Environment and Natural Resources Trust Fund

2024 Request for Proposal

General Information

Proposal ID: 2024-185

Proposal Title: Bioacoustics for Species Monitoring and Conservation Phase II

Project Manager Information

Name: Elena West

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

Office Telephone: (612) 743-1530

Email: elwest@umn.edu

Project Basic Information

Project Summary: This study will leverage our current bioacoustics monitoring framework to assess avian diversity at the statewide scale through a citizen science acoustic monitoring program, with a focus on private lands.

Funds Requested: $568,000

Proposed Project Completion: June 30, 2027

LCCMR Funding Category: Methods to Protect, Restore, and Enhance Land, Water, and Habitat (F)

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.

In the two years since our Bioacoustics project began, artificial-intelligence algorithms that can automatically identify thousands of species of vocalizing taxa are now available, significantly improving the efficiency with which large amounts of audio data can be analyzed. This has enabled an unprecedented approach to biodiversity monitoring that is especially applicable for long-term studies, and for use in habitats where other survey methods are difficult or impossible, such as lands under private ownership.

Importantly, private lands may support rare and declining species in unique ways and may serve as guideposts for integrating ecosystem restoration and biodiversity conservation on public lands. The scarcity of comprehensive biodiversity data on private lands represents a significant opportunity to document and preserve valuable species information for the historical record but also to understand how divergent management strategies and resultant differences in landscape structure between public and private lands have affected avian biodiversity in Minnesota.

Drawing on our acoustic monitoring framework established for a single species, the red-headed woodpecker, we will develop a statewide citizen science program that will address these knowledge gaps by providing acoustic monitoring devices to private landowners, leveraging Minnesotan's enthusiasm and interest in birds to help collect biodiversity data on private lands.

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.

The growing versatility and falling cost of bioacoustics technologies are creating a wildlife-and-ecosystem science that's faster and more powerful, but also more accessible. To that end, we seek funding to develop a statewide citizen science program that will address key knowledge gaps by recruiting, training, and providing acoustic monitoring devices to private landowners. Audio data will then be gathered from volunteers, archived, and analyzed to address our research questions. We will develop a program to manage volunteer recruitment, training, data collection and storage, assessment of key questions, and outreach.

Our approach builds on the bioacoustics monitoring work we have been conducting for red-headed woodpeckers by expanding the spatial and temporal scale of sampling, with a particular focus on private lands, where data on avian community diversity is currently lacking. Our approach also leverages collaborations with local chapters of the Audubon Society, enabling us to increase outreach capacity and sampling throughout the state.

This project will also build capacity of University of Minnesota students to pursue the many kinds of investigations that new bioacoustics tools and enormous datasets make possible through training and mentorship, so that they become natural resource professionals with relevant experience and marketable job skills.

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 has three main outcomes: 1) producing data that fill a knowledge gap needed for biodiversity conservation and management, 2) creating a novel and meaningful program for volunteer participation in citizen science, and 3) training the next generation of natural resource professionals in an emerging technology and providing marketable job skills. This project will result in a comprehensive understanding of avian diversity on public and private lands across Minnesota. With the support of volunteer landowners, we will generate statewide data to capture variation in avian biodiversity in the state and provide key information for management and conservation.

Activities and Milestones

Activity 1: Recruit statewide and train volunteers to participate in the avian bioacoustics monitoring project.

Activity Budget: $74,000

Activity Description:
The objective of this activity is to attract, inform, and enlist the help of private landowner volunteers to participate in the Avian Bioacoustics Monitoring project statewide. To accomplish this objective we will facilitate volunteer recruitment and training through well designed events and resources, including traveling statewide to diverse groups including local Audubon chapters, Pheasants Forever, Ducks Unlimited, the Minnesota Master Naturalists Program, and The Wildlife Society. We will also expand our social media presence and design informative media and handouts related to project recruitment. Our goal is to recruit and train 300 volunteers for each of two years of data collection, which will also help us increase spatial coverage to better represent all of Minnesota's habitats on public and private lands.

Activity Milestones:

Description	Approximate Completion Date
Avian Bioacoustics Volunteer Training	December 31, 2024
Recruit and train 300 volunteers for 2025 field season (avian breeding season)	March 31, 2025
Avian Bioacoustics Volunteer Training	December 31, 2025
Recruit and train 300 volunteers for 2026 field season (avian breeding season)	March 31, 2026

Activity 2: Pilot work, audio data collection throughout Minnesota, data processing, and analysis.

Activity Budget: $420,000

Activity Description:
During pilot work in summer 2024, we will validate field methods and compile species vocalization libraries, focusing on a subset of Audubon Minnesota's Priority Breeding Species at the Cedar Creek Ecosystem Science Reserve, which has natural habitats that represent much of the state, making it an ideal location for collection of training data for focal species.

We will conduct acoustic monitoring statewide to derive measures of avian community diversity relevant to biodiversity conservation. We will integrate a citizen science acoustic monitoring program with emerging artificial intelligence approaches that efficiently identify the identity and occurrence of individual species on both public and private lands. To accomplish this objective, ARU kits will be shared with participating volunteer landowners. Once audio data have been recorded, we will collect sound files from volunteers (via online, mail, and in person), back them up and archive copies, and analyze audio data to evaluate how differences in land management practices (and the resulting differences in forest structure and disturbance regimes) between public and private lands affect avian community diversity and composition. We will use occupancy models to estimate species specific occurrence probabilities and community diversity from the acoustic data while accounting for imperfect detection of rare species.

Activity Milestones:

Description	Approximate Completion Date
Order and prepare equipment, develop ARU deployment methods at Cedar Creek and identify deployment locations	December 31, 2024
ARU deployment and field work (year 1)	September 30, 2025
Audio data backup, processing, and analysis of data collected during year 1	September 30, 2026

ARU deployment and field work (year 2)	September 30, 2026
Audio data backup, processing, and analysis of data collected during year 2	June 30, 2027
Data analysis and summary (ongoing)	June 30, 2027

Activity 3: Dissemination of results and public outreach via media, presentations, publications, and popular articles.

Activity Budget: $74,000

Activity Description:
The objective of this activity is to share project results with private landowner volunteers and disseminate information to conservation professionals, land managers, and the public. To accomplish this objective, we will prepare popular and scientific presentations that will be given to volunteers, individuals, and organizations working at the interface between land management and biodiversity conservation. We will prepare popular articles and manuscripts for publication in peer-reviewed journals. We will also create programs in the use of ARUs and other bioacoustics technologies for bird conservation organizations, such as the Minnesota Ornithologists' Union, local chapters of the Audubon Society, and individuals engaged in Minnesota natural resources stewardship.

Activity Milestones:

Description	Approximate Completion Date
Present at the 2025 meeting of the Minnesota Ornithologists' Union	December 31, 2025
Present at the 2026 Minnesota Chapter of the Wildlife Society meeting	February 28, 2026
Present at the 2026 Ecological Society of America meeting	August 31, 2026
Present at the 2027 Minnesota Chapter of the Wildlife Society meeting	February 28, 2027

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Dr. Caitlin Barale Potter	Cedar Creek Ecosystem Science Reserve	Dr. Potter will help coordinate field logistics, development of project protocols, and will assist with the writing and dissemination of results.	No
Dr. David Andersen	Minnesota Cooperative Fish and Wildlife Research Unit	The Minnesota Cooperative Fish and Wildlife Research Unit will provide in-kind and other support, including purchase and loan of additional supplies (audio recorders, SD cards for recorders, batteries, etc.). Dr. Andersen will also serve as a scientific advisor to the project.	No
Rob Schultz	Audubon Minnesota	Funds provided by Audubon Minnesota will support recruitment and communication with citizen scientist volunteers, dissemination of project results to local Audubon chapters, members of the public, land managers, and state and federal agencies.	No
Marian Weidner	Audubon Chapter of Minnesota	Ms. Weidner will help coordinate development of project training materials and protocols. Funds from ACM will support two research technicians for one year, training materials, citizen science volunteer engagement and communication, and dissemination of project results.	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?

This project will provide foundational data on avian diversity in Minnesota, including rare and declining species. ENRTF support will increase the likelihood that the project can continue longer-term, helping to ensure continued support from the University of Minnesota, Audubon chapters, and numerous small donors and volunteers. This project will initiate long-term research opportunities for students in the Department of Fisheries, Wildlife, and Conservation Biology at the University of Minnesota who will participate in research described herein. Students will continue supervised research activities after this project is completed, which will support development of a long-term dataset and help secure future funding.

Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
Bioacoustics for Broad-Scale Species Monitoring and Conservation	M.L. 2021, First Special Session, Chp. 6, Art. 6, Sec. 2, Subd. 03n	$305,000

Project Manager and Organization Qualifications

Project Manager Name: Elena West

Job Title: Teaching Assistant Professor, Department of Fisheries, Wildlife, and Conservation Biology at the University of Minnesota

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

West's expertise is in wildlife ecology, management, and conservation, with a focus on birds. She has worked on avian behavior and ecology since 2008. Most recently, she and collaborators Minnesota Cooperative Fish and Wildlife Research Unit (Dr. David Andersen), Audubon Chapter of Minneapolis, and Cedar Creek Ecosystem Science Reserve (Dr. Caitlin Barale Potter) have carried out research on red-headed woodpeckers at the Cedar Creek Ecosystem Science

Reserve and through a current bioacoustics monitoring project at the statewide scale (both supported by the ENTRF). Research at Cedar Creek using an online platform has engaged citizen scientists from Minnesota, nearly every state in the U.S., and multiple countries worldwide. To date the project has resulted in three peer-reviewed publications (in preparation), numerous presentations, and a best management plan for this species in the state. Media interest has included outlets such as the Minnesota Star Tribune and PBS Pioneer. West is an active member in The Minnesota Ornithologists' Union, Ecological Society of America, and the American Ornithological Society.

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

Organization Description:
The Department of Fisheries, Wildlife, and Conservation Biology at the University of Minnesota Twin Cities provides world-class training and expertise to contribute to the management, conservation, and sustainable use of fisheries and wildlife resources. Our goal is to use innovative teaching, research, and outreach to respond to societal needs for information and education pertaining to natural resources.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
Elena West		Principle Investigator responsible for responsible for overall project management, organizing all personnel across activities, as well as directly supervising and mentoring project assistant, graduate and undergraduate research assistants.			36.8%	0.46		$66,182
Full-time Graduate Research Assistant		Field Leader responsible for field work, data management, and analyses required to achieve project activities. One 50% GRA for two years.			24.1%	1		$103,922
Undergraduate Research Assistant		Undergraduate Research Assistants will assist with ARU deployments across the state, device and data management, and sound analyses. 6 undergrads 40hrs/wk summer, 20hrs/wk academic year for 2 years.			0%	7.5		$117,000
Project Associate		Leads volunteer recruitment, training, and coordination. Manages equipment and acoustic device inventory, data acquisition and management, assists in the development and testing of acoustic recorder hardware, and co-leads field work safely and efficiently, e.g. most field activities require at least two individuals.			32%	2		$143,520
							Sub Total	**$430,624**
Contracts and Services								
							Sub Total	**-**
Equipment, Tools, and Supplies								
	Equipment	400 Autonomous Recording Unit (ARU) kits: ARU, security case, memory cards, and batteries @ $180 ea.	Required to collect avian acoustic data at sites across Minnesota.					$72,000
	Tools and Supplies	Field supplies for navigation, deploying ARUs, and recording ARU site vegetation information (GPS units, zipties, field notebooks, densiometers,	The purpose to the field supplies is to meet the everyday needs of various aspects of field work, such as					$2,026

		carrying cases and storage containers for equipment and supples): $1,013 per year for 2 years of data collection.	deploying ARUs and recording field data.					
	Equipment	Laptop computers to program ARUs, and download and store audio data: $250/laptop for 8 laptops.	Small, portable computers are needed to program ARUs, download data, store, and transfer data to the cloud.					$2,000
	Tools and Supplies	10 external hard drives: 8TB drives that are portable @ $150 each	Data storage capacity for field, lab, and office data maintenance and analysis.					$1,500
							Sub Total	**$77,526**
Capital Expenditures								
							Sub Total	**-**
Acquisitions and Stewardship								
							Sub Total	**-**
Travel In Minnesota								
	Miles/ Meals/ Lodging	Miles traveled to complete field work. Vehicle rental: 6 vehicles for 4 months each during project duration @ $1,100/month/vehicile = $26,400. Mileage for 2.5 years of fieldwork requiring 65,000 miles of travel for deploying ARUs @ $0.23 per mile = $41,350).	The purpose of this travel support is to provide the transportation support to complete field work/ARU deployment and maintenance, delivering presentations, and meeting with collaborators and citizen science volunteers in Minnesota.					$41,350
							Sub Total	**$41,350**
Travel Outside Minnesota								
	Conference Registration Miles/ Meals/ Lodging	Travel support for PI, Graduate Research Assistant, and Project Assistant to attend one professional meeting each year for 2 years.	Needed for presentation of project methods, results, and implications at relevant professional meetings. For example, Annual meeting of The Ecological Society of America.	X				$4,400
							Sub Total	**$4,400**

Printing and Publication								
	Publication	Publication page charges for peer-reviewed journals: 2 per year @ $2000/article for 2 years.	Needed to pay for publication of project related scientific articles.					$8,000
	Printing	Volunteer recruitment flyers and announcements in print media and training materials.	Needed to broadly recruit volunteers to participate in project activities and for training materials and handouts.					$1,600
							Sub Total	**$9,600**
Other Expenses								
		Site-use fee (Cedar Creek Ecosystem Science Reserve)	Pilot work and reference libraries will be carried out at the Cedar Creek Ecosystem Science Reserve (site-use fee is $500): $500/year for 3 years.					$1,500
		Postage	Needed to mail ARU kits and memory cards to and from volunteers to distribute supplies and collect data.					$3,000
							Sub Total	**$4,500**
							Grand Total	**$568,000**

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
Travel Outside Minnesota	Conference Registration Miles/Meals/Lodging	Travel support for PI, Graduate Research Assistant, and Project Assistant to attend one professional meeting each year for 2 years.	X

Non ENRTF Funds

Category	Specific Source	Use	Status	Amount
State				
			State Sub Total	**-**
Non-State				
In-Kind	Minnesota Cooperative Fish and Wildlife Research Unit	Additional autonomous Recording Units (ARUs) needed for audio recordings: AudioMoth Recorders (25 ARUs @ $100 per ARU = $2,500)	Potential	$2,500
In-Kind	Minnesota Cooperative Fish and Wildlife Research Unit	Additional equipment for fieldwork including batteries, SD cards, and GPS units	Potential	$2,000
In-Kind	Audubon Minnesota	Funds provided by Audubon Minnesota will support recruitment and communication with citizen scientist volunteers, dissemination of project results to local Audubon chapters, members of the public, land managers, and state and federal agencies.	Potential	$2,000
Cash	Audubon Chapter of Minneapolis	Funds provided by the Audubon Chapter of Minneapolis RHWO Recovery Project will support field technician salaries ($8,000/technician x 2 technicians x 1 field season = $16,000)and costs associated with dissemination of project results and the monitoring protocol to local Audubon chapters, members of the public, land managers, and state and federal agencies working on red-headed woodpecker habitat restoration and conservation ($1000/year for 2 years).	Potential	$18,000
Cash	University of Minnesota unrecovered indirect cost return (55% MDTC).	$568,000 direct total - $36,434 tuition (exempt category) = $531,566 x .55 = $292,361 unrecovered IDC	Secured	$292,361
			Non State Sub Total	**$316,861**
			Funds Total	**$316,861**

Attachments

Required Attachments

Visual Component

File: 2a44aa0d-ef0.pdf

Alternate Text for Visual Component

Diagram of our approach to engage volunteers, collect audio data on public and private lands, process and analyze audio data, and share results....

Optional Attachments

Support Letter, Photos, Media, Other

Title	File
University of Minnesota Sponsored Projects Administration Approval Letter	4c292580-2be.pdf
Letter of support for Bioacoustics for Species Monitoring and Conservation Phase ll	c94e797a-b85.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