Environment and Natural Resources Trust Fund

2026 Request for Proposal

General Information

Proposal ID: 2026-569

Proposal Title: Capturing Seasons: PhenoCam Network for Monitoring and Forecasting

Project Manager Information

Name: Bob Basques

Organization: SharedGeo

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Project Basic Information

Project Summary: This project expands Minnesota's PhenoCam Network to enhance forest monitoring, track climate impacts, improve management strategies, support public engagement, and provide real-time, high-resolution ecosystem data for research, education, and conservation.

ENRTF Funds Requested: $295,000

Proposed Project Completion: June 30, 2028

LCCMR Funding Category: Small Projects (G)
Secondary Category: Land (F)

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.

Minnesota's forests are increasingly threatened by climate change, wildfires, and insect outbreaks. To respond effectively, land owners and managers need a reliable way to know when changes are happening over time. However, current monitoring methods, such as recording leaf emergence or fall color changes, rely on human observation, making monitoring inconsistent and difficult to scale.

Although many environmental monitoring sensors are deployed across the state by various agencies, they often face challenges. Harsh outdoor conditions can knock sensors out of place or cause malfunctions that go unnoticed. Without a near real-time monitoring system, issues like low battery levels or full memory storage can disrupt data collection. The proposed systems will address these issues by enabling real-time detection of sensor failures, ensuring immediate maintenance and minimal data loss.

Additionally, managing the vast amount of collected data is a challenge. Long-term data storage and accessibility remain difficult, especially as image resolutions increase. Manually handling hundreds of high-resolution images is impractical. The proposed system will integrate automated storage, processing, and result-sharing, ensuring that valuable information is securely maintained and easily accessible.

This new system will bridge the gap between outdoor environmental monitoring and meaningful, accessible insights for decision-makers and the public.

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.

Monitoring leaf emergence or snow depth in Minnesota's forests requires human observation, making the process time-consuming, inconsistent, and not available everywhere. This project will modernize forest monitoring by expanding the high-resolution PhenoCam Network at key locations statewide. These cameras capture images of nature every 30 minutes year-round, linking on-the-ground environmental data, such as soil and air temperature and precipitation, with satellite and aerial imagery. This system enables automated, scalable, and cost-effective phenological change monitoring with minimal human effort.

All collected data will be securely stored on servers operated by PhenoCam's Northern Arizona University, with support from NSF grants. Authorized agencies can access this data to analyze and visualize trends, providing valuable insights for Minnesota residents. To maximize efficiency and share infrastructure, preference would be to install cameras at existing weather stations, monitoring networks, and tower systems. New camera systems in remote areas will operate using solar power and satellite internet, ensuring a carbon-neutral and reliable system.

The system also includes an automated warning feature to detect malfunctions, failures, or connectivity issues. By continuously monitoring snow depth, leaf emergence, and environmental disturbances such as wildfires and storms, this project will enhance Minnesota's ability to manage and protect its forest resources.

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 design and deploy PhenoCam systems for a range of locations (i.e., limited-to-unlimited power and internet). The near real-time photography and other site condition measurements will enhance our understanding of climate-driven phenological shifts across Minnesota and enable us to create predictive models to assess climate impacts at a site-to-regional scale. This cost-effective project will also support DNR's assessments of peak fall color for aerial photography and provide a unique educational opportunity to combine outdoor learning and engagement into sustainable management planning and training.

Activities and Milestones

Activity 1: Research on ideal site locations, site requirements, and design a range of prototypes

Activity Budget: $50,000

Activity Description:
This activity focuses on assessing ideal site locations for expanding the PhenoCam Network in Minnesota. The process begins with SharedGeo learning about PhenoCam network components and operational requirements to identify pre-existing sites that meet the necessary conditions for installation and operation.

Once potential sites are identified, RAP will seek operational partners who can provide access, infrastructure, and long-term support for sensor installation. These partners include local governments, federal agencies, or public institutions with existing monitoring systems. Additionally, RAP will explore opportunities to collect environmental data such as soil moisture and air temperature, and investigate retired sites in Minnesota to learn more about making them functional with a PhenoCam.

Another key factor is selecting sites that are representative. In mixed forests, for example, selecting sites with a diverse range of tree species will help ensure that PhenoCam data accurately represents local forest characteristics. Through this structured approach, we will ensure that PhenoCam prototype sensors are placed in optimal locations, enhancing our ability to monitor seasonal and long-term ecological changes across Minnesota. Before beginning Phase 1, the goal is to complete an initial systems evaluation for at least three prototypes to be functional for three months.

Activity Milestones:

Description	Approximate Completion Date
Learn PhenoCam network components and operational requirements	September 30, 2026
Assess possible locations for different prototype systems	September 30, 2026
Visit other PhenoCam sites in the region and compare functionality	December 31, 2026
Create a requirements list and complete systems evaluation	March 31, 2027

Activity 2: Deploy prototypes, troubleshoot, conduct initial analyses, and finalize locations and site specifications for expansion

Activity Budget: $150,000

Activity Description:
Phase 1 of this project focuses on equipment, building, testing, and improving the PhenoCam Network prototype systems. SharedGeo will first construct the prototype cameras and RAP will select the best locations for installation. Locations will be chosen based on factors such as accessibility, existing infrastructure, and their ability to capture valuable environmental data.

Once the prototypes are installed, SharedGeo will spend three months testing the system to ensure that images and environmental data are accurately captured and successfully transmitted to the server. This crucial step confirms that the system functions as expected.
During this time, RAP will conduct an initial analysis of greenness monitoring, checking how well the cameras track changes in vegetation over the first three months.

Phase 2 involves refinement of designs and analyses methods based on the findings of Phase 1, improving reliability, efficiency, and data accuracy. By making the refinements early and during a full growing season, we can ensure that the

PhenoCam Network provides high-quality, real-time environmental monitoring, helping stakeholders, policymakers, and communities across Minnesota make informed decisions about forest conservation and climate adaptation.
Phase 3 involves the deploying refined designs initiated by an updated systems evaluation report at the end of the quarter.

Activity Milestones:

Description	Approximate Completion Date
Build the prototypes and finalize install locations	June 30, 2027
Set up systems and begin test data quality and transfer to the server	September 30, 2027
Analyse data and check greenness monitoring for the first month	September 30, 2027
Refine requirements list and update systems evaluation	December 31, 2027

Activity 3: Capture and analyze data, develop system and data maintenance plans, and conduct outreach and education

Activity Budget: $95,000

Activity Description:
To effectively monitor certain environmental changes, data collection should be monitored seasonally to visualize greenness trends over time, while some analyses require longer time periods to see trends. This grant period timeline allows for minimal assessment of vegetation health and environmental conditions for the new PhenoCam sites in Minnesota, so RAP will also compare data collected at other sites in the region.

The comparative analysis will provide insights into seasonal variations and long-term trends that occur well over a year, helping us identify patterns that may indicate improvements or declines in greenness to support informed decision-making. While RAP is conducting these analyses, data will continue to be collected in the new sites, and methods for analyses developed for other regions can begin to be tested and applied here.

Public dissemination of findings enhances awareness and encourages community participation in monitoring and sustainability efforts. RAP will develop outreach and training opportunities to show how organizations can freely access these data, and use it to support evidence-based environmental monitoring and decision-making. SharedGeo will provide website connections to the PhenoCam network website hosted by Northern Arizona University. The project culminates with a close-out systems evaluation and long-term maintenance plan documents.

Activity Milestones:

Description	Approximate Completion Date
Collect available data quarterly and visualize greenness	March 31, 2028
Analyze quarterly data, track changes, and compare to other sites	March 31, 2028
Produce a close-out systems evaluation, including maintenance plan	June 30, 2028
Share analysis results with the public via web and virtual workshop	June 30, 2028

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Jennifer Corcoran	MN DNR Resource Assessment Program	The Resource Assessment Program (RAP) supports DNR goals by providing inventory, monitoring, and data analyses products and services. RAP will collaborate with SharedGeo to research and build prototypes, identify existing sites for integration, deploy and test, analyze trends and compare to regional data, and develop training and outreach materials.	Yes
Kangsan Lee	MN DNR Resource Assessment Program	The Resource Assessment Program (RAP) supports DNR goals by providing inventory, monitoring, and data analyses products and services. RAP will collaborate with SharedGeo to research and build prototypes, identify existing sites for integration, deploy and test, analyze trends and compare to regional data, and develop training and outreach materials.	Yes

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 PhenoCam equipment will be designed to suit the environment, and function as efficiently and sustainably as possible, leveraging existing power and internet resources wherever available. The photos and data analysis information will be incorporated into RAP's Remote Sensing Program, which captures aerial images of the forest during peak fall color. The ongoing costs for cellular and power resources will be maintained by RAP. Along with a close-out systems evaluation report, a long term technological and maintenance plan will be produced and will describe proposed long-term integration into Minnesota DNR's Resource Assessment Program.

Project Manager and Organization Qualifications

Project Manager Name: Bob Basques

Job Title: SharedGeo Technical Director

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

Technical Director at SharedGeo for 17 plus years, and GIS Systems Developer at the City of Saint Paul, Public Works with 37 years of managing engineering data records alongside GIS datasets. The following is a description of the unique projects I've worked on applicable to this application:

Managed hundreds of GIS data layers for publishing and distribution to engineering staff and the public via the web. This included the generation of time-lapse filmstrips for long term analysis.

Coordinating development of a hardware redesign and firmware for a GPS tracking chip for tracking vehicle locations on and near airport runways to track runway incursions.

Coordination and development of computer-based system for capturing near-real time street snow plow location for a 100+ vehicle fleet, including tool activation on the plow vehicle (e.g., plow up/down, sander on/off), and storage of the data in an SQL database.

Coordination and development of online tools that allowed for large dataset access in the field, with or without an internet connection. The device developed included a full Web server software stack that included a Web Server, Database, a local file storage option as well as a fully functional location and mapping interface that was used to develop Web Basemap systems applicable to a number of field data collection needs. The device runs on low power, booted

automatically with an on/off switch, and is accessed through its own WiFi broadcast. The device was configured to update itself when connected to the internet, including updating cached datasets.

Research and development of handheld and drone captured lidar and photogrammetry datasets for construction project progress tracking in the field as well as digital twin dataset management for long term (20 plus years) online access to captured 3D datasets.

Organization: SharedGeo

Organization Description:
SharedGeo was founded in September 2008 as a way to advance the use of mapping technologies and share geographic data in support of disaster response and relief operations in the United States. Since that time, SharedGeo has become engaged in a wide variety of related activities – including emergency response, environmental, Public Health and similar efforts that benefit the common good. SharedGeo's mission is to help government, nonprofit, education, and corporate entities use mapping technologies and share geographic data.

For example, SharedGeo recently completed a Great Lakes Restoration Initiative project with several government and academic partners. This project provided data to conservationists and researchers charged with restoration and monitoring of Great Lakes coastal wetlands. The website and tools developed by SharedGeo are still used by these practitioners today. https://glars.org/home/sharedgeo/

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
							Sub Total	**-**
Contracts and Services								
SharedGeo	Subaward	SharedGeo will collaborate with RAP to research, purchase and build prototypes, deploy and test PhenoCam network components, and document operational requirements. Extensive tests will be conducted to ensure that images and environmental data are accurately captured and successfully transmitted to the server. Field technicians will install and troubleshoot equipment.				2		$140,000
DNR Resource Assessment Program (RAP)	Subaward	RAP will investigate operational site collaboration opportunities collecting environmental data and investigate how to revamp retired PhenoCam sites. RAP will conduct several analyses of monitoring data collected in MN and regionally. RAP will develop outreach and training opportunities to showcase incorporation of these data into environmental monitoring and decision-making.				2		$90,000
							Sub Total	**$230,000**
Equipment, Tools, and Supplies								
	Equipment	Materials for installation of Prototype PhenoCam Sensor Systems	Network Connectivity, Relay of Sensor Data Captured, Weather Hardening Enclosures, Power Systems, Remote Monitoring.					$25,000
							Sub Total	**$25,000**
Capital Expenditures								
							Sub Total	**-**

Acquisitions and Stewardship								
							Sub Total	**-**
Travel In Minnesota								
	Miles/ Meals/ Lodging	Evaluate existing and discovery of potential new sites for installation of PhenoCam Systems	Each PhenoCam site will require a detailed setup and test out procedure to certify operational and standalone operation. The sites will need to be visited on several occasions during their evaluation periods.					$10,000
	Miles/ Meals/ Lodging	Installation of project hardware and network setup of field systems	There will be a need to install the prototype systems and to test out different configuration aspects in the field.					$15,000
	Miles/ Meals/ Lodging	Long term Maintenance evaluation and potential long term expansion of designed field systems	Field sites will need a scheduled recurring visit for checking on system operation and wear and tear of hardware elements of the system.					$5,000
							Sub Total	**$30,000**
Travel Outside Minnesota								
	Miles/ Meals/ Lodging	Meeting attendance for three team members to Northern Arizona University, the current administrators of the PhenoCam Network.	As the creators of the PhenoCam network, there is a need ensure that these project installation will integrate with the current PhenoCam network and that the team can integrate the online Arizon University analysis tools and data output for use in Minnesota.					$10,000
							Sub Total	**$10,000**
Printing and Publication								
							Sub Total	**-**
Other Expenses								

							Sub Total	**-**
							Grand Total	**$295,000**

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request

Non ENRTF Funds

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

Total Project Cost: $295,000

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: a5dd83c8-b19.pdf

Alternate Text for Visual Component

Visual for explaining the project end goals....

Financial Capacity

Title	File
Form 990	d8be1500-813.pdf

Board Resolution or Letter

Title	File
Board Resolution	c10887fa-e11.pdf

Supplemental Attachments

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

Title	File
State of MN Standing for SharedGeo - Non-profit	8a1b84f8-021.pdf

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?

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 proposal:

Jim Klassen - SharedGeo

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