



## Environment and Natural Resources Trust Fund

### 2022 Request for Proposal

#### General Information

**Proposal ID:** 2022-200

**Proposal Title:** Maximizing Lowland Conifer Ecosystem Services: Phase 2

#### 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:** Continue monitoring forested peatland network for hydrology and wildlife including a new species, bog lemming. Add measures to quantify above and below ground carbon by age and forest type.

**Funds Requested:** \$500,000

**Proposed Project Completion:** June 30 2025

**LCCMR Funding Category:** Foundational Natural Resource Data and Information (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?**

Statewide

**When will the work impact occur?**

During the Project

## Narrative

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

Peatland forests account for 20% of all forestland within Minnesota and provide many ecosystem services. However, our knowledge of these systems is limited because they are typically in remote, difficult to access locations. Minnesota's forested peatlands are expected to be greatly impacted by changing climatic conditions because they are at their southern range limit, are sensitive to changes in hydrology, and contain low tree diversity.

With previous allocations from the ENRTF, we established a network of 48 peatland sites that represent a range of forest types and ages to assess vegetation, hydrology, and wildlife use resulting in improved knowledge that helps managers to maximize ecosystem benefits including clean water supply, fiber production, and wildlife habitat.

However, this work has also highlighted information gaps. There is tremendous uncertainty regarding the role peatlands play in climate mitigation (via carbon storage and sequestration (including harvested material)) and how we can manage them to sustain critical timber resources and maintain habitat quality. Questions also remain about habitat usage by several Species of Greatest Conservation Need that rely on peatland habitats including boreal chickadees and bog lemmings. Continued research is critical to guide the development of holistic and effective adaptive forest management recommendations.

### **What is your proposed solution to the problem or opportunity discussed above? i.e. What are you seeking funding to do? You will be asked to expand on this in Activities and Milestones.**

During Phase 1, we documented 114 wildlife species and 140 plant species within our network of 48 peatland forest study sites, filling critical information needs. More data are needed. We propose a three-prong approach that 1) continues monitoring of vegetation, wildlife, and hydrology these sites, 2) adds additional data to measure carbon stores (above and below ground) and bog lemming habitat use, and 3) utilizes a holistic approach (wildlife, vegetation, hydrology, carbon, and soils) to develop adaptive forest management recommendations to ensure continued economic and ecological productivity in Minnesota's peatland forests.

This proposal is supported by public land managers (MN DNR manages the largest percent of peatland forests in the state), private industrial forestry organization (UPM Blandin utilizes black spruce in their Grand Rapids mill), and conservation organizations (The Nature Conservancy is actively working on adaptive forest management), because it offers continued opportunity to maximize existing benefits provided by peatlands and science-based solutions for improving management to address new conditions associated with a changing climate.

### **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 Minnesota Forest Resources Council's assessment of priority research needs on sustaining forests specially identified the need to "Determine relationships between the spatial arrangement of forest conditions (age class structure, cover types, etc.) and forest resources (e.g., fiber productivity, water, wildlife, etc.)." Our research is filling this critical information need. By maintaining peatland forests, Minnesotans will enjoy the benefits of clean water, wildlife habitat, recreation, direct and indirect economic revenue through commercial forest products and recreation, carbon storage, and the quintessential fall colors from eastern larch - a conifer tree that turns gold in the fall.

## Activities and Milestones

### Activity 1: Continued monitoring of the peatland forest network with additional wildlife surveys and habitat assessments.

**Activity Budget:** \$255,260

#### Activity Description:

By June of 2022 we will have four continuous years of data from our network; this represents less than 5% of the average life cycle of these forests. Continued monitoring is necessary to fully capture the dynamics of potential conditions including impacts to hydrology during warm and wet winters compared to warm and dry summers and whether these conditions influence vegetation and breeding bird communities. Specifically we will: 1) maintain monitoring wells and precipitation gauges to collect continuous, hourly measurements of water table fluctuations to estimate water budget components on an annual basis; 2) monitor and assess breeding bird and amphibian communities; 3) assess Boreal Chickadee productivity and habitat use in the post-fledgling period; 4) conduct small mammal surveys in focal sites to determine distribution, density and habitat requirements for bog lemmings (a species of special concern since 1984); and 5) develop metrics of habitat quality for Species in Greatest Conservation Need across forested peatlands.

#### Activity Milestones:

Description	Completion Date
Continued monitoring of network of 48 plots through 2024	November 30 2024
Development and implementation of bog lemming surveys	November 30 2024
Create habitat quality metrics for Species in Greatest Conservation Need	December 31 2024
Analysis and summary of six years of monitoring data to be used in Activity 3	January 31 2025

### Activity 2: Quantify above and below ground carbon

**Activity Budget:** \$207,390

#### Activity Description:

We will conduct a comprehensive sampling campaign to estimate total carbon pools on focal sites within the network. Data on carbon storage is another critical ecosystem service related to climate change mitigation and has the potential to generate revenue for landowners in emerging carbon markets. To quantify aboveground carbon pools, we will measure all aspects of above ground vegetation (trees, shrubs, moss, etc.). For belowground carbon pools, we will sample soils (primarily peat) and quantify other belowground pools (e.g., stumps, roots). This data will be summarized in the field and in the lab through multiple analyses to provide critical information about carbon storage and sequestration in these systems.

Building from individual sites to a broader region, we will utilize new technology through a terrestrial LiDAR scanner. Combining the high-resolution data from the LiDAR scanner with detailed on-the-ground measurements, we will quantify and map carbon pools (above ground & below ground) at local network sites and link these data to national forest inventory data across the state.

#### Activity Milestones:

Description	Completion Date
Comprehensive sampling of above and below ground carbon pools on focal network sites	November 30 2023
Analysis and summary of carbon pool	May 31 2024
Scanning of focal sites with a terrestrial Lidar scanner	November 30 2024
Develop of a statewide map of carbon pools	February 28 2025

### Activity 3: Develop an Ecosystem Risk Metric: Identification of High Risk Forest Ecosystems and Wildlife Habitat

**Activity Budget:** \$37,350

**Activity Description:**

Peatland forest conditions are rapidly changing and continued data collection is critical to fully understand and maximize the ecosystem benefits from peatland forest systems, including the future potential of maintained or increased carbon storage. By analyzing and utilizing the multiple factors assessed in this project (wildlife habitat use, forest productivity, hydrology, and carbon), we can develop a holistic ecosystem risk metric to identify which forest ecosystems and wildlife habitats will be most at risk to changing conditions. The risk metric will allow natural resource managers to strategically prioritize management or assess trade-offs among multiple ecosystem factors with the aim of reducing risk and increasing resilience. For example, a management action focused on increasing tree density may result in increased carbon storage but may not be ideal for certain bird species. By developing a risk metric that is relevant at a landscape scale, we will provide data visualization tools to display potential trade-offs among management strategies with the goal of maximizing ecosystem services. This holistic approach assessment will facilitate transparency in the forest management decision-making process.

**Activity Milestones:**

Description	Completion Date
Development of risk metric utilizing data from Activity 1 and 2	November 30 2024
Creation of data visualization tool to display management and assess trade-offs	May 31 2025

## Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Alexis Grinde	NRRI	Co-PI	Yes
Christopher Edgar	University of Minnesota	Co-PI	No
Robert Slesak	USDA Forest Service	Co-PI	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 be funded?**

The initial investment in the project (Phase 1) captures the geographic range as well as ranges of productivity and cover types in peatland forests in Minnesota, providing critical baseline information. However, given the complexity of issues facing Minnesota's peatlands, more information is urgently needed. We are requesting additional funds to build on our research which will continue to be shared through local, regional, and national outlets, allowing Minnesota to be a leader in the knowledge and sustainable management and conservation of peatland forests. Further, project partners have indicated their intent to directly incorporate our findings into operational practice.

## Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
MITPPC Sub-project # 4 Dwarf Mistletoe Detection and Management in Minnesota	M.L. 2016, Chp. 186, Sec. 2, Subd. 06a-04	\$0
Peatland Forest Management	M.L. 2018, Chp. 214, Art. 4, Sec. 2, Subd. 03d	\$600,000

## Project Manager and Organization Qualifications

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

**Job Title:** Assistant Professor

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

As a silviculturist, Dr. Marcella Windmuller-Campione's overarching research goals are to explore the underlying dynamics of forests – how forests develop or are impacted by current and future disturbances – and to use that basic science to develop management strategies (silvicultural practices) which allow the sustainable management of forest ecosystems in the face of changing conditions. Specifically, Marcella strives to create knowledge which can be applied by foresters and natural resource managers locally, regionally, nationally, and globally to increase forest resilience to current and future threats while maintaining ecological and economic ecosystem services.

She has currently graduated six graduate students. Since 2015, she has been part of project teams that have secured over \$4 million in grants; she has been the primary PI on grants totaling \$2.5 million.

The current team has worked together successfully during Phase 1 of the project and has stayed on track even during the pandemic.

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

**Organization Description:**

For over 100 years, the Department of Forest Resource at the University of Minnesota has been the leader in producing high quality research regarding natural resource management issues across the state of Minnesota.

## Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
<b>Personnel</b>								
M. Windmuller-Campione/Summer Salary		Project Lead			36.5%	0.18		\$23,600
A. Grinde/Researcher		Co-PI, Lead on Wildlife			36.5%	0.24		\$28,000
Researcher 5		Data collection and analysis of vegetation and above ground carbon			36.5%	1.5		\$99,197
Researcher 5		Hydrology, Carbon Soil, Lab Analysis			36.5%	1.5		\$98,800
Post Doc		Carbon Lidar Scanning and Mapping			25.4%	0.75		\$47,967
Research Scientist NRRI		Wildlife surveys (breeding bird, amphibians, and bog lemmings)			31.8%	1.6		\$89,180
Graduate Student		Summer GRA - wildlife surveys			19.9%	0.14		\$12,656
Undergraduate Student Field Techs		Assisting in the collection of data for Activities 1 and 2			0%	0.22		\$28,800
Telemetry Specialist		Telemetry sampling			8%	0.06		\$2,000
							<b>Sub Total</b>	<b>\$430,200</b>
<b>Contracts and Services</b>								
							<b>Sub Total</b>	<b>-</b>
<b>Equipment, Tools, and Supplies</b>								
	Equipment	30 cameras	to track nestling survival, hatch date, and predation events (\$150 ea.)					\$4,500
	Equipment	100 transmitters	To attach to birds to track their movements (\$150 ea.)					\$15,000
	Equipment	Telemetry Receiver	To track birds					\$3,800
	Tools and Supplies	Consumable Sampling Supplies	Flagging, write in the rain paper, and other consumable sampling supplies to collect data for Activity 1 and 2					\$3,500

	Tools and Supplies	Labatory Analysis for Above and Below Ground Carbon Pools	Detailed analysis for carbon within vegetation, soils, and other pools					\$13,000
							Sub Total	\$39,800
Capital Expenditures								
							Sub Total	-
Acquisitions and Stewardship								
							Sub Total	-
Travel In Minnesota								
	Miles/ Meals/ Lodging	We estimate 250 total travel days between Activity 1 and Activity 2 which will be split among 4 researchers, 3 field techs, graduate student, a post-doc, and the PI's and CO-PI's. We estimate \$100 per individual travel event which includes lodging, per diem, and vehicle mileage/rental.	A high travel budget is required due to collection field data across the state in difficult to access and remote locations. During Phase 1 of this project, our project team covered 30,000 miles					\$30,000
							Sub Total	\$30,000
Travel Outside Minnesota								
							Sub Total	-
Printing and Publication								
							Sub Total	-
Other Expenses								
							Sub Total	-
							Grand Total	\$500,000



Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
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## Non ENRTF Funds

Category	Specific Source	Use	Status	Amount
<b>State</b>				
In-Kind	Unrecovered Indirect Costs UMN (54% overhead)	Operating costs of the UMN	Secured	\$270,000
			<b>State Sub Total</b>	<b>\$270,000</b>
<b>Non-State</b>				
			<b>Non State Sub Total</b>	-
			<b>Funds Total</b>	<b>\$270,000</b>

## Attachments

### Required Attachments

#### *Visual Component*

File: [99d1e5f5-abf.pdf](#)

#### *Alternate Text for Visual Component*

In the upper header portion of the figure - there are the University of Minnesota, Natural Resources Research Institute, and US Forest Service logos. There are two pictures of black spruce - one with dense trees and the other is more open. Text reads: "Peatland forests cover 20% (3 million acres) of all forest land in Minnesota and 30% (1.5 million acres) of state-owned land. Phase 1 funding from ENRTF (2018) has provided new and critical information for natural resource managers."

Text r...

### Optional Attachments

#### *Support Letter or Other*

Title	File
U of MN Approval letter for submission	<a href="#">97e4dd51-149.pdf</a>

## Administrative Use

**Does your project include restoration or acquisition of land rights?**

No

**Does your project have potential for royalties, copyrights, patents, or sale of products and assets?**

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

# Maximizing Lowland Conifer Ecosystem Services: Phase 2



Peatland forests cover **20% (3 million acres)** of all forest land in Minnesota and 30% (1.5 million acres) of state-owned land. Phase 1 funding from ENRTF (2018) has provided new and critical information for natural resource managers.



Black spruce forests. Photo credit: Alan Toczydlowski

**Problem:** Given the complexity of issues facing Minnesota's peatlands, more information is urgently needed to determine best management practices for maintaining timber resources, maximizing carbon storage and sequestration and quality wildlife habitat for multiple Species in Greatest Conservation Need.



Wood frog in peatland forest. Photo credit: Alan Toczydlowski



Minnesota's state flower, showy lady's slipper. Photo credit: Laura Reuling



Juvenile boreal chickadee. Photo credit: Alexis Grinde

**Solution:** A holistic approach to address critical information needs:

1. Continue monitoring our uniquely extensive network of 48 peatland forest sites with additional habitat assessments for boreal chickadee and bog lemming.
2. Quantify above and below ground carbon pools.
3. Develop an ecosystem risk metric to identify high risk forest ecosystems and wildlife habitat.



Pitcher plant flower. Photo credit: Laura Reuling

**Project Outcomes:** Risk assessment metrics necessary for **transparent decision making** related to trade-offs in management strategies for peatlands.