Environment and Natural Resources Trust Fund
2026 Request for Proposal

General Information

Proposal ID: 2026-566

Proposal Title: Enhancing Wildlife Education: AI-Powered Interactive Learning Experiences

Project Manager Information

Name: Ce Yang

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

Office Telephone: (612) 626-6419

Email: ceyang@umn.edu

Project Basic Information

Project Summary: This project develops AI-powered interactive wildlife learning tools and hands-on programs to engage students in studying wildlife and ecosystem health across diverse Minnesota biomes.

ENRTF Funds Requested: $295,000

Proposed Project Completion: June 30, 2028

LCCMR Funding Category: Small Projects (G)
    Secondary Category: Education and Outdoor Recreation (C)

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 Minnesota, over 50% of wetlands, 99% of native prairies, and 44% of forests have been lost or fragmented due to urbanization, agriculture, and transportation, leading to reduced wildlife habitats and disrupted ecosystem functions. Additionally, more than 56% of lakes, rivers, and streams fail to meet water quality standards due to pollution, runoff, and invasive species. Monitoring aquatic wildlife species and invasive organisms is critical for adaptive conservation strategies. Educational programs from the University of Minnesota Extension, the DNR, and other organizations engage youth in wildlife identification, habitat management, tracking wildlife, and stewardship activities, emphasizing hands-on nature-based learning. While tools like iNaturalist are used for wildlife identification and citizen science purposes, they lack interactive learning features that make education more engaging. Recent advancements in AI (large language models (LLMs)) enable multimodal systems that combine image recognition with question-answering communication. Through the learning of expert knowledge, these models can be trained to identify species from images and provide detailed responses about the species when users ask questions. By integrating LLMs into wildlife recognition tools, wildlife educators can transform passive identification into active learning for Minnesotan youth.

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.

This project aims to develop AI-enabled interactive learning tools using vision-language models and vision-question-answering techniques to enhance wildlife education in Minnesota, focusing specifically on water bugs (as bioindicators of water quality) and invasive plant and pest species. The proposed technology will allow educators and students to identify species through images, learn about their ecological significance, and receive contextually relevant information in real-time - for example, understanding a water bug's pollution tolerance level or an invasive plant's impact on local ecosystems. Based on input from DNR and Greater Minnesota Regional Parks and Trails Commission experts, and designed for accessibility on both computers and smartphones, this user-friendly tool will support both classroom learning and field applications, ultimately empowering students to explore biodiversity while contributing meaningful data to citizen science initiatives that monitor water quality and track invasive species throughout Minnesota's diverse ecosystems. The plan is to deploy the tool throughout Minnesota.

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?

By engaging youth in interactive wildlife observation through this program, we aim to equip 300 young people distributed throughout the state with various educational programs as citizen naturalists with the skills for (i) observing wildlife (focusing on water bugs and invasive species), (ii) measuring animal behavior and habitat health indicators, and (iii) sharing wildlife conservation knowledge and data effectively with audiences. A by-product of these outcomes is an AI-based wildlife monitoring system that uses vision-language models and vision-question-answering techniques. These outcomes promote the democratization of ecological data collection and lower the barriers to entry, enabling active care about Minnesota's ecosystems.

Activities and Milestones

Activity 1: Development of Wildlife Interactive Learning Tools

Activity Budget: $95,000

Activity Description:

We propose to develop an AI-enabled cutting-edge interactive learning tool that leverages vision-language models (VLMs) and vision-question-answering (VQA) techniques to enhance wildlife education in Minnesota. This tool will focus on two critical categories: identifying and learning about water bugs, which serve as bioindicators of water quality in Minnesota, and identifying and learning of invasive plant and pest species, which threaten Minnesota's ecosystems. By integrating advanced AI technologies, the tool will allow users—particularly educators and students—to identify species through images, gain expert knowledge of the species and ask questions to learn about their ecological roles, and receive real-time, contextually rich answers. For example, users could upload a photo of a water bug to receive the identification and an explanation of its pollution tolerance level, and inquire about the impact of a specific invasive plant on local biodiversity. The app will be designed to be user-friendly and accessible with or without internet access, ensuring its utility in both classroom settings and outdoor fieldwork. This tool is unique in that it leverages the user-labelled image sets in iNaturalist and large language models to provide more accurate identification and interactive wildlife education with a focus on localized, personalized learning through question-answering.

Activity Milestones:

Description	Approximate Completion Date
Data collection of wildlife species image and educational information	December 31, 2026
Development of the AI-based Interactive Learning Tool for Water Bug and Water Quality Education	June 30, 2027
Development of the AI-based Interactive Learning Tool for Invasive Plant and Pest Species	December 31, 2027

Activity 2: Pilot Testing in Diverse Biomes and Gathering Stakeholder Feedback

Activity Budget: $102,000

Activity Description:

To ensure the effectiveness of the tool, we will conduct pilot testing across Minnesota's biomes including urban areas, prairies, and forests. These settings represent distinct ecological challenges and educational opportunities, allowing us to evaluate the tool's adaptability to various environments. During these pilots, we will work with the University of Minnesota Extension to engage educators and conservation professionals to use the app to identify and learn water bugs and invasive species in these biomes while providing feedback on functionality, accuracy, and usability of the tool. Pilot activities will include hands-on workshops where participants test the app in real-world scenarios such as stream sampling or invasive plant surveys. Feedback collected from stakeholders will be analyzed to refine the tool's features, improve its AI-enabled functionalities for better species identification and question-answering accuracy, and ensure it aligns with educational goals. By tailoring the tool based on user input, we aim to create an engaging and effective resource that not only enhances wildlife education but also citizen science with broader ecosystem monitoring, analysis conservation efforts in Minnesota's diverse biomes.

Activity Milestones:

Description	Approximate Completion Date
Pilot test the interactive wildlife learning tool in urban areas.	June 30, 2027
Pilot test the interactive wildlife learning tool in prairies	December 31, 2027
Pilot test the interactive wildlife learning tool in forests.	June 30, 2028

Activity 3: Youth Wildlife Education Through State Parks and Nature Centers

Activity Budget: $98,000

Activity Description:

This activity focuses on engaging middle and high school students in biology and wildlife education by leveraging University of Minnesota Extensions' partnerships with teachers that offer youth education through various programs and curriculums in Minnesota. The goal is two-fold: 1) provide teachers/students immersive, interactive learning experiences that use water bug studies as indicators of water quality and invasive species identification; 2) assess the value of advanced AI technology in wildlife education and put guard to the use of large language models for safe deployment among youth. We will reach out to state parks and nature centers which offer field trips and provide hands-on training such as water sampling and aquatic macroinvertebrates identification and educate students to use our tool to analyze pollution tolerance scores to access water quality and ecosystem health. Through the network of UMN extension, we will also partner with programs such as Driven to Discover and Minnesota School Forest to integrate our AI-interactive tool to their workshops on water bug ecology and invasive species identification. Through these activities, feedback will be collected to improve the design and user-friendliness of the tool.

Activity Milestones:

Description	Approximate Completion Date
Demonstrate to wildlife educators the use of the AI-interactive tool and gather feedback.	May 31, 2027
Integrate the use of the AI-interactive tool in field trips and hands-on trainings of youth	December 31, 2027
Keep improving the AI-interactive tool and expanding its use in more wildlife and biology education	June 30, 2028

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Saad Bedros	University of Minnesota	Supervise activities including the development of AI-interactive wildlife learning tool and outreach activities.	Yes
Vassillios Morellas	University of Minnesota	Advise graduate students to develop the AI-interactive wildlife learning tools.	Yes
Amy Rager	University of Minnesota, Extension	Provide consulting and feedback for the AI-interactive tool and connection with wildlife educators to improve user experience.	Yes
Ted Morris	University of Minnesota	Advise graduate students to evaluate and test digital tools with LLM and VLM for wildlife learning.	Yes
Andrea Lorek Strauss	University of Minnesota, Extension	Connection with wildlife educators to improve user experience through classroom and outdoor programs.	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?

Our AI-powered interactive learning tool development is transferable and scalable. We will expand the identification to wildlife in Minnesota biomes, including trees, birds, mammals, reptiles, forest and landscapes pests, beneficial pests and pollinators. Through the University of Minnesota Extension, we will partner with DNR and other centers, agencies to conduct pilot programs that incorporate the AI-powered interactive learning tool into different wildlife education curriculums. We will align with USDA Natural Resources Conservation Service priorities and apply for the Conservation Innovation Grant in July 2027, which supports the development of innovative tools and technologies to advance conservation efforts.

Project Manager and Organization Qualifications

Project Manager Name: Ce Yang

Job Title: Associate Professor

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

Dr. Yang's expertise lies in leveraging computer vision and AI to develop innovative solutions for environmental challenges. In a recent project, her group is advancing research on multimodal vision-based large language models (LLMs) and interactive question-answering systems that facilitate the learning of landscape and forest pests. Her team is also actively developing smartphone applications as user-friendly tools to advance abiotic and biotic stress detection in agriculture and ecosystems, combining AI-powered interactivity with accessibility to make technology-driven solutions more tangible and impactful to the agricultural and ecosystem community. Her research integrates diverse sensing technologies, including computer vision, multispectral, hyperspectral, and LiDAR imaging, to monitor plant nutrient deficiencies, disease outbreaks, and environmental stressors. This work supports sustainable resource management by optimizing inputs, reducing environmental contamination, and promoting conservation practices. Dr. Yang's research also extends to regenerative farming and ecological studies, including analyzing carbon sequestration processes to enhance climate resilience. At the University of Minnesota, Dr. Yang directs the Agricultural Robotics Laboratory, a hub for innovation in robotic and sensing technologies, AI applications, and interactive tool development. Her team oversees the entire research pipeline—from experimental design and data collection to advanced analytics and dissemination of findings through scientific publications, stakeholder workshops, and outreach initiatives. By collaborating with agronomists, ecologists, technologists, and industry partners, Dr. Yang translates her research into practical tools that

improve agricultural and environmental stewardship and education. Dr. Yang's unique combination of expertise in AI-driven computer vision systems, sensing-based detection technologies for agriculture and ecosystems, and interactive tool development (including smartphone apps) positions her as an ideal leader for projects requiring innovative approaches to wildlife detection, interactive education, and sustainable resource management.

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

Organization Description:
The University of Minnesota-Twin Cities campus, spanning the East Bank, West Bank, and Saint Paul Campuses, is the flagship campus of the University of Minnesota (UMN) system, with nearly 48,000 students and ~3,800 academic staff. Its educational and research programs in science and engineering consistently rank in the top 25 in nearly all disciplines. This project will be housed within the Department of Bioproducts and Biosystems Engineering (BBE) in the College of Food, Agricultural and Natural Resource (CFANS), and the Minnesota Robotics Institute (MnRI) in the College of Science and Engineering and UMN Extension. CFANS is at the core of tackling issues in the environment, agriculture, and natural resources. The BBE department has very dynamic interdisciplinary research activities and wide collaboration across the university including UMN extension. MnRI is an outcome of UMN's Discovery, Research, and Innovation Economy (MnDRIVE) initiative, which brings interdisciplinary researchers together to solve grand challenges and increase Minnesota's position as a global robotic sensing research and education leader. MnRI offers outreach programs ranging from robotics summer camps to support of high school robotics teams throughout the state. This project will be done with UMN Extension specialists and wildlife education programs in their network.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineli gible	% Bene fits	# FTE	Class ified Staff?	$ Amount
Personnel								
Ce Yang-PI		Oversee all activities and milestones of the project. Work with co-PIs and advise the graduate student to work on the three activities.			27%	0.16		$34,666
Saad Bedros-Co-PI		Supervise activities including the development of AI-interactive wildlife learning tool and outreach activities.			27%	0.32		$35,819
Vassilios Morellas - Co-PI		Advise graduate students to develop the AI-interactive wildlife learning tools and outreach to user groups for education.			27%	0.16		$49,342
Amy Rager - Co-PI, extension		Provide consulting and feedback for the AI-interactive tool and connection with wildlife educators to improve user experience.			27%	0.08		$11,455
Andrea Strauss- Co-PI, extension		Connection with wildlife educators to improve user experience through classroom and outdoor programs.			27%	0.08		$11,498
Theodore Morris -Co-PI		Develop, evaluate and test digital tools with LLM and VLM for student wildlife learning			27%	0.16		$33,635
Graduate Research Assistant		Development and improvement of the AI-enables interactive wildlife learning tool.			47%	0.76		$107,649
							Sub Total	**$284,064**
Contracts and Services								
-							**Sub Total**	-
Equipment, Tools, and Supplies								
	Tools and Supplies	Extension and education materials, event space rental and meals	Extension education					$5,936
							Sub Total	**$5,936**
Capital Expenditures								

							Sub Total	-
Acquisitions and Stewardship								
							Sub Total	-
Travel In Minnesota								
	Miles/ Meals/ Lodging	Five trips per year to travel to different centers and schools for extension education activities. Average 100 miles per trip, with 3-4 people. ~$500 per trip.	Extension education					$5,000
							Sub Total	$5,000
Travel Outside Minnesota								
							Sub Total	-
Printing and Publication								
							Sub Total	-
Other Expenses								
							Sub Total	-
							Grand Total	**$295,000**

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: $295,000

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: [334f2119-4db.pdf](334f2119-4db.pdf)

Alternate Text for Visual Component

Visual of the project - Enhancing wildlife education: AI-powered interactive learning experiences. There are three main activities: 1) Develop AI-powered interactive wildlife learning tool; 2) Pilot test in Minnesota biomes including urban areas, prairies and forests; 3) Deploy the tool in youth wildlife education through state parks and nature centers....

Supplemental Attachments

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

Title	File
SPA letter	[b5dfd6aa-f10.pdf](b5dfd6aa-f10.pdf)
Budget & Justification	[658a3bd5-5c9.pdf](658a3bd5-5c9.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?

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:

     Resha Tejpaul, 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

     N/A