Environment and Natural Resources Trust Fund
2011-2012 Request for Proposals (RFP)

LCCMR ID: 129-E

Project Title: Controlling Invasive Plant Species with Portable Microwave Technology

Category: E. Aquatic and Terrestrial Invasive Species

Total Project Budget: $ $275,950

Proposed Project Time Period for the Funding Requested: 3 yrs, July 2011 - June 2014

Other Non-State Funds: $ 0

Summary:

Evaluate the use of portable microwave technology to control the spread of five invasive plant species by terminating seed germination and root propagation.

Name: Marsha Patelke

Sponsoring Organization: U of MN - NRRI

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Web Address

Location

Region: Statewide

Ecological Section: Northern Superior Uplands (212L)

County Name: Statewide

City / Township:

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

2011-2012 MAIN PROPOSAL

PROJECT TITLE: Controlling Invasive Plant Species with Portable Microwave Technology

I. PROJECT STATEMENT

Current methods of controlling invasive and noxious weed plant species include either physical removal of the plant and its roots, biological controls, and/or use of chemical herbicides. Some plants, like buckthorn, are very difficult to control. New quicker and safer methods for controlling the spread of invasive species need to be developed. They should not solely rely on chemical treatment or introduction of biological controls. Presently portable microwave equipment is used to thaw frozen ground to depths of 6 to 8 feet deep for gas, water, and cable utility work during the winter. This equipment could be potentially utilized for invasive species control. Based on limited laboratory testing conducted by NRRI's forest products group, purple loosestrife seeds heated to 200° F in a traditional oven for ½ day are not viable for germination. Microwaves heat items much more quickly than an oven. Our goal is to develop a portable microwave method of treating/controlling a variety of invasive plants that can be used state-wide in ditches, fields, roadsides, and potentially near shore environments.

Four plant species (Buckthorn, Canadian Thistle, Garlic Mustard, and Purple Loosestrife) will be exposed to microwaves to evaluate the potential use of this technology to kill the plant, its roots, and heating the seeds to eliminate their viability to germinate. This study will evaluate:

- seed viability after microwave treatment
- optimum microwave exposure time
- effective treatment thickness (depth of microwave penetration into sediment)
- effective soil moisture content
- soil nutrient quality/fertility post-treatment
- soil microbe content pre- and post-treatment

This study will be completed on the selected plants at both laboratory and field scales. Field treatment sites will be selected from 4 types of invasive plant infestation sites across Minnesota. NRRI is teaming with Seppo Valppu, biologist and invasive plant expert, to guide and direct al plant related research, both in the lab and field.

II. DESCRIPTION OF PROJECT ACTIVITIES

Activity 1: Conduct bench scale microwave treatment of Garlic mustard, Purple loosestrife, Canadian thistle, and Buckthorn, and develop optimum treatment methods. Evaluate soils and plants for effectiveness and negative side effects using microscope and greenhouse studies. The following activities will be completed a) Test effectiveness of microwave treatment on each of 4 plants to determine detrimental temperatures for roots and seeds, as well as required depth of microwave penetration. b) Determine specific exposure time, moisture content, season for treatment, and depth of treatment for each plant. c) Select field test sites based on large infestation locations for each invasive plant. d) Collect soil samples from selected test sites and evaluate for pre-treatment character, such as fertility and microbes.

Budget: $ 137,365

Outcome	Completion Date
1. Test results from Activity 1 will be compiled to create an operating procedure for field demonstration of this technology during the 2nd year.	July 2012

Activity 2: Conduct field trials of microwave technologies in the metro area and northeastern Minnesota: conduct treatment of Garlic mustard, Purple loosestrife, Canadian thistle, and Buckthorn. Evaluation of the effectiveness of microwave treatment applied to each plant species will be tested at field locations. Collect soil samples from each location for evaluation. To evaluate potential negative effects soil and mirco organism samples will be tested in the lab. A return trip to the location will be completed the following year to document effects on vegetation and soils. Complete lab and greenhouse studies to evaluate post treatment results.

Budget: $ 135,585

Outcome	Completion Date
1. A report that contains compiled results from activites1 and 2 to create a report that provides a review of the effectiveness of the use of microwave technology on eradicating invasive plant species and potential side effects to the surrounding environment at application sites.	*May 2014*

Activity 3: Host an educational workshop to present findings to state and local agency representatives. **Budget:** $ 3000

Outcome	Completion Date
1. Summary of investigation findings will be shared with the regulatory personnel	*June 2014*

III. PROJECT STRATEGY

A. Project Team/Partners

Steve Hauck, NRRI, Technical Review, LCCMR funding
Larry Zanko, NRRI, Co-Principle Investigator/Project Manager, LCCMR Funding
Marsha Meinders Patelke, NRRI, Principle Investigator, Research Scientist, LCCMR Funding
Kurt Johnson, NRRI, Biologist, Soils, and Peat Scientist, LCCMR Funding
Seppo Valppu, Contract Biologist, Invasive Plant Species Expert, Partner, LCCMR Funding
Other NRRI personnel, technicians and students, LCCMR Funding

B. Timeline Requirements

This project will require 3 years to complete. Activity 1, laboratory testing of microwave technology, will be completed by Jan 2013. Activity 2, field testing of microwave technology be completed by May 2014. Activity 3, reporting and workshop, will be completed by June 2014.

C. Long-Term Strategy and Future Funding Needs

Positive test results will show that invasive plant species can be treated with microwaves and with minimal side effects to the surrounding soils environment. Providing the outcome is positive, additional investigation as to other invasive species and environments where this treatment method can be applied should be evaluated.

2011-2012 Detailed Project Budget

IV. TOTAL TRUST FUND REQUEST BUDGET- 3 years

BUDGET ITEM	AMOUNT
Personnel:	
MP, Project Scientist/Researcher, 10% FTE, 40.1% Fringe	$ 28,928
S.Hauck, Technical Review, 2.5% FTE, 33.3%	$ 10,515
L. Zanko, Project Management, 5% FTE, 33.3% Fringe	$ 14,463
K. Johnson, Biologist, Soils & Peat Scientist, 10% FTE, fringe, 33.3%	$ 27,826
M. Schreiber, Technician, 5%, 40.1% Fringe	7,164
Student Worker, 50% FTE, 0% fringe, up to 2 part time students	$ 31,200
Total Personnel for 3 years	$ 120,096
Contracts:	$ -
Seppo Valppu- Biologist, Private Invasive Plant Expert	$ 62,400
Dave Hopstock and Associates, Microwave experts,	$ 27,000
Microwave Utilities, Inc., Portable microwave unit operators	$ 30,754
Soil Fertility/nutrient Testing	27,500
Equipment/Tools/Supplies: test pots, soil coring supplies, sample bags, growing trays, transport permits.	$ 3,500
Microscope (DC5-420th, digital)	$ 1,500
Safety Equipment, glasses, gloves	$ 200
Travel: Travel to collect samples. Travel to test sites for in field testing.	$ 1,500
Additional Budget Items: Workshop to present findings.	$ 1,500
TOTAL ENVIRONMENT & NATURAL RESOURCES TRUST FUND $ REQUEST	$ 275,950

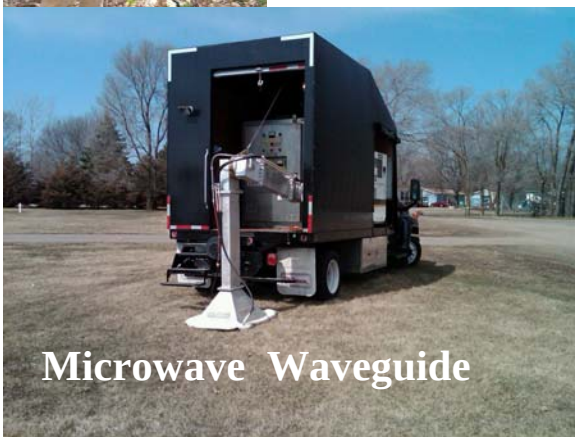
V. OTHER FUNDS

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 ENRTF Appropriation (if applicable):	$ -	
Funding History:	$ -	

Controlling Invasive Plant Species with Microwave Technology

Department of Natural Resources reports over 30 invasive plant species need treatment and control in Minnesota

Traditional methods of managing invasive plants include: physical removal, mowing, spraying herbicides for chemical treatment.



Microwave Waveguide

NEW Portable Microwave Technology Treatment will be evaluated for used to irradicate invasive plants, their roots, and seeds to stop their spread. Both the success of treatment and possible negative side effects will be evaluated.

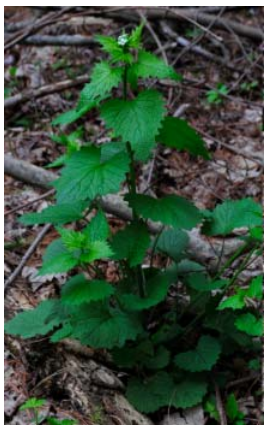
Lab and field work will be conducted. Field trials to be completed in both the Twin Cities metro area and northeastern Minnesota.

Treatment Candidates

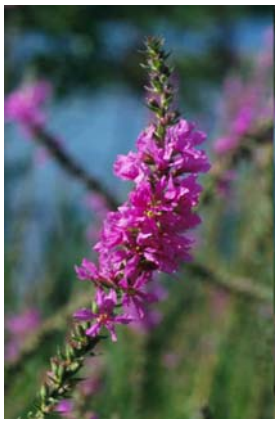
Buckthorn

Canadian Thistle

Garlic Mustard



Purple Loosestrife



UNIVERSITY OF MINNESOTA DULUTH
NATURAL RESOURCE RESEACH INSTITUTE
Michael Lalich, Director

NATURAL RESOURCES RESEARCH INSTITUTE

2010 LCCMR Project Manager Qualifications

Marsha Meinders Patelke - NRRI

Marsha Meinders Patelke is a registered professional geologist (PG) and scientist with the Economic Geology Group at the Natural Resources Research Institute (NRRI)

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Marsha Meinders Patelke is a scientist with the Economic Geology Group at NRRI. Prior to coming to NRRI, she worked for 15 years as project geologist and project manager at environmental/engineering consulting firms, completing a variety of investigation and remediation projects across northern Minnesota. Soil, ground water, surface water, and sediment investigation were completed at sites with contaminants ranging from petroleum, polycyclic aromatic hydrocarbons (PAHs), and metals. During her yeast in consulting she conducted environmental investigation and remediation projects along St. Louis River, Duluth Harbor Historic Use sites, and various sites across NE Minnesota while at Service Engineering Group, American Engineering Testing, and GME Consultants.

She graduated from Eastern Illinois University with at bachelor degree in Geology and is currently finishing her Masters degree in stratigraphy geology at the University of Minnesota Duluth.

Ms. Patelke came to NRRI in 2006 and has worked on projects such as beneficial re-use of harbor sediments, historical use of taconite tailings as aggregate for road construction, literature and available data review related to water quality and taconite tailings, and the stratigraphy of the Biwabik Iron Formation, from which taconite aggregate materials are generated.

Organization Description

Natural Resources Research Institute (NRRI) is a research facility associated with the University of Minnesota Duluth that was develop to foster economic development of Minnesota's natural resources and to promote private sector employment. Focus areas have included minerals, forest products, peat, water quality, biomass, and chemical extractives. http://www.nrri.umn.edu/default/about.htm