



## Environment and Natural Resources Trust Fund

M.L. 2025 Approved Work Plan

### General Information

**ID Number:** 2025-222

**Staff Lead:** Tiffany Schaufler

**Date this document submitted to LCCMR:** June 5, 2025

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

**Project Budget:** \$312,000

### Project Manager Information

**Name:** Amy Kendig

**Organization:** MN DNR - Ecological and Water Resources Division

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### Project Reporting

**Date Work Plan Approved by LCCMR:** June 24, 2025

**Reporting Schedule:** March 1 / September 1 of each year.

**Project Completion:** June 30, 2028

**Final Report Due Date:** August 14, 2028

### Legal Information

**Legal Citation:** M.L. 2025, First Special Session, Chp. 1, Art. 2, Sec. 2, Subd. 03v

**Appropriation Language:** \$312,000 the first year is from the trust fund to the commissioner of natural resources to use existing LiDAR and recurring aerial photographs to determine state grassland acreage and change over the last twenty years, evaluate key drivers of wetland change, and use technology to improve Minnesota's wetland monitoring.

**Appropriation End Date:** June 30, 2028

## Narrative

**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.

**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.

## 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

## Activities and Milestones

### Activity 1: Expanding Wetland Monitoring to Include Grasslands

**Activity Budget:** \$130,500

**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:** \$132,000

**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/NWChangeRequests/>). 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              |

## 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.**

Activities 1 and 3 will be documented with reports that will be made publicly available on the MN DNR's website. Activity 2 will be documented in the form of a thesis, which will be made publicly available through UMN's website. The project will produce at least one publication in a peer-reviewed science journal, one presentation at a local Minnesota conference, and one presentation at a national science conference. All dissemination products will include the trust fund logo (presentations) or attribute language (reports, papers) acknowledging the Environmental and Natural Resource Trust fund as per the ENRTF Acknowledgement Guidelines.

## 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      |

## Budget Summary

| Category / Name   | Subcategory or Type                  | Description  | Purpose  | Gen. Ineligible | % Benefits | # FTE | Classified Staff? | \$ Amount        |
|---|--------------------------------------|--|--|-----------------|------------|-------|-------------------|------------------|
| <b>Personnel</b>  |                                      |  |  |                 |            |       |                   |                  |
| Plant ecologist   |                                      | Activities 1 and 3   |  |                 | 30%        | 2.25  |                   | \$174,787        |
|   |                                      |  |  |                 |            |       | <b>Sub Total</b>  | <b>\$174,787</b> |
| <b>Contracts and Services</b>                             |                                      |  |  |                 |            |       |                   |                  |
| MN DNR, Division of Forestry, Resource Assessment Program | Internal services or fees (uncommon) | Manage imagery transfer and technical advising   |  |                 |            | 0.3   |                   | \$60,000         |
| University of Minnesota                                   | Subaward                             | Funding to support graduate student advised by Emily Fairfax to complete all milestones described for Activity 2 (personnel: \$25,000, fringe benefits: \$22,000). |  |                 |            | 2     |                   | \$47,000         |
|   |                                      |  |  |                 |            |       | <b>Sub Total</b>  | <b>\$107,000</b> |
| <b>Equipment, Tools, and Supplies</b>                     |                                      |  |  |                 |            |       |                   |                  |
|   |                                      |  |  |                 |            |       | <b>Sub Total</b>  | -                |
| <b>Capital Expenditures</b>                               |                                      |  |  |                 |            |       |                   |                  |
|   |                                      |  |  |                 |            |       | <b>Sub Total</b>  | -                |
| <b>Acquisitions and Stewardship</b>                       |                                      |  |  |                 |            |       |                   |                  |
|   |                                      |  |  |                 |            |       | <b>Sub Total</b>  | -                |
| <b>Travel In Minnesota</b>                                |                                      |  |  |                 |            |       |                   |                  |
|   | Conference Registration              | One trip, one person   | Present our findings and receive feedback from Minnesota's experts |                 |            |       |                   | \$500            |

|   |  |   |   |   |  |  |                        |                  |
|---|--|---|---|---|--|--|------------------------|------------------|
|   | Miles/ Meals/<br>Lodging                               |   |   |   |  |  |                        |                  |
|   |  |   |   |   |  |  | <b>Sub<br/>Total</b>   | <b>\$500</b>     |
| <b>Travel<br/>Outside<br/>Minnesota</b> |  |   |   |   |  |  |                        |                  |
|   | Conference<br>Registration<br>Miles/ Meals/<br>Lodging | One trip, one person, national conference | Present our findings and receive<br>feedback from the scientific community  | X |  |  |                        | \$2,500          |
|   |  |   |   |   |  |  | <b>Sub<br/>Total</b>   | <b>\$2,500</b>   |
| <b>Printing and<br/>Publication</b>     |  |   |   |   |  |  |                        |                  |
|   | Publication  | Journal publication                       | Receive peer review and disseminate<br>our results to the scientific community.   |   |  |  |                        | \$2,000          |
|   |  |   |   |   |  |  | <b>Sub<br/>Total</b>   | <b>\$2,000</b>   |
| <b>Other<br/>Expenses</b>               |  |   |   |   |  |  |                        |                  |
|   |  | Direct and Necessary Costs                | DNR direct and necessary costs pay for<br>activities that are directly related to and<br>necessary for accomplishing<br>appropriated projects. People Support<br>(~\$5,418), Safety Support (~\$761),<br>Financial Support (~\$1,739),<br>Communication Support (~\$1,528), IT<br>Support (~\$14,631), and Planning<br>Support (~\$1,137) |   |  |  |                        | \$25,213         |
|   |  |   |   |   |  |  | <b>Sub<br/>Total</b>   | <b>\$25,213</b>  |
|   |  |   |   |   |  |  | <b>Grand<br/>Total</b> | <b>\$312,000</b> |

## Classified Staff or Generally Ineligible Expenses

| Category/Name                   | Subcategory or Type                               | Description                               | Justification Ineligible Expense or Classified Staff Request   |
|---------------------------------|---|---|--|
| <b>Travel Outside Minnesota</b> | Conference<br>Registration<br>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       |
|------------------|-----------------|--|----------------------------|-----------------|
| <b>State</b>     |                 |  |                            |                 |
| In-Kind          | General Fund    | Project supervision, management, technical review, partner coordination. | Secured                    | \$20,000        |
|                  |                 |  | <b>State Sub Total</b>     | <b>\$20,000</b> |
| <b>Non-State</b> |                 |  |                            |                 |
|                  |                 |  | <b>Non State Sub Total</b> | -               |
|                  |                 |  | <b>Funds Total</b>         | <b>\$20,000</b> |

**Total Project Cost: \$332,000**

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

Yes

## Attachments

### Required Attachments

#### *Visual Component*

File: [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 | <a href="#">88392862-e6b.pdf</a> |

## Difference between Proposal and Work Plan

#### *Describe changes from Proposal to Work Plan Stage*

Changed category for Resource Assessment Program budget from subaward to internal service, included plan to acknowledge ENTRF in dissemination, changed answer to hypothesis question to "no", provided more description for subaward to UMN. Changed the personnel title of "Natural Resource Specialist - Intermediate" to "Plant ecologist" so that the work can be completed by a broader group of personnel.

## Additional Acknowledgements and Conditions:

The following are acknowledgements and conditions beyond those already included in the above workplan:

**Do you understand and acknowledge the ENRTF repayment requirements if the use of capital equipment changes?**

N/A

**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 Commissioner's Plan 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?**

No

**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 project:**

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

**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