Environment and Natural Resources Trust Fund

2026 Request for Proposal

General Information

Proposal ID: 2026-456

Proposal Title: Immersive Education: VR-Driven Wetland STEM Engagement

Project Manager Information

Name: Brian Dingmann

Organization: U of MN - Crookston

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Project Basic Information

Project Summary: This project uses VR to enhance wetland research education, training future scientists in microbial sampling and antibiotic discovery while increasing public engagement, conservation efforts, and STEM accessibility through immersive learning.

ENRTF Funds Requested: $697,000

Proposed Project Completion: April 30, 2029

LCCMR Funding 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.

Minnesota's wetlands are among its most ecologically significant resources, serving as biodiversity reservoirs, carbon sinks, and sources of potential biomedical discoveries. However, access to these fragile ecosystems for education and research is hindered by several challenges. Students, particularly those in rural and urban underserved communities, often lack opportunities for hands-on experiences due to financial constraints, geographic isolation, or limited field trip availability. Traditional classroom instruction struggles to convey the complexity of wetland ecosystems, making it challenging to inspire the next generation of scientists and conservationists. Additionally, field-based research in these sensitive environments requires extensive permitting, limiting opportunities for student engagement.

Moreover, key ecological and microbiological processes, such as microbial interactions, carbon sequestration, and antibiotic discovery, are more theoretical than experiential. Students may struggle to grasp these critical concepts without immersive, engaging learning methods, reducing interest in environmental science and conservation careers. Furthermore, researchers and policymakers lack effective tools to visualize and communicate the importance of wetland preservation and restoration. Without innovative solutions, barriers to fieldwork and education will continue to limit scientific literacy and research engagement, weakening efforts to protect and understand Minnesota's wetlands and their vital ecological functions.

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.

Our solution integrates Virtual Reality (VR) technology into wetland science education and conservation, creating immersive learning experiences that make research and exploration accessible to students, educators, policymakers, and the public. With LCCMR funding, we will develop VR simulations that replicate wetland ecosystems, allowing users to experience biodiversity assessments, microbial sampling, and antibiotic discovery in an interactive and controlled environment. This approach eliminates geographic and financial barriers, ensuring equitable STEM access, particularly for rural, tribal, and underserved urban students who lack field-based learning opportunities.

To bridge this gap, we will develop VR learning experiences alongside its research agenda. Approximately 50% of the budget supports research and undergraduate training in field and lab-based methodologies. This integration ensures that VR programming reflects real-world science, allowing students to engage in authentic discovery while reinforcing research-driven conservation efforts. Students will gain hands-on experience in field sampling, microbiological, and molecular techniques, applying these skills in both laboratory and wetland settings.

By collaborating with UMN Extension wetland experts, we will create VR modules that immerse users in wetland ecosystems, visualize ecological processes, and enhance fieldwork training. These experiences will support workforce development in environmental and microbiological research while strengthening conservation efforts and scientific literacy for future generations.

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?

1. Training Future Scientists in Drug Discovery – VR modules will enhance scientific literacy by simulating real-world wetland research, focusing on microbial sampling and antibiotic discovery. Students will engage in biodiversity assessments and bioactive compound exploration, preparing them for careers in drug discovery and environmental science.

2. Reduced Environmental Disturbance – Virtual training will allow aspiring researchers to practice field techniques, minimizing human impact on fragile ecosystems while building essential research skills.

3. Increased Public Engagement – VR experiences will connect citizen scientists, students, policymakers, and researchers to wetland conservation and drug discovery, fostering deeper appreciation and encouraging active participation in preservation efforts.

Activities and Milestones

Activity 1: Development and Deployment of VR Wetland Science Modules into User VR App

Activity Budget: $410,000

Activity Description:
This activity focuses on creating and implementing immersive Virtual Reality (VR) experiences that simulate Minnesota's wetland ecosystems, microbial research, and biodiversity conservation. Partnering with a VR production company, we will develop high-fidelity VR modules replicating real-world field research, allowing users to conduct virtual biodiversity assessments, microbial sampling, and antibiotic discovery. These interactive experiences will enhance scientific literacy and provide equitable access to field-based learning for students from underserved rural and urban communities.

Once developed, the VR content will be piloted in university/college courses, high school classrooms, and informal learning settings such as science museums and community outreach programs. Researchers will use the modules for training and improving their field preparedness while reducing the environmental impact of on-site studies. Additionally, the content will be designed for accessibility across various devices to ensure broad reach.

Key deliverables include producing at least three VR learning modules into a user app, deploying it in multiple educational settings, and collecting initial user feedback for further refinement. By democratizing access to environmental science education, this activity will create long-term engagement with Minnesota's wetlands and foster the next generation of conservationists, scientists, and informed policymakers.

Activity Milestones:

Description	Approximate Completion Date
Develop RFP, solicit bids, select vendor, and define key scientific concepts.	August 31, 2026
Capture wetland video, imagery, microbial samples, and finalize VR design specifications.	September 30, 2027
Create, test, and refine three VR modules integrating wetland biodiversity and microbial research.	August 31, 2028
Deploy VR in five educational settings, train educators, and gather feedback for refinement.	December 31, 2028
Improve VR content, expand access, and launch an online learning platform.	April 30, 2029

Activity 2: Public Engagement, Research Integration, and Policy Outreach

Activity Budget: $287,000

Activity Description:
This activity uses VR technology for public engagement, research applications, and conservation policy advocacy. Through partnerships with local schools, community centers, and science museums, we will provide hands-on experiences with VR-based wetland exploration. These programs will enhance public understanding of wetland ecosystems, biodiversity, and climate resilience while encouraging citizen participation in conservation efforts.

Additionally, VR will be integrated into scientific research training, allowing students and professionals to practice sampling techniques, analyze microbial interactions, and visualize environmental dynamics in a risk-free, immersive setting. This will improve field research efficiency and reduce the need for physical disturbance in sensitive wetland areas.
Policy engagement is another critical component. VR simulations will be used to communicate wetland health and conservation strategies to policymakers and stakeholders. By offering a visually compelling, data-driven perspective, we aim to improve decision-making for wetland protection and restoration initiatives.

Key deliverables include at least five community engagement events, VR integration into at least two research training programs, and outreach to policymakers through interactive presentations. This activity will ensure a long-term impact by fostering collaboration between educators, researchers, conservationists, and decision-makers.

Activity Milestones:

Description	Approximate Completion Date
Identify partners, develop outreach materials, and initiate citizen science initiatives.	November 30, 2026
Implement VR in research programs and conduct student and faculty training.	August 31, 2027
Host community events and policy presentations on VR-assisted wetland conservation.	August 31, 2028
Expand VR research applications and assess effectiveness in environmental and microbiological studies.	December 31, 2028
Secure funding, build partnerships, and refine VR conservation education for lasting impact.	April 30, 2029

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?
Integration into Education – VR modules will be embedded in university/college courses, high school outreach, and citizen science programs to support long-term educational use.

Research and Training – Scientists and students will use VR for field preparation, reducing environmental impact while enhancing research skills.

Public Accessibility – Content will be available to all interested institutions via open-source platforms, university repositories, and public showcases in museums, schools, and community centers.

Ongoing Funding – Long-term sustainability will be supported through university partnerships, research collaborations, and potential licensing agreements with educational institutions.

Scalability and Expansion – The VR framework can be expanded to additional ecosystems and beyond.

Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
Exploring Minnesota's Wetlands: Our Resource For Future Medicine	M.L. 2021, First Special Session, Chp. 6, Art. 6, Sec. 2, Subd. 03k	$210,000

Project Manager and Organization Qualifications

Project Manager Name: Brian Dingmann

Job Title: Associate Professor of Biology

Provide description of the project manager's qualifications to manage the proposed project.
Dr. Brian J. Dingmann is an experienced educator, researcher, and project leader with a strong background in microbiology, environmental science, and innovative teaching methodologies. As an Associate Professor at the University of Minnesota Crookston, he has spent over 20 years mentoring students and leading research projects, successfully guiding over 250 students in their academic and scientific pursuits. His expertise in microbiology and environmental science and his passion for experiential learning make him well-suited to manage this project.

Dr. Dingmann has a proven track record of integrating cutting-edge technologies into education, including interactive and immersive learning experiences. His leadership in internationalizing the biology curriculum, for which he received the C. Eugene Allen Award for Innovative International Initiatives (I3 Award), demonstrates his ability to develop and implement innovative science education programs.

His research focuses on microbial ecosystems, biodiversity, and antibiotic discovery, making him well-suited to lead a project that connects VR technology with real-world scientific applications. His expertise in microbiology instruction gives him the necessary skills to conduct all sampling, microbiological, and molecular techniques proposed in this project. He has extensive experience in bacterial isolation, microbial culturing, molecular characterization, and bioactive compound screening, ensuring high-quality research outcomes.

Beyond the classroom, Dr. Dingmann is actively involved in regional outreach programming, including conducting eye dissection demonstrations in local schools to inspire student interest in biology and STEM fields. His continued engagement with science outreach and experiential learning reinforces his commitment to expanding access to science education.

His expertise in microbiology, research methods, grant management, and student engagement ensures the successful implementation of this project, which will advance wetland conservation, revolutionize STEM education, and inspire future scientists in drug discovery and environmental research.

Organization: U of MN - Crookston

Organization Description:
The marketable laboratory-trained undergraduates and the teaching laboratory protocols produced reflect the University of Minnesota Crookston and Northwest Technical College's mission to focus on practical teaching that prepares students for good-paying jobs. This project is a partnership of two teaching institutions in northern Minnesota committed to the success of the region we serve.

Both institutions serve underrepresented populations of students pursuing science and professional degrees. Specifically, the University of Minnesota Crookston has the highest percentage of first-generation (50% of the student population) and Pell-eligible (31%) college learners within the University of Minnesota system. Likewise, Northwest Technical College has many first-generation (48%) and Pell-eligible (38%) students. High-impact retention activities such as undergraduate research engage and effectively retain more students, especially those related to STEM careers. Practical training of these students has the potential to retain and empower them to seek jobs and careers that will impact their lives and extended families. Students will develop skills that can be applied to high-wage and benefit-paying situations in the region's rural communities, including the Minnesota Department of Natural Resources and the Minnesota Department of Agriculture.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
PI/Project Manager (Brian Dingmann)		Will be responsible for overall management of grant funds and project (1 month salary for 3 summers)			36.6%	0.39		$39,100
Co-PI (Venugopal Mukku)		Mentoring and supervision of chemical extraction and purification (1 month salary for 2 years)			36.6%	0.26		$26,000
Co-PI (Karl Anderson)		Mentoring and supervision of microbiological and educational module production (1 month salary for 3 summers)			36.6%	0.39		$35,500
Undergraduate Research Assistants		Sampling, supervised research and VR development assistance (2 UMC students/summer for 3 summers ($20/hr) for 13 weeks, $62,400 (520 hours per summer student); 2 student researchers during academic year ($20/hr X 600 hours), $24,000			8%	1.17		$86,400
							Sub Total	**$187,000**
Contracts and Services								
Agilent Service Contract	Service Contract	Maintenance of chemical analysis equipment used in the project				-		$30,000
VR Production	Service Contract	Production of video and learning modules to be incorporated into VR app.				0		$340,000
							Sub Total	**$370,000**
Equipment, Tools, and Supplies								
	Equipment	VR headsets to provide immersive experience using VR software (10 headset, $1,000 each)	VR headsets will be used in deployment of VR learning materials through immersive educational modules.					$10,000
	Tools and Supplies	Chemical solvents, pipettors and consummables	Lab supplies and pipettors needed for chemical analysis (extraction, fractionation, and purification) aspect of project.					$55,000

	Tools and Supplies	Microbiological and Molecular lab supplies	The research component requires soil microbiological (culturing and isolation) and molecular lab (DNA extraction and sequencing) supplies.					$40,000
	Tools and Supplies	Field sampling and general consummables	Field sampling materials and general lab consummables used for the research techniques will be needed for project.					$10,000
							Sub Total	**$115,000**
Capital Expenditures								
							Sub Total	**-**
Acquisitions and Stewardship								
							Sub Total	**-**
Travel In Minnesota								
	Miles/ Meals/ Lodging	Sampling in select sites in Minnesota. Travel ($0.575 per mile of travel, 3,000 miles traveling around state, $1,710); meals, 20 trips with 6 people, $4,000; camping/hotel overnight near wetlands, $4,290	There are remote sites that will require long travel trips and require food and lodging funds.					$10,000
							Sub Total	**$10,000**
Travel Outside Minnesota								
	Conference Registration Miles/ Meals/ Lodging	Conference registration to American Society of Microbiology (ASM) Microbe and ASM Conference on Undergraduate Education (6 people X $450, $2,700), airfare (6 people X $500, $3,000) and hotel stays (6 people X $225 per night X 3 nights, $4,050), during conference. Additional $250 for meals not covered by conferences.	Dissemination of educational materials at ASMCUE and student presentations at ASM Microbe will be disciplinary dissemination.					$10,000
							Sub Total	**$10,000**
Printing and Publication								

	Printing	Printing of reports for stakeholders	Miscellaneous printing for production of learning module materials.					$500
	Publication	Article Page Charges	Dissemination of learning materials and description of VR wetland immersive educational process will require publication fees associated with educational journal article page charges					$4,500
							Sub Total	**$5,000**
Other Expenses								
							Sub Total	**-**
							Grand Total	**$697,000**

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: $697,000

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: 504b9b42-eb2.pdf

Alternate Text for Visual Component

Overview of grant outcomes: Immersive education, training of the next generation of scientists, and engaging stakeholders in the conservation of Minnesota's wetlands....

Supplemental Attachments

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

Title	File
2025 NTC Letter of Support	a2af5323-16d.pdf
Board of Regents Letter	ca2b25bc-5fc.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")?

No

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

Donna Larson, University of Minnesota Crookston Grant Officer

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