

**Environment and Natural Resources Trust Fund
2020 Request for Proposals (RFP)**

Project Title:

ENRTF ID: 064-AH

Environmental Factors Influencing Nutritional Content of Wild Rice

Category: H. Proposals seeking \$200,000 or less in funding

Sub-Category: A. Foundational Natural Resource Data and Information

Total Project Budget: \$ 198,092

Proposed Project Time Period for the Funding Requested: June 30, 2022 (2 yrs)

Summary:

This project will establish foundational natural resource data on the nutritional variability of Minnesota's wild rice (*Zizania palustris*) and explore the influence of growth habitat on the nutritional composition.

Name: Emily Onello

Sponsoring Organization: U of MN

Job Title: Dr.

Department: University of Minnesota Medical School, Duluth campus

Address: 153 SMed, 1035 University Drive
Duluth MN 55812

Telephone Number: (218) 726-7820

Email: econello@d.umn.edu

Web Address: _____

Location:

Region: Northeast

County Name: Aitkin, Beltrami, Carlton, Cass, Clearwater, Cook, Itasca, Koochiching, Lake, Pine, St. Louis

City / Township:

Alternate Text for Visual:

Our infographic illustrates the important connections of northern Minnesota's wild rice (or manoomin) to its habitat, its harvest and its consumption to support human health.

_____ Funding Priorities	_____ Multiple Benefits	_____ Outcomes	_____ Knowledge Base
_____ Extent of Impact	_____ Innovation	_____ Scientific/Tech Basis	_____ Urgency
_____ Capacity Readiness	_____ Leverage	_____ TOTAL	_____ %



PROJECT TITLE: Environmental Factors Influencing Nutritional Content of Wild Rice

I. PROJECT STATEMENT

This proposal addresses a critical gap in knowledge by generating foundational natural resource data on the variability in nutritional composition of wild rice (*Zizania palustris*) across our geographic region. There are no comprehensive studies of the natural range of variation of the nutritional quality of northern wild rice. A more detailed understanding of the nutritional variability of wild rice is needed in light of emerging evidence that consumption of northern wild rice can benefit our cardiovascular system while reducing cancer risk.

Wild rice, the official state grain, remains a prominent fixture in Minnesota's unique cultural cuisine. For many tribal members in the region, harvesting and sharing wild rice are celebrated activities that offer cultural, nutritional and spiritual benefits. Further, the harvesting and sale of wild rice represents an important small-scale agricultural industry in the state—an industry which relies on healthy and resilient wetlands, rivers and lakes. Because wild rice faces many threats to its survival—including drought and extreme rain events, invasive species, increased sediment and pollutant loadings--the timing for this project is urgent.

Our proposal plans to:

- 1) characterize the variability of the nutritional content of wild rice across different sites in Minnesota
- 2) analyze the relationship between the habitat and the wild rice's nutritional content

This proposal will increase our knowledge about the relationship between wild rice's resilient growth and its nutritional assets, schematically shown in the **visual infographic** that accompanies this proposal. The list of potential beneficiaries of this research is broad and includes natural resource managers, governmental agencies, policy makers, local food producers and consumers, tourism/hospitality/restaurant industry planners, biologists, tribal communities, and health professionals. The project team is an interdisciplinary group of university faculty who each bring a unique expertise to the research questions, including an ecologist, a geochemist, a nutrition researcher and a physician. As the health benefits of wild rice are increasingly clear, it is hoped that policy makers and citizens will act deliberately to preserve wild rice habitats and promote its consumption.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1 Title: Nutritional Analysis of wild rice seeds from multiple wild and tank test sites

Description:

Experienced wild rice observers have noticed that there is variability in wild rice taste, appearance and perceived nutritional quality from lake to lake that potentially correlates to the seed size. These observations now prompt this deeper inquiry--do different "looking" wild rice seeds *actually differ* in the nutrients provided to the human consumer?

Wild rice will be studied at a minimum of six to eight natural sites across northern Minnesota. In consultation with regional wild rice experts, the multiple research sites across northeastern Minnesota will be identified to include the widest range of wild rice seed size and appearance as well as the broadest spectrum of habitat and growing conditions. Wild rice will also be sampled from a series of ongoing experiments in stock tanks that have been used to examine wild rice productivity in relation to sediment chemistry. The data from these experiments will assist in the evaluation of the field data. Replicate rice samples from each study site and experimental stock tank will be harvested at peak ripeness in late summer/early autumn and then analyzed for content of several macronutrients that are important for human health (e.g. protein, fiber, carbohydrates,



**Environment and Natural Resources Trust Fund (ENRTF)
2020 Main Proposal Template**

fat and fatty acids). Elements that are necessary for normal metabolic functions (e.g. iron, copper, zinc) will also be measured in the rice, along with compounds that are associated with nutritional benefit in humans called secondary plant metabolites or phytochemicals. (Jul 2020 – Jun 2022).

ENRTF BUDGET: \$ 122,313.33

Activity 2 Title: Characterize the water and sediment conditions at multiple test sites during wild rice growth
Description:

For each study site and experimental stock tank, researchers will measure and monitor several important variables within the water and sediment that surround the wild rice plant during its annual growth over two growing seasons (2020 & 2021). These variables include nitrogen, phosphorus, sulfate, iron and organic matter. Each of these variables has been shown to influence the growth and seed production of the wild rice plant but their effect on nutritional quality is unknown.

ENRTF BUDGET: \$ 55,262.33

Activity 3 Title: Map and correlate the findings to create a dataset, report findings

Description:

Combining the findings from Activity 1 and Activity 2, the research team will compile and geospatially map the data. Data will be analyzed to look for associations between growth conditions and the vitality, quality and nutritional composition of wild rice. Water and sediment characteristics will be correlated with the nutritional findings in the wild rice seeds. Findings will be reported. (Jul 2020- Jun 2022)

ENRTF BUDGET: \$ 20,516.34

Outcome	Completion Date
1. Analyze wild rice samples for several indices of plant vitality (seed size, quantity) and nutritional value (nitrogen/protein, fiber, carbohydrate, & phytochemicals)—Activity 1	Jul 2022
2. Collect wild rice samples from northern MN locations & test tanks (annual wild rice harvests from two growing seasons, 2020 & 2021)—Activity 1	Oct 2021
3. Measure water and sediment variables at wild rice sampling sites--Activity 2	Oct 2021
4. Compilation of the wild rice natural resource dataset, documenting the water and sediment conditions, geographic location and profile of wild rice seeds. Analyze and interpret findings—Activity 3	Jun 2022
5. Share findings at regional conference presentations or via publications	Jun 2022

III. PROJECT PARTNERS AND COLLABORATORS:

Daniel Gallaher PhD, Department of Food Science and Nutrition at the College of Food, Agricultural and Natural Resource Sciences (CFANS), University of Minnesota Twin Cities

Nathan Johnson PhD, Department of Civil Engineering, University of Minnesota Duluth

Emily Onello MD, Department of Family Medicine and Biobehavioral Health, UMN Medical School Duluth

John Pastor PhD (emeritus), Biology Department, University of Minnesota Duluth

IV. LONG-TERM IMPLEMENTATION AND FUNDING:

This 2-year research proposal is designed to provide sufficient time to collect field data (Activities 1 & 2) and perform the laboratory analyses (Activity 1). It is not anticipated that this specific project will require funding beyond its end date, though it is possible that additional research questions will arise that necessitate new inquiries. The project team expects that the dataset generated by the work (Activity 3) and any published findings will serve as an enduring resource resulting from the project.

Attachment A: Project Budget Spreadsheet
 Environment and Natural Resources Trust Fund
 M.L. 2020 Budget Spreadsheet



Legal Citation:
 Project Manager: Emily Onello, MD
 Project Title: Environmental Factors Influencing Nutritional Content of Wild Rice
 Organization: Regents of the University of Minnesota - Duluth (UMD)
 Project Budget: \$198,092.00
 Project Length and Completion Date: 2 years, 7/1/2020-6/30/2022
 Today's Date: 4/13/2019

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET		Budget	Amount Spent	Balance
BUDGET ITEM				
Personnel (Wages and Benefits)		\$ 177,592	\$ -	
Emily Onello, Project Manager \$36,079 (74% salary, 26% benefits); 8% FTE for years 1 and 2. Will lead effort on nutritional aspects of project and database creation.				
Bradley Dewey, Laboratory Technician \$53,852 (74% salary, 26% benefits); 60% FTE for year 1. Will maintain test environments (tanks) and perform chemical analyses on rice samples (e.g. nitrogen, fiber) on the UMD campus. Work will cover two wild rice growing seasons.				
Patrick Bright, Research Assistant \$5,290 (77% salary, 23% benefits); 10% FTE during year 2. Integrate data/findings with geospatial and mapping expertise, creation of dataset (UMN Medical School Duluth).				
Graduate Student \$40,936 (52% salary, 48% benefits); 50% FTE in year 1 only. Will work on geochemical aspects of project, with Dr. Nathan Johnson, UMD campus.				
Graduate Student \$41,435 (53% salary, 47% benefits); 50% FTE in year 2 only (higher cost than year 1 graduate student due to inflation/cost of living increase). Will perform the nutritional analyses on the wild rice samples with specialization in complex nutritional components (e.g. secondary plant metabolites) located at the UMN Twin Cities campus, in Dr. Gallaher's laboratory.				
Equipment/Tools/Supplies				
Dietary fiber analysis kits (4)		\$ 1,250		
Protein analysis (Dumas method)		\$ 700		
Fatty Acid, carbohydrate, and trace element analysis (standards solutions, chemicals for digestion, acid for acid-washing of glassware)		\$ 5,800		
Analysis of ferulic acid by HPLC - column, mobile phases, autosampler vials, chemicals and SPE columns for extraction and partial purification		\$ 2,200		
Analysis of total flavonoids and antioxidant capacity by DPPH		\$ 1,250		
Total phenolics measurement - reagents for assay, chemicals for extraction		\$ 900		
General laboratory chemicals (general purpose solvents, buffers, common chemicals, pH meter standard solutions)		\$ 900		
General laboratory supplies (tubes, pipette tips, cuvettes, filtering supplies, nitrogen gas, bottles, bags, preserving reagents)		\$ 2,450		
Consumable filters and water collection supplies (\$650) and sediment coring supplies (\$400)		\$ 1,050		
Travel expenses in Minnesota				
Travel to test sites (sediment and water analysis, collection of wild rice samples)		\$ 800	\$ -	
Conference travel to disseminate project findings (in state conference)		\$ 1,000		
Other				
Publication costs		\$ 1,200		
Conference registration for 2 investigators to present project findings		\$ 1,000	\$ -	
COLUMN TOTAL		\$ 198,092	\$ -	
SOURCE AND USE OF OTHER FUNDS CONTRIBUTED TO THE PROJECT				
	Status (secured or pending)	Budget	Spent	Balance
Non-State:		\$ -	\$ -	\$ -
State:		\$ -	\$ -	\$ -
In kind: Unrecovered indirect costs at 54% modified total direct cost		secured \$ 89,700	\$ -	\$ 89,700
Other ENRTF APPROPRIATIONS AWARDED IN THE LAST SIX YEARS				
	Amount legally obligated but not yet spent	Budget	Spent	Balance
		\$ -	\$ -	\$ -

Environmental Factors Influencing Nutritional Content of Wild Rice



Minnesota's Endowment, Wild Rice Habitat



Water, Air, Sun and Sediment:
Key influences on Wild Rice
Growth



Minnesota's Manoomin
(wild rice) flowering



Wild Rice for Human Health,
What determines the nutritional
value?



Rice Size Varies by Location



The Gift of the Harvest: Wild
Rice for Human Benefit

F. Project Manager Qualifications and Organization Description

Dr. Emily Onello is a full-time faculty member at the University of Minnesota Medical School Duluth campus and is a board-certified family physician. She has experience in managing research and educational grants during her past seven years at the medical school. She has worked on grants from a range of funding sources including the federal government, the University of Minnesota as well as private foundations. She is currently a Co-principal Investigator on a research grant for 2019 to look at the capacity of wild rice to protect against colon cancer in an animal model. (Her collaborator on that project is Dan Gallaher PhD who is also a co-investigator on this proposal).

She has a strong interest in wild rice as an indigenous plant with significant value to the people of Minnesota. She is familiar with many of the geographic, ecological and legislative/regulatory aspects of wild rice growth. Over the past five years, Dr. Onello has been involved in regional discussions of how alterations of natural resources may impact human health. As a result of her work, she recognizes the urgent need for continued scientific study of Minnesota's natural resources in order to support informed decisions about resource preservation and management.

An unanticipated benefit of her advocacy work is that she is part of a professional network of scientific researchers who are expert in their respective fields. Her skills include successful cooperation with scientists and researchers across different disciplines and colleges and campuses of the University of Minnesota. Her well-established working relationships with her co-investigators, as well as her experience in grants management and reporting, will allow her to successfully oversee the project and ensure that each project activity is completed as planned and that the findings will be reported for public use and benefit.

University of Minnesota

The University of Minnesota-Twin Cities is the state's land-grant university and one of the most prestigious public research universities in the nation. The University of Minnesota Duluth is a highly-ranked regional research and liberal arts university with a global reputation for freshwater research. All campuses of the University of Minnesota operate with the accreditation of the Higher Learning Commission. The Twin Cities campus has been accredited continuously since 1913. The Duluth campus has been accredited since 1968. Collectively, the University of Minnesota's research programs have had a significant impact on our state's economic strength. The University of Minnesota ranks eighth among U.S. public universities in research spending, and generates an estimated \$8.6 billion annual economic impact for the state of Minnesota.