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

LCCMR ID: 125-E

Project Title: Microwave Heating to Kill EAB in Logs/Firewood

Category: E. Aquatic and Terrestrial Invasive Species

Total Project Budget: $ $220,078

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

Other Non-State Funds: $ 0

Summary:

Project will develop treatment schedules for industrial microwave heating that will kill 100% of emerald ash borer infestations so that ash logs can be transported for use in value-added products.

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Sponsoring Organization: U of MN - NRRI

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Location

Region: Statewide

Ecological Section: Statewide

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 _____%

PROJECT TITLE: Microwave Heating to Kill EAB in Logs/Firewood

I. PROJECT STATEMENT: "Emerald ash borer (EAB) is an insect that destroys ash trees – and it just arrived in Minnesota. EAB has already killed millions of ash trees in North America. It is expected to have a huge effect on Minnesota's landscape and the 937 million ash trees that grow in our cities and forests. Although the EAB can fly short distances on its own, much of its spread is due to humans transporting it as larvae burrowed under the bark of firewood or landscape trees." ~Minnesota DNR.

Microwave energy has demonstrated potential to rapidly kill EAB in logs and firewood. **Our project team will demonstrate efficacy and develop treatment schedules for microwave heating that will kill 100% of EAB infestations in ash logs so that these logs can be safely transported from quarantined areas to sawmills for used in value-added products or as certified EAB-free firewood.** The information needed for approval of microwave as an alternate control technology by USDA Animal and Plant Health Inspection Service (APHIS) will be developed in this project. Currently, the only approved wood sanitation methods as mandated by USDA APHIS are quarantines on wood movement and heat treatment of firewood. Quarantines prevent use of the wood for higher value-added products, since most sawmills are outside the quarantine zones. For firewood, the use of heat as a sterilization technique is the only approved method for killing EAB; currently there is insufficient data to support approval of alternate treatments.

This proposal builds on previous work completed by the project team on the use of microwaves as a control for invasive species (EAB) and for certifying firewood as insect-free through the use of heat treatments. A strong team of University and federal laboratory experts in phytosanitary treatments, wood products, microwave heating and EAB has been established. This goal of this project is to produce sufficient scientific and economic evidence for using 915 MHz industrial microwave energy as a rapid and economically viable treatment for killing 100% of EAB in logs, lumber and firewood. If infested ash logs in Minnesota could be effectively sanitized, higher quality wood could be safely transported to commercial sawmills while lower-quality wood could be certified as insect-free firewood. Successful validation of microwave treatment will allow movement of logs from quarantine zones so that higher-grade ash can be processed into value-added products like flooring, cabinetry, furniture, and decorative panels. This project will result in additional employment and will likely increase employment as this treatment technology is implemented, while protecting jobs in our wood products manufacturing sectors.

II. DESCRIPTION OF PROJECT ACTIVITIES

Activity 1: Conduct trials using ash logs and lumber to determine microwave energy treatment schedules and equipment capable of achieving known lethal temperatures for EAB. **Budget:** $52,290

Green, black and white ash materials will be treated by a contractor using portable microwave equipment with industrial oven heating frequencies of 915 MHz. Combinations of power (up to 38 kilowatts), time (0.5, 1.0 and 1.5 minutes) and run-pulsing will be used to develop equipment parameters required to achieve surface and internal temperatures that are known to kill EAB. The portable microwave equipment options evaluated will include a linear conveyor that heats from four sides and a hood on a portable arm. This work will be completed in Minnesota on ash at approved waste disposal sites inside the current quarantine zone in Hennepin and Ramsey counties.

Outcome	Completion Date
1. Comprehensive review of available information on thermal, MW and radio frequency treatments of wood for insects.	August 2011
2. Completion of microwave energy heating trials on black, white and green ash to determine microwave treatment parameters and equipment that achieve temperatures known to kill EAB.	December 2011

Activity 2: Conduct microwave treatments on EAB infested ash at a USDA EAB laboratory to validate the treatment regimes (activity 1 outcome) that kill 100% of EAB. **Budget:** $122,362

This activity will take place at the USDA EAB laboratory in Brighton, MI, since there is not a similar USDA laboratory in MN. Ash logs with a high probability of EAB infestation will be collected in MI and treated by a contractor using portable microwave equipment. To validate that 100% of EAB is killed by the microwave treatments, USDA personnel will monitor post-emergence of EAB from treated and control logs. This work will be conducted both in 2012 and 2013 due to the EAB life cycle.

Outcome	Completion Date
1. Collection of EAB infested ash and comprehensive assessment of log condition.	Jan 2012 & Jan 2013
2. Completion of microwave energy heating of the ash logs and monitoring of post-treatment emergence of EAB to ensure that 100% EAB is killed. Conduct second series of tests to replicate data and make necessary process changes.	May 2012 & May 2013
3. Adequate data has been developed for submission to USDA APHIS.	July 2012/2013

Activity 3: Submit complete package of efficacy data and recommended microwave treatment schedules to APHIS for review and consideration. **Budget:** $45,426

All microwave treatment data, including temperature profiles and EAB emergence data, will be summarized and submitted to APHIS. Based on this review, we will produce and provide additional data as necessary for potential acceptance of 915 MHz microwave treatment as an alternate control technology for killing EAB, allowing for safe transport of ash logs, lumber and firewood.

Outcome	Completion Date
1. Delivery of comprehensive report on microwave treatment to USDA APHIS.	October 2012
2. Completion of additional testing as required by USDA APHIS. Resubmit results.	October 2013
3. USDA approves use of 915 MHz microwave as an effective treatment for EAB.	Dec 2013
3. Demonstration trials of microwave technology for state and federal agencies, interested firewood producers and organizations that are affected by log quarantines.	Dec 2013

III. PROJECT STRATEGY

A. Project Team/Partners

Organization	Role	ENRTF funds requested?	Matching funds?
University of Minnesota Duluth NRRI	Project leader with expertise in heat treating firewood to kill invasives.	Yes	
Penn State University	Expert consultants with recognized experience in using microwave energy to kill invasives.	Yes	
USDA APHIS	Conduct EAB emergence testing	No	In-kind
MN DNR	Interaction with MN forest industry and state agencies	No	In-kind
Microwave Utilities Inc.	Equipment contractor with only known portable microwave equipment.	Yes	In-kind
USDA Forest Products Lab.	Research cooperator	No	In-kind

B. Timeline Requirements. The project is proposed for 2.5 years and conducted in three phases. Microwave trials will be completed to verify process requirements prior to treating EAB infested logs. This alternate EAB treatment technique will need approval by USDA APHIS.

C. Long Term Strategy and Future Funding Needs. This project utilizing high power microwave technology builds on previous research conducted by researchers at Penn State and others. It is projected that future studies may be required for other invasive species that may affect MN in the future.

2011-2012 Detailed Project Budget

IV. TOTAL TRUST FUND REQUEST BUDGET - - 2.5 years

BUDGET ITEM	AMOUNT
Personnel: UMD NRRI, Brian K. Brashaw, PI (20% FTE, 75% salary, 25% fringe): Overall project management, microwave treatment coordinator, interface with all cooperators, reporting.	$ 67,172
Personnel: UMD NRRI, Robert Vatalaro, Technician, 25% FTE, 71% salary, 29% fringe): Material preparation, testing, data management.	$ 53,107
Personnel: Undergraduate student, 50% FTE (100% salary, 0% fringe, no tuition): Testing, data processing.	$ 21,187
Contracts: Expert consulting services on Phytosanitary treatment of EAB (Dr. Kelli Hoover and Dr. John Janowiak)	$ 16,000
Contracts: Microwave Utilities Inc. 915 MHz microwave treatment of logs and travel during project	$ 40,000
Equipment/Tools/Supplies: Thermal imaging camera to monitor surface temperatures of logs.	$ 6,000
Equipment/Tools/Supplies: Fiber optic temperature probes and data acquisition hardware	$ 4,500
Equipment/Tools/Supplies: EAB incubation tubes to hold logs	$ 812
Travel: Microwave heating trials activity 1 in Minnesota (mileage, per diem lodging and meals)	$ 2,200
Travel: Microwave and EAB emergence trials (activity 2 and 3) at USDA APHIS lab in Brighton, MI since no equivalent lab for EAB emergence is located in MN. (Three one week trips for 2 people to include airfare, lodging, per diem meals, rental car are planned.)	$ 9,100
TOTAL ENVIRONMENT & NATURAL RESOURCES TRUST FUND $ REQUEST	$ 220,078

V. OTHER FUNDS

SOURCE OF FUNDS	AMOUNT	Status
In-kind Services During Project Period: *In-kind services will be provided Microwave Utilities Inc. and USDA Forest Products Laboratory to include ash log selection, data collection, post-microwave EAB emergence assessments and report preparation. These activities are critical for conducting the project and achieving its planned objectives. The in-kind will consist of personnel salary and fringe, travel and the total is estimated at $50,000.*	$ 50,000	Secured
In-kind Services During Project Period: *In-kind services will be provided USDA APHIS to include post-microwave EAB emergence assessments. These activities are critical for conducting the project and achieving its planned objectives. The in-kind will consist of personnel salary and fringe.*	$ -	Secured

Microwave Heating to Kill EAB in Logs/Firewood

Microwave energy has demonstrated potential to rapidly kill EAB in logs and firewood. Our project team will demonstrate efficacy and develop treatment schedules for microwave heating that will kill 100% of EAB infestations in ash logs so that these logs can be safely transported from quarantined areas to sawmills or used as certified EAB-free firewood, resulting in use as value-added products. The information needed for approval of microwave as an alternate control technology by USDA APHIS will be developed in this project.

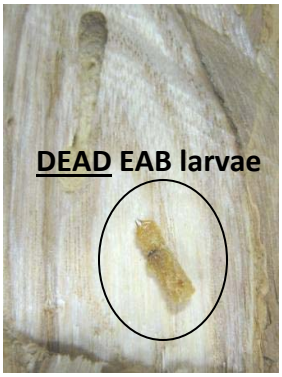
The Challenge

EAB larvae girdle ash trees resulting in rapid death. EAB beetles emerge in summer, traveling only a few miles on their own. (Images: Bugwood.org)

Millions of dead ash trees are quarantined for use as low value biomass. (Images: USDA, Bugwood.org)

The Opportunity

Portable 915MHz microwave equipment will be used to treat ash logs for EAB. (Images: Microwave Utilities Inc.)



EAB emergence testing will be done with USDA APHIS to verify 100% of EAB is killed, allowing for certification of EAB-free logs for use in firewood and value-added wood products. (Images: USDA Forest Service, Crystal Cabinets, Hotsticks)

Proposal Title: Microwave Heating to Kill EAB in Logs/Firewood

Project Manager Qualifications and Organization Description

Brian Brashaw
Brian Brashaw is the Director of the Wood Materials and Manufacturing Program at the Natural Resources Research Institute, University of Minnesota Duluth where he has been employed since 1991. Brian is an accomplished manager of a broad-based research program focused on wood products manufacturing, resource utilization, and nondestructive evaluation technologies.

He has served as the co-Investigator on two previous USDA Forest Service Wood Education and Resource Center projects involving heat treatment of wood packaging materials for the ISPM 15 standard and heat treatment of ash firewood for EAB standard. He is a key member of a cooperative research team including the USDA Forest Products Laboratory, UMD NRRI and USDA APHIS working on heat sterilization research for preventing the spread of invasive species.

The primary mission of this program is to facilitate economic growth and stability of Minnesota and other Lake States wood product manufacturers. Key strategic partnerships have been established with state agencies, federal laboratories, economic development groups and private industry. He has broad knowledge of the wood products industry in Minnesota, the Lake States and the world. He has developed strategic relationships with wood product manufacturers ranging in size from entrepreneurs to Fortune 500 companies. He is currently serving as the project director for the University of Minnesota Duluth Wood Utilization Research (WUR) Center and has held a number of past and current leadership positions for the Forest Products Society. He is currently serves on the International Advisory Committee for the International Nondestructive Testing and Evaluation of Wood Symposium Series. He has published over 100 journal articles and technical reports.

University of Minnesota Duluth Natural Resources Research Institute (UMD NRRI)
Founded by the State Legislature in 1983, the Natural Resources Research Institute fosters the economic development of Minnesota's natural resources in an environmentally sound manner to promote private sector employment. NRRI researchers provide a wide range of research and development service to industries large and small, from substantial iron ore operations to entrepreneurial start-ups. NRRI scientists also provide resource decision-makers with environmental information-from water quality to effects on moose populations