Environment and Natural Resources Trust Fund

2025 Request for Proposal

General Information

Proposal ID: 2025-049

Proposal Title: Protecting Coldwater Fish Habitat in Minnesota Lakes

Project Manager Information

Name: Gretchen Hansen

Organization: U of MN - College of Food, Agricultural and Natural Resource Sciences

Office Telephone: (612) 624-4228

Email: ghansen@umn.edu

Project Basic Information

Project Summary: Identify lake-specific watershed protection targets and management practices needed to maintain coldwater fish habitat given warming temperatures and increasing extreme rain events, and integrate this information into conservation planning tools.

ENRTF Funds Requested: $587,000

Proposed Project Completion: June 30, 2028

LCCMR Funding Category: Air Quality, Climate Change, and Renewable Energy (E)

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.

Coldwater fish habitat in Minnesota lakes is threatened by climate change and nutrient pollution. Bottom waters of lakes can support coldwater fish even when surface temperatures are too warm, but only if deep waters maintain sufficient oxygen. Extreme rain events can flush nutrients into lakes and deplete oxygen, threatening fish habitat and causing fish kills. Protecting forested watersheds can reduce nutrient loads and maintain coldwater fish habitat even as lakes warm and extreme rain events increase in frequency. State agencies and non-profit organizations are actively engaged in watershed management to protect coldwater fish habitat. However, current conservation targets are not lake specific, do not account for the impacts of extreme rain events, and cannot identify the effectiveness of specific types of watershed management practices in terms of their impact on coldwater fish habitat. Indeed, some lakes have experienced fish kills following extreme rain events in spite of high levels of watershed protection, pointing to an urgent need to update existing targets to account for extreme rain events, to develop more specific guidance that accounts for variability among lakes, and to specify on-the-ground management practices that increase the resilience of coldwater fish habitat to climate warming and extreme rain events.

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 quantify the effectiveness of diverse watershed management practices in maintaining coldwater fish habitat in lakes as the climate warms and extreme rain events become more common. By partnering with government agencies and conservation groups, this work ensures that conservation planning tools are updated with this best-available science. We will identify lake-specific, on-the-ground protection targets that can increase the resilience of coldwater habitat to warming and extreme rain events. Specifically, we will:
-Estimate lake-specific watershed protection targets for conserving coldwater fish habitat in all lakes in Minnesota that currently contain coldwater species like cisco. These targets will be based on statistical models that account for the impacts of warming temperatures, extreme precipitation events, and detailed watershed characteristics.
-Conduct a detailed assessment of coldwater fish habitat, coldwater fish populations, and watershed characteristics and land use practices on lakes that are either surprisingly resilient or surprisingly sensitive to quantify how extreme storm events influence coldwater fish habitat and populations and to identify specific practices that increase resilience.
-Collaborate with state and non-profit groups currently engaged in watershed protection to tailor our approach and integrate results into existing planning tools to directly support effective conservation and efficient use of public 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?

1. Up-to-date watershed protection model that generates lake-specific watershed protection targets for coldwater fish habitat. 2. Identification of specific, on-the-ground management actions that mediate coldwater fish habitat responses to warming and extreme rain events. 3. Detailed understanding of how watershed characteristics, dissolved oxygen dynamics, and coldwater fish populations are connected in case study lakes where habitat is either surprisingly resilient or surprisingly sensitive. 4. Integration of results into existing planning tools to prioritize conservation easements, land purchases, and restoration of watersheds to protect coldwater fish habitat. 5. Public webinars and information tools communicating best practices for protecting coldwater fish habitat.

Activities and Milestones

Activity 1: Identify lake-specific watershed protection targets and best practices for maintaining coldwater habitat in a changing environment

Activity Budget: $230,594

Activity Description:

We will build up-to-date statistical models linking vulnerability of coldwater fish habitat to warming and precipitation with detailed watershed characteristics. We will predict lake-specific coldwater fish habitat responses to scenarios of warming and increased precipitation in order to identify watershed protection strategies most likely to protect coldwater fish habitat under a range of future conditions. We will improve on models used to identify existing targets in a number of ways. First, we will collate up-to-date temperature and oxygen data collected by federal, state, and local agencies to estimate fish oxythermal habitat at a high spatial and temporal resolution. Next we will use aerial imagery, land use information, and geoprocessing tools to delineate detailed lake and watershed specific factors hypothesized to influence resilience to climate change including watershed soil type, the configuration of forests and wetlands in the watershed, and shoreline development. The inclusion of these factors is based on partner input and will increase the accuracy of and the trust in model predictions. Finally, we will include updated high-resolution downscaled climate data including temperature, precipitation, and winter severity to both quantify current relationships and predict lake responses to future climate scenarios.

Activity Milestones:

Description	Approximate Completion Date
Assemble detailed lake specific climate, watershed, coldwater fish, and water quality data	June 30, 2026
Estimate historic coldwater fish habitat availability from temperature and dissolved oxygen profile data	June 30, 2026
Create statistical models relating watershed, climate, coldwater fish habitat under current and future climate conditions	June 30, 2027
Identify lake-specific protection targets for all lakes with coldwater fish in Minnesota	December 31, 2027

Activity 2: Detailed assessment of coldwater fish habitat and population responses to extreme weather events in highly sensitive and highly resilient lakes

Activity Budget: $247,126

Activity Description:

We will identify case study lakes that are either highly sensitive, meaning oxythermal habitat and/or cisco populations are worse than expected given current watershed conditions; or highly resilient, meaning conditions are better than expected given current watershed conditions. We will install sensors to continuously monitor dissolved oxygen and temperature. Partner agencies (MNDNR, USFWS, NPS) have collected continuous temperature and oxygen data on 10 Minnesota lakes spanning a range of watershed development since 2018. Together, these data represent an unprecedented opportunity to document the effects of extreme precipitation events on coldwater fish habitat in lakes with differing degrees and types of watershed land use. We will generate detailed watershed land cover and geomorphological data from on the ground surveys and aerial photography and will collect water quality for all monitored lakes. We will to quantify how watershed characteristics and land use can dampen or amplify the impacts of high precipitation events on dissolved oxygen and coldwater fish habitat. To document coldwater fish population responses to oxythermal habitat loss, we will partner with MN DNR and NPS on coldwater fish surveys using gillnets and bioacoustics to evaluate cisco population size, age structure, recruitment, and habitat use under different habitat conditions.

Activity Milestones:

Description	Approximate Completion Date
Identify case study lakes and deploy additional oxygen and temperature loggers	April 30, 2026
Delineate and survey watersheds for detailed information on soils, slope, and land use	June 30, 2027
Conduct gillnet and bioacoustic surveys to determine Coldwater fish population structure in case study lakes	November 30, 2027
Water quality assessment of all monitored lakes	December 31, 2027
Identify watershed land use practices that determine coldwater fish habitat suitability	June 30, 2028

Activity 3: Engage with conservation practitioners throughout Minnesota to identify information gaps and integrate results into existing planning frameworks

Activity Budget: $109,280

Activity Description:

We will facilitate a series of partner engagement workshops with conservation practitioners working on watershed protection to ensure that our work addresses the practical needs of these partners. We will use structured decision making to identify key uncertainties and information gaps that our project can fill. We will integrate with existing conservation partnerships with which project personnel (The Nature Conservancy) are involved, such as the North Central Conservation Roundtable (NCCR), and with county and state agencies working to implement plans including One Watershed, One Plan and Watershed Restoration and Protection Strategies. We will co-develop a process for integrating results into existing conservation planning tools currently being used to prioritize watershed conservation and protection with private, state, and federal funding, including those already being used by NCCR, TNC, and state agencies. We will develop communication tools (e.g., website, fact sheets, directed communications) to communicate with conservation groups, watershed property owners, and decision makers at multiple scales (lake association to statewide). To disseminate results, we will hold integration workshops with conservation partners; present a public, recorded webinar to communicate results broadly; present at in-state scientific conferences; publish in peer-reviewed journals; and provide content to media and social media outlets.

Activity Milestones:

Description	Approximate Completion Date
Structured workshops with conservation and watershed protection groups	June 30, 2026
Integrate lake specific conservation targets into existing planning tools	June 30, 2028
Fact sheets, website, and maps providing lake- and watershed- specific guidance for protecting coldwater habitat	June 30, 2028
Public webinar describing project results and implementation	June 30, 2028
Peer reviewed scientific publication in open access journal communicating results to a broad audience	June 30, 2028

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Casey Schoenebeck	Minnesota Department of Natural Resources	Expertise in lake ecology, fisheries, and monitoring. Will help assemble existing water quality, temperature, oxygen, and fisheries data, will help conduct targeted coldwater fish surveys and deploy additional sensor arrays, and will help conduct post survey analysis of hydroacoustic and continuous temperature and dissolved oxygen data	No
Beth Holbrook	Minnesota Department of Natural Resources	Expertise in coldwater fish habitat and assessment. Will help assemble existing water quality, temperature, oxygen, and fisheries data, will help conduct targeted coldwater fish surveys and deploy additional sensor arrays, and will help conduct post survey analysis of hydroacoustic and continuous temperature and dissolved oxygen data	No
Heather Baird	Minnesota Department of Natural Resources	Expertise in watershed planning and land management and coordinator of conservation partners throughout Minnesota. Will help assemble detailed watershed data, help identify watershed features that impact coldwater habitat in response to climate and land use, plus help identify and implement watershed management strategies.	No
Ryan Maki	National Park Service	Expertise in fisheries and lake ecology. Will assist with field work within Voyageurs National Park lakes as well as provide data from existing loggers and help with interpretation and communication of results.	No
Kristen Blann	The Nature Conservancy	Freshwater Ecologist with expertise in conservation planning and partnerships. Will lead the development of structured partner engagement workshops to provide input on and feedback on information needs, tool design and integration with existing planning efforts, and communication with conservation partners.	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?
Because this project is in partnership between conservation practitioners, we have built into our planned activities the work necessary to integrate results into existing conservation planning tools used to drive watershed protection decisions. In addition to co-development of research products and integration with existing planning tools, we will support implementation through communication via webinars, social media, and the popular press. If additional work is needed, we will apply for funding from a National Science Foundation program that allocates $16 Million annually to support the development and implementation of evidence-based activities to advance conservation (Partnership to Advance Conservation Science and Practice).

Project Manager and Organization Qualifications

Project Manager Name: Gretchen Hansen

Job Title: Assistant Professor

Provide description of the project manager's qualifications to manage the proposed project.
Dr. Gretchen Hansen is an assistant professor of fisheries ecology in the UMN-TC Department of Fisheries, Wildlife, and Conservation Biology. Dr. Hansen has extensive experience developing tools for fisheries management and watershed protection and has established collaborative relationships with partners in state, federal, and non-profit conservation agencies and organizations. Her work is not only scientifically rigorous but is also relevant for policy makers and stakeholders and has directly influenced fisheries and land use policies. Dr. Hansen is an active member of national, regional, and state-level teams and working groups related to science based management of aquatic ecosystems, including the Midwest Glacial Lakes Partnership Science and Data Team, the Red Lake Fisheries Management committee

as a technical expert, the Minnesota Department of Natural Resources Walleye Zebra Mussel task force,and the advisory board for the Minnesota Long Term Lake Monitoring program. She conducts high quality, high impact, and actionable science– as evidenced by publication and high citation rates in peer reviewed journals (n=68, 2331 citations). Dr. Hansen has secured over $4.2M in extramural funding from international, federal, regional, and state sources since joining the University of Minnesota faculty in 2018. Dr. Hansen has been invited to give several keynote addresses and seminars, and her research has regularly appeared in the media. Dr. Hansen has experience supervising students, post-doctoral researchers, and staff engaged in research and application of results.

Organization: U of MN - College of Food, Agricultural and Natural Resource Sciences

Organization Description:
The University of Minnesota Twin Cities is the state's land-grant university and one of the most prestigious public research universities in the nation. The research mission of the University is to seek new knowledge that can change how we all work and live. We apply our research and expertise to meet the needs of Minnesota, our nation, and the world through partnerships in addressing society's most pressing issues.
Within the University of Minnesota, faculty, staff, and students of Department of Fisheries, Wildlife, and Conservation Biology work on applied and fundamental problems related natural resource management and conservation. The mission of the Department of Fisheries, Wildlife, and Conservation Biology is to inspire and create solutions for biological conservation and management in a diverse and changing world.. Our goals are to respond to societal needs for information and education pertaining to the conservation of our natural resources and to ensure excellent teaching, research, and outreach programs.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
Project manager Gretchen Hansen		Lead all aspects of project, including study design, supervision of staff and students, data collection and analysis, interpretation and communication of results, and engagement with partners.			37.1%	0.24		$51,986
Post doctoral research associate		To conduct statistical analyses and coordinate with partners on implementation and integration of research			27.1%	3		$245,988
Research Scientist Michael Verhoeven		To coordinate and lead field work with state and non-profit partners, coordinate data acquisition, assist with analysis and communication.			37.1%	1.5		$163,288
Undergraduate technician		To assist with field work and data entry			0%	0.78		$24,750
							Sub Total	**$486,012**
Contracts and Services								
The Nature Conservancy	Sub award	The Conservancy will lead the development of structured partner engagement workshops, develop communication materials, host and convene integration workshops for integrating results with existing planning tools. As the convener of multiple collaborative initiatives for watershed conservation in Minnesota, the Conservancy is well-positioned to carry out this work.				0.3		$26,630
University of Minnesota Natural Resources Research Institute Water Quality Testing	Internal services or fees (uncommon)	Water chemistry analysis for 8 lakes at 10 sites per lake . Costs calculated based on per sample cost for Dissolved organic carbon ($17.44), Total phosphorus + Total Nitrogen ($49.80), chlorophyll-A ($32.30), turbidity ($11.70), Total Suspended Solids ($21.90) and filtration ($9.10).				0		$8,691
							Sub Total	**$35,321**

Equipment, Tools, and Supplies								
	Tools and Supplies	Dissolved oxygen and temperature loggers (26 @$900) to deploy for measuring coldwater habitat in priority lakes (6 loggers per lake in 4 lakes, 2 extra loggers in case of failure)	These loggers will be deployed in high priority lakes that are highly resilient or highly sensitive to measure coldwater habitat and its response to climate and weather events. Four lakes will be outfitted with a string of 6 loggers extending from the surface to the bottom, with two additional loggers purchased for back up.					$23,400
	Tools and Supplies	Field and lab Supplies(e.g., rope [$400], buoys [$400], clamps and ties [$150], cinder blocks [$50], personal protective equipment [$400], coolers [$200], sample bottles [$1600], decontamination equipment [$200], gloves [$20], ice [$300], trays and buckets [$400], processing supplies (scalpels, forceps, freezer bags) [$400], replacement batteries for loggers [$40]	Field and lab supplies for deploying oxygen and temperature loggers, collecting water quality samples, collecting fish samples, processing fish samples					$4,160
	Tools and Supplies	Boat gasoline	Gasoline for boat for field work related to deploying loggers, collecting water quality samples, collecting fish samples.					$260
							Sub Total	$27,820
Capital Expenditures								
							Sub Total	-
Acquisitions and Stewardship								
							Sub Total	-
Travel In Minnesota								
	Miles/ Meals/ Lodging	Fieldwork to deploy, maintain, and download data from oxygen loggers from case study lakes and to collect fish and water quality data. Costs estimated for 2 ppl* 3 travel weeks for year 1, 5 travel weeks for year 2, and 3 travel weeks for year 3. Total based	Fieldwork to visit case study lakes to deploy and maintain loggers, collect water quality data, collect fish data in support of project objectives.					$24,112

		off weekly costs of 600 miles@$0.67/mi + 4 lodging nights per person @$150/night + 5 days of meals @$59/day per person for 2 people (meal estimate based on state per diem rate; actual costs will be reimbursed) = $2,192 per travel week						
	Miles/ Meals/ Lodging	Travel for 2 people to attend 2 outreach and stakeholder meetings in each of three years. Costs estimated per meeting as 400 miles@$0.67/mi + 2 lodging nights@$150/night per person + 3 days of meals @$59/day for 2 people (meal estimate based on University per diem rate; actual costs will be reimbursed)	Travel for two people to attend two outreach and stakeholder coordination and integration meetings in each of three years to conduct structured decision making and work with conservation partners to co-develop research and integrate project results into conservation planning tools.					$7,332
	Conference Registration Miles/ Meals/ Lodging	Travel for in state meetings and conferences 1 person attending 1 per year in years 2 and 3. Costs estimated as $250 registration fee, 400 miles@$0.67/mi + 2 lodging nights@$150/night + 3 days of meals @$59/day (meal estimate based on University per diem rate; actual costs will be reimbursed)	Travel for one person to travel to an in state conference (e.g., the Minnesota chapter of the American Fisheries Society or the Water Resources Conference) to present and communicate results					$1,990
							Sub Total	$33,434
Travel Outside Minnesota								
-							Sub Total	-
Printing and Publication								
	Publication	Open access publication fee for peer reviewed journal article ($3000)	Publishing research results in open access journal so that the public can read results without being behind a paywall					$3,200
							Sub Total	$3,200
Other Expenses								
		Boat Maintenance	Maintenance of lab-owned boat used for field sampling, including winterizing and regular maintenance					$1,213
							Sub Total	$1,213

						Grand Total	$587,000

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				
In-Kind	Minnesota Department of Natural Resources Salary and benefits - in kind support	Minnesota DNR Fisheries Research Scientists Beth Holbrook and Casey Schoenebeck and Forest Fisheries Landscape Coordinator Heather Baird will each provide 140, 115, and 100 hours, respectively, of in-kind support of this project for each of three years, for a value of $47,925	Secured	$47,925
			State Sub Total	**$47,925**
Non-State				
In-Kind	National Park Service Aquatic Ecologist Ryan Maki and Technician salary and benefits	In-kind support (salary of an Aquatic Ecologist and a Biological Science Technician equivalent to $15,771) to achieve project objectives.	Secured	$15,771
In-Kind	University of Minnesota foregone indirect costs	Administrative costs associated with support of research activities including payroll and human resources, finance, facilities, and IT.	Secured	$321,953
			Non State Sub Total	**$337,724**
			Funds Total	**$385,649**

Total Project Cost: $972,649

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: [34b886a4-484.pdf](#)

Alternate Text for Visual Component

Visual representation of the problem statement - warming, extreme rain events, and nutrient loading can result in coldwater fish habitat loss and fish kills. Visual display of project objectives, including identifying lake specific watershed protection targets, identifying specific actions to reduce sensitivity, and integration with existing tools....

Supplemental Attachments

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

Title	File
Minnesota Department of Natural Resources Support Letter	[2e5f548d-e3e.pdf](#)
National Park Service Support Letter	[043850a9-1f1.pdf](#)
Northern Waters Land Trust Support Letter	[a4807060-23b.pdf](#)
The Nature Conservancy Commitment of Work	[b133d23d-0b7.pdf](#)
University of Minnesota Sponsored Projects Administration approval to submit	[c2c4473f-004.pdf](#)

Administrative Use

Does your project include restoration or acquisition of land rights?

    No

Does your project have potential for royalties, copyrights, patents, sale of products and assets, or revenue generation?

    No

Do you understand and acknowledge IP and revenue-return and sharing requirements in 116P.10?

    N/A

Do you wish to request reinvestment of any revenues into your project instead of returning revenue to the ENRTF?

    N/A

Does your project include original, hypothesis-driven research?

    Yes

Does the organization have a fiscal agent for this project?

    No

Does your project include the pre-design, design, construction, or renovation of a building, trail, campground, or other fixed capital asset costing $10,000 or more or large-scale stream or wetland restoration?

    No

Do you propose using an appropriation from the Environment and Natural Resources Trust Fund to conduct a project that provides children's services (as defined in Minnesota Statutes section 299C.61 Subd.7 as "the provision of care, treatment, education, training, instruction, or recreation to children")?

    No

Provide the name(s) and organization(s) of additional individuals assisting in the completion of this proposal:

Michael Verhoeven, University of Minnesota