



Environment and Natural Resources Trust Fund

2023 Request for Proposal

General Information

Proposal ID: 2023-029

Proposal Title: Nature's Benefits to People in Minnesota

Project Manager Information

Name: Saleh Mamun

Organization: U of MN - Duluth - NRRRI

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Project Basic Information

Project Summary: We will develop a decision tool for stakeholders and resource managers to assess tradeoffs among ecosystem service benefits that result from different land use policy and management options.

Funds Requested: \$624,000

Proposed Project Completion: June 30, 2026

LCCMR Funding Category: Foundational Natural Resource Data and Information (A)

Project Location

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

Region(s): NE, Central,

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

Region(s): NE, Central,

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.

The lands and waters of Minnesota provide numerous benefits to the citizens of the state: timber and agricultural crops, fishing, hunting and other outdoor recreation opportunities, habitat for pollinators and wildlife, among others. These benefits, collectively known as “ecosystem services”, are affected by how landscapes and watersheds are managed. Land use and land management decisions often involve tradeoffs among provision of different ecosystem services. For example, intensifying agricultural production can generate higher yields and increase farmer income but can result in soil erosion and degraded water quality. Combining agricultural improvement with conservation investments can offer improvements in multiple benefits, high yields and improved water quality. The 2010 Statewide Conservation & Preservation Plan emphasized that natural resource management decisions are interwoven with economic health, regulatory frameworks, human health, and a changing climate. Understanding the broader and long-term consequences of land management decisions and the potential effects on ecosystem services is important. Making poor decisions can be costly in terms of reduced benefits with potentially long-term impacts. The ability to make informed, science-based decisions is critical for ensuring multiple benefits and improving outcomes for both people and nature.

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 develop a decision support tool for stakeholders and managers to understand the effects of land use or land management choices on ecosystem services. This tool will put local, reliable, relatable, quantitative information into the hands of managers to make informed, science-based decisions. This tool will allow alternative “what-if” scenarios to test the impact of actions on ecosystem services, and identify solutions that balance competing needs. For example, the tool will provide information on how a user that can include private landowners and state agencies can improve water quality without reducing other ecosystem benefits.

The first step is to identify and map relevant ecosystem services, such as timber, agricultural products, carbon storage, habitat, water flow, and nutrient retention under current land management in pilot forested and agricultural study areas. Next, we will model alternative land management actions that are legally, logistically, and financially possible to determine land use and management actions that provide maximum benefits to people and nature. This tool can identify critical locations that provide the highest benefits at the lowest cost. The decision-relevant information will be made available as a web-based interactive tool for managers and stakeholders to implement their own goal-based “what-if” scenarios.

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 best aligns with priority A(3) as the outcomes are tied to specific research to help understand how to quantify the services provided by natural resources and conservation and assess the cost and benefits of alternative management actions. This information serves as the necessary first step of the economic valuation of those services. The decision support tool will also provide managers and policymakers with the ability to choose land use and land management options that reflect optimal outcomes considering multiple ecosystem services including carbon management and greenhouse gas emissions, leading to better mitigation and adaptation to climate change.

Activities and Milestones

Activity 1: Identify and map ecosystem services; model alternative land use management scenarios.

Activity Budget: \$415,000

Activity Description:

We will identify two pilot areas; one in a forested landscape and the other in agricultural-dominated land. We will identify and map ecosystem services associated with current land use and management. Initially, we will consider agricultural production, timber harvesting, greenhouse gas emissions (carbon and nitrous oxide), water quality (nitrogen, phosphorus, and sediment retention), wildlife habitat quality, and recreational hunting and fishing. However, we will consider other relevant ecosystem services that are sensitive to land use and management based on recommendations from an expert advisory group.

We will develop alternative land use and land management scenarios based on land management goals. Examples of land use and management include agricultural best management practices, switching to perennial or energy crops for marginal lands, and use of prairie strips to mitigate runoff and enhance biodiversity in agricultural areas. Based on these scenarios we will develop spatially-explicit models for the ecosystem services. Building on the existing research and in-house expertise, we will improve existing ecosystem service models by using higher resolution local data and updated methodologies.

Activity Milestones:

Description	Completion Date
Identify relevant ecosystem services in two pilot areas of Minnesota	December 31, 2023
Map ecosystem services at management-relevant spatial scales	June 30, 2024
Develop alternative land use and land management scenarios	August 31, 2024
Develop spatially-explicit models for each of these land use and management scenarios for ecosystem services.	December 31, 2024

Activity 2: develop a decision support tool that incorporates integrated evaluation of ecosystem services at scales relevant to managers

Activity Budget: \$209,000

Activity Description:

Previous research shows that a small fraction of land is capable of providing a majority of the ecosystem services; we will identify the areas where nature's contribution to people are highest to determine ecosystem services hotspots. Determining ecosystem service hotspot will allow managers to identify areas where alteration of land use and management have a high potential of changing ecosystem services. We will also determine the combination of land use and management patterns that provide optimal benefits for both people and nature. Finally, we will design and develop a web-based interactive tool for policymakers and managers. We will leverage the web-based tools developed by the NRR for the ForCAST and Natural Resources Atlas to develop a decision support tool that will provide information on the distribution of ecosystem service, identify hotspots, and explore consequences of different land use and land management scenarios.

Activity Milestones:

Description	Completion Date
Determine the area where nature's contribution to people is highest to determine ecosystem services hotspots	December 31, 2025
Identify optimal land use and land management scenarios that provide maximum benefits	December 31, 2025
Design and develop a web based interactive decision support tool for policymakers and managers	March 31, 2026

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Stephen Polasky	U of MN - CFANS	CoPI	Yes
John Du Plissis	U of MN - Duluth - NRRRI	CoPI	Yes
Saleh Mamun	U of MN - Duluth - NRRRI	PI	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?

This project builds on decades of collaborative multidisciplinary research at Natural Resources Research Institute and University of Minnesota. For this project, we choose two distinct pilot areas reflecting dominant land-use types in Minnesota and the associated ecosystem services. The modeling approach we take is modular and can be extended to the entire state and to additional ecosystem services. These results can be used in a Phase 2 project to include the entire state of Minnesota, place an economic value on the ecosystem services, and provide an alternative ranking of various land use and management scenarios.

Project Manager and Organization Qualifications

Project Manager Name: Saleh Mamun

Job Title: Postdoctoral Associate

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

Saleh Mamun (he/him) is a Postdoctoral Associate at the University of Minnesota. He is jointly appointed at the Applied Economics Department and Natural Resources Research Institute. His research interest lies in the field of natural resource economics and ecological economics. His research focuses on optimizing decisions for managing natural resources considering nature’s contribution to people. He also uses non-market valuation approach to quantify behavioral and market responses to environmental amenities and hazards. He is a team member of The Natural Capital Project, a collaborative initiative between Stanford University and University of Minnesota.

Mamun has been involved in interdisciplinary collaborative research inquiring the impact of land use and management decisions on ecosystem services. He is a core member of the Natural Capital Index (NCI) project (funded by World Bank) and the Climate Resilience project (funded by Microsoft). In the NCI project, he estimated the land use and management efficiency considering tradeoffs among ecosystem services at country scale for more than 140 countries of the world. The Climate Resilience project investigates how a resource manager’s land use and management decision changes with their climate resilience goals. Mamun is also listed as senior personnel at an LCCMR-funded project where he estimates the tradeoff among ecosystem services for alternative forest management practices.

Mamun earned his Ph.D. in Economics from the University of New Mexico. Prior to his doctorate, Mamun completed an MBA in Finance from the Institute of Business Administration, University of Dhaka, and a Bachelor’s in Civil Engineering from Bangladesh University of Engineering and Technology. He worked for six years in construction, marketing, and government in Bangladesh. He brings business, development, and engineering perspective to his research experience.

Organization: U of MN - Duluth - NRRRI

Organization Description:

The Natural Resources Research Institute (NRRI) is a part of the University of Minnesota research enterprise and employs over 130 scientists, engineers and technicians. Its mission is to deliver integrated research solutions that value our resources, environment and economy for a sustainable and resilient future.

NRRI collaborates broadly across the University system, the state and the region to address the challenges of a natural resource-based economy.

By partnering with industry, business leaders, agency decision-makers and many others, NRRI researchers frame and deliver on real-world solutions. NRRI scientists have extensive experience in managing large, interdisciplinary projects. Major objectives include the development of tools for environmental assessment and resource management. NRRI's role is as an impartial, science-based resource that develops and translates knowledge by characterizing and defining value-resource opportunities, minimizing waste and environmental impact, maximizing value from natural resource utilization and maintaining/restoring ecosystem function.

Major outcomes from NRRI projects include informing environmental management and policy and assisting industry and communities in defining and maintaining the social license to operate in natural systems. NRRI has established mechanisms for sharing outcomes through press releases, publication in peer-reviewed journals, technical reports, annual reports, periodicals, and through social media channels.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
Personnel								
Saleh Mamun, Principal Investigator		Project management, optimization, hotspot/critical natural assets			17.28%	0.6		\$52,308
John Du Plissis, Co-PI		Stand-level management and growth and yield modeling			25.1%	0.21		\$34,810
Steve Polasky, Co-PI		Managing the project and advising			25.1%	0.03		\$14,564
Kris Johnson		Spatial data management and analysis, programming, application development			25.1%	0.6		\$59,183
Chris Wright		Carbon Modeling			25.1%	0.3		\$34,490
Kristi Nixon		Spatial analysis and data management			22.3%	0.39		\$33,330
Katya Kovalenko		ES hotspots in relation to inequality; Model fish and aquatic cultural ES; Contribute to modeling, statistical analysis of other ES			25.1%	0.21		\$22,508
Mei Cai		HSPF modeling of water quantity and water quality			25.1%	0.51		\$50,762
Will Bartsch		Spatial data management and analysis, application development			25.1%	0.12		\$15,056
Chris Filstrup		defining ES in aquatic ecosystems; analysis & interpretation of water quality data			25.1%	0.12		\$12,719
Chan Lan Chun		Impacts of water quality and nutrient management on ES; Interpretation of water quality modeling data for impacts (toxicity, environmental degradation)			25.1%	0.12		\$20,127
Ron Moen		Wildlife / Habitat modeling			25.1%	0.24		\$40,311
Alexis Grinde		Wildlife / Habitat modeling			25.1%	0.24		\$29,790
David Mulla		Ag ecosystem service modeling			25.1%	0.03		\$9,518
Solomon Folle		Ag ecosystem service modeling			25.1%	0.75		\$65,661
William Lazarus		Ag ecosystem service modeling			25.1%	0.15		\$26,836
Jane Reed		Jane will lead website development and assist with the mapping application development.			22.3%	0.21		\$16,367
Lucinda Johnson		The main role as consultant to the overall project			25.1%	0.03		\$7,361

William Herb		Water quality and quantity modeling			25.1%	0.15		\$16,983
							Sub Total	\$562,684
Contracts and Services								
Hawthorne Spatial LLC	Sub award	Develop optimization code and documentation. Support optimization analysis. Contribute to DST development. Contribute to project reports and papers.				0.06		\$43,443
							Sub Total	\$43,443
Equipment, Tools, and Supplies								
							Sub Total	-
Capital Expenditures								
							Sub Total	-
Acquisitions and Stewardship								
							Sub Total	-
Travel In Minnesota								
	Conference Registration Miles/ Meals/ Lodging	Standard GSA rates will be applied.	This allocation will be used to cover travel related to the presentation of results to scientific communities.					\$4,400
	Miles/ Meals/ Lodging	Standard GSA rates will be applied	This allocation will be used to cover travel costs between Twin Cities and Duluth for meetings and collaboration.					\$2,280
							Sub Total	\$6,680
Travel Outside Minnesota								
							Sub Total	-

Printing and Publication								
							Sub Total	-
Other Expenses								
		GIS Lab Fees	The NRRI GIS Lab charges an hourly fee of \$5.52 on a proportion of the hours that GIS Lab members work on the project. This covers lab IT infrastructure and software licenses.					\$10,653
		Domain Fee and Web Hosting	NRRI uses private companies to host the website and services and manage the domain. Annual fees are incurred for this service.					\$540
							Sub Total	\$11,193
							Grand Total	\$624,000

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
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Non ENRTF Funds

Category	Specific Source	Use	Status	Amount
State				
			State Sub Total	-
Non-State				
In-Kind	UMN unrecovered indirect costs are calculated at the UMN negotiated rate for research of 55% modified total direct costs.	Indirect costs are those costs incurred for common or joint objectives that cannot be readily identified with a specific sponsored program or institutional activity. Examples include utilities, building maintenance, clerical salaries, and general supplies. (https://research.umn.edu/units/oca/fa-costs/direct-indirect-costs)	Secured	\$333,057
			Non State Sub Total	\$333,057
			Funds Total	\$333,057

Attachments

Required Attachments

Visual Component

File: [f40866df-558.pdf](#)

Alternate Text for Visual Component

The visual shows a flow diagram of activities involved in this project. It shows alternative land uses and managements with pictures, then corresponding ecosystem services with dials and arrows. It show optimization and solution with a computer and dials and arrows respectively....

Optional Attachments

Support Letter or Other

Title	File
UMD Sponsored Projects Administration transmittal letter	347cbbb1-0c1.pdf
Hawthorne Spatial LLC	9b4db18b-234.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

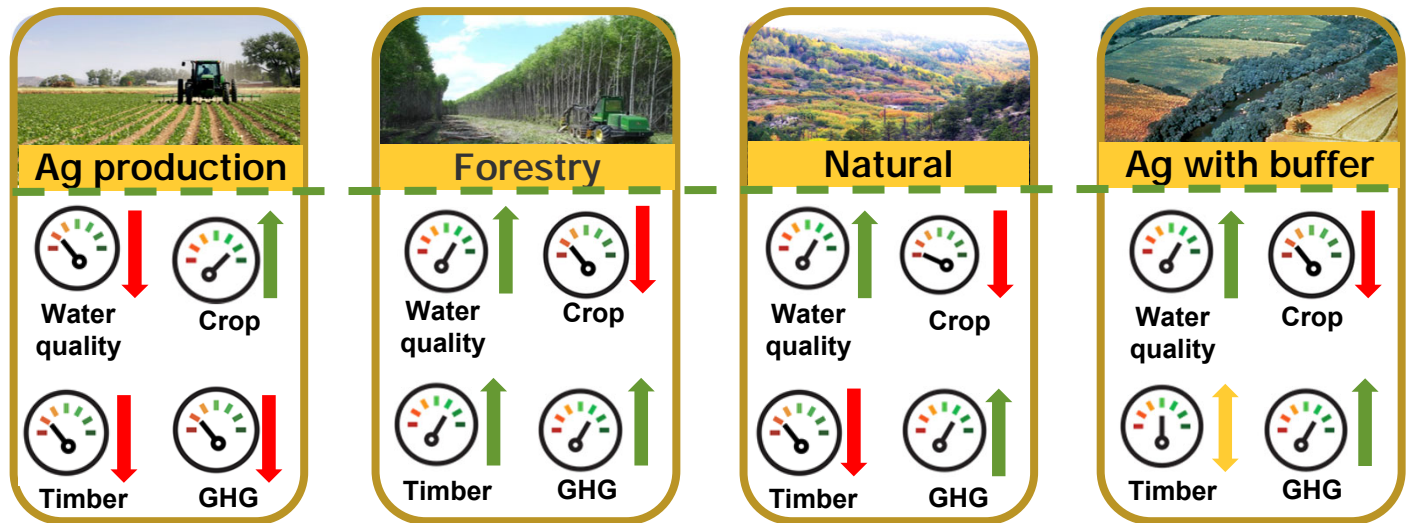
Does the organization have a fiscal agent for this project?

Yes, Sponsored Projects Administration

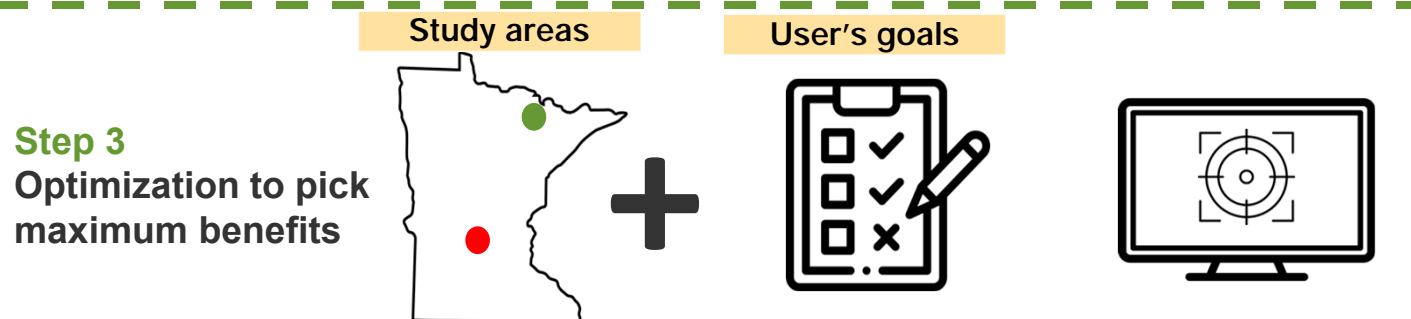
MINNESOTA CHALLENGE: Land managers have no way to holistically evaluate ecosystem services - basic services that make life possible for people - for land parcels which allows for optimized land use.

PROJECT DESCRIPTION: Develop a web-based, interactive decision tool for land managers to define benefits among ecosystem services that result from different land use policy and management options.

Step 1 Develop land use and management scenarios



Step 2 Model ecosystem services



Step 3
Optimization to pick maximum benefits

Step 4 Series of land use planning recommendations



PROJECT OUTCOMES: By assessing land use holistically managers and stakeholders can incorporate a variety of ecosystem services into their land use management options to make decisions that benefit both people and nature in Minnesota.

