Environment and Natural Resources Trust Fund

2024 Request for Proposal

General Information

Proposal ID: 2024-153

Proposal Title: Managing Future Floods and Droughts in Minnesota

Project Manager Information

Name: Heidi Roop

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

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Project Basic Information

Project Summary: Leveraging new statewide climate data, we will assess future change in the duration, frequency and magnitude of heavy precipitation and drought events and engage communities to prepare for these extremes.

Funds Requested: $480,000

Proposed Project Completion: June 30, 2026

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.

Minnesota's climate is getting warmer and wetter with more extreme precipitation events. The top-10 combined warmest and wettest years on record all occurred between 1998 and 2020. Research also suggests that while dry extremes have largely remained unchanged across the Midwest, transitions between wet to dry conditions are happening more quickly and more frequently, posing significant management challenges across sectors from forestry and water resource management to ecosystem conservation and agriculture. 2021 and 2022 are primary examples of this shifting balance between floods and droughts and their impacts on Minnesota's residents, species, and natural and cultural resources.

It is essential that we are able to plan not only for increased intensity and frequency of heavy precipitation events and rapid onset drought, but also for moving more frequently between these wet and dry extremes. Current projections of future climate conditions in Minnesota do not yet provide necessary details about these changing extremes or subsequent impacts on hydrological processes. Additionally, resources are needed to translate this research into meaningful information to support planning and decision-making that will ensure we are able to sustain Minnesota's thriving economy, communities, and natural landscapes.

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.

In partnership with Great River Greening and the National Integrated Drought Information System (NIDIS), the University of Minnesota Climate Adaptation Partnership (MCAP) will develop needed data and information to fill the knowledge gap around Minnesota's changing extremes as well as resources to support integration of this critical climate information decision-making.

MCAP is generating future climate projections to 2100 that directly factor in Minnesota's unique climate setting. This project will leverage these data to conduct essential analysis to enable a clearer characterization of the impacts of climate change on the state, including how extreme precipitation events and droughts will change under future climate conditions. These new data will be incorporated into hydrologic models to provide specific information about how changing extremes will impact surface water resources at a watershed scale.

Throughout the project, data and resource development will be refined to incorporate specific information needs through direct consultation with communities, practitioners, and rights holders through "action planning" workshops. Through this interactive process, results will be integrated into an interactive online tool, Extension programming, and communication resources. These resources will inform effective climate risk management for individuals and practitioners from across different sectors including forestry, water and natural resources management, and agriculture.

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 produce publicly available information about how extreme precipitation and drought events will change in the future and how these changes may impact soil moisture, lake levels, and streamflows based on analysis in pilot watersheds. The information will be used to inform planning and decision-making by state, local, and Tribal governments, water and natural resource managers, and agricultural producers, among others. Potential applications include adaptive planting of resilient species in conservation areas, evaluating future irrigation needs, and managing water levels for the long-term benefit of wild rice.

Activities and Milestones

Activity 1: Climate projections analysis and integration with soil moisture data and hydrologic models

Activity Budget: $265,046

Activity Description:

First, we will analyze the observed climate record and future projections of wet and dry periods to understand how precipitation extremes are changing and will continue to change into the future. We will use the Standardized Precipitation Index (SPI) to identify wet and dry periods and will assess their duration, intensity, and occurrence on an interannual time scale, comparing the observed record with future projections to detect anticipated changes. These results will allow us to investigate how changing precipitation extremes will subsequently affect soil moisture and lake and stream water levels. Using soil moisture observations we will compare our historical and future precipitation simulations to project any anticipated long-term trends in soil moisture across the state. We will also employ a detailed hydrologic model to quantify how expected future changes in precipitation will impact surface waters including lakes and rivers. Watershed selection will be done in direct consultation with practitioners (Activity 2). As a warmer climate delivers more available energy into the hydrologic system, shifts between extreme wet and dry conditions may happen at a more rapid pace. Thus we will include any indicators of changes to the frequency of floods and flash droughts in our research outcomes.

Activity Milestones:

Description	Approximate Completion Date
Statewide - Analysis of wet and dry periods in the observational record and future climate	January 31, 2025
Statewide - Assessment of changing soil moisture conditions by integrating stations observations with precipitation data	January 31, 2025
Priority watershed - Hydrologic modeling of lake levels and streamflows using HSPF or similar model	December 31, 2025
Priority watershed - Data analysis for change detection and statistical significance	December 31, 2025
Summarize findings and support integration of results into final project resources	June 30, 2026

Activity 2: Community and End User Engagement to Inform Data Delivery and Resource Development

Activity Budget: $106,477

Activity Description:

To ensure our results are useful and usable, we will engage community members and practitioners throughout the project to assess how the information matters and is best presented to effectively inform different types of decision making. In Year 1 we will host an 'Action Planning' workshop, in collaboration with Great River Greening and NIDIS, to discuss potential strategies related to natural resources management decisions and the connection to changing climate and weather extremes. We will determine the data qualities (e.g., spatial scale, time scale, format) needed to inform these decisions. We will also seek guidance from workshop participants on a pilot study area for the hydrologic modeling component of the project. Results of the workshop will be used to incorporate the climate projections into the suite of interactive tools, trainings, convenings, and technical support services that are part of our dedicated climate services Extension program designed to deliver critical climate-related information to a diversity of communities and practitioners across the state. Additionally, we will develop case studies to highlight proactive and reactive management decisions identified for Tribal lands (see letter), natural resources management, water resources, forest health, and community well-being that demonstrate how the information can be applied.

Activity Milestones:

Description	Approximate Completion Date

Conduct Action Planning workshop to assess user information needs and inform resource, training, tool development	March 31, 2025
Integrate climate data, hydrologic modeling outputs, and workshop participant feedback into draft resources for testing	January 31, 2026

Activity 3: Connecting Climate Science to Adaptation Implementation

Activity Budget: $108,477

Activity Description:

The aim of this activity will be to further refine project deliverables through end user testing to ensure usefulness and useability. Using draft resources updated to incorporate initial workshop participant feedback, we will conduct a second Action Planning workshop which will allow end users to test the data and information to determine its usefulness and useability during an example planning scenario. The scenario would incorporate future conditions based on the climate and hydrologic projections developed for the project and would require participants to evaluate the degree to which the data equips them to make informed decisions about the most desirable strategies to direct towards desired outcomes. Feedback from the workshop will be used to inform the final iteration of the interactive tool and supporting resources. Final deliverables will be based on the scientific research and informed by practitioner perspectives to develop a suite of resources and presentations that effectively address community and practitioner needs. The tools and resources will provide not only actionable climate data and information but also recommendations for strategies to address the impacts of future precipitation extremes to advance Minnesota-specific climate adaptation and resilience.

Activity Milestones:

Description	Approximate Completion Date
Conduct second Action Planning workshop to test the tools and resources	February 28, 2026
Integrate climate data, hydrologic modeling outputs, and workshop participant feedback into final resources	June 30, 2026
Delivery of final project results, tools, and resources	June 30, 2026
Journal article submission	June 30, 2026

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Heidi Roop	University of Minnesota Climate Adaptation Partnership	Principle Investigator, Oversee scientific analysis and engagement efforts and serve as the primary point of contact for the project	Yes
Stefan Liess	University of Minnesota Climate Adaptation Partnership	Climate Modeler; lead climate data analysis and provide technical support and assistance to project partners	Yes
Amanda Farris	University of Minnesota Climate Adaptation Partnership	Co-PI, Program manager; lead project and partner coordination and end user engagement, including 2 workshops	Yes
Data Visualization Specialist	University of Minnesota - U-Spatial	Communication; integrate climate and hydrologic modeling projections into MCAP's climate visualization tool	Yes
Climate Adaptation Researcher	University of Minnesota Climate Adaptation Partnership	Research and Development; lead translation of climate and hydrologic projections data into useful and usable formats to support decision making, support planning and execution of workshops	Yes
Postdoctoral Associate	University of Minnesota Climate Adaptation Partnership	Hydrologic Modeler; lead hydrologic modeling efforts to integrate climate data into hydrologic model and provide technical support and assistance to project partners	Yes
Extension Educator	University of Minnesota Climate Adaptation Partnership	Community and Practitioner Engagement; assist in developing educational resources and trainings for end user engagement, support planning and execution of workshops	No
Climate Data Visualization Specialist	UNM U-Spatial	Communication; integrate climate and hydrologic model projections into MCAP climate visualization tool	Yes
Todd Rexine	Great River Greening	Community and Practitioner Engagement; project management, implementation, and dissemination lead for Great River Greening	Yes
Sara Nelson	Great River Greening	Community and Practitioner Engagement; assist with implementation, dissemination, and coordination with partners, land managers/owners, and natural resource individuals for workshops	Yes
Jessica Drummond	Great River Greening	Project Coordination; grant fund coordination and status reporting for Great River Greening	Yes
Molly Woloszyn	National Integrated Drought Information System	Community and Practitioner Engagement; support the project team in connecting with drought decision makers and other end users in Minnesota and the broader Midwest region, participate in workshops as a project partner and end user	No
Climate Specialist	1854 Treaty Authority	Outreach and engagement and community science; Tribal liaison, help to identify lake of interest for hydrologic modeling, assist with coordination with Tribal partners for workshops	No

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 data and information developed through this project will be incorporated into an interactive online tool and associated resources and will be accessible via the MCAP website (climate.umn.edu). Information will also be integrated into Extension programming led by MCAP to provide ongoing training and educational opportunities. Great River Greening will use the information to inform ongoing and future conservation and landscape restoration efforts. The National Integrated Drought Information System (NIDIS) will share project results to facilitate use of the information by a broader range of users and transferability of the methodology across Minnesota and across the Midwest region.

Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
Water and Climate Information to Enhance Community Resilience	M.L. 2022, , Chp. 94, Art. , Sec. 2, Subd. 04f	$564,000

Project Manager and Organization Qualifications

Project Manager Name: Heidi Roop

Job Title: Assistant Professor

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

Principal Investigator Heidi Roop is a trained climate scientist and science communicator, with years of experience developing innovative ways to build bridges between the theory and practice of science communication. Dr. Roop's research focuses on developing communications tools and methods for connecting climate science to decision-making. Dr. Roop holds appointments in the University of Minnesota Extension and College of Food, Agricultural and Natural Resource Sciences, is Director of the University of Minnesota Climate Adaptation Partnership (MCAP) and was formerly the Lead Scientist for Science Communication at the University of Washington Climate Impacts Group. She has grown MCAP from a volunteer-run annual conference to a university-funded organization with more than ten scientists, staff, and interns. Her expertise in climate science, communication, and stakeholder engagement gives her the skills to lead this project. She has experience in climate research across the globe, from Antarctica to Greenland to Minnesota, and her knowledge of climate models and climate data will inform Activity 1. Dr. Roop is also currently the principal investigator of MCAP's Agricultural Weather Study, which gives her intimate knowledge of MCAP's new climate data visualization tool for Activities 2 and 3. Finally, as a result of her research at the University of Minnesota and elsewhere, she is experienced in stakeholder engagement and science communication, which will enable her to lead Activities 2 and 3.

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

Organization Description:

The mission of the Department of Soil, Water, and Climate is to advance the understanding of Earth system processes and the interaction among land, atmosphere, and water. Through research, teaching, and outreach it seeks to: (1) improve and protect the quality of soil, air, and water resources in natural and managed ecosystems; (2) enhance agricultural and forest productivity and sustainability; (3) predict and mitigate impacts of environmental change on ecosystems and society; and (4) provide science-based knowledge for improved decision making and a better-informed citizenry.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
Principal Investigator		To oversee scientific analysis and engagement efforts; serve as primary point of contact for project			36.8%	0.08		$13,442
Co-PI, Senior Program Manager		lead project and partner coordination and end user engagement, including 2 workshops			36.8%	0.5		$43,125
Climate Modeler		Lead climate data analysis and provide technical support and assistance to project partners			36.8%	1.34		$110,744
Postdoctoral Associate		Hydrologic Modeler; lead hydrologic modeling efforts to integrate climate data into hydrologic model and provide technical support and assistance to project partners			25.7%	2		$147,270
Climate Adaptation Researcher		Research and Development; lead translation of climate and hydrologic projections data into useful and usable formats to support decision making, support planning and execution of workshops			36.8%	6		$29,759
Climate Data Visualization Specialist		Communication; integrate climate and hydrologic model projections into MCAP climate visualization tool			36.8%	6		$36,671
							Sub Total	**$381,011**
Contracts and Services								
Great River Greening	Sub award	Assist with community and practitioner engagement coordination, dissemination of project results, and implementation of project findings into land restoration and conservation efforts led by Great River Greening and its partners				0.68		$79,400
							Sub Total	**$79,400**
Equipment, Tools, and Supplies								
	Tools and Supplies	General operating supplies, such as workshop materials (flip charts and travel case, markers, tubs and totes to move materials, binders, name tags,	To facilitate workshops with community members and practitioners					$1,086

		markers, etc. ($543)), and printing and project promotion materials ($543).						
	Tools and Supplies	Adobe Creative Cloud License for two years	Adobe Creative Cloud license for two years to produce graphics and other resources to disseminate to communities and practitioners at workshops and online. ($420/year)					$840
							Sub Total	**$1,926**
Capital Expenditures								
							Sub Total	**-**
Acquisitions and Stewardship								
							Sub Total	**-**
Travel In Minnesota								
	Miles/ Meals/ Lodging	We estimate total costs based on expenses for 6 project team members. Trip costs are expected to be approximately $525.08/person, with variability based on the distance traveled. We anticipate 2 trips of the following approximate distances and durations: average mileage will be 220 miles/round trip at 0.655/mile for a total of $144.10 per trip. Average per diem, based on 2023 GSA rates, is expected to be $148 per night for accommodation and approximately $79 for food and incidentals. $6,301 is requested to meet these approximate costs for six project team members for Minnesota-based travel.	For the MCAP project team to travel to two community member and practitioner engagement workshops, locations and dates to be determined through the project process and interaction with partners, community members, and practitioners.					$6,301
							Sub Total	**$6,301**
Travel Outside Minnesota								
							Sub Total	**-**
Printing and Publication								

	Publication	Peer-reviewed journal article publication fees	Funds are requested for publication costs in a peer-reviewed journal article in Year 2. Publication journal to be determined.					$2,000
							Sub Total	**$2,000**
Other Expenses								
		Workshop Location Rental Fees	Funds are requested to cover room rentals and associated fees to host 2 in-person workshops ($1,400/year)					$2,800
		Workshop Participant Costs	Funds are requested to cover participant costs for workshop attendance. This will include reimbursement for parking ($100 calculated at $10/day), mileage ($655 calculated at 100 miles/round trip at 0.655/mile for a total of $65.50/trip) and honoraria ($1,250 calculated at $125 per person at a rate of $25/hour) for 10 people for each 5-hour workshop. $2.005 is requested to meet these approximate costs for 10 workshop participants for 2 workshops					$4,010
		Climate Data Storage	Funds are requested to pay for data storage on the Minnesota Supercomputing Institute's (MSI) data drives, necessary to process and store model data. 10TB above the in-kind Tier 1 storage are requested at a rate of $127.58/TB/year.					$2,552
							Sub Total	**$9,362**
							Grand Total	**$480,000**

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	**-**

Attachments

Required Attachments

Visual Component

File: e526ccc7-94a.pdf

Alternate Text for Visual Component

The visual demonstrates the iterative, co-production process by which the project team and our partners will create needed data and information to better equip practitioners and communities to address the impacts of future drought and heavy precipitation events in Minnesota....

Optional Attachments

Support Letter, Photos, Media, Other

Title	File
National Integrated Drought Information System (NIDIS) Letter of Support	1b09ac5b-889.pdf
1854 Treaty Authority Letter of Support	ea833ce2-f5c.pdf
University of Minnesota Letter	3cffa50c-4d0.pdf

Administrative Use

Does your project include restoration or acquisition of land rights?

No

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

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?

Yes, Sponsored Projects Administration

Does your project include the design, construction, or renovation of a building, trail, campground, or other capital asset costing $10,000 or more?

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?

No