

### **Environment and Natural Resources Trust Fund**

#### 2026 Request for Proposal

#### **General Information**

Proposal ID: 2026-394

Proposal Title: Monitoring, Modeling, and Managing Minnesota's Beavers

#### **Project Manager Information**

Name: Emily Fairfax Organization: U of MN - St. Anthony Falls Laboratory Office Telephone: (517) 290-0623 Email: efairfax@umn.edu

#### **Project Basic Information**

**Project Summary:** We will close key data gaps on Minnesota's beaver population distribution, management practices and outcomes, and conflict vs ecosystem service potential in support of evidence-based beaver management strategies

ENRTF Funds Requested: \$506,000

Proposed Project Completion: June 30, 2029

LCCMR Funding Category: Fish and Wildlife (D)

#### **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.

Beavers are ecosystem engineers that rapidly transform a variety of landscapes into dynamic wetland ecosystems. This transformation leads to improved water quality, enhanced groundwater recharge, flood mitigation, drought resistance, sediment and nutrient retention, and increased biodiversity and resilience in freshwater systems. However, beavers can also cause property damage by flooding infrastructure (homes, roads) or felling valued trees. Many states have beaver management plans (BMPs) that guide balanced management of beavers as a keystone species, a natural resource, and a frequent source of human-wildlife conflict. However, Minnesota does not have a BMP, primarily providing guidance for beaver dam removal and lethal management in online conflict mitigation materials. Minnesota Department of Natural Resources (MNDNR) acknowledges 20,000-30,000 beavers are lawfully trapped annually, but no statewide census of beaver population or distribution exists. This limits our ability to understand the role of beaver wetlands across Minnesota's ecoregions and their influence on other species (e.g., fish, waterfowl, rice), hindering evidence-based management. Collaborative research will provide a comprehensive synthesis of existing relevant beaver science and current conflict management practices, and will create a new statewide census of beaver dams. These data will provide a robust scientific foundation for developing beaver management strategies statewide.

## 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 1) synthesize existing beaver science, population data, and information on beaver management actions and outcomes in Minnesota, 2) create a statewide beaver dam distribution dataset for recent years and develop state-specific habitat-based models for historic, current, and future beaver distributions, and 3) produce a technical report clearly summarizing our findings, identifies knowledge gaps, and describes likely environmental outcomes of possible future beaver management strategies. For Activity 1, we will conduct expert interviews and thorough review of peer-reviewed science, technical reports, and policy documents about beavers in Minnesota using scientific search engines and library collections. For Activity 2, we will use a combination of high-resolution remote sensing and field visits to identify, map, and model the distribution of beaver dams (recent past, present, future) in Minnesota. We will use these data to develop a Minnesota beaver population model and determine if there are notable trends overall or in specific ecoregions. For Activity 3, we will model conflict and coexistence potential, then format our final technical report like a typical BMP, with sections on 1) General Background, 2) Beaver Population Estimates and Management, 3) Managing Human/Wildlife Conflicts. Our results will be shared with collaborators, the legislature, and the public.

## 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?

 Our project helps position the state of Minnesota to create and implement beaver management strategies that balance managing beavers for their ecosystem benefits and their potential to create human-wildlife conflict.
Our beaver dam census and population models close a significant knowledge gap of beaver as a natural resource and facilitate region-specific beaver management strategies that can integrate with other natural resource management plans.

3) We will train management agency staff and community members to contribute to the dam census beyond the completion of this project and to understand where, when, and how different beaver management strategies are effective.

#### Activities and Milestones

# Activity 1: Synthesis of General Science and Management Background (Literature Review, Expert Interviews)

#### Activity Budget: \$118,100

#### **Activity Description:**

The objective of this activity is to gather and synthesize existing knowledge of beaver science, policy, and management that is relevant to Minnesota's beaver population. We will compile a database and report detailing statewide history of beaver distribution and management; identify potential benefits and drawbacks of beaver activity in different regions; examine strategies for managing human-beaver conflict; and identify partners, stakeholders, tribes, and other organizations that may participate in beaver management.

To do this, we will:

• systematically review peer reviewed literature on beavers using scientific search engines (i.e. Web of Science, Google Scholar)

• identify known and suspected relationships between beavers and other Minnesota natural resources (i.e., water, timber, fisheries)

• assess non-peer reviewed literature (i.e. reports from nonprofits, government) by accessing relevant organization websites, using targeted search terms, and directly requesting information from entities participating in Minnesota beaver management

• review the content and implementation of existing BMPs in other states, especially those with similar ecoregions to Minnesota (e.g., neighboring states)

• interview experts based in Minnesota and elsewhere to capture working knowledge. Experts will be identified by asking a small group of known experts to identify other experts until we have a sufficiently large sample of perspectives

#### **Activity Milestones:**

Description	Approximate Completion Date
Identify relevant peer-reviewed literature, grey literature, and case studies	November 30, 2026
Interview beaver experts	November 30, 2026
Write a review of Minnesota beaver history, regional biology, benefits and concerns, and list stakeholders	April 30, 2027
Describe goals and objective of a state beaver management plan / strategy	June 30, 2027
Section complete	June 30, 2027

# Activity 2: Beaver Population, Distribution, and Proximity to Other Natural Resources: past, present, and future (Remote Sensing, Modeling)

#### Activity Budget: \$248,563

#### **Activity Description:**

The objective of this activity is three-fold: first, to estimate the complete beaver population and distribution in Minnesota in the present and the recent past by cataloging and mapping all beaver dams visible in aerial / satellite imagery; second, to model how that distribution may change under different management scenarios; and third to integrate other geospatial natural resource information and identify areas of overlap - and thus potential co-benefits or

conflict - at the sub-watershed level.

To do this, we will:

• use very-high resolution satellite imagery (0.1-3 meters) to map all beaver dam locations and sizes across the state in the recent past and present. We will identify and trace beaver dams as geospatial shape files, and record their location and associated metadata in spreadsheets.

• model the potential for beavers to build additional dams by developing a Minnesota-specific version of the existing Beaver Restoration Assessment Tool (BRAT), which combines vegetation, stream hydrology, and beaver habitat preference data to estimate how many beaver dams could be built in each 100-meter section of the stream network.

• integrate geospatial models of beaver distribution with known distributions of other natural resources and environmental considerations (timber, rice, fisheries, stormwater priority areas, etc) to create interactive

#### **Activity Milestones:**

Description	Approximate Completion Date
Map existing and recent beaver dams in Minnesota with Remote Sensing	January 31, 2027
Run Beaver Restoration Assessment Tool (BRAT) model for Minnesota	January 31, 2028
Validate BRAT model results with mapped dams and ground truthing	October 31, 2028
Re-run validated BRAT model	December 31, 2028
Create interactive beaver population estimate and distribution maps	January 31, 2029

### Activity 3: Human-Wildlife Conflict Prediction and Management (Modeling, Strategy Mapping)

Activity Budget: \$139,337

#### Activity Description:

The objective of this activity is to identify current and potential beaver conflict areas in Minnesota, then develop guidance for mitigating damages and maximizing the amount of beaver-supported ecosystem benefits preserved.

To do this, we will:

• use dam mapping and modeled dam capacity from Activity 2 to identify regional habitat preferences, and predict where human-beaver conflict might arise under different management scenarios. Minnesota encompasses several ecoregions (prairie grasslands, coniferous forest, deciduous forest) where the impacts of beaver are likely to vary, so we will consider conflict potential in ecoregions separately.

• evaluate how land use, beaver interactions with other natural resources, and cultural considerations may influence conflict management decision-making.

• identify and describe the state of science of non-lethal management methods (i.e., pond levelers, tree protection) and removal (i.e. lethal trapping, non-lethal relocation) based on conflict type and potential.

• develop a decision support model to guide human-beaver conflict management with consideration for regionspecific concerns and environmental needs. We will consult with experts and other stakeholders (identified in Activity 1) on structure, feasibility, and funding mechanisms for all management recommendations included.

• host training workshops for land managers to assist with understanding and applying our model results and decision support model

#### **Activity Milestones:**

Description	Approximate Completion Date
Interview beaver conflict management experts, analyze interview data	December 31, 2026
Identify high conflict potential areas via combined modeling and interview results	March 31, 2028
Create beaver conflict decision support model with input from land/wildlife managers	June 30, 2028
Host training workshops on conflict decision support tool and model	June 30, 2029

#### **Project Partners and Collaborators**

Name	Organization	Role	Receiving
			Funas
Andy Riesgraf	University of	Andy is a research scientist at St. Anthony Falls Laboratory with expertise in	Yes
	Minnesota, St.	measuring and managing water quality and aquatic species in Minnesota. He will	
	Anthony Falls	lead literature review and expert interviews about beaver management in	
	Laboratory	Minnesota, and lead the development of a decision support model for managing	
		conflict.	
Jessie	University of	Dr. Moravek is a postdoctoral associate in the Fairfax Lab. She specializes in	Yes
Moravek	Minnesota,	beaver habitat and population modeling and validation in novel ecosystems. She	
	Geography	will lead beaver dam mapping and the validation of the updated Beaver	
	Department	Restoration Assessment Tool (BRAT) model for Minnesota.	
	and St.		
	Anthony Fall		
	Laboratory		

#### 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?

We will produce and share a usable report with managers and stakeholders (e.g. MN DNR) to help guide beaver-related decision making and the development of an official beaver management plan. We will share results, particularly of beaver population and distribution modeling for Minnesota, with the scientific community through peer-reviewed publications, workshops, and presentations. We will reach the general public through social media, news coverage, and online articles, utilizing the St. Anthony Falls Laboratory's public relations team and Dr. Fairfax's media presence. If more work is needed (e.g. modeling or mapping efforts), we will apply for additional funding.

#### Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
Wind Wave and Boating Impacts on Inland Lakes	M.L. 2023, , Chp. 60, Art. 2, Sec. 2, Subd. 04c	\$415,000

#### Project Manager and Organization Qualifications

#### Project Manager Name: Emily Fairfax

#### Job Title: Assistant Professor of Geography

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

Dr. Emily Fairfax is an assistant professor in the Department of Geography, Environment, and Society as well as an Affiliate Faculty Member at the Saint Anthony Falls Laboratory, both at the University of Minnesota. Dr. Fairfax is an interdisciplinary ecohydrologist with expertise in ecosystem engineers, environmental disturbance, remote sensing, and science communication. She has 10 years of experience studying beavers and their influence on biophysical processes. Dr. Fairfax is globally recognized as a leading expert on beaver ecology and management, and her research has been featured in the media over 250 times, including in The New York Times, The LA Times, NPR, PBS, Science Friday, BBC, and National Geographic, amongst others. Dr. Fairfax has been invited to testify before the state legislatures in Oregon and New Mexico on the topic of beaver science and management, and has contributed to the writing of California's state beaver management plan (in progress). Dr. Fairfax frequently partners and collaborates with state land and wildlife management agencies across the US, including MNDNR, to better understand and manage beaver populations. Fairfax

currently runs a productive beaver research lab at the University of Minnesota with 2 postdoctoral associates, 3 PhD students, 2 masters students, 2 undergraduate students, and 2 professional research assistants.

Organization: U of MN - St. Anthony Falls Laboratory

#### **Organization Description:**

The St. Anthony Falls Laboratory at the University of Minnesota Twin Cities is an interdisciplinary fluid dynamics research lab that specializes in computer and physical modeling as well as education about rivers, streams, and lakes. The Department of Geography, Environment, and Society at the University of Minnesota Twin Cities is dedicated to creating and disseminating geographical and environmental knowledge through world-class research and teaching.

## Budget Summary

Category /	Subcategory	Description	Purpose	Gen.	%	#	Class	\$ Amount
Name	or Type			Ineli	Bene	FTE	ified	
				gible	fits		Staff?	
Personnel								
Emily Fairfax		Assistant Professor. Lead, manage, and conduct all			36.6%	0.33		\$66,945
(PI)		project activities and dissemination. Summer salary						
		for 2 months in Yr 1, then 1 month each in Yr 2 and 3.						
Andy		Research Scientist. Involved in all project activities			36.6%	0.99		\$113,250
Riesgraf		and dissemination. Specifically leads literature						
(research		review, expert interviews, decision support						
scientist)		modeling, and field validation. 33% time allotted to						
		project each year for 3 years						
Jessie		Postdoctoral Associate, 100% time allotted to project			25.9%	2		\$184,271
Moravek		for Yr 1 and Yr 2. Lead and conduct beaver dam						
(Postdoctoral		mapping and beaver habitat and population						
Associate)		modeling, statistical validation, field validation, and						
		integration of ecology + management results						
Graduate		PhD Student, 50% time for 3 years of project			23.2%	1.5		\$123,710
Student		(academic years and summers), conducts beaver						
		dam mapping and beaver habitat and population						
		modeling and validation, builds model to understand						
		trends in beaver dam presence/absence over time						
		and by ecoregion						
							Sub	\$488,176
							Total	
Contracts								
and Services								
							Sub	-
							Total	
Equipment,								
Tools, and								
Supplies								
	Tools and	Miscellaneous field supplies (e.g. wader repair kits,	Field validation of mapping and					\$824
	Supplies	first aid kits, batteries, memory cards). Cost per item	beaver habitat population model					
		variable.						
							Sub	\$824
							Total	
Capital								
Expenditures								

					Sub Total	-
Acquisitions and Stewardship						
					Sub Total	-
Travel In Minnesota						
	Miles/ Meals/ Lodging	Vehicle travel at \$0.70 per mile for personal vehicles, plus overnight lodging for 4 people for 1-2 nights per trip. Variable trip distances and numbers per year, to be determined based on remote sensing and modeling results. Estimate \$5000 per year for all three years for validation and ground truthing field visits (Activity 2) and meetings with stakeholders and community organizations that have experience with beaver conflict and management (Activities 1 and 3). Exact number of trips and locations will be selected to maximize research impact and stay within \$5000/yr that is budgeted here.	Trips to ground truth and validate beaver habitat model at real beaver dams across Minnesota biomes, meet with stakeholders and community members			\$15,000
					Sub Total	\$15,000
Travel Outside Minnesota						
					Sub Total	-
Printing and Publication						
	Publication	Peer-reviewed publication, page charges. Publications that waive most page charges will be preferred.	Receive peer review and disseminate our results to the scientific community.			\$2,000
					Sub Total	\$2,000
Other Expenses						
					Sub Total	-
					Grand Total	\$506,000

## 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				
Cash	University of Minnesota unrecovered indirect cost	\$506,000 direct total - \$8564 (tuition, exempt from IDC) = \$497,436 x	Secured	\$268,615
	return (54% MDTC)	0.54 = \$268,615 unrecovered IDC.		
			Non State	\$268,615
			Sub Total	
			Funds	\$268,615
			Total	

Total Project Cost: \$774,615

This amount accurately reflects total project cost?

Yes

#### Attachments

#### **Required Attachments**

*Visual Component* File: 51b3ddc1-ada.pdf

#### Alternate Text for Visual Component

This graphic titled "Monitoring, Modeling, and Managing Minnesota's Beavers" states the problem and proposed solution at the top of the page, then has four images accompanied by descriptions of our activities as explained in the project narrative....

#### Supplemental Attachments

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

Title	File
UMN Letter	a4ee6dc9-a4d.pdf
Minnesota Coalition of Lake Associations Letter of Support	<u>4f4545cc-5d0.pdf</u>
Valley Branch Watershed District Support Letter	1d2a4ad6-2fc.pdf
Minnesota Lakes and Rivers Support Letter	880682e4-78b.pdf
Brown's Creek Watershed District Support Letter	2264e96b-903.pdf
Dakota County Parks Support Letter	<u>b522c905-f51.pdf</u>
Beaver Institute Support Letter	04664b6a-5e2.pdf
Trout Unlimited Support Letter	d6dd5714-2ac.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?

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Yes, I understand the UMN Policy on travel applies.
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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:

Andy Riesgraf (Saint Anthony Falls Laboratory)

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