



Environment and Natural Resources Trust Fund

2027 Request for Proposal

General Information

Proposal ID: 2027-370

Proposal Title: Forest Disturbance, Risk and Resiliency Mapping and Monitoring

Project Manager Information

Name: Keb Guralski

Organization: MN DNR - Forestry Division

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Project Basic Information

Project Summary: Emerging and existing technologies will create a forest disturbance, risk and resiliency framework for mapping and monitoring changes to our forests and support improved forest management and data quality.

ENRTF Funds Requested: \$500,000

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?

Statewide

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

Statewide

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.

Mapping risk, monitoring disturbance and assessing resiliency of forests across ownerships in Minnesota is challenging in the face of climate change, land use changes, and extreme weather driven events. Across Minnesota, the impact and return interval of disturbance related to forest pathogens, fire, weather and climate continues to impact land managers and landowners playing a role in the overall health and economic well-being of all residents of Minnesota.

Eastern Larch Beetle has killed over 1.2 million acres since 2001, with nearly 300,000 new acres impacted in 2025; Emerald Ash Borer was newly detected in six additional counties in 2025, now totaling 59 counties; wind damage to forests in 2025 increased nearly three times from 2024 to 2025; and wildfires burned over 86,000 acres in 2025, up from around 15,000 acres in 2024 (source: MN DNR).

This project aligns with Statute 89A Policy for sustainable resource management by broadening our knowledge of where and why our forests are vulnerable and how we can better manage forest resources through mitigating disturbance impacts, protecting life and property and continuing to support a sustainable forest products driven economy across site, landscape and statewide scales.

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.

This proposal aims to develop forest disturbance, risk and resiliency mapping and monitoring resources spanning all ownership types across Minnesota. Assessing elements across ownerships produces more meaningful data and incentivizes partnerships, such as shared stewardship and watershed scale planning. Objectives include identifying conditions where forests are most at risk or have experienced change and developing mapping resources that serve to assist land managers and landowners plan and conduct proactive management or respond to disturbance events.

Identifying landscape and site level change also provides a core need for Forest Inventory and Guideline Monitoring by providing essential data used to plan and assess management activities and improve forest inventory data and forest resource planning efforts.

Using lidar and stereo-derived 3D data collected over time creates valuable data products that assist landowners in detecting emerging threats and determining management priorities at site-landscape levels, monitoring the spread of forest health concerns, detecting natural (e.g., flooding, forest blowdown, fire, insects, disease outbreaks) and anthropogenic changes (e.g., harvest, land cover change), mitigating fuels strategically, and assessing overall risk to forests. We plan to collect existing and new foundational datasets to assess forest disturbance over time, building information into mapping and monitoring layers across the

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?

This project will build capacity for the Forest Inventory, Guideline Monitoring, and Remote Sensing Programs within RAP and also provide datasets and tools that are critical to landowners and managers that RAP supports by guiding the shared mission of protecting, conserving and enhancing our forest resources. The project deliverables will assist landowners in making their properties more resilient, prioritize management activities, respond to disturbance events, and identify broad areas of impact. The project can serve all landowners and the public across ownerships by establishing common workflows, providing more investment in cross-boundary collaboration.

Activities and Milestones

Activity 1: Strategic Planning and Design for Programmatic Approach to Forest Disturbance, Risk and Resiliency Mapping and Monitoring

Activity Budget: \$50,000

Activity Description:

Strategic design and collaboration will begin with new investment from ENRTF in FY28. This design work will continue throughout the first six months of the proposed project, with heavy emphasis on the first three months. This activity will be coordinated by RAP and the core programs of Forest Inventory (tracking current and historic forest composition and conditions), Guideline Monitoring (Forest Management Guideline implementation monitoring and education), and Remote Sensing (acquiring, processing and analyzing remotely sensed data). Other stakeholders will be involved in development of priorities, including: DNR's Forest Health, Private Forest Management, Planning, Silviculture, Fire and Timber Programs, MNDNR division staff outside the DOF, University of Minnesota Extension Service, Minnesota Forestry Association, and the Minnesota Forest Resources Council Landscape Committees. RAP will have responsibility during this stage to outline and gather resources for consideration in risk assessment and canopy change monitoring, including lidar derived products, remotely sensed data, field data, and ancillary data sets. RAP will develop roles, resources, working group needs and assess potential pathways for project completion during this planning stage.

Activity Milestones:

Description	Approximate Completion Date
Create and Document RAP Strategic Plan and document project management tasks/goals	December 31, 2027
Develop organizational roles and responsibilities, project organizational chart	December 31, 2027
Determine working group needs; define stakeholder groups needed	December 31, 2027
Organize available resources and methods for consideration by working group	December 31, 2027

Activity 2: Develop Disturbance, Risk and Resiliency Mapping and Monitoring Working Group, Priorities and Assessment Parameters

Activity Budget: \$50,000

Activity Description:

Collaboration in the form of a working group comprised of professional resource managers familiar with forest risk, change, management and planning is critical to developing priorities and parameters during the project. This activity is collaborative in nature and serves to create a risk assessment, change detection and disturbance response priorities and parameters that are effective across all stakeholder groups. Activities include researching current methods, determining prioritized risk categories and parameters, defining forest change scale and response needs, engaging staff and partners in decision making, considering workflow integration, and collaborating on operational considerations relating to product creation, maintenance schedules, data delivery, assessing training needs and general consultation.

The working group will serve to guide the decision-making process and assist in determining the proper scope for the analysis performed. Making the data operational is a key part of the project and the working group will be tasked with determining use cases for the data, implementation strategies, other potential dependencies or integration into existing workflows and developing concepts for new workflows. The group will meet regularly throughout the first year of the project and occasionally during development and implementation.

Activity Milestones:

Description	Approximate Completion Date
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Determine partner “working group” composition and assign roles, determine meeting schedules	March 31, 2028
Determine meeting schedule, discuss logistics and goals of working group and develop charter	March 31, 2028
Determine risk priorities and parameters at both statewide and regional scales	June 30, 2028
Conduct research, consider current assessment criteria and emerging analyses and technology	September 30, 2028
Develop proactive assessment, detection and response protocol	September 30, 2028
Determine analysis needs and operational consideration	September 30, 2028

Activity 3: Remotely Sensed Data Acquisition

Activity Budget: \$200,000

Activity Description:

Collecting remotely sensed data, acquiring and testing available resources and upgrading resolution of data for testing will be considered during this activity. Collection intervals, resolution, timing and supplemental data collection needs are important logistical consideration for this project. These logistical considerations serve to enhance existing efforts to leverage remotely sensed data in existing workflows. Developing an acquisition plan that utilizes current workflows and incorporates the project need is critical. Timing of change detection flights, using and enhancing resolution of NAIP imagery, acquiring digital surface models and considering previously underutilized technology in remote sensing will be important considerations. This activity will consider additional flight needs to test assessments, response to change workflows and assist in mapping current and emerging threats.

Activity Milestones:

Description	Approximate Completion Date
NAIP 2027 Acquisition with Digital Surface Model and Resolution Enhancement	December 31, 2028
Acquire and Test Additional Remotely Sensed Data Sources	December 31, 2028
Conduct Supplemental Aerial Photo Flights	December 31, 2028

Activity 4: Process Data, Test and Develop Mapping Layers

Activity Budget: \$150,000

Activity Description:

This phase will develop the forest Disturbance, risk and resiliency mapping and monitoring layers that prioritize conditions using the priorities and parameters established by the working group. This phase will be iterative and will include testing, working group review and use case development. Testing will utilize lidar based grid metrics and forest inventory models, cover type models and satellite and stereo derived data. The development of additional indices, formulation of models and equations, scaling to site-landscape scales, and combining analyses in a comprehensive set of data will be explored using these layers. Workflows for processing this data will be defined in the strategic planning and working group phases of the project, while data production and organization will be the focus of this activity. This activity will assess the use of stereo derived data, satellite data and lidar derived Canopy Height Models to determine reliable change detection and risk assessment return intervals. Analysis will be supported by field validation and will evaluate the capacity to detect tree health conditions and support individual tree mapping workflows for assessing disturbance risks of specific agents.

Activity Milestones:

Description	Approximate Completion Date
Develop Initial Mapping Layers	June 30, 2029
Test Initial Layers, Review and Recommend Improvement	September 30, 2029
Process Aerial Acquisition Data, Perform Field Validation	March 31, 2030

Develop Final Mapping Layers	March 31, 2030
Documentation and Guidance Development	March 31, 2030

Activity 5: Product Delivery, Integration and Data Maintenance

Activity Budget: \$50,000

Activity Description:

The Activity focuses on data delivery, metadata production, developing web applications, data maintenance plans, training materials, integration planning for MNDNR workflows, training staff and partners, presenting at conferences and engaging with partners, stakeholders and the public.

Engaging partners and the public through outreach materials, presenting at a variety of events and creating accessible resources promotes buy-in and makes landowners feel invested in the common goal of building healthy resilient forests on all ownerships.

Development of an integration plan and use cases for MNDNR staff will require engagement with working group and various program staff to determine where the assessment layers intersect forest inventory, guideline monitoring, timber sale administration, landscape level planning, forest resource planning and silvicultural objectives.

Data maintenance, return interval and scheduling updates to align with other remote sensing acquisitions and products will be a critical need and outcome for this project. Wholistic approaches to Remote Sensing activities must consider the broader objectives of a programmatic approach. Utilizing existing data sets to develop a long-term plan can be done efficiently, timely and in a cost-effective way. This activity aims to create a fully integrated approach to existing data acquisition and processing.

Activity Milestones:

Description	Approximate Completion Date
Deliver data to relevant platforms (4trees, GDRS, Forest Finder, Web Apps, etc.)	June 30, 2030
Develop Staff and Partner Training Materials	June 30, 2030
Present Data at Conferences and to Stakeholders, Partners and the Public	June 30, 2030
Develop Integration and Return Interval Plan	June 30, 2030

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Resource Assessment Program	Minnesota DNR - Forestry	Strategic Planning, Project Management, Data Acquisition, Data Analysis and Production, Partner Coordination, Data Delivery, Training	Yes
Minnesota Forest Resources Council	Minnesota DNR - Forestry	Partner Coordination, Strategic Direction, Project Objectives and Deliverables Consultation, Resource Monitoring Integration	No
Minnesota Forestry Association	Minnesota Forestry Association	Private Landowner Representation and Collaboration	No
Natural Resources Research Institute	University of Minnesota - Duluth	Online GIS Map Hosting and Tools	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.

The dissemination of the resulting products is a key objective for this proposal. Details for distribution of data are outlined in the proposal, and in activity 5, outlining product delivery, integration and data maintenance and updates related to new data sources and updates to existing data. Data will be made available as internal (DNR) services as well as hosted on the Minnesota Geospatial Commons and public facing web applications.

All data layers will be hosted publicly on the Minnesota Geospatial Commons and integrated into public facing web mapping applications. Forest Finder, the Minnesota DNR web mapping application tracking forest inventory data will serve the data. The Minnesota Natural Resources Atlas, a public facing data atlas, will serve the data. For internal staff and GIS users, the layers will be available for viewing and analysis in GIS systems. The creation of a standalone public-facing web application will be considered during the project and a goal of hosting information and links on several MNDNR internal web pages will be considered.

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 project deliverables include statewide mapping and monitoring resources including change and risk layers available for stakeholder use, accessible to MNDNR staff on the GDRS, and available for access through public facing applications and web pages. Accompanying metadata, methods, parameters and guidance will be developed with stakeholder input. Change detection and risk mapping will be kept up to date by RAP through repeat NAIP and Satellite imagery acquisition occurring at regular intervals between lidar collections. Risk models are initially developed using lidar metrics, indices and supplemental predictors. Repeatable update needs and capabilities will be assessed as part of this project.

Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
Forest Data Inventory	M.L. 2022, , Chp. 94, Art. , Sec. 2, Subd. 10d	\$500,000

Statewide Forest Carbon Inventory and Change Mapping	M.L. 2023, , Chp. 60, Art. 2, Sec. 2, Subd. 03f	\$987,000
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Project Manager and Organization Qualifications

Project Manager Name: Keb Guralski

Job Title: Forest Inventory Research Scientist

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

Keb Guralski holds a B.S. in Forest Management from the University of Wisconsin Stevens Point. Keb has 19 years of experience in the field of forestry across a broad range of disciplines including Forest Inventory, Forest Management, Private Forest Management, Fire Management and Suppression, Geographic Information Systems, Forest Modeling, Project Management, Database Management, Field Technology and Application Development.

Keb has nearly 5 years of experience working with forest biometrics data, statistical analysis of natural resources data (esp. forest inventory) and developing spatial and statistical models from field-based and remotely sensed data.

Currently Keb is leading the Lidar Derived Forest Inventory work being conducted by Resource Assessment and manages additional projects for RAP including, 1) Minnesota Forest Resource Council's Regional Landscape Dashboard development project; 2) Forest Carbon Analysis Project (MNDNR- DOF); 3) State Forest Action Plan, and has also recently transitioned to the Forestry Projects program lead, managing and overseeing the work done between Resource Assessment and the Division of Forestry, a critical role for planning long range direction and resource allocation for both RAP and the DOF.

Keb has nearly 15 years of field experience in Forestry working across a diverse range of forest conditions and management objectives. Keb began his career as Assistant District Forester managing State Trust Lands in Colorado (2007-2012) on multi-use parcels. Keb transitioned to Senior Forester with the Wisconsin Board of Commissioners of Public Lands (2012-2017), managing complex hardwood systems using research-driven silvicultural practices and implementing a Continuous Forest Inventory system across those lands. Keb then transitioned to a GIS Specialist and Inventory Forester for the Douglas County (WI) Forestry Department, (2017-2021). He then began his work with the Minnesota DNR as the Forest Inventory Coordinator in 2021 and transitioned into his current role as Forest Inventory Research Scientist in 2024.

Organization: MN DNR - Forestry Division

Organization Description:

The MN 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.

Division of Forestry's mission is to provide a shared expertise to understand, sustain, and manage Minnesota's trees, woodlands, and forests; provide a sustainable supply of multiple forest resources and opportunities; protect lives and property from wildfires; and fulfill responsibilities to the permanent school trust.

RAP supports these missions with our Forest Inventory Program, Guideline Monitoring Program, and Remote Sensing Program by providing tools and datasets critical for decision-making, by providing expertise in field inventory and best management practices implementation monitoring, and collecting and processing spatial data (e.g., lidar and aerial or satellite imagery). These programs, products, and services are foundational in supporting management of forest health, timber, wildlife, water resources, among other values. The rich data analyses and monitoring provided by RAP are important to understand effects of widely variable forest change patterns, invasive species and disease, destructive forest events, and impacts of climate change.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
Personnel								
Project Manager		Project Management and Coordination			25%	1.8		\$276,274
							Sub Total	\$276,274
Contracts and Services								
TBD	Service Contract	Aerial Photo Collection - NAIP 2027 Digital Surface Model and Resolution Enhancement, Supplemental Aerial Photo Flights.				0		\$200,000
							Sub Total	\$200,000
Equipment, Tools, and Supplies								
							Sub Total	-
Capital Equipment								
							Sub Total	-
Acquisitions and Stewardship								
							Sub Total	-
Travel In Minnesota								
							Sub Total	-
Travel Outside Minnesota								
							Sub Total	-
Printing and Publication								

							Sub Total	-
Other Expenses								
		MN DNR Direct and Necessary	DNR's direct and necessary costs pay for activities that are directly related to and necessary for accomplishing appropriated projects. People Support (~\$4,366), Safety Support (~\$573), Financial Support (~\$3,322), Communication Support (~\$2,086), IT Support (~\$11,837), and Planning Support (~\$1,543).					\$23,726
							Sub Total	\$23,726
							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
State				
			State Sub Total	-
Non-State				
			Non State Sub Total	-
			Funds Total	-

Total Project Cost: \$500,000

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: [b1f11912-9df.pdf](#)

Alternate Text for Visual Component

The visual display recently created for the 2026 Minnesota SAF, AFS & TWS joint meeting depicts a recently created spruce budworm susceptibility map for Northeast Minnesota using lidar derived data, cover type modeling and forest health program recommended spruce budworm risk conditions of the Spruce-Fir cover type....

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?

N/A

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 proposal:

Dennis Kepler (MNDNR Division of Forestry), Jennifer Murphy (MNDNR Division of Forestry), Patty Thielen (MNDNR Division of Forestry), Michelle Mitchell (MN Office of Management and Budget)

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

Yes, I understand