Environment and Natural Resources Trust Fund
2017 Request for Proposals (RFP)

Project Title: **ENRTF ID: 112-D**

Mountain Pine Beetle Phase II: Protecting Minnesota

Category: D. Aquatic and Terrestrial Invasive Species

Total Project Budget: $ 384,838

Proposed Project Time Period for the Funding Requested: 3 years, July 2017 - June 2020

Summary:

Phase I found that mountain pine beetle can kill every species of pine in Minnesota. This insect attacks in numbers. Now we extend surveys and determine minimum number for survival.

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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, Mahnomen, Marshall, Mille Lacs, Morrison, Mower, Olmsted, Ott

City / Township:

Alternate Text for Visual:

Map of potential entry routes of mountain pine beetle to Minnesota

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

I. PROJECT STATEMENT

Overview: Our project focuses on protecting Minnesota's pines from mountain pine beetle, the most devastating forest insect in North America. **During outbreaks, this insect *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. This insect is native to western North America, where it has impacted almost 125 million acres of mature pine forests.

What we learned in Phase I (ends 30 June 2017): the threat is real.

- Mountain pine beetle can attack, colonize, mate, and reproduce in all species of pines present in Minnesota. In some cases, our pines are *better* suited for the insect than western pines.
- Winters are no longer cold enough to kill the insects. Small introduced populations would likely survive.
- No live mountain pine beetles have established here, yet, as far as we know. We have surveyed pine forests extensively using special traps.

Outcomes from Phase I:

- The Minnesota Department of Agriculture enacted an exterior state quarantine against pine logs with bark on them. This should ensure that live insects do not arrive on logs.
- Heightened awareness throughout the state, region, and world. The prospect of pine forests being decimated in the Great Lakes and eastern US continues to attract global attention.

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

1. **From the west: Movement across pineless regions of the Dakotas from the Black Hills.** This could occur through aerial dispersal, or movement of wood products.
2. **From the north: Minnesota's pine forests connect to Canadian jack pine that stretches to populations in western Canada.** Currently, an ongoing outbreak of mountain pine beetle in western Canada totals almost 50 million acres in size, making it the world's largest outbreak of any forest insect. In 2000, the insect moved over the Rocky Mountains into northwestern Alberta, Canada, where it can now move through the jack pine of the boreal forest to Minnesota and Wisconsin and beyond. 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 front in Canada, but there is contiguous pine in between.

Objectives for Phase II:

1. **Enhance survey (MDA).** We have closed off the high-risk pathway of green logs, but additional work remains to understand if a significant risk is posed by other wood products such as bark chips.
2. **Control strategies** (MDA &UMN). One standard technique is chipping infested trees, but we need to determine survival of these insects that live in the wood. (Biocontrol is showing limited success).
3. **Characterize minimum founding population size**. Mountain pine beetles needs high numbers to cooperatively kill trees, but this number actually changes depending on the tree and region. We need to quantify the risk here in Minnesota if live insects arrive.

II. DESCRIPTION OF PROJECT ACTIVITIES

Activity 1: *Expand survey for potential insects and routes of entry* **Budget: $74,801**

The MDA will place bark beetle traps in pine locations near sites at risk for introductions of bark beetles. Including traps with some general attractants in addition to mountain pine beetle attractants will provide an

opportunity to monitor for a wide suite of invasive bark beetles and thereby increase the impact of the project without substantially increasing labor costs. Continued monitoring is justified by the difficulty of detecting small populations as well as the unknown risk of bark chips and long distance dispersal.

Outcome	Completion Date
1. Identification of survey sites. We anticipate 25 sites per year.	*12/31/2017*
2. Inventory of bark beetles and predators responding to mountain pine beetle and other lures (3 yrs)	*06/30/2020*

Activity 2: *Control strategies: Can chipping work?* **Budget: $126,637**

Chipping infested trees is a frequent tool to kill wood-boring insects such as emerald ash borer. However, mountain pine beetles are the size of mouse poops and could survive in bark chips. A postdoc scientist with expertise in establishment of invasive wood and bark boring beetles will come to UMN and analyze survival in different chipping treatments. The MDA will also conduct a study to determine how frequently pine bark chips are imported to Minnesota from western states and how they have been processed prior to import.

Outcome	Completion Date
1. Comparison of survival in different pine species	*06/30/2020*
2. Comparison of survival in different pine chip sizes	*06/30/2020*
3. Survey of pine bark pathways into Minnesota.	*06/30/2020*

Activity 3: *Founding populations: Can our native bark beetles fight them?* **Budget: $183,400**

In small numbers, mountain pine beetles actually depend on other species of bark beetles to help them survive. Our native bark beetles are different than the species out west. We need to know if our native bark beetles would allow mountain pine beetle to persist if introduced. This work will be conducted by the postdoc scientist from Activity 2, with involvement from students at the Wheaton College Science Station; an arrangement that worked superb in Phase I.

Outcome	Completion Date
1. Collection and trapping of live, native bark beetles and mountain pine beetles	*08/30/2018*
2. Comparison of survival with different ratios of natives vs. mountain pine beetle	*06/30/2020*

III. PROJECT STRATEGY

A. Project Team/Partners

This proposal is a joint partnership with the MDA, USDA Forest Service, and the University of Minnesota.

Receiving funds: The MDA (Ambourn) 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 chipping control and reproduction.

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 continue collaborating with the DNR and other federal agencies, including Canadian. Canadian researchers have a $3M federal grant on the approaching northward invasion front; our proposal continues to complement and does not overlap.

B. Project Impact and Long-Term Strategy

Mountain pine beetle is not here yet, and we hope it never arrives. LCCMR invested in the emerging mountain pine beetle problem in Phase I (2014-2017). That project demonstrating insects can reproduce in Minnesota's pines (i.e., food that they have never tried). This project will build on those results and address if additional steps are needed to further safeguard Minnesota's pines from this insect.

C. Timeline Requirements

The project will run for three years from 7/1/2017 to 6/30/2020.

2017 Detailed Project Budget

Project Title: Mountain Pine Beetle Phase 2: Protecting Minnesota

IV. TOTAL ENRTF REQUEST BUDGET *3* **years**

BUDGET ITEM *(See "Guidance on Allowable Expenses", p. 13)*	**MDA**	**UMN**
Personnel: Activity 1 (Enhanced survey): MDA technician 0.34 FTE: Salary $44,688 ($21.28/hr x 2,122 hrs) + Fringe $5,363 (12% of salary) = $50,051 **Activity 2 (Control strategies):** MDA temporary Plant Health Specialist 0.10 FTE: Salary ($21.28/hr x 600 hrs) + Fringe (35% of salary) = $17,237; U of M postdoc 1 yr $65K inclusive of 22.4% benefits, partial faculty summer support $18K x 1.5 summers inclusive of 33.4% fringe, 1 summer undergrad help (40 hrs x 16 wks x $12.50/hr = $8K, no fringe charge) **Activity 3 (Founding populations):** U of M postdoc 2 yrs @ $65K each inclusive of 22.4% benefits, partial faculty summer support $18K x 1.5 summers inclusive of 33.4% fringe, 1 summer undergrad help (40 hrs x 16 wks x $12.50/hr = $8K, no fringe charge), 2 Wheaton part-time students at the science station, $1K each (total) to include them in data collection (similar to Phase I)	$ 67,288	$ 267,000
Equipment/Tools/Supplies: Activity 1 (Enhanced survey): MDA supplies for conducting survey and sampling including traps, lures, bags, vials and other supplies needed for monitoring approx. $3,000 per year x 3 years; **Activities 2&3 (Control strategies):** UMN insect husbandry supplies, vials, replacement trap cups as necessary $1,000 per year x 3 years	$ 9,000	$ 3,000
Travel expenses in Minnesota **MDA** Vehicle rental and fuel (we will use the least expensive method of travel which will be either a state vehicle or a rented vehicle) approx. $5,000 per year x 3 years ; Meals and lodging as needed for MDA Technician (estimated 22 days of travel per year) approx. $250 per year * 3 years **UMN** Vehicle fuel/insurance (lab truck) $1K/summer each of three years for Activity 3 to collect native bark beetles for experimentation	$ 15,750	$ 3,000
Additional Budget Items: **Travel outside of Minnesota** We will again work in South Dakota so we do **NOT** bring these insects to Minnesota; rental vehicle for work in SD est. $10K ($5K for 6 mo. X 3 yrs); request additional permission to travel to meet with western mountain pine beetle experts as budget permits; food and sporadic lodging at Wheaton College Science Station (have guaranteed space from which to launch work, charges of $4800 ($2K each sumer 2017, 2018, partial $800 concluding spring)	$ -	$ 19,800
SUBTOTALS	$ 92,038	$ 292,800
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND $ REQUEST =	$	384,838

V. OTHER FUNDS *(This entire section must be filled out. Do not delete rows. Indicate "N/A" if row is not applicable.)*

SOURCE OF FUNDS	**AMOUNT**	**Status**
Other Non-State $ To Be Applied To Project During Project Period: NA	$ -	
Other State $ To Be Applied To Project During Project Period: NA	$ -	
In-kind Services To Be Applied To Project During Project Period: • MDA oversight of project, 5% FTE MDA Scientist = $15,000	$ 15,000	Secured
Funding History: • ENRTF Project on Mountain Pine Beetle to MDA and U of M in FY 15, 16 and 17 $250K • Canadian federal agencies have invested $12M in research in the past 8 years on eastward range expansion of mountain pine beetle towards Ontario (and by extension, Minnesota, which shares a border). We are in contact with another group studying the genetics of mountain pine beetle as it approaches ($2.977M Canadian). 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 continue to share results and leverage effort wherever possible. This work has recently attracted the attention of Los Alamos National Labs for example, due to the potential changes in the eastern US if all the pines were to suddenly die from an introduction of mountain pine beetle.	$ 250,000	ongoing
Remaining $ From Current ENRTF Appropriation: • ENRTF Project on Mountain Pine Beetle to MDA and U of M in FY 15, 16 and 17	$ 28,267	unspent but obligated

Mountain Pine Beetle Phase 2: Protecting Minnesota

Phase 1 Summary: Even though Minnesota's species of pines are not found where mountain pine beetles live to the west and north, we found that the insects can live in all of Minnesota's pine species. They must kill trees to reproduce. Although insects have been introduced to the state in the past, they have been dead. The front is now closer.

Objective 1: Survey

Small populations are hard to find, especially if they sneak in - as has happened in the past

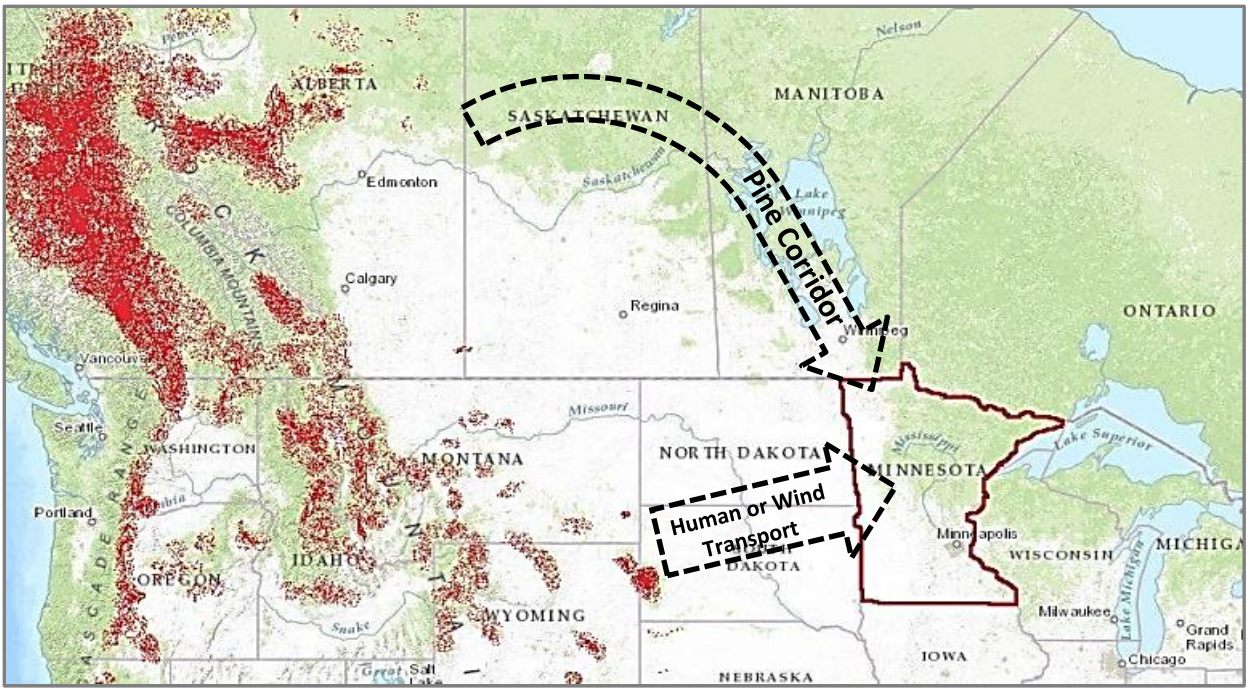
Objective 2: Control strategies

Mountain pine beetles live inside pines. Can they survive in bark chips?

Objective 3: Minimum threat

Mountain pine beetles need numbers to kill trees. Do our native pine beetles hinder them?

Informed rapid response to this impending 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

Similar to Phase I, this proposal is a joint partnership with the MDA, USDA Forest Service, and the University of Minnesota. We continue to collaborate with and involve students with the Wheaton College Science Station in the Black Hills of South Dakota (where there are populations of live beetles) to avoid introducing mountain pine beetle to the state of Minnesota.

Dr. Brian Aukema will administer the project at the University of Minnesota. 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. Prof. Aukema and his students work on 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, eastern larch beetle and larch casebearer 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 $2 million in research project funding from a wide variety of state, federal and industrial sources in his career. He has received early career awards for Creativity and Innovation (Government of Canada) and a University of Minnesota McKnight Land-Grant award.

Dr. Robert Venette will co-advise the postdoctoral scientist on this project. Dr. Venette works for the United States Forest Service, but holds an adjunct faculty position at the University of Minnesota and is director of the Minnesota Invasive Terrestrial Plants and Pest Center. No money will go to the Forest Service.

Angie Ambourn would be responsible for the survey work proposed (Activity 1). Ms. Ambourn is an entomologist in the Minnesota Department of Agriculture's plant protection division with responsibilities for prevention, detection, and response to invasive insect pests. Ms. Ambourn has prior experience working directly with mountain pine beetle as a forest entomologist with the USDA Forest Service on the eastern front of the epidemic in the Black Hills of South Dakota.