Environment and Natural Resources Trust Fund

2025 Request for Proposal

General Information

Proposal ID: 2025-222

Proposal Title: Expanding the Application of Minnesota's Wetland Monitoring Data

Project Manager Information

Name: Amy Kendig

Organization: MN DNR - Ecological and Water Resources Division

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Project Basic Information

Project Summary: We will use recurring aerial photographs, collected 2006 to present, to produce new information and tools that enhance statewide grassland and wetland monitoring.

ENRTF Funds Requested: $318,000

Proposed Project Completion: June 30, 2028

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?
In the Future

Narrative

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

Over the past 18 years, the DNR's Wetland Status and Trends Monitoring Program (WST) has collected 22,500 high-resolution photos from airplanes to measure changes in wetland acreage over time. Because WST employed a statistically rigorous design and has now built a dataset capturing long-term change, it can be used to address a range of timely and important environmental problems. Additionally, recent advances in USDA's National Agriculture Imagery Program and Minnesota's LiDAR acquisition will extend the value of the WST dataset. We propose using WST photos to address three problems. The first is that we currently lack a statewide program to monitor grasslands. Estimates of grassland and wetland change in western and southern Minnesota are key indicators of success for Minnesota's Prairie Conservation Plan. The second problem is that we do not know the relative effects of specific drivers of wetland change, such as beaver dams and restoration projects. The third problem is we cannot consistently monitor wetland changes in areas of the state not captured by WST photos, which would improve our understanding of wetland gains and losses and keep Minnesota's National Wetland Inventory (NWI) updated.

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 use WST photos—3,750 1-square mile plots that are randomly located throughout the state and photographed every three years—to address three problems. First, to estimate statewide grassland changes, we will map and quantify grasslands in the WST photos, measure change in grassland acreage over time, and assign causes of the change where possible. We will identify prairie and wetland restorations, addressing the second problem–unknown drivers of change. We will also address the second problem by identifying beaver activity in WST photos. Beavers are an important influence on wetlands, their ponds can improve watershed health, and, unlike more indirect drivers of wetland change, their dams are detectable in WST photos. In addition, we will estimate surface water storage of beaver ponds in Minnesota, an important, but current unknown for measuring watershed health and planning for high rainfall and floods. To address the third problem of missed wetland changes, we will use the WST photos to train and test wetland detection models. These computer-based models will indicate where on the landscape wetland gains and losses are occurring. "Training" models involves providing known wetland changes to the model. "Testing" models involves comparing model outputs to known wetland changes.

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 first outcome is grassland acreage and change over the past 18 years, which contributes to conserving and enhancing Minnesota's prairies, of which only fragments remain. Understanding remnant prairie loss, prairie reconstruction, and drivers of change informs implementation of Minnesota's Prairie Conservation Plan. The second outcome is estimated statewide beaver activity and associated surface water storage, which contributes to enhancing Minnesota's waters by informing flood mediation decisions. The third outcome is wetland change detection across the entire state, improving NWI accuracy and contributing to Minnesota wetland conservation. Extensive, updated wetland information improves land-use decisions, ecosystem service estimates, and policy implementation.

Activities and Milestones

Activity 1: Expanding Wetland Monitoring to Include Grasslands

Activity Budget: $133,500

Activity Description:

The Minnesota Prairie Conservation Plan prioritized habitat for conservation and restoration, but, as described in the plan, the many organizations involved prevents statewide quantification of grassland changes. A 2006 report by the MN DNR and MPCA, "A Comprehensive Wetland Assessment, Monitoring, and Mapping Strategy for Minnesota", identified this same challenge for wetlands, which led to the creation of WST. Therefore, applying WST photos to grassland monitoring is a straightforward extension. We will first identify native prairie, reconstructed prairie, and disturbed grasslands in the photos (618 plots fall into the Prairie Conservation Plan or native prairie area), which can be validated with at least 55 ground survey plots already collected by the DNR. Next, we will quantify changes in grassland area, and identify specific drivers of change, including reconstruction and development. During this process, we will update our dataset of wetland changes to include specific drivers. Finally, we will create a report using the analysis methods already developed for WST. This activity will provide estimated changes in acreage, which compliments other ongoing ground-based monitoring of prairie quality (e.g., SPICE, Grassland Monitoring Team, Ecological Monitoring Network). Complimentary forest monitoring is undertaken by USFS Forest Inventory and Analysis.

Activity Milestones:

Description	Approximate Completion Date
Identify and classify grasslands in WST photos.	June 30, 2026
Quantify gains, losses, or change in grassland type.	March 31, 2027
Assign a specific driver to grassland changes (e.g., reconstruction, development).	March 31, 2027
Report the status and trends of grasslands.	March 31, 2028

Activity 2: Explaining Wetland Change with Beaver Activity

Activity Budget: $49,500

Activity Description:

Beaver activity in Minnesota is not only associated with wetland habitat creation, but also functions as extensive surface water storage, which can affect flood dynamics, wildfire resistance, and drought tolerance. We will first identify and digitize beaver dams in the WST photos. Next, the beaver dam location data will be integrated into a previously developed artificial intelligence (AI) model that automatically identifies beaver wetlands in photos. The AI model will support rapid identification of beaver activity in future rounds of WST. Finally, we will estimate the maximum surface water storage of beaver ponds based on dam length, ponded area, or both. Occupied, active beaver wetlands are typically filled at or near their full capacity, while abandoned or inactive beaver wetlands are filled well below their full capacity. This will be the first study in the nation to census beaver activity and their influence on wetland dynamics at the statewide level. The resulting data will be immediately valuable for water, wildlife, and landscape managers. It will also create a baseline for monitoring changes in beaver distribution and influence as climate changes and beaver management decisions are made.

Activity Milestones:

Description	Approximate Completion Date
Identify and digitize beaver dams in WST photos.	June 30, 2026
Train and test AI model to detect beaver dams in Minnesota.	December 31, 2026
Estimate surface water storage of beaver ponds.	June 30, 2027

Activity 3: Improving Minnesota's Wetland Monitoring with New Technologies

Activity Budget: $135,000

Activity Description:

The Minnesota DNR oversees the updated National Wetland Inventory (NWI), which was funded by the ENTRF as recommended by the LCCMR 2008-2019. We are also responsible for monitoring the status and trends of wetland quantity, implemented with WST. To update the NWI, we accept user-submitted suggestions through an online portal (https://arcgis.dnr.state.mn.us/ewr/NWIchangeRequests/). However, recent research by ESRI has shown that our WST photos can be used to train and test AI models that could eventually be used to update NWI (https://storymaps.arcgis.com/stories/8f68ed081906402c85518034228dd908). Further developing these tools would allow us to detect wetland changes throughout the state, not just within the WST plots. The ESRI research determined that a model trained in one area of Minnesota, such as the prairie pothole region, does not perform well in an area with different wetlands, such as northern peatlands. Therefore, Minnesota's diverse wetland landscape requires wetland detection models that are specific to each region. We propose training and testing wetland detection models for each of Minnesota's ecological provinces. This is an important step to developing a comprehensive statewide wetland change detection program.

Activity Milestones:

Description	Approximate Completion Date
Train and test Prairie Parkland model	December 31, 2026
Train and test Tallgrass Aspen Parklands model	June 30, 2027
Train and test Eastern Broadleaf Forest model	December 31, 2027
Train and test Laurentian Mixed Forest model	June 30, 2028

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Gentry Carlson	MN DNR - Forestry	Data Manager and Technical Advisor	Yes
Greg Hoch	MN DNR - Fish and Wildlife	Activity 1 Advisor	No
Emily Fairfax	University of Minnesota - Geography, Environment & Society	Activity 2 Lead	No
Lucas Spaete	MN DNR - Forestry	Activity 3 Advisor	Yes
Gina O'Neil	ESRI	Activity 3 Advisor	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 outcomes from this project will be usable products at the conclusion of this grant. They will be used and supported by existing DNR and UMN projects and associated non-grant funding. Aerial imagery of the 3,750 plots will continue through DNR funding allocated to the Wetland Status and Trends Monitoring Program (WST). Continued monitoring of grasslands can be built into WST.

Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
Foundational Hydrology Data For Wetland Protection And Restoration	M.L. 2021, First Special Session, Chp. 6, Art. 5, Sec. 2, Subd. 03d	$400,000

Project Manager and Organization Qualifications

Project Manager Name: Amy Kendig

Job Title: Biometrician/Wetland Research Scientist

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

Amy earned her PhD in Ecology, Evolution, and Behavior at the University of Minnesota and completed post-doctoral studies in invasion ecology at the University of Florida before starting her role as Biometrician/Wetland Research Scientist at the MN DNR. In these roles, she managed ecological research projects that evaluated the impacts of nutrients on plant diseases, plant invasion on disease emergence, and management practices on aquatic plants. In her role as Wetland Research Scientist, she manages the business needs of Minnesota's National Wetland Inventory, oversees the DNR's Wetland Status and Trends Monitoring Program, and, in collaboration with the DNR's Wetland Program Coordinator, leads the Wetland Hydrology Monitoring Program, which is an LCCMR-funded project with an end date in 2025. In her role as Biometrician, Amy consults on study designs and analyzes data for the Minnesota Biological Survey, participating in projects such as the Ecological Monitoring Network (LCCMR-funded), prairie management assessments, long-term monitoring of rare plants, and development of species distribution models (LCCMR-funded).

Organization: MN DNR - Ecological and Water Resources Division

Organization Description:

The proposed project will be led by the Minnesota Biological Survey, a unit within the MN DNR's Division of Ecological and Water Resources. Our unit has a proven record of effectively monitoring Minnesota's natural areas, with expertise across taxa. We also have years of experience managing large datasets and creating products accessible for natural resource managers and the public. The long-term dataset that serves as the basis for this proposal was created within the Ecological and Water Resources Division, but the Minnesota Biological Survey only became intimately familiar with it in 2022 with the creation of Amy's position, which moved responsibilities of multiple wetland programs into the unit.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
Natural Resource Specialist - Intermediate		Activities 1 and 2			30%	2.25		$180,736
							Sub Total	**$180,736**
Contracts and Services								
MN DNR, Division of Forestry, Resource Assessment Program	Sub award	Manage imagery transfer and technical advising				0.3		$60,000
TBD (supervised by Emily Fairfax), University of Minnesota	Sub award	Activity 2				2		$47,000
							Sub Total	**$107,000**
Equipment, Tools, and Supplies								
							Sub Total	-
Capital Expenditures								
							Sub Total	-
Acquisitions and Stewardship								
							Sub Total	-

Travel In Minnesota								
	Conference Registration Miles/ Meals/ Lodging	One trip, one person	Present our findings and receive feedback from Minnesota's experts					$500
							Sub Total	**$500**
Travel Outside Minnesota								
	Conference Registration Miles/ Meals/ Lodging	One trip, one person, national conference	Present our findings and receive feedback from the scientific community	X				$2,500
							Sub Total	**$2,500**
Printing and Publication								
	Publication	Journal publication	Receive peer review and disseminate our results to the scientific community.					$2,000
							Sub Total	**$2,000**
Other Expenses								
		Direct and Necessary Costs	DNR direct and necessary costs pay for activities that are directly related to and necessary for accomplishing appropriated projects. People Support (~$5,418), Safety Support (~$761), Financial Support (~$1,790), Communication Support (~$1,528), IT Support (~$14,631), and Planning Support (~$1,137)					$25,264
							Sub Total	**$25,264**
							Grand Total	**$318,000**

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
Travel Outside Minnesota	Conference Registration Miles/Meals/Lodging	One trip, one person, national conference	This project will provide training for an early career scientist, and the opportunity to present at a national conference will not only expand their career opportunities, but elicit the rigorous feedback needed for the research proposed, as it is likely to inform management and policy decisions.

Non ENRTF Funds

Category	Specific Source	Use	Status	Amount
State				
In-Kind	General Fund	Project supervision, management, technical review, partner coordination.	Secured	$20,000
			State Sub Total	**$20,000**
Non-State				
-			**Non State Sub Total**	-
			Funds Total	**$20,000**

Total Project Cost: $338,000

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments
Visual Component
File: [071936b8-6cf.pdf](071936b8-6cf.pdf)

Alternate Text for Visual Component
A map of Minnesota with photo locations and a photo of wetland restoration to represent the existing dataset. A photo of prairie plants, a photo of a beaver dam, and a map of wetlands represent the three proposed activities....

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

Title	File
UMN Support Letter	[88392862-e6b.pdf](88392862-e6b.pdf)

Administrative Use

Does your project include restoration or acquisition of land rights?
> No

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:
> Bruce Carlson (DNR), Holly Bernardo (DNR), Evan Host (DNR), Tom Klein (DNR), Emily Fairfax (UMN)