



Environment and Natural Resources Trust Fund

2027 Request for Proposal

General Information

Proposal ID: 2027-053

Proposal Title: Parks of Fire and Ice

Project Manager Information

Name: Andrew Wickert

Organization: U of MN - St. Anthony Falls Laboratory

Office Telephone: (651) 625-6878

Email: awickert@umn.edu

Project Basic Information

Project Summary: State-of-the-art scientific information to educate and inspire visitors of northeastern Minnesota's state parks, delivered through oft-breathtaking Key Sites and built into Connected Narratives describing how our shared home formed.

ENRTF Funds Requested: \$485,000

Proposed Project Completion: June 30, 2030

LCCMR Funding Category: Education and Outdoor Recreation (C)

Project Location

What is the best scale for describing where your work will take place?

Region(s): NE, Metro,

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

Region(s): NE, Metro,

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 state parks along the Midcontinent Rift—where ancient lava flows record a time when North America nearly split apart and glaciers later carved the landscape during the last ice age—share a unique natural history and host over three million visitors per year. However, information available to park visitors on geological history and landscape evolution dates to the mid- to early 20th century, missing key opportunities in environmental education: Why did the Midcontinent Rift form, and why did it stop just before splitting North America apart? How did this ancient rift shape the landscape that became Lake Superior? How quickly did the iconic waterfalls evolve? When and how did floodwaters from Lake Superior form the Interstate State Park potholes? Park staff and available information cannot answer these questions—indeed, the answers have been unknown to science. But not any longer: through federally funded research, our team is uncovering the broader history that connects these parks. These advances present a timely opportunity to update interpretive and informational media, training, and naturalist programs. Improved geoscientific information will increase interest in park landscapes by park visitors and organized tour groups, and will support the new bipartisan Outdoor School for All Minnesota Act.

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 share the geological story of Minnesota's Midcontinent Rift parks by generating educational materials, engaging with parks staff, sharing emerging scientific results, and augmenting our new knowledge with targeted additional data. We will focus on a geographic span of highly visited parks: Interstate, Jay Cooke, and those along Lake Superior's North Shore. First, our team of scientists and Minnesota State Parks partners will build a strategic plan to construct natural-history narratives spanning these parks. Second, we will gather targeted data to connect the timelines and histories that each park shares; this includes correlating the lava flows at Interstate State Park with those across the North Shore, establishing when the floods that created the potholes at Interstate State Park occurred, and reconstructing rapid changes in Lake Superior's water level as the glaciers retreated. Third, we will distill our knowledge into materials—maps, graphics, timelines, and stories—to share in Parks materials and with Parks visitors; these will be designed to incorporate into Parks signage when it is updated. Fourth, we will train Parks staff and develop and deliver educational programming—including story maps, ranger programs, and K–12-appropriate teaching materials—to support the mission of the Parks and Minnesota's geoheritage.

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?

After this project, state parks will be equipped with modern scientific information—including maps, data, and visualizations—describing the natural history and ongoing change in each environment. These new educational materials will inform naturalist programs and enhance visitor enjoyment of parks: visitors will see how the story of the landscape spans the state and connect with state-of-the-art scientific research. Our materials will place Minnesota in Earth history and connect our stories to those of North America, drawing visitors and deepening their appreciation. When we understand just how special Minnesota is, we take better care of our landscapes and their heritage.

Activities and Milestones

Activity 1: Strategic planning: Telling an updated and unified story of northeastern Minnesota's state parks

Activity Budget: \$22,794

Activity Description:

From Interstate State Park in the south to Grand Portage State Park along the Canadian border, the landscapes and geology of northeastern Minnesota record 1850 million years of Earth history—equal to the span of time preserved in the Grand Canyon. Northeastern Minnesota's story, written into the land and rocks, begins with North America's formation and near-breakup. Shallow seaways then formed, tectonic forces warped the land, ice sheets advanced, lakes filled, and rivers sliced fresh gorges into ancient bedrock through waterfall retreat. Although Minnesota's state parks are well known for their wildlife and natural beauty, visitors lack access to the unique stories across time shared among these parks.

As a team of scientists and parks managers, we will develop a strategic plan to share Minnesota's geoheritage and its fundamental connections across our state. We will identify Key Sites that demonstrate geological history and processes. From these Key Sites, we will build Connected Narratives spanning the parks and inviting visitors to be curious about Minnesota's dramatic landscapes.

We will direct this plan through video calls followed by an in-person meeting. The Key Sites and Connected Narratives that we collectively decide to prioritize will shape the specific directions for park interpretation.

Activity Milestones:

Description	Approximate Completion Date
Share the current state of geoscientific knowledge on Northeastern Minnesota's parks (videoconference)	January 31, 2028
Share park interpretive and programmatic priorities (videoconference)	January 31, 2028
In-person meeting at the University of Minnesota, Twin Cities	February 28, 2028
Finalize plan of Key Sites and the links needed to tell the landscape's story	March 31, 2028

Activity 2: Data gathering: Targeted research on Key Sites to interpret Minnesota's geoheritage

Activity Budget: \$202,298

Activity Description:

Over the past decade, the scientists on our team have transformed our understanding of northeastern Minnesota's geological evolution and modern landscapes—from the chronology of Midcontinent Rift volcanism, to the deglacial history of Interstate State Park and the Lake Superior basin, to the processes driving landscape development along the North Shore. These knowledge advances inspired this project. Nonetheless, their studies were designed with scientific rather than interpretive aims. Using these results alone would leave curious park visitors with critical knowledge gaps and questions.

To fill these knowledge gaps, we propose three key scientific targets, comprising sample collection, sample analysis, and interpretation of the geological materials and dates in their broader context. Our project team chose these sites based on high visitation, educational opportunities, and the potential to connect Park interpretation across Minnesota; we will confirm or modify them based on our Activity 1 strategic planning.

(1) Connecting volcanic history from Interstate State Park to the Canadian border through preserved magnetic

orientations and geological age determinations.

(2) Obtaining the timing of flooding and erosion that formed the potholes at Interstate State Park.

(3) Finding the ages of Lake Superior's past shorelines to reconstruct when falling lake levels drove waterfall formation.

Activity Milestones:

Description	Approximate Completion Date
Gather samples to date and correlate ancient lava flows	October 31, 2027
Gather samples to date erosion of the Interstate State Park potholes	October 31, 2027
Gather samples to date past shorelines of Lake Superior	October 31, 2027
Analyze and date samples	September 30, 2028
Interpret and contextualize ages and geological histories	February 28, 2029
Give our findings longevity and usability by publishing them in peer-reviewed scientific journals	June 30, 2030

Activity 3: Generating materials: Graphics and text to share northeastern Minnesota's geoheritage

Activity Budget: \$131,867

Activity Description:

With data and direction in hand, we turn to building the materials required to share Minnesota's geoheritage. This comprises graphics—maps, diagrams, and illustrations—and textual passages distilling state-of-the-art natural science into broadly understandable language and explanations. Graphics and text will be designed to be presented online, in naturalist talks, in informational brochures, and within state-park signage updates. These materials will follow the Key Sites and Connected Narratives developed in Strategic Planning (Activity 1); we anticipate this to include:

- (1) Ancient mountain building and the initial formation of North America recorded at Jay Cooke State Park
- (2) Lava flows and a rift that almost tore North America apart, from Interstate State Park to the North Shore
- (3) A billion years of gradual landscape change across Minnesota between rifting and glaciation
- (4) Ice ages transforming landscapes across the region over the past three million years
- (5) Ice retreat, glacial lakes, and meltwater rivers from the Lake Superior basin to the St. Croix River valley
- (6) River incision and waterfall retreat along the North Shore and the St. Croix River
- (7) Natural hazards along Minnesota's rivers and coasts, including landslides and flash floods, and their connections to geological history

Activity Milestones:

Description	Approximate Completion Date
Diagrams of geological processes that shaped northeastern Minnesota	November 30, 2028
Illustrations of Key Sites and their histories	September 30, 2029
Paleogeographic and modern maps showing environmental change over time	October 31, 2029
Descriptive text written for an audience with a broad range of backgrounds	January 31, 2030
Publish this information and our visitor-engagement strategy in the open-access journal, "Geoscience Communication"	June 30, 2030

Activity 4: Sharing knowledge: Parks and educational programming

Activity Budget: \$128,041

Activity Description:

We will share knowledge of Minnesota's parks and their integrated geological and landscape histories with visitors through tried-and-true methods alongside modern and digital tools. The text and graphics (Activity 3) will be supplied to our Minnesota State Parks Project Partners and colleagues, who will be able to incorporate them into the next signage

updates in their respective parks. To bring information to visitors sooner, our team will create Story Maps, which provide an interactive interface for park visitors (and prospective visitors) to be guided through the geography and natural history of each park, complete with maps, illustrations, and photos. These can be shared with park guests flexibly through QR codes. For in-person experiences, our team will train park naturalists in current geological and landscape science and will design naturalist programs. Project-Partner scientists will present within the parks to engage with visitors and reinforce lasting knowledge transfer to park naturalists. Finally, we will develop K–12-appropriate teaching materials to guide learning exercises through the parks. This will enhance already-iconic student visits to State Parks with the most recent science on Minnesota's landscapes and environmental change, building curiosity about nature, insights into its processes, and a deep-time sense of our shared home.

Activity Milestones:

Description	Approximate Completion Date
Deliver graphics and text to Minnesota State Parks	February 28, 2030
Story Maps for the Key Sites and their connections across Minnesota	April 30, 2030
Park-ranger training, including ranger programs and talks by project scientists	June 30, 2030
K–12-appropriate educational materials on Minnesota's geoheritage	June 30, 2030
Final hand-off and coordination meeting at UMN-TC with Project Partners	June 30, 2030

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Nicholas Swanson-Hysell	University of Minnesota	Geology: Geological evolution and chronology of the Mid-Continent Rift and its basalts, history of mountain-building preserved in Minnesota's rocks, paleogeography, educational materials for Parks visitors	Yes
Phillip Larson	Minnesota State University, Mankato	Geomorphology and Geoscience Education: Deglacial Evolution of Interstate State Park, past shorelines along Lake Superior, geological and geomorphic context, K-12 educational materials	Yes
Karen Gran	University of Minnesota	Geomorphology: Landscape development on the North Shore of Lake Superior, especially of the rivers and their waterfalls; developing materials for Parks visitors	Yes
Kat Cantner	University of Minnesota	Geoscientist and artist: creating diagrams and illustrations for geological processes and history, building K-12 and general educational materials	Yes
Clare Croteau	Minnesota DNR	Minnesota State Parks: Guiding and integrating knowledge and communications-material generation and implementation as Northeast Regional Naturalist for the Minnesota DNR	No
Michael Dunker	Minnesota DNR	Minnesota State Parks: Aiding and advising in interpretive material generation and dissemination as a Naturalist for the Minnesota DNR	No
Jennifer Conrad	Minnesota DNR	Minnesota State Parks: Advising and coordinating educational material development and sharing her role as the Interpretation and Information Services Supervisor at the Minnesota Department of Natural Resources	No

Dissemination

Describe your plans for dissemination, presentation, documentation, or sharing of data, results, samples, physical collections, and other products and how they will follow ENRTF Acknowledgement Requirements and Guidelines.

Dissemination of this work and its products lies at the core of our purpose in performing it. All graphics, text, and educational materials generated during this project will be shared with the Minnesota State Parks through our Project Partners. All of these will be licensed for public use, including by the State Parks, under the Creative Commons Attribution 4.0 license (CC-BY 4.0). This will give the State Parks (and any other entity) the ability to use, alter, and republish the materials, while requiring attribution to the authors. In the attribution request, we will include formal language requiring that the ENRTF be acknowledged in the use of these materials. To enable accessibility, these resources will be made available on site as well as online. In-person presentations and online-available Story Maps will further the goals of sharing these resources with a broad community and enhancing park interpretive efforts; these as well as signage updates will acknowledge the ENRTF. In addition, we will publish peer-reviewed scientific literature advancing knowledge of the landscapes and geological history of Minnesota, and these will include the ENRTF in their acknowledgments.

During scientific research associated with this project, we will gather rock and sediment samples. Rock samples will be processed and stored at the University of Minnesota, Twin Cities, in the Surface Processes Instrumentation Laboratory and the Institute for Rock Magnetism; portions of these samples will be sent to external laboratories, where these materials will be consumed in the process of determining geological ages. Sediment samples will be consumed in analyses for geological age determination, and any remaining sediment-sample material will be stored in the EARTH Systems laboratory at Minnesota State University, Mankato.

By building a comprehensive geoheritage education plan that spans parks across northeastern Minnesota, we will educate visitors about the 1.85 billion years of Earth history that these regions traverse, demonstrating just how special a place Minnesota is. A primary goal in disseminating this information is to share the uniqueness and value of

Minnesota's geology, landscapes, and natural environments, in order to educate and inspire those here to care for, conserve, protect, and enjoy our natural spaces.

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?

Major impacts will occur after the project and without anticipated additional funding. We will share the information gathered and resources developed with the DNR for use, at their discretion, in their interpretive media and programming. These will be available in perpetuity. As public-university faculty in the state of Minnesota, we will build relationships with the parks and make ourselves available to give guest lectures and participate in community-engaged parks events during and following the project. By connecting parks staff with current science and equipping them with durable materials, this project will transform how visitors experience and understand Minnesota's dramatic landscapes.

Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
Land-Use and Climate Impacts on Minnesota's Whitewater River	M.L. 2022, , Chp. 94, Art. , Sec. 2, Subd. 03h	\$199,000
Ditching Delinquent Ditches: Optimizing Wetland Restoration	M.L. 2023, , Chp. 60, Art. 2, Sec. 2, Subd. 04a	\$199,000

Project Manager and Organization Qualifications

Project Manager Name: Andrew Wickert

Job Title: Associate Professor

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

Dr. Andrew Wickert, Associate Professor in Geomorphology at the University of Minnesota, has broad expertise in understanding Earth's surface environments and how they change. He obtained his S.B. in Earth, Atmospheric, and Planetary Science from MIT (2008), where his research on river systems and geophysics earned him the highest honors in his department, the Goetze Prize and Crosby Award. For his Ph.D. in Geology from the University of Colorado Boulder (2014), he demonstrated how global glaciation deformed the solid Earth and its gravity field and reshaped rivers across North America. Alongside this research, Wickert developed and built open-source electronic instrumentation for environmental monitoring and gained experience working in environmentally focused projects in rivers and watersheds. He added field and computational experience in river response to changing climate and flooding during his 2014–2015 postdoc at the Universität Potsdam before arriving at the University of Minnesota in Fall 2015, where he joined the Department of Earth & Environmental Sciences and the St. Anthony Falls Laboratory.

Dr. Wickert currently leads a 5-university, \$2.8M collaborative project on the geoscientific history and evolution of the Lake Superior basin, funded by the National Science Foundation (NSF). This project benefits from Wickert's 20 years of experience in studying rivers, 15 years in reconstructing ancient ice sheets, his focused expertise on landscapes and their evolution across Minnesota and Wisconsin, and his capacity to coordinate large and interdisciplinary groups. As leader of this NSF-funded project, Wickert is well poised to directly funnel current and upcoming findings into interpretive information for the State Parks and the people of Minnesota.

Organization: U of MN - St. Anthony Falls Laboratory

Organization Description:

The Saint Anthony Falls Laboratory (SAFL) is a world-renowned research facility for environmental fluid mechanics and related fields. This 4,880-square-meter facility is built into the side of St. Anthony Falls in downtown Minneapolis, whose water it uses to run some of the largest hydraulics experiments in the world. In addition to direct experimentation with flowing water, SAFL hosts a diverse group of scientists and engineers who work on environmental fluid mechanics as it applies to the atmosphere, climate, land surface, sediments, and biological processes. The faculty, staff, and students at SAFL spread their efforts across both basic scientific advances and work with immediate applications to infrastructure, the environment, and societal needs. The current SAFL director is Prof. Lian Shen, with Jeff Marr as the associate director for engineering and facilities.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
Personnel								
Dr. Andrew Wickert		Geoscientist and project manager			27.8%	0.24		\$55,248
Dr. Nicholas Swanson-Hysell		Geologist			27.8%	0.12		\$31,705
Dr. Karen Gran		Geomorphologist			27.8%	0.12		\$26,258
Kathleen Cantner		Artist, technical illustrator, geoscientist			27.8%	0.39		\$39,335
Ben Erickson		Equipment and Lab Management			27.8%	0.12		\$13,215
Graduate Student		Geological research and science communication			47.3%	2		\$122,064
							Sub Total	\$287,825
Contracts and Services								
Minnesota State University, Mankato	Subaward	Landscape history and evolution, especially at Taylor's Falls and Lake Superior shorelines, and linking stories of Minnesota's geoheritage across the parks. Strategic planning, obtaining geological ages, generating educational materials, and supporting dissemination including K–12 instructional materials. Personnel: \$99,516 Equipment, Tools, and Supplies: \$24,542 Travel: \$24,943				2.16		\$149,021
Lawrence Livermore National Laboratory	Service Contract	The Center for Accelerator Mass Spectrometry at the Lawrence Livermore National Laboratory recently developed a new and accurate method to date surface exposure using the isotope ³⁶ Cl. We will send them 12 samples from eroded surfaces at Interstate State Park, and they will tell us when the deglacial flood happened.				0		\$13,500
U-Pb TIMS laboratory;	Service Contract	Uranium–Lead Thermal Ionization Mass Spectrometry to obtain geological ages (x3) of ancient lava flows at Interstate State Park and across				0		\$7,500

specific lab TBD		Lake Superior's North Shore. These will anchor the timing of these events and give necessary information to guide visitors through geological time as they visit State Parks.						
							Sub Total	\$170,021
Equipment, Tools, and Supplies								
	Tools and Supplies	Geological Field Supplies: Paleomagnetic drill bits, sample bags, orientation tools, and consumables	Collecting oriented samples to correlate and date the basalt lava flows					\$500
	Tools and Supplies	Geomorphological Field and Lab Supplies: Hammer and chisel, sample bags, grinding plates for rock pulverizing, and sieves for sample processing	Gathering surface samples from state-park sites without creating obvious tool marks; processing these samples to send for geological ages at national laboratory					\$1,489
							Sub Total	\$1,989
Capital Equipment								
							Sub Total	-
Acquisitions and Stewardship								
							Sub Total	-
Travel In Minnesota								
	Miles/ Meals/ Lodging	2 trips (6 nights, 5 travelers; 4 nights; 4 travelers); 2 vehicles at 1100 miles each; 10 nights lodging (6 camping; 4 hotel); 55 person-days of per-diem meals & incidentals	Field work, meetings, and presentations from Jay Cooke State Park to Grand Portage State Park					\$6,835
	Miles/ Meals/ Lodging	12 day trips and 2 overnight trips; 3210 vehicle-miles total; 2 nights lodging (hotel); 44 half-person-days of per-diem meals & incidentals	Travel to Interstate State Park for field work, engagement, and presentations					\$4,414
	Miles/ Meals/ Lodging	7 individuals (year 1) and 5 individuals (year 3) traveling to Minneapolis from across Minnesota: 3600 vehicle-miles; 24 hotel-room-nights, 36 days of per diem.	Strategic planning meeting (Year 1) and project-conclusion meeting (Year 3) at the University of Minnesota in Minneapolis					\$8,916

							Sub Total	\$20,165
Travel Outside Minnesota								
							Sub Total	-
Printing and Publication								
	Publication	Page charges for two open-access scientific journal articles	Provide a peer-reviewed scientific basis for updated interpretive information in the State Parks and as a reference for and record of current research outcomes.					\$5,000
							Sub Total	\$5,000
Other Expenses								
							Sub Total	-
							Grand Total	\$485,000

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: \$485,000

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: [7992769b-7ae.pdf](#)

Alternate Text for Visual Component

Map of northeastern Minnesota showing the locations of the state parks where we will add interpretive materials. Photos inset, describing rocks from North America's assembly, lava flows from continental rifting, potholes carved into bedrock by meltwater floods, incising rivers, Lake Superior shoreline change, and landslides on glacial lake sediment....

Supplemental Attachments

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

Title	File
University of Minnesota SPA letter	b7aa558f-c81.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 UMN Policy on travel 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:

Angela Boutch, University of Minnesota

Do you understand that a named service contract does not constitute a funder-designated subrecipient or approval of a sole-source contract? In other words, a service contract entity is only approved if it has been selected according to the contracting rules identified in state law and policy for organizations that receive ENRTF funds through direct appropriations, or in the DNR's reimbursement manual for non-state organizations. These rules may include competitive bidding and prevailing wage requirements

Yes, I understand