total</b>	<b>\$310,499</b>
<b>Non-State</b>				
Cash	USDA Forest Health and Monitoring Grant	Used to set up the original vegetation sampling in 2022, 2023	Secured	\$50,140
			<b>Non State Sub Total</b>	<b>\$50,140</b>
			<b>Funds Total</b>	<b>\$360,639</b>

**Total Project Cost: \$935,639**

**This amount accurately reflects total project cost?**

Yes

## Attachments

### Required Attachments

#### *Visual Component*

File: [9a91ed1c-8e0.pdf](#)

#### *Alternate Text for Visual Component*

The background is healthy eastern larch. There is a map of Minnesota that show the extensive damage of eastern larch. Each of our four activities is highlighted with an associated photo - plants, eastern black beetle, a bird, and water highlighted the integrated and holistic approach we are taking...

### Supplemental Attachments

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

Title	File
Signed Letter of Approval	<a href="#">cc5e159b-6b7.pdf</a>

## 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:**

Sponsored Programs at the University of Minnesota - Kelsey Grachek (SPA - grach013@umn.edu), Andrea Little (Finance - littl018@umn.edu)

**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