

**Environment and Natural Resources Trust Fund
2010 Request for Proposals (RFP)**

LCCMR ID: 123-D

Project Title:

Controlling Invasive Purple Loosestrife Seeds in Recycled Sediment

LCCMR 2010 Funding Priority:

D. Invasive Species

Total Project Budget: \$ \$130,000

Proposed Project Time Period for the Funding Requested: 2 years, 2010 - 2012

Other Non-State Funds: \$ \$0

Summary:

This project expects to determine the effectiveness of using microwave technology to eradicate purple loosestrife seeds contained in recyclable sediment that could be used for beneficial purposes, including wetland creation.

Name: Lawrence Zanko

Sponsoring Organization: UMD, NRRI

Address: 5013 Miller Trunk Hwy
Duluth MN 55811

Telephone Number: (218) 720-4274

Email: lzanko@nrri.umn.edu

Fax: (218) 720-4329

Web Address: _____

Location:

Region: NE

County Name: St. Louis

City / Township: Duluth

_____ Knowledge Base	_____ Broad App.	_____ Innovation
_____ Leverage	_____ Outcomes	
_____ Partnerships	_____ Urgency	_____ TOTAL

MAIN PROPOSAL

PROJECT TITLE: Controlling Invasive Purple Loosestrife Seeds in Recycled Sediment

I. PROJECT STATEMENT

Minnesota regulations (Statute 84D.05) prohibit the transport of purple loosestrife. As St. Louis County Invasive Weeds Specialist, Gary Kuyava, has advised, managing purple loosestrife begins with eradicating the seeds, and that any plan that could render the seeds unviable is worth pursuing. Recycled dredge sediment can be beneficially used once techniques to eliminate viable seeds are developed that prevent the spread of purple loosestrife and infestation of other locations. This project will evaluate at the laboratory and pilot scale microwave heating of sediment and seeds: 1) in-situ; and 2) during loading of sediment for beneficial use sites. This proposal addresses LCCMR priorities: Invasive Species and Creative Ideas.

Erie Pier, an 82 acre confined disposal facility (CDF) for dredge sediment from the St. Louis River, annually receives approximately 100,000 cubic yards of sediment dredge from the navigational channels in Duluth-Superior Harbor and St. Louis River. Erie Pier is approaching its designed capacity. Only a small fraction of the dredge material is currently reused/recycled. Once the site is full, a new dredge material CDF of similar size will need to be constructed along the St. Louis River, potentially displacing the existing habitat.

Purple loosestrife seeds were identified in stockpiled sediment during a 2007 study. The presence of the seeds hinders efforts to reuse otherwise clean dredge sediment in off-site locations. This is unfortunate, because a previous study by Eger (2004) showed the Erie Pier material is an excellent soil amendment for: 1) revegetating nutrient-poor sites where vegetation needs to be improved for remediation, reclamation, and restoration projects; and 2) as a substrate for creating wetlands. Potential uses also include improving soil fertility for sustainable, locally-grown energy crop production on disturbed lands (see attachment).

Purple loosestrife seeds germinate when heated to 55° F for a period of 3 days within a soil thickness of about centimeter. This study will evaluate the potential to heat the seeds during loading. For example, could the material be treated along a conveyor as it is loaded into a truck? Sediment and seed mixes will be heated by portable microwave method to produce heat high enough to eliminate the seed's viability. Items to be evaluated in this study include:

- seed viability after microwave treatment,
- optimum microwave exposure time,
- effective treatment thickness (depth of microwave penetration into sediment), and
- effective moisture content.

The NRR is collaborating with the United States Army Corps of Engineers to develop a pilot study, beginning in the summer of 2009, which will evaluate the beneficial use of the recycled sediment to produce locally grown biofuel on disturbed lands.

This project is needed because controlling purple loosestrife in recycled sediment is the key to beneficial re-uses of dredge material and reducing the need for construction of a new CDF along the St. Louis River, at the attached letter of resolution from the Duluth Seaway Port Authority attests. The goal of developing an effective method to eradicate loosestrife seeds could be applied to other noxious weed seeds beyond the study area. The project will achieve its goal by combining biological science with engineering technology to achieve an innovative solution.

II. DESCRIPTION OF PROJECT RESULTS

Result 1: Evaluation of Portable Microwave Technology

Budget: \$ 80,000

Activities: Collection of sediment samples containing purple loosestrife, construction of test apparatus, and subjecting seed/sediment mixes to various heating times, soil thicknesses, and moisture contents to determine the most effective methods using microwave technology. The samples will then be evaluated to verify destruction of the plant. This study will be completed in the lab.

Deliverable

1. *Results of seed destruction*
2. *Results from heating times*
3. *Results of soil thickness testing*
4. *Results of moisture testing*

Completion Date

Summer 2011
Summer 2011
Summer 2011
Summer 2011

Result 2: Scale-Up Use of Microwave Technology

Budget: \$ 20,000

Activities: Evaluate the scaling-up of the microwave technology for application on-site as a pilot study.

Deliverable

1. *Summary of potential to scale-up and identified limitations*

Completion Date

Summer 2011

Result 3: Data Compilation and Final Reporting

Budget: \$ 30,000

Activities: Compile all data generated by the study, compare the times, thickness and moisture of sediment for effectiveness; and provide methodology for field scale testing of the technology(ies). All data, results and recommendations will be presented in a final report.

Deliverable

1. *Data compilation of test results*
2. *Final report with recommendations*

Completion Date

Fall 2011
Fall 2011

Total Budget: \$130,000

III. PROJECT STRATEGY

A. Project Team/Partners

Our project team includes: Lawrence Zanko, NRRI, Principle Investigator and responsibility for overall project management, sample collection, and sample testing; Seppo Valuppo, purple loosestrife expert, determine effectiveness of technologies on seed viability; and David M. Hopstock & Associates, microwave technology expertise.

B. Timeline Requirements

One and a half (1.5) years will be required for this study. The first year will investigate the best methods for applying the microwave technologies to just seeds in sediment. Remaining time will be used for data compilation, evaluation for pilot study and reporting. Funding requirements are \$130,000.

C. Long-Term Strategy

If this technology is seen to kill purple loosestrife at bench scale testing and can be scaled up, the next phase of the investigation would be to complete a field demonstration at Erie Pier, with the results of this study having good potential to leverage additional non-LCCMR support.

Project Budget

IV. TOTAL PROJECT REQUEST BUDGET (1.5 years)

BUDGET ITEM <i>(See list of Eligible & Non-Eligible Costs, p. 13)</i>	AMOUNT	
Personnel: Project Manager (LZ) includes salary and benefits	\$	22,000
Scientist (MP)	\$	28,000
Technician	\$	10,500
Contracts: Purple Loosestrife seed Evaluation - Expert - Seppo	\$	35,000
Microwave Expert - Dave Hopstock & Associates	\$	32,000
Equipment/Tools/Supplies: Sampling equipment, containers, shovels, etc	\$	1,500
Containers for microwave testing, materials for germination assessment		
Travel: Mileage and lodging for meeting attendance, field site visits, etc.	\$	1,000
Additional Budget Items:	\$	-
TOTAL PROJECT BUDGET REQUEST TO LCCMR	\$	130,000

V. OTHER FUNDS

SOURCE OF FUNDS	AMOUNT	Status
Other Non-State \$ Being Applied to Project During Project Period:		
Other State \$ Being Applied to Project During Project Period:	\$ -	
In-kind Services During Project Period:	\$ -	
Remaining \$ from Current Trust Fund Appropriation (if applicable):		/
Funding History:	\$ -	

Question: Can purple loosestrife seeds be managed with microwave technology?

Erie Pier, St. Louis River, Duluth



1) **Problem:** 82 acre dredge material confined disposal facility~100,000 cubic yards added annually. Silty loam dredge material is ideal for restoration and reclamation project. If filled to capacity, a new facility will need to be build along the St. Louis River. Habitat along the river would likely be effected.



06/22/2009

2) **Reason:**
Purple loosestrife contaminates the dredge material after arriving at Erie Pier. Seeds in the sediment restricts transport to other locations for beneficial use. Minnesota statute states it is illegal transport sediment containing purple loosestrife in Minnesota. (Mn-DNR-Website)



3) **Project Goal:** Evaluate portable existing microwave technology as an on-site treatment to eliminate viable purple loosestrife seeds in sediment.



4) **Potential outcome:** A treatment method that kills Purple loosestrife seeds on-site so dredge material can be recycle for restoration projects and wetlands creation.

2010 LCCMR Project Manager Qualifications

Lawrence Zanko, NRRI

Mr. Zanko is a Research Fellow and Group Leader for By-Product Reuse and Remediation within the Minerals Division of the Center for Applied Research and Technology Development of the Natural Resources Research Institute (NRRI), University of Minnesota Duluth. He has worked in the minerals field and has conducted geological, mineral resource and minerals industry-related applied research for most of his 26-year career. Since his start with NRRI in 1988, he has participated in or led a broad spectrum of research projects – often conducted in cooperation with private industry – dealing with non-ferrous minerals, ferrous minerals, industrial minerals (most recently focusing on construction aggregates), contaminated sediment remediation and reuse, and related policy issues. He regularly interacts and collaborates with public and private sector professionals and academicians in the geological, minerals, transportation, and environmental fields, inside and outside Minnesota. He is a graduate of the University of Minnesota – Twin Cities, where he received bachelor degrees in Geological Engineering and Microbiology, and a Masters degree in Geological Engineering.

Since 2000, Mr. Zanko has also worked on projects related to the remediation and beneficial reuse of contaminated and uncontaminated sediment and soil, experience that is particularly relevant to this proposal to LCCMR. Project collaborators have included the U.S. Army Corps of Engineers (Detroit District and Duluth Area Office) via the United States Environmental Protection Agency; state agencies; local entities like the Duluth Seaway Port Authority; and the private sector. Much of this work has focused on evaluating innovative technologies related to soil, sediment, and water cleanup.

Organization Description

NRRI was established in 1983 to encourage economic growth for Minnesota's natural resources-based industries while keeping watch over that growth's impact on the environment.

<http://www.nrri.umn.edu/default/about.htm>

Project Partners

Seppo Valppu

Botanist and purple loosestrife expert/consultant. Will assess purple loosestrife seeds and the effectiveness of the technology on seed viability.

David M. Hopstock, PhD

David M. Hopstock & Associates, LLC, will provide microwave technology expertise, safety guidance, and microwave technology development.