Environment and Natural Resources Trust Fund

2023 Request for Proposal

General Information

Proposal ID: 2023-218

Proposal Title: Old Growth Forest Monitoring

Project Manager Information

Name: Emily Peters

Organization: MN DNR - Ecological and Water Resources Division

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Project Basic Information

Project Summary: We will develop a method to monitor approximately 93,000 acres of protected old growth forest in Minnesota to ensure that these rare and important forest resources are properly protected.

Funds Requested: $441,000

Proposed Project Completion: June 30, 2026

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?

Statewide

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.

Old growth forests develop over a long period of time, essentially free from major disturbances like wildfire or timber harvest. They provide unique habitats for native plants and animals, store large amounts of carbon, and provide important recreational and cultural opportunities for Minnesotans. These forests, however, are rare in Minnesota today (~6%) compared to what existed prior to European settlement (~50%). To protect this rare and important resource, the Minnesota DNR has a longstanding goal to maintain a viable statewide network of high-quality old growth forests on state lands. At this time, the network consists of ~93,000 acres of designated and candidate old growth forest stands that are protected from timber harvest and other human-caused disturbances. Most designated stands, however, were last assessed 20-30 years ago and their current status is unknown. The DNR needs a cost-effective approach for monitoring the status of this network over time to ensure adequate protection. This proposal will build from the work of an interdisciplinary DNR project, which has been testing field and remote sensing approaches. Although conventional field monitoring methods provide valuable fine-scale information about site condition and management needs, they are cost-prohibitive to implement statewide (~$3,000,000 per cycle).

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.

We will develop a practical approach for monitoring the status of old growth forests in Minnesota. To do this, we propose adopting recent advances in aerial imagery collection and processing techniques that allow large areas of forested land to be monitored at a fraction of the cost of conventional field monitoring methods. First, we will establish current baseline conditions over the 93,000 acres of protected old growth forests by collecting and analyzing high resolution images and 3D vegetation structural data. Establishing a current and consistent baseline across the entire old growth network is necessary given the large amount of time that has passed since most of these sites were last assessed. This work will leverage the DNR Division of Forestry's newly acquired Quest Kodiak airplane and 150 MegaPixel Phase One Aerial camera system. Next, we will develop a monitoring methodology that leverages National Agriculture Imagery Program (NAIP) aerial imagery to detect stand-level changes from the baseline old growth status, such as from fire, pathogens, flooding, and wind-throw events. This approach allows for a strategic application of field visits, targeting only places that require on-the-ground investigation to determine management actions.

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?

Old growth forests are a critical component of Minnesota's rich biological diversity, providing unique structure, function, habitat, cultural connections and ecosystem services. This project will generate reliable and timely information about the status (amount, distribution and condition) of DNR's old growth forest network, which will be used by land managers and decision makers to support site-level management, statewide forest policy, and land-use decisions. This project will also allow us to regularly update information currently provided to the public about accessible old growth forest stands to visit on DNR's external website.

Activities and Milestones

Activity 1: Collect high resolution aerial imagery of old growth forest stands

Activity Budget: $155,000

Activity Description:
We will collect the high resolution imagery (10 cm) necessary for establishing current baseline conditions at the ~93,000 acres of old growth forest stands. Imagery will be collected across two growing seasons using a Quest Kodiak airplane and a 150 MegaPixel Phase One Aerial camera system. Collecting the imagery during peak growing season and with the Phase One camera system allows detection of sub-tree characteristics, which is necessary for assessing tree canopy health and/or damage at each old growth forest stand. The Phase One camera system has an inertial compensating gyroscope and captures survey-grade locations, allowing for crisp and clear orthorectified imagery. Using lower resolution imagery would result in misinterpretation of the status of the old growth forest stand and lead to errors in subsequent monitoring efforts described in Activity 3. We will process the imagery to produce canopy height models and orthorectified imagery for the ~3000 designated and candidate old growth forest growth stands, which will be used in Activity 2.

Activity Milestones:

Description	Completion Date
Collect imagery for 50% of the old growth forest stands	August 31, 2023
Process aerial imagery from summer 2023	October 31, 2023
Collect imagery for remaining 50% of the old growth forest stands	August 31, 2024
Process aerial imagery from summer 2024	October 31, 2024

Activity 2: Determine current baseline conditions of old growth forest stands

Activity Budget: $175,000

Activity Description:
In a geographic information system (GIS) environment, we will combine the canopy height models and orthorectified imagery from Activity 1 to conduct a status assessment of each old growth forest stand and determine its baseline conditions. The status assessment will score each stand based on the forest type (e.g., northern hardwoods, pine, lowland conifer), the percentage of the stand in a forested condition, the percentage of trees with visible trunk or branch damage, and the percentage of trees with foliar damage. The resulting score will be added to an old growth forest stand inventory along with the imagery and canopy height models, which will serve as the baseline status from which to monitor and detect change over time for each stand.

Activity Milestones:

Description	Completion Date
Assess baseline status of the first 50% of old growth forest stands	June 30, 2024
Finish assessing the baseline status of the remaining 50% of old growth forest stands	June 30, 2025

Activity 3: Develop long-term old growth monitoring protocol

Activity Budget: $111,000

Activity Description:
We will leverage past and future NAIP imagery to develop a long-term old growth forest monitoring protocol. The long-term stability, resolution (60 cm), and frequency of NAIP imagery collection makes it suitable for this purpose. NAIP imagery is collected every two years by the U.S. Department of Agriculture, with the next two flights planned for 2023

and 2025. For each old growth forest stand, we will extract 2023 and 2025 NAIP imagery and calculate a spectral measure of vegetation greenness, Normalized Difference Vegetation Index (NDVI). We will analyze the difference in NDVI between years 2023 and 2025 (i.e., increase or decrease in vegetation greenness) to detect any significant change in structure and composition at each old growth forest stand. We will field-validate these results for a subset of stands. The amount of change, both in intensity and spatial coverage, will be used to identify sites that need further attention by DNR land managers (e.g., field visit, management action).

Activity Milestones:

Description	Completion Date
Field visit 100 old growth forest stands for NAIP validation	August 31, 2025
Process NAIP imagery	June 30, 2026

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
MN DNR Resource Assessment	MN DNR Resource Assessment	Professional or technical service contract	Yes
Section managers from DNR's Forestry, Parks and Trails, Fish and Wildlife, and Ecological and Water Resources divisions.	MN DNR	Collectively provide interdisciplinary oversight and leadership direction on DNR old growth management and monitoring efforts.	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 result in an old growth forest monitoring protocol that leverages federally collected NAIP imagery and is inexpensive for DNR to implement going forward. DNR is committed to internally funding the long-term monitoring of its statewide old growth forest network to ensure this rare and important resource is part of Minnesota's natural heritage. Over the past two years, DNR dedicated ~2000 hours of staff time and $15,000 to old growth monitoring efforts that were shared across four divisions. In addition, DNR already has organizational structures in place to support long-term implementation once the monitoring protocol is developed.

Project Manager and Organization Qualifications

Project Manager Name: Emily Peters

Job Title: Forest Ecology Program Consultant

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

Emily Peters is the statewide Forest Ecology Program Consultant in the DNR's Ecological and Water Resources Division. She has the scientific expertise, communication and project management skills needed to ensure this project delivers results on time and within budget. Emily has a doctorate degree in forest ecology and seven years of experience overseeing the implementation of DNR's old growth forest management policy. She manages many complex interdisciplinary projects at DNR, including an active project to designate lowland conifer old growth forests on state lands. She is also DNR's old growth business data steward, overseeing and coordinating all major data management activities with technical data stewards.

Organization: MN DNR - Ecological and Water Resources Division

Organization Description:

The Minnesota DNR's mission is to work with citizens to conserve and manage the state's natural resources, to provide outdoor recreation opportunities, and to provide for commercial uses of natural resources in a way that creates a sustainable quality of life. The Department consists of seven Divisions including Fish and Wildlife, Forestry, Lands and Minerals, Parks and Trails, Enforcement, Operations Services and Ecological and Water Resources, as well as four regions. Since the 1990s, DNR has been managing a statewide network of old growth forest sites located on various units of Minnesota's Outdoor Recreation System (e.g., State Forests, Wildlife Management Areas, State Parks, Scientific

and Natural Areas) and across its four regions. Old growth data stewardship is shared across the DNR's Forestry and Ecological and Water Resources divisions and well as with MN.IT.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
Natural Resources Program Consultant		Project manager. Oversee project deliverables and timeline; ensure the proposed work is completed.			25%	0.3	X	$38,000
Interns		Interns to conduct field monitoring for 12 weeks in summer to validate remote sensing approach.			7%	0.46		$24,000
							Sub Total	**$62,000**
Contracts and Services								
DNR Resource Assessment	Professional or Technical Service Contract	The following actions will be performed by Resource Assessment personnel: imagery acquisition, imagery analysis and management, baseline old growth assessment, monitoring protocol development.				6		$360,000
							Sub Total	**$360,000**
Equipment, Tools, and Supplies								
							Sub Total	**-**
Capital Expenditures								
							Sub Total	**-**
Acquisitions and Stewardship								
							Sub Total	**-**
Travel In Minnesota								
	Miles/ Meals/ Lodging	Overnight stay for 20 nights, including lodging and per diem for 2 interns. Vehicle cost to visit 100 old growth sites at an average travel distance of 50 miles.	Travel for 2 interns to field visit 100 old growth sites to validate remote sensing methods.					$10,000

							Sub Total	**$10,000**
Travel Outside Minnesota								
							Sub Total	**-**
Printing and Publication								
							Sub Total	**-**
Other Expenses								
		Direct and Necessary Expenses	To support the costs related to the program administration. Direct and Necessary expenses: People Support (~$1385), Safety Support (~$279), Financial Support (~$962), Communications Support (~$1811), IT Support (~$3124), and Planning Support (~$1020) necessary to accomplish funded programs/projects.					$9,000
							Sub Total	**$9,000**
							Grand Total	**$441,000**

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
Personnel - Natural Resources Program Consultant		Project manager. Oversee project deliverables and timeline; ensure the proposed work is completed.	**Classified :** This classified staff position will either 1) be backfilled with a new position or 2) the work done by this position will be delayed, eliminated, or completed by the start of the project. A portion of one classified staff, statewide forest ecology program consultant, is directed to being the project manager of this work program. Due to extensive old growth policy and data management experience, this position brings knowledge and perspectives that will result in high quality results.

Non ENRTF Funds

Category	Specific Source	Use	Status	Amount
State				
			State Sub Total	**-**
Non-State				
			Non State Sub Total	**-**
			Funds Total	**-**

Attachments

Required Attachments

Visual Component

File: 922422c0-14b.pdf

Alternate Text for Visual Component

Photos of old growth forest characteristics and the imagery we will use to develop a monitoring protocol....

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?

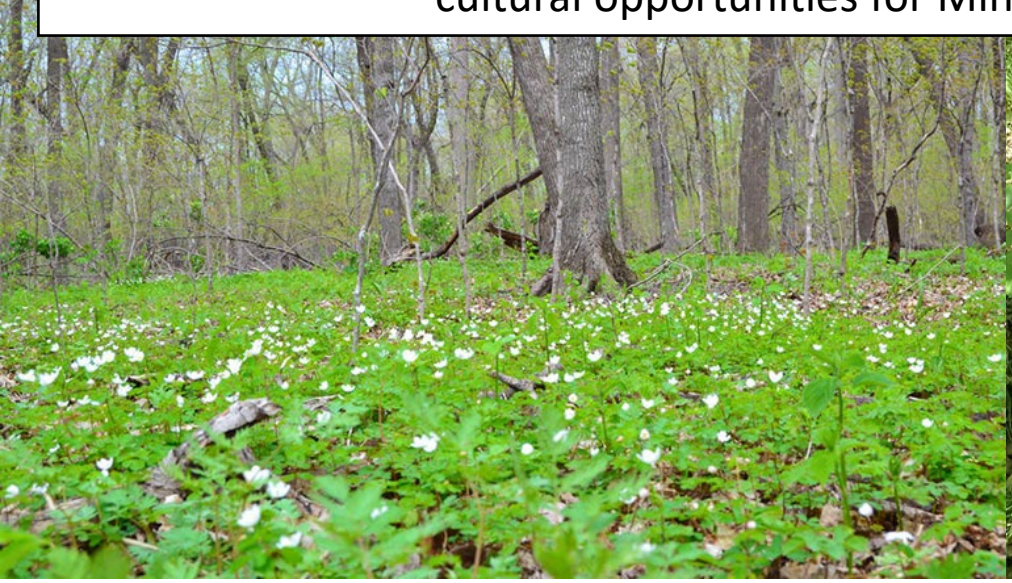
No

Does the organization have a fiscal agent for this project?

No

Old Growth Forest Monitoring

Old growth forests provide unique habitats for native plants and animals, store large amounts of carbon, and provide important recreational and cultural opportunities for Minnesotans.



A Two Part Approach to Old Growth Monitoring:

- Establish a baseline condition for state managed old growth forests.
- Develop a long-term monitoring protocol that is economical and repeatable.