

**Environment and Natural Resources Trust Fund
2014 Request for Proposals (RFP)**

Project Title:

ENRTF ID: 099-D

Mountain Pine Beetle: Invasive Threat to Minnesotas Pines

Category: D. Aquatic and Terrestrial Invasive Species

Total Project Budget: \$ 382,100

Proposed Project Time Period for the Funding Requested: 3 Years, July 2014 - June 2017

Summary:

Mountain pine beetle kills pines. Given a recent find and two potential arrival pathways, we survey and characterize risk to Minnesota's pine forests to inform early detection and rapid response.

Name: Brian Aukema

Sponsoring Organization: U of MN

Address: 1980 Folwell Ave
St. Paul MN 55108

Telephone Number: (612) 624-1847

Email brianaukema@umn.edu

Web Address http://www.forest-insects.umn.edu

Location

Region: Central, Metro, Northwest, Northeast, Southeast

County Name: Aitkin, Anoka, Becker, Beltrami, Benton, Carlton, Cass, Chisago, Clearwater, Cook, Crow Wing, Fillmore, Houston, Hubbard, Isanti, Itasca, Kanabec, Kittson, Koochiching, Lake, Lake of the Woods, Mahanomen, Marshall, Mille Lacs, Morrison, Mower, Olmsted, Otter Tail, Pine, Polk, Ramsey,

City / Township:

<input type="checkbox"/> Funding Priorities	<input type="checkbox"/> Multiple Benefits	<input type="checkbox"/> Outcomes	<input type="checkbox"/> Knowledge Base
<input type="checkbox"/> Extent of Impact	<input type="checkbox"/> Innovation	<input type="checkbox"/> Scientific/Tech Basis	<input type="checkbox"/> Urgency
<input type="checkbox"/> Capacity Readiness	<input type="checkbox"/> Leverage	<input type="checkbox"/> Employment	<input type="checkbox"/> TOTAL _____%



I. PROJECT STATEMENT

Overview: Our project focuses on survey and characterization of risk to Minnesota's pines from mountain pine beetle, the most devastating forest insect in North America. Six months ago, mountain pine beetle was found in a shipment of logs to Minnesota. Fortunately, the insect was dead, but live insects may be here already.

The threat: Mountain pine beetle is a specialist on all species of pines. During outbreaks, it *must* kill trees in order to reproduce. Minnesota has 191,000,000 red, jack, and white pines susceptible to mountain pine beetle (2011 US Forest Service data), as the insect prefers trees larger than 5" diameter. Our pine forests create valuable wildlife habitat, regulate water runoff, and promote recreational opportunities. To date, mountain pine beetle has impacted almost 125 million acres of mature pine forests in western North America, where it is native.

There are two routes of entry to Minnesota (see graphic page):

- 1. Through import of green logs into the state from proximate western states with the insect.** Interstate movement of logs is not regulated, so it is challenging to quantify the extent of this risk. The Minnesota Department of Agriculture (MDA) recently formed an expert task force on mountain pine beetle. Early investigation revealed one supplier in Montana who indicated they distribute wood to 900 builders, including "hundreds" in Minnesota and Wisconsin. Last fall, five site visits were performed from an initial list of 79 businesses potentially involved in wood movement (sawmills, log home builders, etc.). Dead mountain pine beetle were found in one visit.
Raw wood imports brought Douglas fir beetle, a kissing cousin of mountain pine beetle, to Grand Rapids, a few years ago. For unknown reasons, those insects died after being established from 2002-2006. Minnesota got lucky, but needs to learn from that experience. Statewide monitoring is needed now and should be continued until evidence suggests the beetle could not establish here.
- 2. From the northwest through a corridor of jack pine stretching across Canada's boreal forest into northern Minnesota.** Currently, an ongoing outbreak of mountain pine beetle in western Canada totals 45 million acres in size, making it the world's largest outbreak of any forest insect. The insect is typically kept in check by cold winter temperatures, but recent warming trends have unleashed the beetle over the Rocky Mountains on a path to Minnesota's pines. In a "good" year, the insects can disperse up to 500 miles (even visible on Doppler radar). Minnesota is 500 miles from the Black Hills of South Dakota, but there is little pine in between. We are twice this distance from the approaching front in Canada, but there is contiguous pine in between. Estimating the approaching front is difficult, as monitoring is an imperfect science: much like emerald ash borer, we know where trees have died, not how much closer the beetle is now.

We have two objectives:

- 1. Survey 25 state locations for presence of mountain pine beetle.** If low numbers have been introduced, they may persist for a number of years before exploding (similar to emerald ash borer). Unlike emerald ash borer, there *is* an effective trap and lure. Management of isolated, endemic populations may not be impossible – *if* we know they are there first.
- 2. Characterize the risk to Minnesota's pine species.** Studies by Canadian researchers indicate jack pine is an excellent food source for the insect. We will characterize development and survival in red, white, and Scots pines to inform and direct rapid response management for Minnesota's pine species.



II. DESCRIPTION OF PROJECT ACTIVITIES

Activity 1: Survey pine forests for mountain pine beetle **Budget: \$106,000**

Two part-time technicians at the MDA will survey pine locations throughout Minnesota for two years spring - fall. Sites will be selected based on known or suspected importation routes of green timber. Technicians will identify trap contents for mountain pine beetle and native natural enemies.

Outcome	Completion Date
1. Identification of survey sites	12/31/2014
1. Inventory of bark beetles and predators responding to mountain pine beetle lures (3 yrs)	06/30/2017
2. Inventory of which local natural enemies can track MPB chemicals (potential biocontrol)	06/30/2017

Activity 2: Determine developmental rate in Minnesota's pines **Budget: \$175,282**

Beetles will develop faster, slower, or not at all in "new" tree species. Initial Canadian data suggests that mountain pine beetle can easily kill and reproduce in jack pine. A graduate student and undergraduate summer worker (U of M) will characterize development of mountain pine beetle in logs of red, jack, white, and Scots pine. Note: we request permission to transport logs to pine forests in South Dakota for this work, as we have no desire to inadvertently introduce this insect to Minnesota. Beetles will be introduced to the logs, deployed to the field, and attraction and development rates will be measured.

Outcome	Completion Date
1. Comparison of Minnesota's pines for attractiveness to flying beetles	06/30/2015
2. Comparison of development times in Minnesota's pines	06/30/2016

Activity 3: Characterize cold tolerance in Minnesota's pines **Budget: \$100,817**

Outcome	Completion Date
1. Identification of which of Minnesota's pines confer greatest overwintering protection	06/30/2015

In western pines, cold tolerance differs depending on species of pine. The same graduate student and an undergraduate summer worker will characterize the effects of freezing temperatures on beetle mortality levels in logs of red, jack, white, and Scots pine in the BSL-2 quarantine facility at U of M to inform risk maps.

III. PROJECT STRATEGY

A. Project Team/Partners

Similar to the ongoing EAB projects on biocontrol, detection, and monitoring, this proposal is a joint partnership with the MDA, USDA Forest Service, and the University of Minnesota.

Receiving funds: The MDA (Abrahamson) will lead the survey efforts. The U of M and the Forest Service (Aukema/Venette) will lead the characterization of risk to Minnesota's pines through studies of reproduction and cold tolerance.

Not receiving funds: The Forest Service will not receive funds. All institutions will provide in-kind equipment, facilities, intellectual input, and GIS/technical support, and we will collaborate with the DNR and other federal agencies, including Canadian. Canadian researchers have submitted a \$3M research proposal to their federal authorities on the approaching eastward invasion front; our proposal complements and does not overlap.

B. Timeline Requirements

The project will run for three years from 7/1/2014 to 6/30/2017.

C. Long-Term Strategy and Future Funding Needs

LCCMR has not spent any funds on the emerging mountain pine beetle problem to date. Over the past 10 years, Canada has spent \$1.5B on spread control and mitigation of ecologic consequences. This figure does not include \$285,000 earmarked this year by provinces such as Ontario that share a border with MN. Wisconsin has already deployed sentinel traps in five locations for early detection.

2014 Detailed Project Budget

Project Title: Mountain pine beetle: invasive threat to Minnesota's pines

IV. TOTAL ENRTF REQUEST BUDGET 3 years

<u>BUDGET ITEM</u> (See "Guidance on Allowable Expenses", p. 13)	<u>MDA</u> <u>AMOUNT</u>	<u>U of M</u> <u>AMOUNT</u>
Personnel: Activity 1 (Survey): MDA, two part time MDA staff two years (\$28040 x 2 + 14.6% benefits) for coordination of survey and beetle and natural enemy identification. Activity 2 (Development in Minnesota's pines): U of M PhD student 1.5 years (\$41,466 indexed at 2.5% x 1.5), one 0.67FTE student worker 3 years (\$20K with 8% benefits x 3), 3 years faculty partial summer support during beetle flight (\$18,740 indexed at 2.5% per year, inclusive of 20% benefits). Activity 3 (Cold tolerance): U of M PhD student 1.5 years (\$42,504 indexed at 2.5% x 1.5), one 0.67FTE student worker 3 years (\$20K with 8% benefits x 3)	\$ 66,000	\$ 245,172
Equipment/Tools/Supplies: Activity 1 (Survey) 25 sites x 8 traps/sites x 2 years; insect lures purchased from Contech \$6,000 x 2 years; miscellaneous trapping supplies (ropes, plastic bags, gloves, vials, cups, etc.) \$1,000 x 2 years. Activity 2 (Development in Minnesota's pines): Vials for collection, rope, rearing tubes, screening (\$1,500 x 2 years, \$1,328 in year 3). Activity 3 (Cold tolerance): \$500 x 3 years for thermocouple wire, styrofoam cooling blocks	\$ 14,000	5828
Travel: Activity 1 (Survey): Rental vehicle and fuel for trap monitoring May - Sept, 2 years (\$13,000 x 2). Activity 2 (Minnesota's pines): Rental vehicle for field work in South Dakota \$5,000 (6 mo x 2 years), food and sporadic lodging at Wheaton College Biological Station (have guaranteed space from which to launch this work; expected 60d x \$80/day station charge x 2 summers): \$9600; vehicle rental for field work \$5,000 in South Dakota x 2 summers. Activity 3 (Cold tolerance): none	\$ 26,000	20,600
Additional Budget Items: Activity 2 (Minnesota's pines): Rental of BSL-2 quarantine facility space on U of M campus for cold tolerance testing of beetle in Minnesota's pines (\$1,500 x 3 years). Printing costs for dissemination of results (e.g., poster presentation at regional invasive species meeting) are subsumed within supply budget	-	4500
Subtotals:	\$ 106,000	\$ 276,100
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST =	\$	382,100

V. OTHER FUNDS

<u>SOURCE OF FUNDS</u>	<u>AMOUNT</u>	<u>Status</u>
In-kind Services During Project Period: Unrecovered federally negotiated F&A (calculated at 52% MTDC)	\$ 166,382	<i>secured</i>
Funding History: 1. (\$42K) Incoming graduate student Derek Rosenberger has received a competitive U of M incoming Graduate School Fellowship to support his first year of studies (\$42K). In his first year, Derek is being trained by Brian Aukema and Rob Venette on insect identification, trapping design, and cold tolerance methodology related to this project so he can begin experiments if funded; Derek's funding will expire summer of 2014 at the time this proposal would commence if successful. 2. (\$2,977,148) Canadian federal agencies have invested \$12M in research in the past 6 years on eastward range expansion of mountain pine beetle towards Ontario (and by extension, Minnesota, which shares a border). Currently, another large \$2.977M Canadian federal network grant is pending (past initial review stages, full proposal was invited and submitted, pending outcome where one of two final teams will be selected). That work does not duplicate this proposal (nor vice versa) and does not fund this work, as Canadian grants cannot be spent outside of Canada. However, we are in close contact with these colleagues and will share results and leverage effort wherever possible.	\$ 2,977,190	<i>secured and pending</i>

Mountain Pine Beetle: Invasive Threat to Minnesota's Pines

OBJECTIVE 1: Has it reached us yet?

This beetle was imported into Dodge County, Minnesota, fall 2012. Fortunately, this mountain pine beetle was dead, but pioneers may have reached us previously.



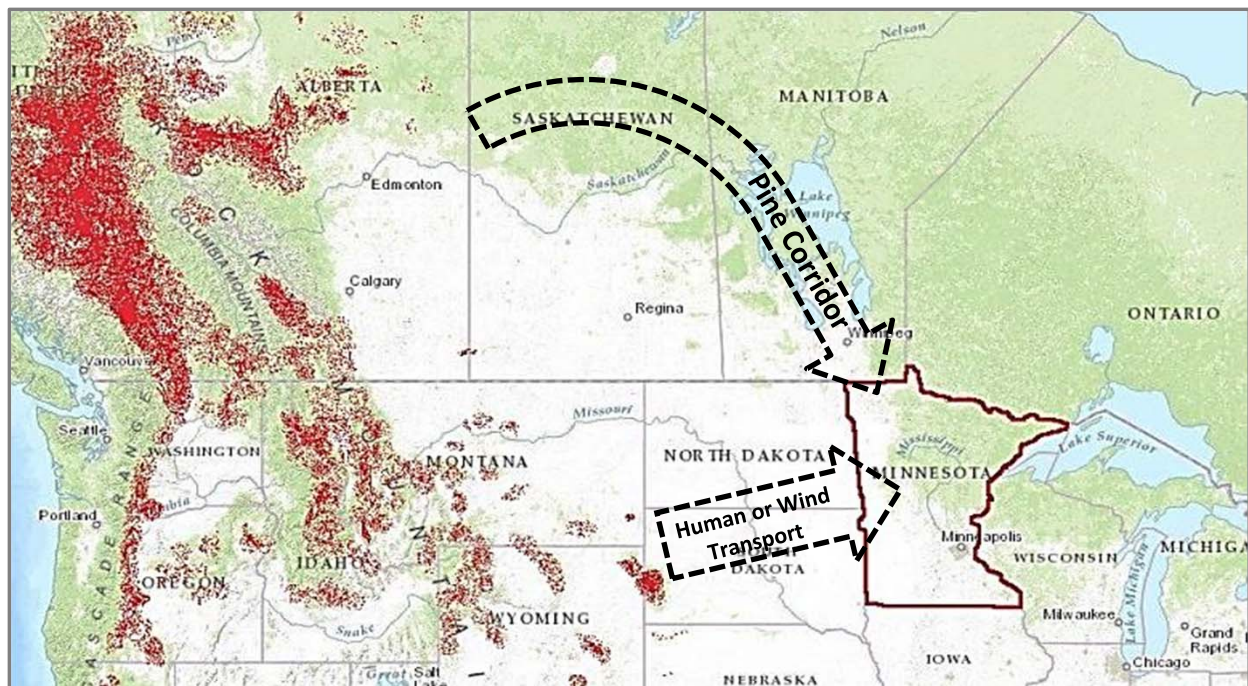
OBJECTIVE 2: How destructive will it be to our pine forests?

The insect appears to do better on pines in newly invaded areas. We need to know how much better our pines may be than its usual western pines.



GOAL

Informed rapid response to this invasive threat



Shaded areas indicate conifer forest. Dark areas on the left indicate the current extent of forests with high mortality due to mountain pine beetle. Routes to Minnesota from current epidemic populations are shown.



Project Director Qualifications and Organization Description

Mountain Pine Beetle: Invasive Threat to Minnesota's Pines

Similar to the ongoing emerald ash borer projects funded by LCCMR on detection, monitoring, and biological control, this proposal is a joint partnership with the MDA, USDA Forest Service, and the University of Minnesota.

Dr. Brian Aukema will administer the project at the University of Minnesota, the state's land grant university with a teaching, outreach, and research emphasis. Prof. Aukema joined the Department of Entomology as their Forest Insect specialist in the fall of 2010. Prior to this, he was a research scientist for five years with the government of Canada responsible for a program managing large-area insect outbreaks – including mountain pine beetle in western Canada.

At the University of Minnesota, Prof. Aukema oversees the Forest Insect Research Laboratory where his students work on a variety of forest pest problems of both native and invasive species in the state of Minnesota and beyond (e.g., emerald ash borer on ash, gypsy moth on oak and aspen, thousand cankers disease on walnut, jack pine budworm on pine, eastern larch beetle on tamarack, and more). Students he has taught can be found in a wide variety of resource professional positions, from city arborists to federal government program administrators.

Prof. Aukema has successfully administered more than \$1.6 million in research project funding to date from a wide variety of state, province, federal, and industrial sources. He has received early career awards for Creativity and Innovation (Government of Canada) and a McKnight Land-Grant award recognizing him as a promising early career faculty member at the University of Minnesota. Recently, he received the Department of Entomology's 2013 FAME award from the graduate students: Faculty Award for Mentorship in Entomology.

Dr. Robert Venette will co-advise the graduate student on this project and mentor the cold tolerance aspects of this work. Dr. Venette works for the United States Forest Service, but holds an adjunct faculty position at the University of Minnesota. Similar to the emerald ash borer projects funded by LCCMR to date, no money will go to the Forest Service.

Mr. Mark Abrahamson of the Minnesota Department of Agriculture will be responsible for the survey work proposed. A well-known name for his work in the state for detection and management of emerald ash borer, Mark works in the MDA's plant protection division with responsibilities for prevention, detection, and response to invasive insect pests.