



Environment and Natural Resources Trust Fund

2025 Request for Proposal

General Information

Proposal ID: 2025-178

Proposal Title: Leveraging Statewide Datasets for Native Rough Fish

Project Manager Information

Name: Grant Vagle

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

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Project Basic Information

Project Summary: To support future conservation and research efforts and enhance knowledge of Minnesota's native rough fish, we propose species distribution models to predict their presence and abundance across Minnesota streams.

ENRTF Funds Requested: \$250,000

Proposed Project Completion: June 30, 2027

LCCMR Funding Category: Small Projects (H)

Secondary Category: Foundational Natural Resource Data and Information (A)

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.

Fish are one of the most important natural resources to Minnesotans for their value as food, recreational opportunities, and deep cultural value. Specifically, there is growing appreciation of “native rough fish” (including suckers, buffalo, redhorses, and many others) which provide unique fishing opportunities and serve important roles in ecosystem functioning. The Minnesota Department of Natural Resources (DNR) emphasized the need for conservation of these native rough fish with a report published in December of 2023. In the DNR report, several research priorities were detailed including establishing monitoring efforts, age structure, and habitat use for many of these species. However, research on many of these species is many years (even decades) behind that of popular game species such as walleye. In particular, there is limited knowledge on the distributions of many of these species in Minnesota. Developing rigorous, statewide species distribution models for these species and establishing a reference library of young native rough fish for further study (e.g., growth or diet studies) would support the research priorities outlined in the DNR report, aid in prioritizing locations for future monitoring and research, and improve accessibility to fishing opportunities for all Minnesotans.

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 propose a project to construct species distribution models for 21 native rough fish species in Minnesota, predicting presence and abundance across the state’s rivers and streams. We will utilize data from over 5000 complete-community fish surveys conducted by the Minnesota Pollution Control Agency Biological Monitoring program and gather publicly available covariate data from state and federal datasets such as hydrology, land use/land cover, climate, and water chemistry variables. We will use two high-performance predictive models: (1) a top-performing species distribution model that can incorporate numerous covariates, boosted regression trees, and (2) spatial statistical network models, which account for the inter-connectedness and flow of river systems. We will evaluate these models to provide the best predictions of presence and abundance, then we will identify: (1) “hot spots” where species diversity is highest, (2) “bright spots” where a species is more abundant than predicted, and (3) “dark spots” where a species is less abundant than predicted. These hotspots and bright spots can then be targets for protection, while the dark spots may be targets for additional monitoring or restoration efforts. We will construct an interactive mapping tool to make the predicted distributions of these native rough fish available to all.

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?

We will submit scientific publications to document the distributions and preferred environmental conditions of native rough fish in Minnesota, for utilization in future conservation and research efforts. We will construct an online interactive mapping tool intended to serve as documentation of fish diversity for local conservation organizations and interested Minnesotans, enhancing public knowledge of native rough fish and enabling their further protection. Our outreach efforts will utilize fish specimens to grow knowledge of native rough fish through participation in regional blogs, e-newsletters, events with local fishing groups and nature centers, and a workshop targeting native rough fish scientists and managers.

Activities and Milestones

Activity 1: Building species distribution models and identifying bright spots

Activity Budget: \$100,000

Activity Description:

We will construct species distribution models for 21 native rough fish species (of 26 that occur in Minnesota) which were detected in at least 15 locations for sufficient predictive power, including all species indicated as priorities in the DNR report, and excluding state or federally listed species whose specific locations are protected by law. To predict each species' occurrence and abundance throughout the state, we will gather covariate data from state and federal datasets including hydrology (e.g., stream flow), land use/land cover (e.g., % agricultural, % wetland), climate, and water chemistry. We will integrate boosted regression trees, a high-performing machine learning model commonly used for species distribution models, with a spatial statistical network model which accounts for the interconnectedness of stream networks. We will compare the separate predictive power of these two models with a “stacking” approach that combines the two models. We will evaluate these models using best practices (including cross-validation and independent test sets) and select the approach (separate or combined) that gives the best estimates. Given these estimates, we will then identify the “hotspots”, “bright spots” and “dark spots”.

Activity Milestones:

Description	Approximate Completion Date
Identify and collect data on hydrological, land use/land cover, climate, and water chemistry covariates.	August 31, 2025
Collect and process available Minnesota Pollution Control Agency data for fish surveys	October 31, 2025
Build spatial statistical network models to predict species presence and abundance	February 28, 2026
Build boosted regression tree models to predict species presence and abundance	April 30, 2026
Evaluate, combine, and compare the species distribution models, and select the best final model	June 30, 2026

Activity 2: Building interactive mapping tool to display species distribution models

Activity Budget: \$100,000

Activity Description:

To share the statewide predictions from our species distribution models, we will construct a “Shiny app”, a web tool that will allow users to view a map of model predictions for their species of interest. We intend for this tool to be dynamic and interactive, such that users can use “check-boxes” to select species of interest to display on the map, while also allowing users to zoom in and click on stream segments and view the observed and predicted species likely present there. This tool will be constructed using RShiny, built and maintained under version control with git, and submitted to USGS hosting to be made publicly available (at no cost) as a webpage (providing a permanent home). To evaluate the effectiveness of this tool, we will consider feedback (and incorporate updates accordingly) gathered as part of Activity 3 from native fish groups, tribal groups, and managers. State or federally listed species' specific locations will be obscured as required by Minnesota state law, and pending newly listed species, the tool will be updated accordingly.

Activity Milestones:

Description	Approximate Completion Date
Develop plan of desired functionality of the tool	August 31, 2026
Implement example functioning tool, evaluate effectiveness of the tool towards the plan	December 31, 2026
Develop final version of interactive tool, submit to USGS server	June 30, 2027

Activity 3: Share results and interactive tool, conduct outreach activities, and support future outreach efforts

Activity Budget: \$50,000

Activity Description:

We will share our results and the interactive tool by presenting it at local scientific conferences (e.g., MN AFS) and to various interested groups (e.g., Native Fish for Tomorrow, a local non-profit organization working to conserve native fish). We will connect with tribal groups and representatives (e.g., Great Lakes Indian Fish and Wildlife Commission) to gauge interest in the tool and model results, making model predictions on tribal lands only with active collaboration and permission. In sharing the interactive tool, we will also incorporate feedback and ground-truth our model predictions, since these groups have detailed local knowledge on these species. We will extend the value of fish specimens collected as part of the MN PCA Biological Monitoring program by using them for further research, education, and outreach. Currently, these fish specimens are stored in the Bell Museum (UMN) for five years as public record, then destroyed. We will sort, store, and distribute those to-be-destroyed specimens for further use and use them for our own outreach activities with local partners. In addition, we will share our work through participation in regional blogs, e-newsletters, events with local groups and nature centers, and a workshop targeting native rough fish managers.

Activity Milestones:

Description	Approximate Completion Date
Prepare Minnesota PCA specimens for outreach activities, conduct outreach with native rough fish specimens	August 31, 2026
Outreach with native fish groups to ground-truth model predictions, gauge interest and preferences for tool	December 31, 2026
Present at scientific conferences	March 31, 2027
Further outreach activities to share the interactive tool and native rough fish diversity	June 30, 2027
Submit for open-access scientific publication	June 30, 2027

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Grant Vagle - Researcher 5	U of MN - College of Food, Agriculture, and Natural Resource Sciences	Project Manager, PI. Leading project management, data analysis, collaboration with partners, and outreach.	Yes
Lynn Waterhouse	U of MN - College of Food, Agricultural, and Natural Resource Sciences	Co-PI. Assisting with project management, data analysis, collaboration with partners, and outreach.	No
Solomon David	U of MN - College of Food, Agriculture, and Natural Resource Sciences	Project Collaborator. Provide native rough fish expertise, assist with science communication and outreach.	No
Kassandra Ford	U of MN - Bell Museum of Natural History; U of MN - College of Food, Agriculture, and Natural Resource Sciences	Project Collaborator. Assisting with specimen processing, guidance of undergraduate tasked with specimen work, and outreach.	No
Undergraduate Researcher (to be named)	U of MN - Bell Museum of Natural History	Assist with specimen work at Bell Museum and outreach activities.	Yes

Long-Term Implementation and Funding

Describe how the results will be implemented and how any ongoing effort will be funded. If not already addressed as part of the project, how will findings, results, and products developed be implemented after project completion? If additional work is needed, how will this work be funded?

The project will be shared via multiple outreach activities and presentations with various local groups. The resulting manuscript(s) and accompanying code will be submitted to free, open-access scientific journals. The interactive tool will be submitted for USGS web hosting (free with L. Waterhouse's USGS position), with ongoing maintenance by G. Vagle. Additionally, we will archive a static version of the interactive tool via Zenodo.org (a free repository) for long-term reproducibility. The project will also be shared with broad audiences via submissions to regional publications such as the Minnesota Conservation Volunteer, Outdoor News, etc.

Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
Predicting the Future by Understanding the Past	M.L. 2023, , Chp. 60, Art. 2, Sec. 2, Subd. 03g	\$170,000

Project Manager and Organization Qualifications

Project Manager Name: Grant Vagle

Job Title: Postdoctoral Associate, University of Minnesota Department of Fisheries, Wildlife, and Conservation Biology

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

Grant Vagle is a Postdoctoral Associate in the Department of Fisheries, Wildlife, and Conservation Biology at the University of Minnesota (UMN). G. Vagle received his PhD in Ecology and Evolutionary Biology from the University of Colorado, Boulder. G. Vagle is an early-career scientist with experience in biodiversity research, data science, and species distribution modeling with large, complex datasets and multiple species. Currently, G. Vagle’s primary duties are on a collaborative project modeling (using boosted regression trees) invasion risk of waterbodies to aquatic invasive species in the Upper Mississippi River Basin, with project collaborators at UMN and USGS, including project co-PI Lynn Waterhouse. Additionally, G. Vagle serves as co-PI on an environmental DNA project funded by the USGS Aquatic Invasive Species Grant program with USGS collaborators. At this stage in his career, G. Vagle is increasingly gaining experience in project management, supported by L. Waterhouse and other mentors in his professional network at UMN and elsewhere.

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

Organization Description:

In the College of Food, Agricultural and Natural Resources Sciences (CFANS) we look at the bigger picture. We use science to find answers to the world’s grand challenges and solve tomorrow’s problems. The goal of CFANS is to advance Minnesota as a global leader in food, agriculture, and natural resources through extraordinary education, science-based solutions, and dynamic public engagement that nourishes people and enhances the environment in which we live. Few other public universities come close to the breadth of our expertise, allowing us to tackle challenges in novel ways. We develop leaders that see more possibilities and produce solutions that work for real people. This creates a powerful force for change. The university also hosts a cutting edge Minnesota Supercomputing Center which researchers use to tackle cutting edge problems. Twelve academic departments and 10 research and outreach centers make up our college, along with the Minnesota Landscape Arboretum, the Bell Museum, and dozens of interdisciplinary centers. The Department of Fisheries, Wildlife, and Conservation Biology has about 20 faculty, 40 staff, 60 graduate students, 200 undergraduates, 1200 alumni, and many friends....all working together to advance our knowledge of fisheries, wildlife, and conservation biology.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
Personnel								
Researcher 5 (9742R5) - Grant Vagle		Lead data collection, analysis, and outreach efforts.			37.1%	2		\$202,772
Undergraduate researcher (to be named) (500 hours each year)		Assist with specimen work at Bell Museum and outreach activities.			0%	0.48		\$17,655
							Sub Total	\$220,427
Contracts and Services								
							Sub Total	-
Equipment, Tools, and Supplies								
	Tools and Supplies	Plush native rough fish, laminated cards, maps, game materials	Materials for outreach activities					\$2,569
	Tools and Supplies	Glass jars for specimen storage	For specimen storage and sorting at Bell Museum of native rough fish					\$2,500
	Tools and Supplies	Labels for glass jars	For specimen storage and sorting at Bell Museum of native rough fish					\$100
	Tools and Supplies	Ethanol	For specimen storage and sorting at Bell Museum of native rough fish					\$100
							Sub Total	\$5,269
Capital Expenditures								
							Sub Total	-
Acquisitions and Stewardship								
							Sub Total	-

Travel In Minnesota								
	Conference Registration Miles/ Meals/ Lodging	2 people, conference registration \$300 (\$150each), mileage 320 miles x \$0.67/mi = \$214 (using 320 miles Duluth as proxy for each trip), lodging \$1,600 (\$200/ng x 4 nights x 2 rooms), meals \$711 (2 people x 2 days travel @ \$59.25, 3 full days@ \$79)	Travel to 2026 Minnesota American Fisheries Society (AFS) meeting (location TBD) to present progress of project.					\$2,825
	Conference Registration Miles/ Meals/ Lodging	2 people, conference registration \$300 (\$150each), mileage 320 miles x \$0.67/mi = \$214 (using 320 miles Duluth as proxy for each trip), lodging \$1,600 (\$200/ng x 4 nights x 2 rooms), meals \$711 (2 people x 2 days travel @ \$59.25, 3 full days@ \$79)	Travel to 2027 Minnesota American Fisheries Society (AFS) meeting (location TBD) to present final results of project.					\$2,825
	Miles/ Meals/ Lodging	6 total trips. 2 people per trip. Mileage 320 miles x \$0.67/mi = \$214 (using 320 miles Duluth as proxy for each trip), lodging \$800 (\$200/ng x 2 nights x 2 rooms), meals \$395(2 people x 2 days travel @59.25, 1 full day @ \$79). \$1,409 each trip x 6 trips = \$8,454 total.	Trips for project PIs to meet with native rough fish fishers and experts throughout project.					\$8,454
							Sub Total	\$14,104
Travel Outside Minnesota								
							Sub Total	-
Printing and Publication								
	Publication	Publication fees	Scientific publication fees, open access (2 x \$4000)					\$8,000
	Printing	Printed materials (and lamination) for outreach activities	Materials for outreach activities. Materials will be reused for additional future outreach events.					\$1,000
							Sub Total	\$9,000
Other Expenses								
		Coffee, tea, light snacks	Refreshments for meetings with native rough fish experts	X				\$1,000
		Coffee, tea, light snacks	Refreshments for meeting on quantitative methods at UMN to share final models and interactive tool	X				\$200
							Sub Total	\$1,200

							Grand Total	\$250,000
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Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
Other Expenses		Coffee, tea, light snacks	These meetings are integral to our project, specifically to Activity 3, where we incorporate knowledge from native rough fish experts for our interactive tool. Refreshments will ensure our meetings have sufficient turnout of experts and are as productive as possible.
Other Expenses		Coffee, tea, light snacks	This meeting is an important component of Activity 3, to share the final models and interactive tool with native rough fish managers.

Non ENRTF Funds

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

Total Project Cost: \$250,000

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: [bb26b4ca-671.pdf](#)

Alternate Text for Visual Component

Graphic showing steps of data collection, model building, model predictions, and project outcomes (including scientific publication, an interactive tool, and outreach activities) for leveraging statewide datasets on native rough fish....

Supplemental Attachments

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

Title	File
Letter of support for Bell Museum fish specimen use from Dr. Cassandra Ford	4e761ead-4cc.pdf
Letter of support from Native Fish for Tomorrow	a2b19bcb-fbf.pdf
SPA Approval Letter	6207f013-e5a.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?

Yes, Sponsored Projects Administration

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")?

Yes

Do you certify that background checks are performed for background check crimes, as defined in Minnesota Statutes, section 299C.61, Subd. 2, on all employees, contractors, and volunteers who have or may have access to a child to

whom children's services are provided by your organization?

Yes

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

Lynn Waterhouse, U of MN - College of Food, Agriculture, and Natural Resource Sciences

