Environment and Natural Resources Trust Fund
2019 Request for Proposals (RFP)

Project Title: **ENRTF ID: 024-A**

Wild Rice Conservation: Building a Genetic Resource Database

Category: A. Foundational Natural Resource Data and Information

Sub-Category:

Total Project Budget: $ 296,000

Proposed Project Time Period for the Funding Requested: June 30, 2022 (3 yrs)

Summary:

This project aims to build a foundational genetic resource to be routinely used for wild rice conservation. This database will become increasingly powerful with new additional environmental and trait data.

Name: Jennifer Kimball

Sponsoring Organization: U of MN

Title: Assistant Professor

Department:

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Web Address

Location

Region: Statewide

County Name: Statewide

City / Township:

Alternate Text for Visual:

Project activities breakdown 1. Collecting 5-10 samples of wild rice, sequencing, and developing a DNA marker array, 2. Collecting 1000s samples and genotyping on DNA array, and 3. Develop an instructional workshop to teach interested parties how to use the genetic resources we develop.

_____ Funding Priorities	_____ Multiple Benefits	_____ Outcomes	_____ Knowledge Base
_____ Extent of Impact	_____ Innovation	_____ Scientific/Tech Basis	_____ Urgency
_____ Capacity Readiness	_____ Leverage	_____ TOTAL	_____%
____ If under $200,000, waive presentation?			

PROJECT TITLE: Wild Rice Conservation: Building a Genetic Resource Database

I. PROJECT STATEMENT

The overarching goal of this project is to build a large-scale genetic resource that can be routinely used to better conserve Minnesota's wild rice natural resources. Scientists, resource managers, and tribal communities can contribute and use information in this database to monitor levels of genetic diversity and inbreeding in wild rice beds across the state. This database will become increasingly powerful with the addition of environmental and trait data. Eventually, it could allow scientists to identify genetic regions associated with traits of specific interest to conservation efforts, such as sulfate tolerance or heat tolerance.

In order to set up targets for conservation efforts, we need to establish an initial baseline of genetic diversity. Genetic diversity is important in this context because it is central to any species' ability to adapt to environmental stresses and changing environmental norms. An initial assessment in 2011 of Minnesota wild rice genetic diversity (M.L. 2011, First Special Session, Chp. 2, Art. 3, Sec. 2, Subd. 040) using fifteen DNA markers identified varying levels of genetic diversity depending on geographical location across the state. The population structure or relationships between wild rice beds in different lakes and rivers were difficult to elucidate with the limited number of DNA markers. The study also identified higher levels of inbreeding than expected within native stands of wild rice and is a question that needs to be further explored.

Minnesota's wild rice stands will increasingly depend on organized protection for their survival. This genetic resource database will provide foundational knowledge that will allow efficient conservation strategies. The project will do this by collecting and analyzing the genetic diversity across native wild rice stands in the state using a high density DNA marker array. By leveraging 1,000s of DNA markers against thousands of plants geographically distributed across the state, we will build a map of Minnesotan wild rice diversity. This powerful dataset will allow us to answer questions central to wild rice conservation and begin to investigate the relationships between diversity and environmental factors affecting wild rice in its native habitat.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1: ***Develop genetic resources for monitoring wild rice populations across Minnesota.***
Description: Five-ten plants collected from geographically distributed wild rice beds will be used to generate sequence data for molecular marker development. Data will be aligned with the wild rice reference genome currently being assembled in Dr. Kimball's program, and 1,000s of single nucleotide polymorphisms (SNPs) will be developed. A DNA marker array will then be developed to genotype wild rice samples.

ENRTP Budget: $115,000

Outcome	Completion Date
1. Wild rice genetic sequence data and DNA marker information will be publically available for future use in research related to conservation efforts.	September 2020
2. A small, economical DNA marker array will be developed for resource managers and other interested parties to utilize for monitoring their regional wild rice beds.	June 2022

Activity 2: ***Characterize the genetic diversity of wild rice populations across Minnesota using 1000s of DNA markers.***
Description: We will assess the genetic diversity of native stands of wild rice distributed across Minnesota by collecting tissue from ~25 plants from ~100 lakes for a total of ~2,500 samples. Geographic information systems methods will be used to choose the wild rice stands to sample with the aim of collecting across the broadest range possible of geographic and ecological variation in the state. GPS coordinates for all sites will be documented.

Samples will be genotyped on our DNA marker array to create a powerful wild rice diversity dataset. Genotypic data will be analyzed and conservation genetic questions will be addressed using various computational and bioinformatics tools.

ENRTP Budget: $ 179,000

Outcome	Completion Date
1. Samples of wild rice plants from ~100 lakes will be collected and their location documented using GPS coordinates.	August 2020
2. A map of Minnesota wild rice genetic diversity will be made publically available.	January 2021
3. This genetic resource will address questions related to the vulnerability of wild rice populations across the state.	June 2022

Activity 3: ***Develop an instructional workshop for interested parties to learn how to utilize this genetic resource to answer their own questions surrounding Minnesota wild rice conservation.***
Description: The success of this genetic resource will hinge on its utilization by other researchers, resource managers, and tribal communities; as well as interested parties including their own environmental and trait data. We will develop an instructional workshop as well as user-friendly interactive tools geared toward natural resource managers who are interested in utilizing this database in their conservation planning.

ENRTP Budget: $ 2,000

Outcome	Completion Date
1. An instructional workshop will be created to instruct interested parties in how to utilize the database to answer their own questions surrounding wild rice conservation.	January 2022
2. The Kimball program's website will host a user-friendly, interactive tool accessible to DNR resource managers for immediate use in their conservation planning of wild rice stands.	June 2022

III. PROJECT PARTNERS:

A. Partners receiving ENRTF funding

n/a

B. Partners NOT receiving ENRTF funding

Name	*Title*	*Affiliation*	*Role*
Dr. Colin Khoury	Research Associate	CIAT/USDA-ARS	Geographic analyses
Dr. Chris Richards	Plant Geneticist	USDA-ARS	Population genetics

IV. LONG-TERM- IMPLEMENTATION AND FUNDING: The impact of the proposed work will be to provide a knowledge base for maintenance of wild rice genetic diversity in our Minnesota waters. The project will enhance conservation efforts that maintain wild rice stands, provide information regarding specific wild rice populations at high risk of loss and vulnerable geographical areas, and provide databases, interactive tools, and workshops for resource managers that are user-friendly. These databases and tools will be housed permanently on Dr. Kimball's program website.

V. TIME LINE REQUIREMENTS:

We are requesting funding for three years beginning on 07/01/2019 and ending on 6/30/2022.

2019 Proposal Budget Spreadsheet

Project Title: *Wild Rice Conservation: Building a Genetic Resource Database*

IV. TOTAL ENRTF REQUEST BUDGET *3* **years**

BUDGET ITEM *(See "Guidance on Allowable Expenses")*	**AMOUNT**
Personnel: *Postdoctoral researcher. 50% full-time. 46% dollars toward salary, 23% dollars toward benefits, 3 year time. 1 person.* *Graduate Student. 50% full-time. 23% dollars towards salary, 7% dollars towards benefits, 2 year time. 1 person.*	$128,384
Professional/Technical/Service Contracts: *Next generation-sequencing of wild rice samples: The University of Minnesota Genomic Institute.* *DNA marker array development: The University of Minnesota Genomic Institute.* *Genotyping wild rice samples on DNA marker array: The University of Minnesota Genomic Institute.*	$151,616
Equipment/Tools/Supplies: *DNA extraction kits* *Collection supplies for sampling* *Access to computing power at the University of Minnesota Supercomputing Institute for data analysis.*	$10,000
Travel: *Researchers will travel throughout the state to collect wild rice samples in our lake and river systems. Gasoline and hotel accomodations for overnight stays will be required.*	$6,000
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND $ REQUEST =	$296,000

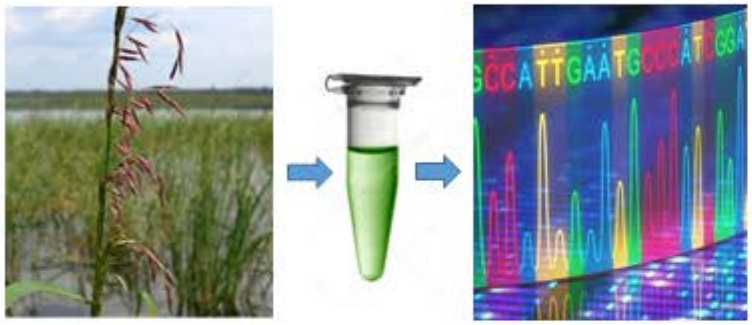
V. OTHER FUNDS

SOURCE OF FUNDS	**AMOUNT**	**Status**
Other Non-State $ To Be Applied To Project During Project Period:	n/a	*n/a*
Other State $ To Be Applied To Project During Project Period:	*n/a*	*n/a*
In-kind Services To Be Applied To Project During Project Period:	*n/a*	*n/a*
Past and Current ENRTF Appropriation: *n/a*	*n/a*	*n/a*
Other Funding History: *n/a*	*n/a*	*n/a*

Wild Rice Conservation: Building a Genetic Resource Database

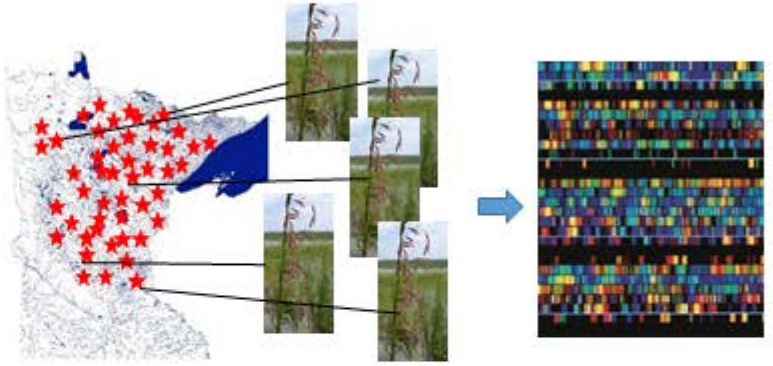
Activity 1:

Sequence wild rice DNA to develop 1,000s of species-specific molecular markers



Activity 2:

Collect ~25 wild rice leaf tissue samples from ~100 lakes, and genotype to assess genetic diversity



Activity 3:

Develop an instructional workshop in how to utilize this resource in conservation planning

Project Manager Qualifications & Organization Description

Project Manager:

Dr. Jennifer Kimball is an assistant professor in the Department of Agronomy and Plant Genetics at the University of Minnesota working on wild rice research. Dr. Kimball's background is in germplasm characterization and genetic diversity assessments. She has characterized genetic diversity in white rice (*Oryza sativa*), white rice wild relatives (*Oryza rufipogon*, *Oryza glaberrima*, and *Oryza nivara*) several species of turfgrass, and sorghum (*Sorghum bicolor*) over the past ten years.

Organization Description:

The University of Minnesota is a leading Research 1 land-grant university leading the way in innovation crossing disciplines. Every dollar invested in the University of Minnesota by the state generates #13.83 in the statewide economy. The university's overall economic impact in Minnesota totals $8.6 billion annually.