



Environment and Natural Resources Trust Fund

2026 Request for Proposal

General Information

Proposal ID: 2026-478

Proposal Title: Mating Confusion to Protect Wild Rice Habitats

Project Manager Information

Name: Stephen Kells

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

Office Telephone: (612) 625-4798

Email: kells002@umn.edu

Project Basic Information

Project Summary: Developing a system that reduces damage to wild rice through the natural interruption of pest mating behavior, promoting natural and cultivated crop production that is more environmentally and economically sustainable.

ENRTF Funds Requested: \$608,000

Proposed Project Completion: December 31, 2029

LCCMR Funding Category: Water (B)

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.

The MN state grain, Wild Rice (*Zizania palustris*) is an emblematic plant with ecological, cultural, and agriculture state-wide significance, growing in 55 of 87 counties. The harvest of wild rice in both natural stands and cultivated settings contributes substantially to MN livelihoods, cultures, and to MN's economy. Pest outbreaks can decimate wild rice populations, resulting in drastic reductions in yield and major economic losses. Two major insect pests include the rice stalk borer (*Chilo plejadellus*) and the rice worm moth (*Apamea apamiformis*). In 2024, both pest populations increased dramatically causing major damage in wild rice stands. Insecticides are the only tool available for the management of both pests but there are many issues with this tactic, including: applying insecticides on flooded lands, the lack of predictive tools helping properly time insecticides, and the risk of insecticides impacting existing natural enemies of these pests and non-target fauna. Unnecessary or mis-timed insecticide applications may exacerbate negative environmental impacts, given the necessity of fresh water in both natural and cultivated wild rice production. State-wide, cultivated wild rice uses ~21 billion gallons of freshwater both from precipitation and surface water sources during the production season, with end-of-season water returned to natural waterways, enabling harvest.

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.

Developing a better understanding of these two pests will lead to improved detection of outbreaks, optimized timing of insecticides if needed, and an opportunity for developing mating disruption as a non-toxic control method averting economic damage. Many moth species use air-borne chemical attractants (i.e., pheromones) for mating. Used to our advantage, deploying these pheromones in traps enables monitoring when these insect pests appear as moths and their population size. Applied in high concentrations, these pheromones can disrupt mating behavior, preventing males from orienting to females, reducing the number of eggs laid, and decreasing the number of caterpillars available to damage the crop. Both monitoring and mating disruption have shown success in other cropping situations and, for wild rice, these methods have real potential for preserving yield in natural and cultivated wild rice stands. We will start with what is known of existing pheromones of closely related species, enabling early results for monitoring these two pests and a better initial idea of their seasonal timing. The next step is to refine and optimize the pheromone blends for mating disruption purposes. Finally, we will provide efficacy and economic analyses of using these new technologies for improving production sustainability of wild rice.

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?

Developing predictive monitoring and non-toxic insect suppression supports the 2026 Funding Priorities in demonstrating innovative practices, strategies, and/or partnerships preventing water issues in rural regions (B.4.). In other cropping systems, pheromone-based monitoring and mating disruption greatly reduces the need for chemical insecticide applications and increases efficacy when applications are needed. Reducing chemical inputs in cultivated wild rice and protecting natural wild rice stands through non-toxic means provides environmental and economic benefits for Minnesota's wild rice producers and Minnesota's surface waters. This project will have immediate benefits for cultivated wild rice, and a "halo effect" protecting natural wild rice.

Activities and Milestones

Activity 1: Summer 2026 through 2027, deploy a trapping screening study based on pheromone compounds from the general species group.

Activity Budget: \$77,829

Activity Description:

Published research on other species within the group suggests a blend of sex pheromones with common components, though differing concentrations. Three compounds blends per species will be tested in a trap screening program that provides information on moth activity and seasonal weather data. The screening program will evaluate efficacy of trap type, placement and distance. Collection of moths for a laboratory colony will also occur during this initial work. This work enables us to use the first growing season of this project to jump start the field work and obtain collections of moths as early as possible.

Activity Milestones:

Description	Approximate Completion Date
Deploy initial traps with test mixtures	September 30, 2026
Collection of moth eggs, larvae and adults for laboratory colonies through summer	September 30, 2026
Establishment of best colony rearing techniques, artificial diet and colony establishment	December 31, 2026
Maintain and grow colony through winter	April 30, 2027

Activity 2: Summer 2027, develop and refine pheromone chemistry in the management of these wild rice pests.

Activity Budget: \$214,278

Activity Description:

Established laboratory colonies will enable volatile collection from calling females for determining specific concentrations of the blend responded to by males. As per existing methods, we will collect volatiles from calling females by placing the individuals into a volatiles collection chamber, passing filtered air through the chamber, collecting the volatiles in an absorbent filter, then eluting the volatiles into a suitable solvent. Gas Chromatography (GC) will enable us to determine concentration and relative proportions of different volatiles in the mix, with GC linked electroantennography (GC-EAD) to confirm which compounds are active to the males.

With the components confirmed, we can then use an optimal pheromone blend to determine threshold concentrations when their behavior becomes interrupted.

Activity Milestones:

Description	Approximate Completion Date
Volatile collections and component characterization of active	February 28, 2027
Behavioral trials with pheromones	June 30, 2027
Mating disruption threshold concentrations	October 31, 2027

Activity 3: During 2027 through 2029, deploy mating confusion concentrations from Activity 2 into a mating disruption study modified from Activity 1.

Activity Budget: \$175,496

Activity Description:

Minimal and maximal concentrations will be used in field assessments of identified pheromone compositions in a monitoring-to-mating confusion program against these pests. Starting with a monitoring concentration, study fields will have monitoring traps placed to detect onset of moth flights, as per Activities 1 and 2. With the detection of male moths, mating disruption will be deployed, for four weeks. Females will be placed in cages in the field and at distances to the mating disruption source and males will be trapped on the outside of the cages. These captures of males in the disrupted field will be compared against captures in the non-disrupted (control) fields. The fields will be assessed for damage and yield between mating disrupted fields and control fields.

Activity Milestones:

Description	Approximate Completion Date
2027 Initial Mating Confusion Trails	October 31, 2027
2028 Mating Confusion Trials	October 31, 2028
2029 Final Mating Confusion Trials	October 31, 2029

Activity 4: During 2028 through project's end, an environmental and economic analysis of current mating disruption versus pesticide usage.

Activity Budget: \$140,397

Activity Description:

A cost benefit analysis will determine the benefits gained by the monitoring portion of the project and the addition of mating disruption (MD) in the program to protect wild rice. We will collect data on current pesticide usage, including pesticides and application costs, application frequency, efficacy, and yield impact. We will collect data about using pheromones with this crop, such as costs of obtaining pheromone traps (including the pheromone components), labor to place and monitor both traps and MD stations, labor to collect data, efficacy and yield impact from any decisions made. We will perform a cost-benefit analysis including direct cost comparison, yield benefits, risk assessment, and a cost-effectiveness ratio; with the intention of making recommendations and projecting long-term impacts.

Activity Milestones:

Description	Approximate Completion Date
Prepare data for the cost-benefit analysis	June 30, 2029
Cost-benefit analyses with economic evaluations to develop best use recommendations. of this technology	December 31, 2029

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Dr. Jennifer Kimball	Agronomy and Plant Genetics Department, College of Agriculture, Food and Natural Resource Sciences	Chief research agronomist for the cultivated wild rice program in Minnesota, support of field research in wild rice production, coordinating this project with existing efforts and communications with Minnesota growers of wild rice.	Yes
Dr. Ian MacRae	UM Crookston, Department of Entomology, College of Agriculture, Food and Natural Resource Sciences	Field Crops Entomologist involved with plant protection, integrated pest management and environmental stewardship for sustainable crop production	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?

Demonstration of successful research results will provide support for the use of pheromones by growers. The tactic is expected to become widely adopted. Additional funding for the project is not expected to be necessary.

We respect the reverence for wild rice held by the Anishinaabeg and need their input as key stakeholders in this project. We will listen to concerns related to the research and if (or how) they might benefit from it. Shared preliminary data and experiences will ensure discussions are adequately supported and mutually beneficial.

Project Manager and Organization Qualifications

Project Manager Name: Stephen Kells

Job Title: Professor

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

Professor Kells is a researcher and extension specialist with responsibilities that include chemical ecology (i.e., how chemicals affect insect behavior) and integrated pest management. He has extensive research and extension experience with diverse and challenging pest situations including insects, arthropods, and rodents in urban, animal, and cropping systems. During the recent bed bug resurgence he worked to understand the chemical ecology of this pest. Recently he has studied the chemical ecology of red-legged ham beetles, a serious pest in retail stores and food warehouses. From an extension perspective Dr. Kells has worked to provide educational programming to a number of diverse populations in Minnesota and has published articles on ways to identify and work with groups that have additional challenges coping with pests. Dr. Kells previously worked with Tribal First Nations through their casino systems and local public health services to provide information about bed bugs and address this pest's impacts in the larger local community. These experiences with the expertise of Drs MacRae and Kimball position this team for success.

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

Organization Description:

Ranked the top U.S. public university for Interdisciplinary Science, this proposal is supported by personnel within the College of Food, Agriculture, and Natural Resource Sciences, a national leader in innovative scientific discovery and application of discoveries to everyday life. CFANS is the key center in this State for research, teaching, and development of novel extension information that supports agriculture and other industries. The proposal is further supported by CFANS system of Research and Outreach Centers which supports the research onsite and closer to the major wild rice cropping areas. Within the team we have an interdisciplinary approach that covers all aspects of this proposal from field discovery, to lab work studying the problem, and then back to infield application of improved techniques to detect and prevent pests of wild rice. The team has extensive contacts throughout Minnesota to ensure the information reaches the people and systems who would best benefit from the work and ensure adoption of improved methods.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
Personnel								
Post-Doctoral Research Associate		Post-Doctoral Research Associate (or "Post-doc" at 1 FTE) is a full-time position enabling advanced training for managing complicated or complex research projects and producing results. This is the next step for a PhD Student, beyond learning how to conduct research and concentrating on a single project. We will mentor this Post-Doc as they oversee the various project elements including results from the field data and how that affects the lab studies, as well as conducting the pheromone work during lab research. The Post-Doc will be mentored on managing outcomes of the project and planning next steps in the research process. This is the next step in developing qualified research personnel to address future challenges related to pests in crops.			25.9%	3		\$268,167
Graduate Research Assistant		The Graduate Research Assistant is a 2-year Master's level (0.5 FTE) program where a successful undergraduate student is provided the opportunity to conduct a more involved research project. Master's students may continue on to a PH.D or may choose to apply their expertise in an advanced industry or agronomic position. Tuition is included in the budget.			23.2%	1.5		\$108,341
Undergraduate Research Assistants		Undergraduate Research Assistants (0.5 FTE) are needed to support the day-to-day lab operations, including support of laboratory colonies, assisting in research trials both in lab and in-field and supervised use of research equipment. It is usually their first foray into a practical research experience, beyond the basic training they receive in classes.			0%	1.5		\$46,800
Field Technical Staff		Given the project scale and use of the NCROC and area farms, we are requesting part of a field technical staff position (0.4 FTE for 3 years) to oversee the infield trapping, collection of insects, weather data, and deployment of mating disruption			32.3%	1.2		\$138,280

		trials. This individual coordinates the field activities with the Post-Doc and submits data during the various project steps for evaluation and reporting.						
							Sub Total	\$561,588
Contracts and Services								
							Sub Total	-
Equipment, Tools, and Supplies								
	Tools and Supplies	Sufficient funds supporting lab and field materials and consumables, such as chemicals, volatile collection and analysis supplies, and field trapping supplies	All items are required to perform work both infield and in lab relative to the proposed activities.					\$16,000
							Sub Total	\$16,000
Capital Expenditures								
							Sub Total	-
Acquisitions and Stewardship								
							Sub Total	-
Travel In Minnesota								
	Miles/ Meals/ Lodging	Sufficient funds for housing at NCROC, per diem, for three students and post-doc when in the field and working at a distance to the lab facilities in St Paul and Crookston. The car rental is for 15 trips per year.	These travel expenses support work in cultivated wild rice fields at a distance to the NCROC research site. The fields are managed by local growers and provide us with additional field sites with ongoing common agronomic practices.					\$29,040
							Sub Total	\$29,040
Travel Outside Minnesota								
							Sub Total	-

Printing and Publication								
	Publication	We are requesting \$1,372 to support publication costs of peer-reviewed articles which disseminate the results of our work.	Generating peer reviewed publications enable a larger disperseal of communications from this work with colleagues and advancement of the discipline. Derivatives from this publication will be shared with students and stakeholders. The cost supports an open-access approach to publishing this work.					\$1,372
							Sub Total	\$1,372
Other Expenses								
							Sub Total	-
							Grand Total	\$608,000

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: \$608,000

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: [4d000ea7-815.pdf](#)

Alternate Text for Visual Component

Comparative pictures of the rice worm moth (left) and rice stalk borer (right). The rice worm picture shows a brown-mottled, delta-winged, adult and the rice stalk borer is a light colored moth with brown speckles. Larvae and associated damage can be seen in the other two pictures for each species....

Supplemental Attachments

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

Title	File
Notes on Insect pests of Wild Rice	f7cab89a-007.pdf
UMn Endorsement Letter	f3eb90b9-f18.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:

No additional personnel or organizations assisted in completion of this proposal

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

