

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

LCCMR ID: 239

Project Title:

Ecological and Hydrological Impacts of Emerald Ash Borer

LCCMR 2010 Funding Priority:

D. Invasive Species

Total Project Budget: \$ \$636,435

Proposed Project Time Period for the Funding Requested: 5 years, 2010 - 2015

Other Non-State Funds: \$ \$107,000

Summary:

The project assesses impacts of emerald ash borer on Minnesota's black ash swamps. Results will quantify impacts on native forest vegetation, invasive species spread, and hydrology.

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Location:

Region: NW, NE, Central

County Name: Aitkin, Becker, Beltrami, Carlton, Cass, Clearwater, Cook, Crow Wing, Hubbard, Itasca, Kanabec, Koochiching, Lake, Lake of the Woods, Mille Lacs, Morrison, Pine, Roseau St. Louis, Stearns

City / Township:

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

MAIN PROPOSAL

PROJECT TITLE: Ecological and Hydrological Impacts of Emerald Ash Borer

I. PROJECT STATEMENT

The Emerald Ash Borer (EAB) has been decimating ash throughout the Great Lake States and is currently advancing into Minnesota, threatening the future of the ash-dominated forests that occur across much of the state (Fig 1). Of particular concern is the impact EAB will have on the ecology and functioning of black ash swamps, which cover over one million acres in Minnesota and represent the state's most common ash forest type. Although research from other states is currently addressing how to detect and control EAB within urban areas, these approaches have little utility within rural, forested settings making the threat of losing black ash from Minnesota quite serious once EAB reaches the northern portion of the state; an event expected to occur within several decades if not sooner.

- **Hydrological and Ecological Impacts**

The EAB impacts on black ash swamps will likely be extreme, resulting in dramatic changes in native plant communities and increasing the potential for invasion by exotic plant species. In particular, black ash trees grow and thrive in swamps and occupy a unique wet niche where few other tree species grow. Mature trees absorb and transpire over 50 gallons of water a day, in effect pumping this water into the air. Consequently, if black ash trees are killed by EAB, there will be a much larger volume of water in swamps leading to expanded swamp areas and flooding. These increased water levels may kill other trees and vegetation and could lead to flooding of adjacent forests, agricultural lands, private property, and public road infrastructure. As a result, immediate research is needed to assess the impacts of EAB on native biodiversity, ecosystem functioning, and hydrology, as well as to evaluate possible mitigation strategies for increasing the resilience of these systems to EAB.

This project will increase our understanding of the ecological and hydrological impacts of EAB through the establishment of a network of research sites in black ash forests in Minnesota. Treatments simulating EAB-induced ash mortality will be implemented at each site to characterize how the loss of ash from these systems will impact native plant communities, the spread of invasive species, and site hydrology. In addition, the survival and growth of a mixture of planted tree seedlings will be evaluated to determine what species might be able to mitigate the ecological impacts of the loss of black ash from these forests. Finally, laboratory experiments assessing the cold tolerance of EAB will be used to determine the potential for EAB spread into northern Minnesota. Importantly, results from this project will allow for predictions into how EAB will affect northern Minnesota's forests and will serve to inform management recommendations for mitigating the impacts of this exotic insect prior to its establishment in black ash stands.

- **Project urgency**

There is a considerable amount of research underway at other academic institutions, such as Michigan State University and Ohio State University, examining potential ways for controlling EAB using bio-control or chemical means. These studies are generating important future results that will be a critical component of strategies for slowing EAB spread within Minnesota, particularly within urban settings. Nonetheless, there is a very high likelihood that EAB will reach the vast black ash swamps in northern Minnesota long before these techniques are perfected, creating a great unmet research need in terms of how EAB might affect the ecology and hydrology of these ecosystems. Although the Minnesota Department of Agriculture has

received funds for addressing the management challenges posed by EAB in Minnesota, these funds cannot be used towards research. As such, there is a critical need for research that can assess the potential impacts of EAB on our ash forests, as well as generate management strategies for maintaining the functioning of these systems, even after EAB has arrived.

- **Project duration**

This project is intended to be a 5-year study. This time period is necessary to allow for research site identification, treatment implementation, and 4 years of post-treatment measurements. Importantly, having multiple measurement years to assess tree seedling survival and hydrological changes following ash mortality will be critical for generating well-informed management and conservation strategies aimed at minimizing the impacts of EAB on black ash swamps.

II. DESCRIPTION OF PROJECT RESULTS

Result 1: Develop a network of research sites within black ash forests to assess impacts of EAB on biodiversity and productivity

Budget: \$143,475

We will locate and establish 15 study sites within black ash forests in northern Minnesota. Experimental treatments at each site will include three levels of ash loss (retain all ash, simulated EAB mortality by girdling all ash, or harvest all ash) and two levels of planting (planting or no planting). Sites will be a minimum of 50 acres to allow for assessment of hydrological impacts of EAB.

Deliverable

	Completion Date
1. Work with MNDNR, USFS, and counties to identify black ash forest sites	October, 2010
2. Conduct pre-harvest measurements of forest conditions	November, 2010
3. Implement treatments (carry out timber sales and girdle trees)	March, 2011

Result 2: Determine the impacts of ash mortality from EAB on native plant communities, survival and growth of possible replacement tree species, spread of invasive species, and hydrologic patterns

Budget: \$426,639

To assess the impacts of EAB on native plants, tree regeneration, invasive species, and hydrology, we will plant seedlings and monitor their survival and growth, characterize the abundance of native and invasive plant species in unplanted areas, and assess changes in hydrology following ash mortality. Seedlings will consist of a mix of species adapted to lowland forest conditions, allowing us to address questions related to appropriate species for increasing the resiliency of ash swamps to EAB. Results concerning the impacts of ash mortality on native plant communities, tree regeneration, and hydrology will be summarized in public project reports and conveyed to managers through outreach activities.

Deliverable

	Completion Date
1. Plant seedlings and conduct post-harvest measurements	October, 2011
2. Assess plant communities, planted seedlings, and hydrology for 4 years	October, 2014
3. Develop and publish project summaries aimed at resource managers working with black ash swamps within the state	June, 2015

Result 3: Determine potential for spread of EAB into northern Minnesota

Budget: \$66,321

The potential for EAB to impact black ash communities in Minnesota hinges on the cold tolerance of this insect. We will conduct laboratory experiments investigating the tolerance of EAB larvae to winter temperatures commonly occurring in northern Minnesota. Findings from these experiments will be integrated into models predicting the potential spread of EAB throughout the state. Results concerning the cold tolerance and potential spread of EAB

strategies will be summarized in public project reports and conveyed to managers through outreach activities.

Deliverable

Completion Date

- | | |
|--|----------------|
| 1. Determine the cold tolerance of EAB | November, 2012 |
| 2. Incorporate results into models of EAB spread | November, 2013 |
| 3. Publish project summaries aimed at resource managers working with black ash swamps within the state | June, 2014 |

III. PROJECT STRATEGY

A. Project Team/Partners

The research team will be led by scientists at the University of Minnesota, Department of Forest Resources, namely Dr. Anthony D'Amato, Dr. Alan Ek, Dr. Peter Reich, and Grant Domke, scientists at the U.S. Forest Service Northern Research Station, namely Dr. Brian Palik and Dr. Rob Venette; and scientists with the Minnesota Forest Resources Council, namely Dr. Rob Slesak. Collaborators will include the Minnesota Department of Natural Resources, Chippewa National Forest, Saint Louis County, and other counties in northern Minnesota.

B. Timeline Requirements

The project duration is five years. The requested time is necessary to identify sites, implement treatments, analyze ecosystem responses and integrate results into models of EAB spread.

C. Long-Term Strategy

This proposed project will build upon an existing project examining the decline of black ash within northern Minnesota established with \$120,000 in grants from the USDA Forest Service (USFS). Project participants are committed to long-term maintenance and monitoring of sites established in this proposed project. Although we anticipate subsequent proposals to LCCMR, we are also seeking additional funds from the USDA, US Forest Service Forest Health Monitoring Program, and the National Science Foundation.

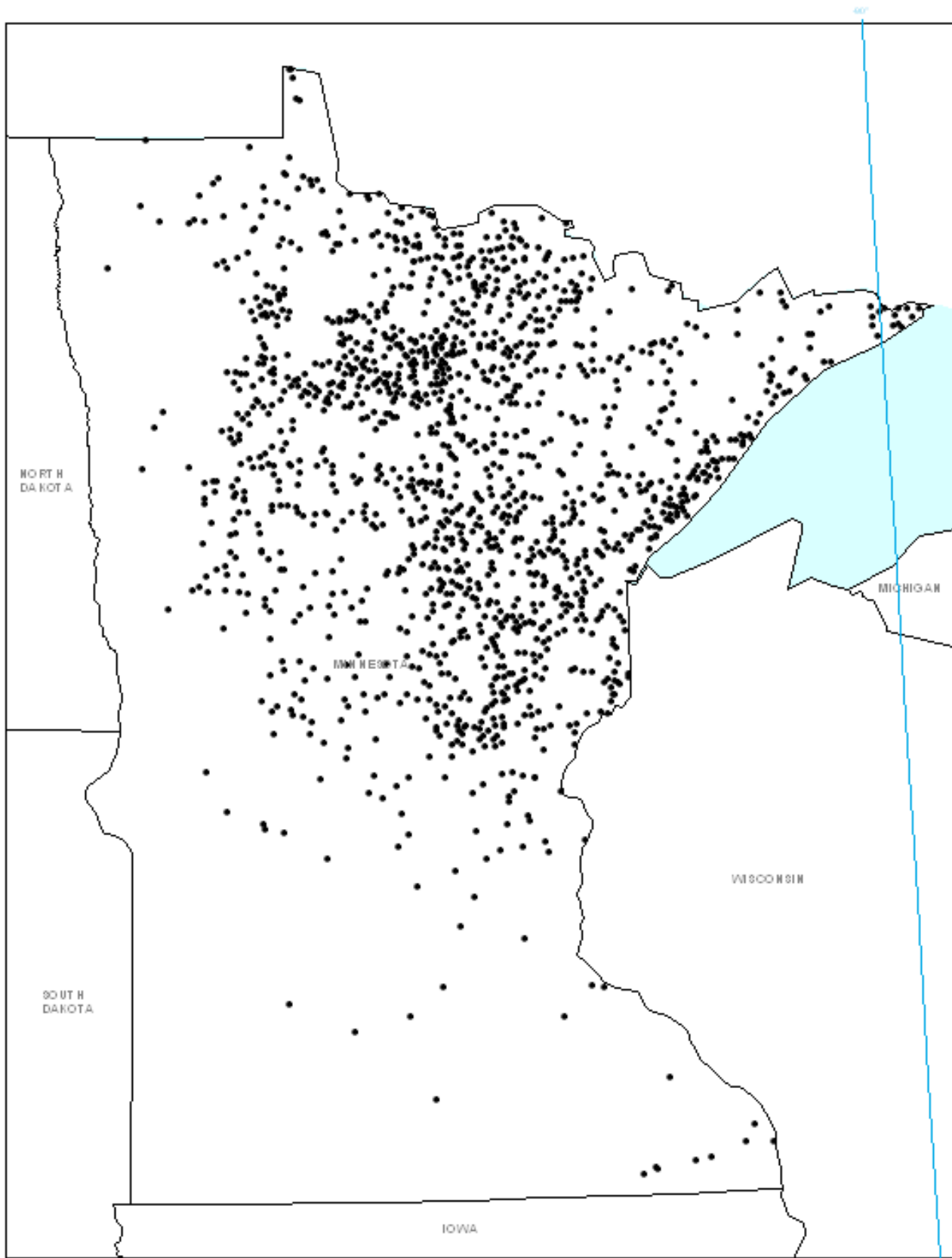


Figure 1. USDA Forest Service Forest Inventory and Analysis plots in Minnesota on which black ash is present (2003-2007 FIA inventory period).

Project Budget
Ecological and Hydrological Impacts of Emerald Ash Borer

Pis: Dr. Anthony D'Amato, Dr. Peter Reich, Dr. Alan Ek, and Grant Domke, University of Minnesota; Dr. Brian Palik, Dr. Rob Venette, USDA Forest Service; Dr. Rob Slesak, Minnesota Forest Resources Council

IV. TOTAL PROJECT REQUEST BUDGET (5 years)

<u>BUDGET ITEM</u>	<u>AMOUNT</u>
Personnel: Salary and fringe for two graduate students; one for four years and the other for 2 years. Graduate fringe is budgeted at 0.7694 of salary load and includes tuition for the academic year, health care for the fiscal year, and social security and Medicare for 6.5 pay periods (summer)	\$ 208,460
Salary and fringe (0.1812) for a post-doctoral research associate for four years.	\$ 225,717
Salary and fringe (0.3230) for a research associate for three years (0.5 FTE)	\$ 118,044
Salary and fringe (0.0743) for two summer students for four years	\$ 37,214
Equipment/Tools/Supplies: Equipment includes rebar for permanently marking plot centers (\$550), supplies for constructing wells for monitoring hydrology at each site (\$15500), Haglof distance measuring equipment (\$700), stake whisks for marking subplots (\$110), calipers for measuring seedling growth (\$320), supplies for constructing frames for measuring understory vegetation (\$150), draw knives and pruning saws for girdling trees (\$1000), gloves for field crew girdling trees (\$60), diameter tapes for measuring overstory trees (\$150), data loggers for micrometeorological measurements (\$3460)	\$ 22,000
Travel: Due to the high number of study sites and logistics associated with establishing the harvest treatments and baseline data collection, \$25,000 is budgeted for domestic travel within Minnesota. This money will be used to pay for mileage (75%) and lodging (25%) for researchers, the field technician, post-doc, graduate students, and undergraduate students	\$ 25,000
TOTAL PROJECT BUDGET REQUEST TO LCCMR	\$ 636,435

V. OTHER FUNDS

<u>SOURCE OF FUNDS</u>	<u>AMOUNT</u>	<u>Status</u>
Other Non-State \$ Being Applied to Project During Project Period: U.S. Forest Service "Evaluating black ash decline in the upper midwest."	\$ 120,000	Secured
In-kind Services During Project Period: In-kind salaries provided by UMN researchers on the project.	\$ 107,000	Secured

Ecological and Hydrological Impacts of Emerald Ash Borer

Project Manager Qualifications

Anthony W. D'Amato

Qualifications

Anthony is an Assistant Professor of Silviculture and Applied Forest Ecology in the Department of Forest Resources, University of Minnesota. He conducts teaching, research, and participates in outreach/Extension programs. His research primarily focuses on traditional and experimental silvicultural strategies for meeting diverse forest management objectives ranging from the sustainable production of woody biomass for biofuels to the maintenance of native biodiversity within managed forests. His primary outreach audiences are natural resource managers.

Anthony has been the project manager on a large-scale Minnesota Forest Resources Council project aimed at evaluating the effectiveness of Minnesota's biomass harvesting guidelines. He has published several peer reviewed and non-technical articles which address the impacts of forest harvesting practices, introduced insects, and natural disturbances on forest growth and development and has been involved with several outreach programs focused on the development of sustainable harvesting strategies for Minnesota's forests.

Responsibilities

As Project Manager, Anthony would coordinate and manage the overall project, coordinate the establishment of research sites and implementation of harvests and treatments in Result 1, provide oversight for the establishment and measurement of seedling responses to each treatment (Result 2), and provide oversight on the integration of cold tolerance findings into models predicting the spread of emerald ash borer spread (Result 3). In the coordination and management role, he would convene meetings of project participants throughout the life of the project to facilitate collaborative efforts, share results, discuss future directions, and identify additional outreach opportunities that could be pursued. His research would focus on evaluating the impact of ash mortality on native plant communities, tree seedling survival, and spread of invasive species (Result 2).

Organization Description

The Department of Forest Resources is part of the University of Minnesota.

