Environment and Natural Resources Trust Fund

2026 Request for Proposal

General Information

Proposal ID: 2026-251

Proposal Title: Integrating Sustainability into High School Science Curriculum

Project Manager Information

Name: Bo Hu

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

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Project Basic Information

Project Summary: We propose a two-week summer camp for Minnesota high school teachers, focusing on sustainability, bioresources, and environmental restoration, to inspire students to pursue careers in science, engineering, and natural resources.

ENRTF Funds Requested: $360,000

Proposed Project Completion: June 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?

Region(s): Metro

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.

Environmental education in Minnesota's high schools is more critical than ever as concerns about climate change, resource depletion, and environmental degradation intensify. The urgency of these issues demands that the next generation be well-prepared to address environmental challenges. However, many high school science educators in Minnesota lack the necessary training and resources to effectively teach sustainability concepts related to bioresource utilization and environmental restoration. Without proper professional development, educators may struggle to incorporate these vital topics into their curricula, limiting students' understanding of sustainability and hindering their ability to make informed decisions about the environment. There is a significant gap in equipping teachers with the knowledge and tools required to inspire students and guide them towards careers in environmental science, natural resources, and sustainable engineering fields. This gap presents a unique opportunity to provide high-quality, targeted professional development that will directly benefit both educators and their students across Minnesota.

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.

To address this gap, we propose a hands-on, high-quality summer camp designed for high school science teachers across Minnesota. The camp will focus on sustainability education, specifically bioresource utilization, environmental restoration, and the application of technology in these fields. Through interactive learning modules and field-based experiences, the camp will provide teachers with concrete teaching tools, lesson plans, and strategies for integrating sustainability into their science curricula. Teachers will also gain a deeper understanding of how to foster student engagement in sustainability topics, preparing them to inspire students to pursue careers in environmental science, natural resources, and biosystems engineering. The project will be open to educators from both the Twin Cities and greater Minnesota regions, ensuring broad geographic impact and accessibility to a diverse range of educators. By providing this professional development opportunity, the camp will directly equip teachers with the resources to incorporate sustainability into their classrooms and inspire future generations of students to tackle pressing environmental challenges.

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 will enhance the public's understanding of sustainability and contribute to the protection and preservation of Minnesota's natural resources. By equipping high school teachers with the knowledge and tools to teach sustainability, we are fostering a generation of environmentally-conscious students. These students will be inspired to pursue careers in environmental science and natural resources, leading to better-informed decision-makers who will contribute to the conservation and sustainable management of Minnesota's resources. Through this initiative, the project will help safeguard the state's environmental future by creating a ripple effect of sustainability education across Minnesota's classrooms.

Activities and Milestones

Activity 1: Curriculum Development on Sustainable Technology Development

Activity Budget: $141,485

Activity Description:
We will develop comprehensive course materials focused on sustainable system development, addressing three key areas: bio-based products, renewable energy, and ecological restoration. A detailed curriculum guide contains 4 lesson modules designed for teachers. Tentative modules include: PFAS and Phytoremediation, which explores the environmental impact of PFAS (Per- and Polyfluoroalkyl Substances) and introduces phytoremediation as a sustainable mitigation method. Ethanol as Biofuel examines the production of ethanol as a renewable energy source, its role in reducing greenhouse gas emissions, and the environmental impacts of its production, such as land use changes and water consumption. Microplastics and Plastics Degradation teaches students on the types, environmental impact, and biodegradation challenges of microplastics, with hands-on activities and discussions on solutions to reduce plastic pollution. Peatland Restoration and Climate Change focuses on the role of peatlands in the global carbon cycle and discusses how peatland restoration can help mitigate climate change by reducing greenhouse gas emissions. These modules will provide teachers with valuable tools and real-world examples to integrate sustainability into their classrooms and inspire students.

Activity Milestones:

Description	Approximate Completion Date
Initial completion of engineering teaching modules	March 31, 2027
Internal evaluation of engineering teaching modules	June 30, 2027

Activity 2: Curriculum Development on Sustainable System Management

Activity Budget: $107,643

Activity Description:
We will also develop course materials on sustainable system management, addressing three key areas: life cycle assessment, waste recycling and treatment, and sustainable system management. The curriculum will include five lesson modules for teachers, such as Systems Thinking and Sustainable Food Production, which explores complex food systems and the life cycle of food products (e.g. processing, packaging, and waste), guiding students to create systems diagrams and brainstorm ways to reduce environmental impacts across the life cycle. Stakeholders and Water Resources Management uses a Minnesota water resources case study to teach stakeholder analysis, conflict navigation, and collaborative problem-solving through role-playing and facilitated discussions. Life Cycle Thinking and Food Choices engages students in an interactive activity assessing the environmental impacts of pizza toppings, comparing greenhouse gas emissions of different ingredients, and discussing ways to reduce food-related carbon footprints. Lastly, Nutrient Cycling within Agricultural Production dives deeper into nitrogen and carbon cycling in crop and livestock production, using terrarium demonstrations to teach about water and airborne losses and their impact on sustainability. These modules provide teachers with practical, real-world tools to inspire students.

Activity Milestones:

Description	Approximate Completion Date
Initial completion of management teaching modules	March 31, 2027
Internal evaluation of management teaching modules	June 30, 2027

Activity 3: Teacher Summer Camp on Sustainability, Follow-Up and Evaluation

Activity Budget: $110,872

Activity Description:

The summer camp will offer professional development on sustainability education for high school science teachers, with a focus on educators from rural areas. Taking place over two weeks at the UMN St. Paul campus, the camp will cover technology development in the first week and system management in the second. Teachers can attend one or both weeks, with up to 25 teachers per week participating. Recruitment will be through outreach to rural school districts and partnerships with organizations like the Minnesota Science Teachers Association. Stipends of $1000 per week will help offset costs for participants. We will pilot the 8 teaching modules we've developed, using them to guide learning throughout the camp, and continue refining them at every project year. Activities will include lectures, hands-on labs, field trips to local sustainability sites, and collaborative workshops to help teachers create lesson plans that incorporate sustainability topics. Each day will end with time for teachers to work on personalized lesson plans and share ideas. Pre- and post-camp surveys will track changes in participants' understanding of sustainability education. After the camp, we'll provide ongoing support through cohort coaching sessions, allowing teachers to test the modules, share experiences, and collaborate on further development.

Activity Milestones:

Description	Approximate Completion Date
Summer camp year 1 and post camp evaluations	August 31, 2027
Summer camp year 2 and post camp evaluations	August 31, 2028
Summer camp year 3 and post camp evaluations	June 30, 2029

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Erin Cortus	University of Minnesota	Co-PI	Yes
Natalie Hunt	University of Minnesota	Co-PI	Yes
Chris Lenhart	University of Minnesota	Co-PI	Yes
William Tze	University of Minnesota	Co-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?

In the future, the project can be expanded to serve even more teachers statewide, and we envision a lasting network of sustainability-minded educators. The University of Minnesota's Bioproducts and Biosystems Engineering Department is committed to supporting this initiative beyond the initial phase, exploring funding opportunities to expand the program to additional regions and to offer continuous professional development.

Project Manager and Organization Qualifications

Project Manager Name: Bo Hu

Job Title: Professor

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

Dr. Bo Hu is a Professor and Director of Undergraduate Studies in the Department of Bioproducts and Biosystems Engineering at the University of Minnesota, where he has played a pivotal role in enhancing undergraduate education, particularly in the area of sustainability. With his innovative teaching methods, Dr. Hu integrates sustainability concepts across various courses, providing students with both theoretical knowledge and practical, real-world applications. His focus on critical thinking and hands-on learning ensures that students are well-prepared to address global environmental challenges in their future careers.

In addition to his commitment to education, Dr. Hu has over 20 years of active research experience, specializing in biomass utilization, fermentative conversion, and waste management. His research projects include innovative solutions for removing phosphorus from manure and wastewater, using plants to clean polluted soil and water, and exploring synthetic ecology through the co-cultivation of microalgae and fungi in lichen biofilms. His team is also working on upcycling low-quality agricultural byproducts into nutritious animal feeds.

Dr. Hu's research team at the University of Minnesota has developed cutting-edge techniques, such as 16s rDNA-based microbial analysis using high-throughput pyrosequencing to study microbial species in waste treatment, and ITS sequencing to identify fungal species. Additionally, his team is advancing several conversion platforms, including fungal and microalgae co-cultivation, pelletized fungal fermentation, and solid-state fermentation of filamentous fungi, to produce biofuels and bioproducts from agricultural waste while addressing nutrient removal and pollution in contaminated water.

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) at the University of Minnesota, we look at the bigger picture. When we envision a better tomorrow, it includes disease-resistant crops, products that protect our health, lakes free from invasive species, and so much more. We use science to find answers to Minnesota and the world's grand challenges and solve tomorrow's problems. Almost 93 percent of students who earn CFANS undergraduate degrees find jobs in their
career field or enter graduate school within six months of graduation.

The Department of Bioproducts and Biosystems Engineering, in CFANS, discovers and teaches solutions for the sustainable use of renewable resources and the enhancement of the environment. We discover innovative solutions to address challenges in the sustainable production and consumption of food, feed, fiber, materials, and chemicals by integrating engineering, science, technology, and management into all degree programs.

We have a public impact through community engagement and extension efforts. We develop and deliver high quality, regionally and nationally-recognized research-based programs to meet current and emerging needs of industry and communities. We also have a long-standing tradition of close partnerships with alumni, industry professionals, organizations, government agencies, donors and community members.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
Lead PI - summer salary only		Lead and coordinate entire project			26.8%	0.24		$61,905
CoPI- summer salary only		Ag Outreach specialist			26.8%	0.12		$27,517
Co-PI - summer salary only		Erosion specialist			26.8%	0.12		$14,925
Co-PI - contract faculty/summer salary		Hydrology specialist (wetlands)			26.8%	0.12		$19,522
Co-PI - summer salary only		Biomass products specialist			26.8%	0.12		$24,625
Post doctoral student		Assist lead PI with scheduling, logistics, recruitment			20.6%	0.51		$41,507
							Sub Total	**$190,001**
Contracts and Services								
							Sub Total	**-**
Equipment, Tools, and Supplies								
	Tools and Supplies	General supplies - paper and/or flash drive handouts, supplies for experiments	to engage workshop attendees and provide them tools for their classrooms					$15,454
							Sub Total	**$15,454**
Capital Expenditures								
							Sub Total	**-**
Acquisitions and Stewardship								

							Sub Total	**-**
Travel In Minnesota								
							Sub Total	**-**
Travel Outside Minnesota								
							Sub Total	**-**
Printing and Publication								
							Sub Total	**-**
Other Expenses								
		25 science teachers receive $2000 for participating with summer science program	recruitment, compensation for time					$154,545
							Sub Total	**$154,545**
							Grand Total	**$360,000**

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: $360,000

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: 2b215dcd-a8b.pdf

Alternate Text for Visual Component

A possible flyer to recruit high school science teachers to the summer camp for integrating the sustainability concept into their curriculum...

Supplemental Attachments

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

Title	File
SPA Letter	2c46e08e-d40.pdf
audit	8fe90982-2fd.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?

N/A

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?

No

Does the organization have a fiscal agent for this project?

No

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:

Wendy Moylan

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