M.L. 2014, Chp. 226, Sec. 2, Subd. 04e-2 Project Abstract
For the Period Ending June 30, 2017

PROJECT TITLE: Mountain Pine Beetles Invasive Threat to Minnesota's Pines (MDA - Activity 1)
PROJECT MANAGER: Mark Abrahamson
AFFILIATION: Minnesota Department of Agriculture
MAILING ADDRESS: 625 Robert Street North
CITY/STATE/ZIP: St. Paul, MN 55115
PHONE: 651-201-6505
E-MAIL: mark.abrahamson@state.mn.us
WEBSITE:
FUNDING SOURCE: Environment and Natural Resources Trust Fund
LEGAL CITATION: M.L. 2014, Chp. 226, Sec. 2, Subd. 04e-2

APPROPRIATION AMOUNT: $75,000.00
AMOUNT SPENT: $
AMOUNT REMAINING: $

Overall Project Outcomes and Results

Mountain pine beetle (MPB), is native to western North America, where periodic outbreaks are a normal part of its ecology; in recent years, however, MPB has experienced the largest population explosion ever recorded and has caused the mortality of approximately 125 million acres of coniferous forest in North America. There is concern that MPB may reach Minnesota and cause similar devastation. Adult beetles have been shown to attack many different species of healthy pines including some that are found in Minnesota.

Mountain pine beetle has been detected in Minnesota two times in recent past: in 2012 in lodgepole pine from Montana for log cabins and furniture building and in 2014 in pine firewood from Wyoming for retail sale. In both cases, the insects were dead; however, this demonstrated the existence of a pathway across the plains for MPB to enter Minnesota. Interviews with wood product businesses in Minnesota indicated past instances where western pine had been imported as well. As a result, the MDA began conducting a detection survey in 2014 to determine if low-level populations of MPB are present. Lindgren funnel traps baited with pheromone lures were checked at sites near businesses such as log home and furniture builders and sawmills for 3 consecutive field seasons. Twenty five sites were chosen and 5 traps per site were monitored bi-weekly throughout the field season. Trap catches were screened for presence of mountain pine beetle. Subsamples of captures were also kept to better characterize the community of potential predators, parasitoids, and other associates already present in Minnesota. A total of 2150 trap checks were conducted from 2014-2016, fortunately no mountain pine beetle were detected. Estimating the arrival of MPB is difficult, thus monitoring is an important part of informing land managers so that management of isolated, endemic populations may be attempted.

Project Results Use and Dissemination

Dissemination of information from the monitoring portion of this mountain pine beetle project was ongoing through the entire three years 2014-2017. Staff participated in a variety of events with an emphasis on MPB. Our presence at trade shows, conferences, and community events provided unique and valuable opportunities to interact with different audiences in-person. We attended more than 20 events, where we interacted with over 13,000 people. At these events we specifically focused on invasive pest and pathogens. Three of the most trafficked events attended include the Minneapolis Home and Garden Show, whose audiences included families, gardeners, and outdoors enthusiasts; the Minneapolis/St. Paul RV and Camping Show, whose audiences included outdoors enthusiasts, families, and firewood users; and a Minnesota Twins Plaza Day, whose audiences included homeowners. Information and materials related to MPB were displayed and distributed to event visitors.

Materials produced for events included updated flyers, wallet-sized identification cards, display boxes, brochures and fact sheets. In addition, web pages focused on MPB and related surveys were added and updated as part of a larger, ongoing development project aimed at improving user experience. Cooperators, the public and the forest industry were also engaged and updated via phone, email, and through personal encounters in the field. Information and data was also continually updated throughout the project on the MDA MPB webpage: https://www.mda.state.mn.us/plants/insects/mpb.aspx

Environment and Natural Resources Trust Fund (ENRTF)
M.L. 2014 Work Plan Final Report

Date of Report: August 11, 2017

Date of Next Status Update Report: Final Report

Date of Work Plan Approval: June 4, 2014

Project Completion Date: June 30, 2017

Does this submission include an amendment request? Yes

PROJECT TITLE: Mountain Pine Beetle Invasive Threat to Minnesota's Pines (MDA - Activity 1)

Project Manager: Mark Abrahamson

Organization: Minnesota Department of Agriculture

Mailing Address: 625 Robert Street N

City/State/Zip Code: St. Paul, MN 55155

Telephone Number: (651) 201-6505

Email Address: mark.abrahamson@state.mn.us

Web Address:

Location: Statewide - Minnesota

Total ENRTF Project Budget:		
	ENRTF Appropriation:	**$75,000**
	Amount Spent:	**$75,000**
	Balance:	**$0**

Legal Citation: M.L. 2014, Chp. 226, Sec. 2, Subd. 04e-2

Appropriation Language:
$175,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota and $75,000 the second year is from the trust fund to the commissioner of agriculture to survey for the presence and characterize the potential risk of the invasive mountain pine beetle to Minnesota's pine forests to inform early detection and rapid response. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

I. PROJECT TITLE: Mountain pine beetle: invasive threat to Minnesota's pines – MDA Activity 1

II. PROJECT STATEMENT:

This project focuses on survey and characterization of risk to Minnesota's pines from mountain pine beetle. Native to the western United States and Canada, mountain pine beetle is the most devastating forest insect in North America. In the fall of 2012, mountain pine beetle was found in a shipment of logs to Minnesota. Fortunately, the insect was dead, but live insects may be here already.

Mountain pine beetle reproduces in almost all species of pines. It breeds in the water-conducting tissues of the tree, just underneath the bark, much like emerald ash borer. During outbreaks, mountain pine beetle *must* kill their tree in order to reproduce. The insect can only breed in trees larger than 5" diameter, so prefers healthy, larger diameter trees. US Forest Service data from 2011 indicates that Minnesota has 191,000,000 red, jack, and white pines large enough for mountain pine beetle to attack. 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.

This project is being initiated due to two high-priority 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. Minnesota Department of Agriculture attempted contact with 79 business potentially receiving wood from western sources. Seventeen businesses were interviewed and 5 did state importing pine from western areas in the past. One site visit was made to a business as a result and dead mountain pine beetle were found in lodgepole pine logs from Montana.
   Raw wood imports brought Douglas fir beetle, a kissing cousin of mountain pine beetle, to Grand Rapids,MN, a few years ago. For unknown reasons, those insects died after being established from 2002-2006. The state was very fortunate, and needs to learn from that experience. This project implements critically-needed statewide monitoring 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 forest 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.

This project uses a collaborative multi-agency team to undertake two objectives. The Minnesota Department of Agriculture will assume Objective 1 (Activity 1), while the University of Minnesota will undertake Objective 2 (Activities 2 & 3).

Objective 1. Survey state locations for presence of mountain pine beetle. If low numbers of insects 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.

Objective 2. Characterize the risk to Minnesota's pine species. Studies by Canadian researchers indicate that jack pine is an excellent food source for the insect. We will characterize development and winter survival in red, white, and Scots pines to inform and direct rapid response management for Minnesota's pine species.

III. PROJECT STATUS UPDATES:

Project Status as of November 15, 2014:
The survey portion of this project was completed this year without major issue. In future years we will aim to place traps 2-3 weeks earlier, though the placement dates achieved this year were sufficient. We were able to fully meet project expectations by monitoring 100 traps at 25 sites. Sample processing has not been completed as of the date of this report, so results from 2014 will not be available until the May 15, 2015 report.

Project Status as of May 15, 2015:
The monitoring portion project continues to proceed as planned. Sample processing has been completed and results are discussed under Project Activities and Outcomes, Activity 1. Field season plans for summer and fall 2015 are in progress and traps will be placed mid - late June. We will again monitor 100 traps at 25 sites in pine stands selected as possible introduction sites for mountain pine beetle.

Project Status as of November 15, 2015:
The survey and monitoring aspect of this study is on schedule and moving forward as planned. Trapping for Mountain pine beetle was conducted June- September 2015 with the addition of 25 control (non-baited) traps. Sample processing has not been completed as of the date of this report, so results from 2015 will not be available until the May 15, 2016 report.

Project Status as of May 15, 2016:
The second year of the monitoring portion of this project was completed successfully. Sample processing has been completed and results are discussed under Project Activities and Outcomes, Activity 1. Field season plans for summer and fall 2016 are progressing and traps will be placed mid - late June. We will monitor 125 traps at 25 sites for the final time under this project.

Project Status as of November 15, 2016:
The final year of the monitoring portion of this project has been completed. Trapping for mountain pine beetle was conducted June 13, 2016- September 26, 2016. Sample processing has begun but is not yet completed. Results from 2016 will be available and discussed in the final report.

Retroactive Amendment Request November 18, 2016:
We request to move $5,000 from the Travel category to Personnel. The travel for this project is nearly completed but some work remains to screen and identify trap captures. During the course of this project we found that our staff person maintaining the traps was able to devise travel routes that minimized costs. However, we also found that samples required more screening time than originally anticipated. For these reasons we found that we had surplus funds in the travel category but needed additional funds in the salary category.
Amendment Approved: [12/09/2016]

Retroactive Amendment Request August 11, 2017:
Final travel costs for the project were even lower (by $318) than accounted for in the November 18, 2016 amendment request. However, some additional supply costs incurred in finishing the trapping and sample

screening came in after the amendment request ($185) and we request to use the surplus travel funds to cover these costs. Finally, staff time to finish sample screening exceeded the budget and we request to use the amount remaining from the travel surplus ($133) to help cover these costs.

Overall Project Outcomes and Results:

Mountain pine beetle (MPB), is native to western North America, where periodic outbreaks are a normal part of its ecology; in recent years, however, MPB has experienced the largest population explosion ever recorded and has caused the mortality of approximately 125 million acres of coniferous forest in North America. There is concern that MPB may reach Minnesota and cause similar devastation. Adult beetles have been shown to attack many different species of healthy pines including some that are found in Minnesota

Mountain pine beetle has been detected in Minnesota two times in recent past: in 2012 in lodgepole pine from Montana for log cabins and furniture building and in 2014 in pine firewood from Wyoming for retail sale. In both cases, the insects were dead; however, this demonstrated the existence of a pathway across the plains for MPB to enter Minnesota. Interviews with wood product businesses in Minnesota indicated past instances where western pine had been imported as well. As a result, the MDA began conducting a detection survey in 2014 to determine if low-level populations of MPB are present. Lindgren funnel traps baited with pheromone lures were checked at sites near businesses such as log home and furniture builders and sawmills for 3 consecutive field seasons. Twenty five sites were chosen and 5 traps per site were monitored bi-weekly throughout the field season. Trap catches were screened for presence of mountain pine beetle. Subsamples of captures were also kept to better characterize the community of potential predators, parasitoids, and other associates already present in Minnesota. A total of 2,150 trap checks were conducted from 2014-2016, fortunately no mountain pine beetle were detected. Estimating the arrival of MPB is difficult, thus monitoring is an important part of informing land managers so that management of isolated, endemic populations may be attempted.

Dissemination of information from the monitoring portion of this mountain pine beetle project was ongoing through the entire three years 2014-2017. Staff participated in a variety of events with an emphasis on MPB. Our presence at trade shows, conferences, and community events provided unique and valuable opportunities to interact with different audiences in-person. We attended more than 20 events, where we interacted with over 13,000 people. At these events we specifically focused on invasive pest and pathogens. Three of the most trafficked events attended include the Minneapolis Home and Garden Show, whose audiences included families, gardeners, and outdoors enthusiasts; the Minneapolis/St. Paul RV and Camping Show, whose audiences included outdoors enthusiasts, families, and firewood users; and a Minnesota Twins Plaza Day, whose audiences included homeowners. Information and materials related to MPB were displayed and distributed to event visitors.

Materials produced for events included updated flyers, wallet-sized identification cards, display boxes, brochures and fact sheets. In addition, web pages focused on MPB and related surveys were added and updated as part of a larger, ongoing development project aimed at improving user experience Cooperators, the public and the forest industry were also engaged and updated via phone, email, and through personal encounters in the field. Information and data was also continually updated throughout the project on the MDA MPB webpage https://www.mda.state.mn.us/plants/insects/mpb.aspx

IV. PROJECT ACTIVITIES AND OUTCOMES:

ACTIVITY 1: Survey pine forests for mountain pine beetle

Description:
MDA will survey pine locations during the timeframe of potential MPB flight period (July – September) throughout Minnesota for three years. Sites will be selected based on known or suspected importation routes of green timber. MDA will identify trap contents for mountain pine beetle, related species and natural enemies. We anticipate that we will be able to maintain a total of approximately 100 traps. These traps will be divided across sites to optimize the number of sites trapped and the trapping coverage at each site. We expect that there will be approximately 25 targeted sites with 4 traps surrounding each site, however the actual number of sites trapped each year may vary based on the discovery of new sites or the determination that previously trapped sites do not justify additional survey.

Summary Budget Information for Activity 1:

ENRTF Budget: $ 75,000
Amount Spent: $ 75,000
Balance: $ 0

Activity Completion Date: June 30, 2017

Outcome	Completion Date	Budget
1. Identify survey sites, order supplies, place and monitor traps	October, 2014	$19,529
2. Complete identification of trap captures in each year	January, 2015 – 2017	$12,489
3. Identify survey sites and order supplies in each year	July, 2015 - 2016	$7,088
4. Place and monitor traps in each year	October, 2015 - 2016	$35,894
9. Complete and submit final report	June 30, 2017	0

Activity Status as of November 15, 2014:
A total of 100 traps were set at 25 sites (4 traps per site). Sites consisted of pine stands near businesses such as log home and furniture builders and selected mills. Past work has indicated that these businesses may be the greatest risk for past importation of pine from western sources. Lindgren funnel traps baited with mountain pine beetle pheromone lures were used for the survey and the traps were placed and baited from July 23 through August 5, 2014 and checked biweekly through September. Traps were removed from October 1 through October 9, 2014 and sample processing is currently underway.

Activity Status as of May 15, 2015:
All samples from the 2014 field season have been screened and processed. Traps were screened by MDA employees who emptied the traps and any suspect samples were brought into the St. Paul office for further determination. All samples from the 2014 monitoring season were negative for mountain pine beetle. After the final screening was conducted, the samples were given to cooperators at the University of Minnesota to look for predators, parasitoids, and associates.

Related to this study the MDA has enacted an exterior quarantine to prohibit the movement of pine wood with bark from states where MPB is known to exist. It does not prohibit the movement of 100% debarked pine wood, pine mulch or chips, pine Christmas trees or pine nursery stock as these items are unlikely to vector MPB. The quarantine went into effect January 1, 2015. Work related to these regulations has been supported by state general funds and not funds from this project.

Activity Status as of November 15, 2015:
A total of 125 traps were set at 25 sites (5 traps per site). This year an additional trap per site (non-baited control) was added at the request of the University of Minnesota to look at the response of possible mountain pine beetle natural enemies that are native to Minnesota. Past work has indicated that pine stands near businesses such as log home and furniture builders and selected mills may be the greatest risk for importation of pine from western sources. Sites were chosen based on their proximity to such businesses, and as after the 1st

year, some sites where shifted to survey new areas. The same Lindgren funnel traps baited with mountain pine beetle pheromone lures were used for the 2015 survey and the traps were placed and baited from June 23 through July 8, 2015. Traps were checked biweekly through September and baits were changed 1 time during the season. Traps are all removed and sample processing is currently being conducted.

Activity Status as of May 15, 2016:
All samples from the 2015 field season have been screened and processed. One hundred and twenty-five traps were emptied 5 times throughout the season for a total of 625 samples. Traps were pre-screened by MDA employees who emptied the traps and any suspect samples were brought into the St. Paul office for further determination. All samples from the 2015 monitoring season were negative for mountain pine beetle. After the final screening was conducted, the samples were given to cooperators at the University of Minnesota to continue looking for predators, parasitoids, and associates. A site map containing all sites from 2014-2016 will be provided in the November 15, 2016 update.

Activity Status as of November 15, 2016:
A total of 125 traps were set at 25 sites; 5 traps per site including the control traps which were placed for the first time last year and then again in 2016. These traps were placed in order to determine if there is a response of possible mountain pine beetle natural enemies that are native to Minnesota. Sites were again chosen based on their proximity to such businesses, and as after the 1st year and 2nd years, some sites where shifted to survey new areas (Figure 1) The same Lindgren funnel traps baited with mountain pine beetle pheromone lures were used for the 2014 and 2015 survey and the traps were placed and baited beginning on June 13, 2016. Traps were checked biweekly through September 26, 2016 and baits were changed 1 time during the season. A total of 815 trap checks were conducted during the 2016 field season. Traps are all removed and sample processing is currently being conducted.

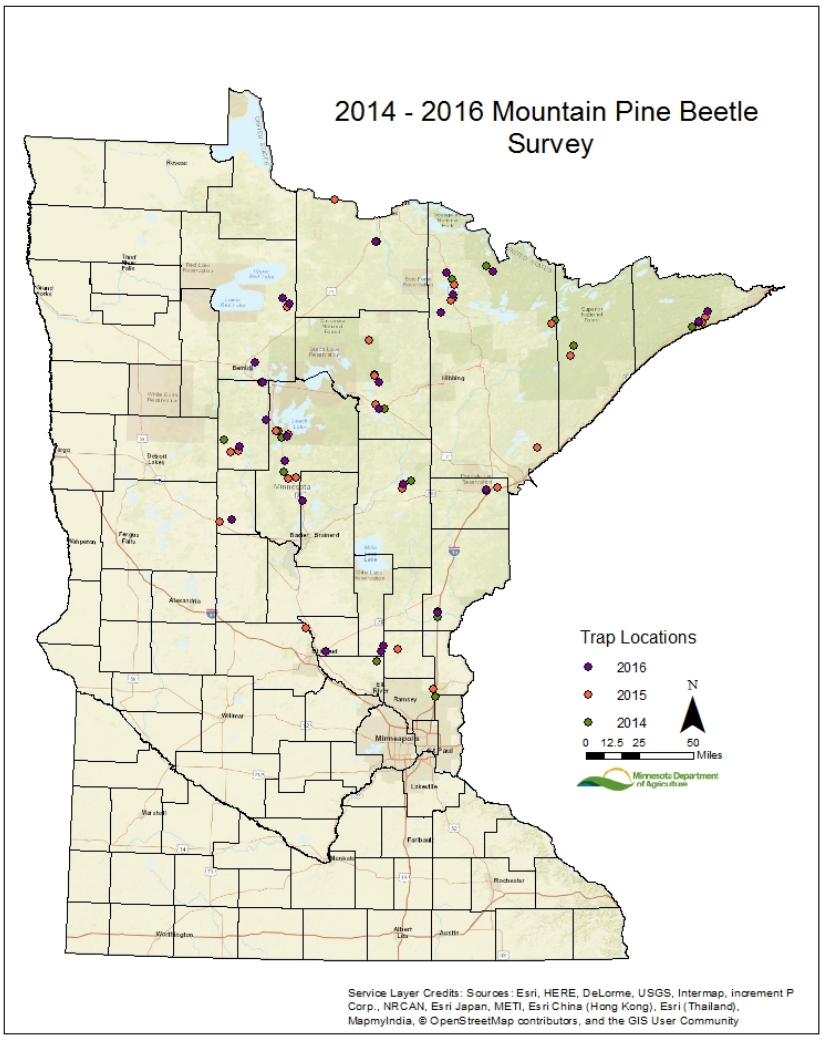


Figure 1: MDA Mountain Pine Beetle Monitoring Sites 2014-2016

Final Report Summary:

The MPB monitoring project was initiated in the summer of 2014. Sites were chosen based on their proximity to businesses such as log home and furniture builders and sawmill. Monitoring in the first year was conducted at 24 sites. Each site had 4 traps for a total of 96 traps, traps were checked bi- weekly through the end of October. A total of 480 trap checks were conducted in 2014. No mountain pine beetle were found.

During 2015, the MDA monitored a total of 125 Lindgren funnel traps lures at 25 sites (five traps per site). Sites were chosen based on their proximity to businesses such as log home and furniture builders and sawmills. At each site, four traps were baited with MPB lure and the fifth trap was an unbaited control. The control trap was to assist the U of M's research project by evaluating the response of natural enemies native to Minnesota to MPB pheromone. Traps were placed and baited from June 23, 2015, through July 8, 2015. Traps were checked biweekly through September and baits were changed one time during the season. A total of 835 trap checks were conducted in 2015. A subsample of the trap captures were kept to better characterize the community of potential predators, parasitoids, and other associates already present in Minnesota. No mountain pine beetle were found.

Along with monitoring efforts, the MDA had also been communicating with forest product industry groups and businesses that might use western pine to determine if actions could be taken to minimize the risk of MPB

importation. As a result, it was determined that regulations on the importation of western pine were appropriate and could be implemented without significant impact to businesses or individuals in Minnesota. An exterior quarantine was drafted which prohibits the movement of pine wood with bark from states where MPB is known to exist, but does not prohibit the movement of 100% debarked pine wood, pine mulch or chips, pine Christmas trees or pine nursery stock as these items are unlikely to vector MPB. This quarantine for MPB went into effect on January 1, 2015. To alert stakeholders, the MDA issued a press release, published articles in the *Plant Pest Insider*, and mailed letters to business who were anticipated to be affected

In 2016, the MDA again monitored a total of 125 Lindgren funnel traps lures at 25 sites (five traps per site). Traps were placed and baited and then checked biweekly from June 13, 2016 through September 26, 2016. A total of 835 trap checks were conducted in 2016. Baits were changed one time during the season. No mountain pine beetle were found. Over 2000 MPB trap checks were conducted in the state of MN between 2014 and 2017. To date, no mountain pine beetle have been trapped in the state of Minnesota.

State general funds were used for administration and oversight of this project which included:

- coordination with the University of Minnesota and others working with MPB
- training intermittent staff member to implement monitoring work
- identification of trap captures
- budget administration and report submissions

The MDA also provided the use of office and lab space and equipment for identification of trap captures.

ACTIVITY 2: Determine developmental rate in Minnesota's pines
Description:
This activity will be carried out by UMN. See UMN work plan for project description and budget.

ACTIVITY 3: Characterize cold tolerance in Minnesota's pines.
Description:
This activity will be carried out by UMN. See UMN work plan for project description and budget.

V. DISSEMINATION:

Description:
This work will be shared with relevant stakeholders through meetings and presentations (e.g., Upper Midwest Invasive Species Council, MN Forest Resource/Stewardship Council, North Central Forest Pest Workshop, etc.). Presentations have already been given on this important topic for groups such as the Great Lakes Log Crafters Association. We will be available for media requests, as well. This insect is well known in the western United States and Canada and western media outlets periodically request interviews from personnel in states at risk of introduction or invasion to find out about preparedness levels.

Status as of November 15, 2014:
There was no dissemination of this work by MDA during this reporting period beyond communication with land managers / owners for access to place traps. Once sample processing is completed and results are available there will be opportunities to report on this year's work to various audiences.

Status as of May 15, 2015:

Results from the mountain pine beetle survey have been disseminated by MDA since the last progress report in the following ways:

- Stakeholders were emailed or mailed a hard copy of our report entitled "Status of Mountain Pine Beetle in Relation to Minnesota."
- Results and status of this project were presented at the January 7th MISAC (Minnesota Invasive Species Advisory Council) quarterly meeting.
- Results were presented at the Rochester Arborist Workshop on February 19, 2015 in Rochester, Minnesota.

Status as of November 15, 2015:
This study will be highlighted in a presentation to the University of Minnesota, Department of Entomology's Forest Entomology class on November 23, 2015.

Status as of May 15, 2016:
Results from the mountain pine beetle survey have been disseminated by MDA since the last progress report in the following ways:

- The project was highlighted in a presentation to the University of Minnesota, Department of Entomology's Forest Entomology class on November 23, 2015 and specimens were used as instructional material for students.
- Stakeholders were emailed a link to our annual stakeholder report entitled "Status of Mountain Pine Beetle in Minnesota."

Status as of November 15, 2016:
There has been no dissemination of this work by MDA during this reporting period beyond communication with land managers / owners for access to place traps. Once sample processing is completed and results are available we will report this year's work to various audiences.

Final Report Summary:

Dissemination of information from the monitoring portion of this mountain pine beetle project was ongoing through the entire three years 2014-2017. Staff participated in a variety of events with an emphasis on MPB. Our presence at trade shows, conferences, and community events provided unique and valuable opportunities to interact with different audiences in-person. At no cost to this project, we attended more than 20 events, where we interacted with over 13,000 people. At these events we specifically focused on invasive pest and pathogens. Three of the most trafficked events attended include the Minneapolis Home and Garden Show, whose audiences included families, gardeners, and outdoors enthusiasts; the Minneapolis/St. Paul RV and Camping Show, whose audiences included outdoors enthusiasts, families, and firewood users; and a Minnesota Twins Plaza Day, whose audiences included homeowners. Information and materials related to MPB were displayed and distributed to event visitors.

Materials produced for events (at no cost to this project) included updated flyers, wallet-sized identification cards, display boxes, brochures and fact sheets. In addition, web pages focused on MPB and related surveys were added and updated as part of a larger, ongoing development project aimed at improving user experience Cooperators, the public and the forest industry were also engaged and updated via phone, email, and through personal encounters in the field. Information and data was also continually updated throughout the project on the MDA MPB webpage https://www.mda.state.mn.us/plants/insects/mpb.aspx

VI. PROJECT BUDGET SUMMARY:

A. ENRTF Budget Overview:

Minnesota Department of Agriculture

Budget Category	$ Amount	Explanation
Personnel:	~~$56,328~~ $56,461	1 Survey technician (0.34 FTE): 2,064.5 hours were worked on this project over 3 years (.33 FTE) at an average rate of $27.35 for salary and fringe
Travel	~~$10,750~~ $10,432	- 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. $3,583 per year * 3 years. ** - Meals and lodging as needed for MDA Technician (estimated 22 days of travel per year) approx. $250 per year * 3 years
Equipment/Tools/Supplies:	~~$7,922~~ $8,107	Supplies for conducting survey and sampling including traps, lures, bags, vials and other supplies needed for monitoring approx. $2,640 per year * 3 years
TOTAL ENRTF BUDGET:	**$ 75,000**	

**Based on a pilot project in 2013, we estimate that maintaining the trapping network will entail driving approx. 17,000 miles per year (actual mileage in 2013 project). At the current reimbursement rate of 56 cents/mile, it would cost us ~$9,500 per year to reimburse a staff person for mileage, almost 2x what we will spend by providing a rental or state vehicle (actual travel expenses in 2013 approx. $4,800 with rental vehicle).

Explanation of Use of Classified Staff: MDA would like to use an intermittent Plant Industry Inspector as the survey technician for this project. Although this is a permanent position, it is also intermittent meaning that the staff person is only employed when work is available. At this point in time we do not foresee other work for this position and we anticipate that the staff person will not be working during the time period of July – October unless working on this project.

If additional work becomes available that would have resulted in this intermittent position being employed during this time period on other funding, MDA will hire additional temporary staff to perform that other work. Thereby the funds provided by the ENRTF will be used to supplement, not supplant MDA work.

Explanation of Capital Expenditures Greater Than $5,000: N.A.

Number of Full-time Equivalents (FTE) Directly Funded with this ENRTF Appropriation:
MDA Survey Technician: 1.02 FTE over 3 years

Number of Full-time Equivalents (FTE) Estimated to Be Funded through Contracts with this ENRTF Appropriation: N.A.

B. Other Funds:

Source of Funds	$ Amount Proposed	$ Amount Spent	Use of Other Funds
Non-state			
	$	$	

State			
	$15,000	$15,000	
TOTAL OTHER FUNDS:	**$15,000**	**$15,000**	

VII. PROJECT STRATEGY:

A. Project Partners:

Similar to the ongoing EAB projects on biological control, 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 (Activity 1). 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 (Activities 2/3).

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. As stated above, a collaborative Canadian research team was recently awarded $3M from their federal authorities to study the approaching eastward invasion front. Our proposal complements theirs and does not overlap.

B. Project Impact and Long-term Strategy:

This project has immediate impact for Minnesota by surveying whether the insect has established in the state, given that dead insects were found on imported pine logs in the fall of 2012 with a random inspection. Mountain pine beetle can exist for years at "endemic" levels where it reproduces in but does not kill trees. When environmental conditions permit, the insect suddenly erupts and begins killing trees until either 1) it runs out of trees to kill or 2) unfavorable winter temperatures kill a significant portion of the insects.

A longer-term strategy has already begun here and elsewhere. In Minnesota, the threat of mountain pine beetle has prompted convening of an expert task force through the Minnesota Department of Agriculture. Several outreach presentations have been given to relevant stakeholder groups highlighting the necessity to reduce likelihood of transporting the insect – or any of its associates – to the state.

In the event that mountain pine beetle is found or arrives in the near future, the work on risk assessment in various pine species and cold tolerance will inform rapid response strategies. We will know within a few years which tree species produce the most beetles, and what level of cold might be needed to kill populations in the winter.

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.

C. Spending History:

Funding Source	**M.L. 2008 or FY09**	**M.L. 2009 or FY10**	**M.L. 2010 or FY11**	**M.L. 2011 or FY12-13**	**M.L. 2013 or FY14**
State General Funds				$9,200	$26,900

VIII. ACQUISITION/RESTORATION LIST: N.A.

IX. VISUAL ELEMENT or MAP(S):

X. ACQUISITION/RESTORATION REQUIREMENTS WORKSHEET:
N.A.

XI. RESEARCH ADDENDUM:
N.A.

XII. REPORTING REQUIREMENTS:
Periodic work plan status update reports will be submitted no later than 11/15/2014, 5/15/2015, 11/15/2015, 5/15/2016 and 11/15/2016. A final report and associated products will be submitted between June 30 and August 15, 2017.

Environment and Natural Resources Trust Fund

M.L. 2014 Project Budget

Project Title: Mountain Pine Beetle Invasive Threat to Minnesota's Pines (MDA - Activity 1)
Legal Citation: M.L. 2014, Chp. 226, Sec. 2, Subd. 04e-2
Project Manager: Mark Abrahamson
Organization: Minnesota Department of Agriculture
M.L. 2014 ENRTF Appropriation: $75,000
Project Length and Completion Date: 3 year project, to be completed June 30, 2017
Date of Report: August 11, 2017

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET	Activity 1 Budget	Revised Activity Budget 08/11/2017	Amount Spent	Activity 1 Balance	Activity 2 Budget	Amount Spent	Activity 2 Balance	Activity 3 Budget	Amount Spent	Activity 3 Balance	TOTAL BUDGET	TOTAL BALANCE
BUDGET ITEM					**Attractiveness and development in Minnesota's pines (See UMN budget)**			**Determine cold tolerance (See UMN budget)**				
Personnel (Wages and Benefits) 1 Survey technician (0.34 FTE): Salary ($45,169 = $21.28/hr x 2,122 hrs) + Fringe ($6,159 = 12% of salary)	~~$56,328~~	$56,461	$56,461	$0							$56,328	$0
Equipment/Tools/Supplies Supplies for conducting survey and sampling including traps, lures, bags, vials and other supplies needed for monitoring approx. $2,640 per year * 3 years	~~$7,922~~	$8,107	$8,107	$0							$7,922	$0
Travel expenses in Minnesota - 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 * 3 years** - Meals and lodging as needed for MDA Technician (estimated 22 days of travel per year) approx. $250 per year * 3 years	~~$10,750~~	$10,432	$10,432	$0							$10,750	$0
COLUMN TOTAL	$75,000		$75,000	$0							$75,000	$0

**Based on a pilot project in 2013, we estimate that maintaining the trapping network will entail driving approx. 17,000 miles per year (actual mileage in 2013 project). At the current reimbursement rate of 56 cents/mile, it would cost us ~$9,500 per year to reimburse a staff person for mileage, almost 2x what we will spend by providing a rental or state vehicle (actual travel expenses in 2013 = approx. $4,800 with rental vehicle).

Mountain Pine Beetle: An Unprecedented Invasive Threat to Minnesota's Forests

OBJECTIVE 1: How destructive will it be to our pine forests?

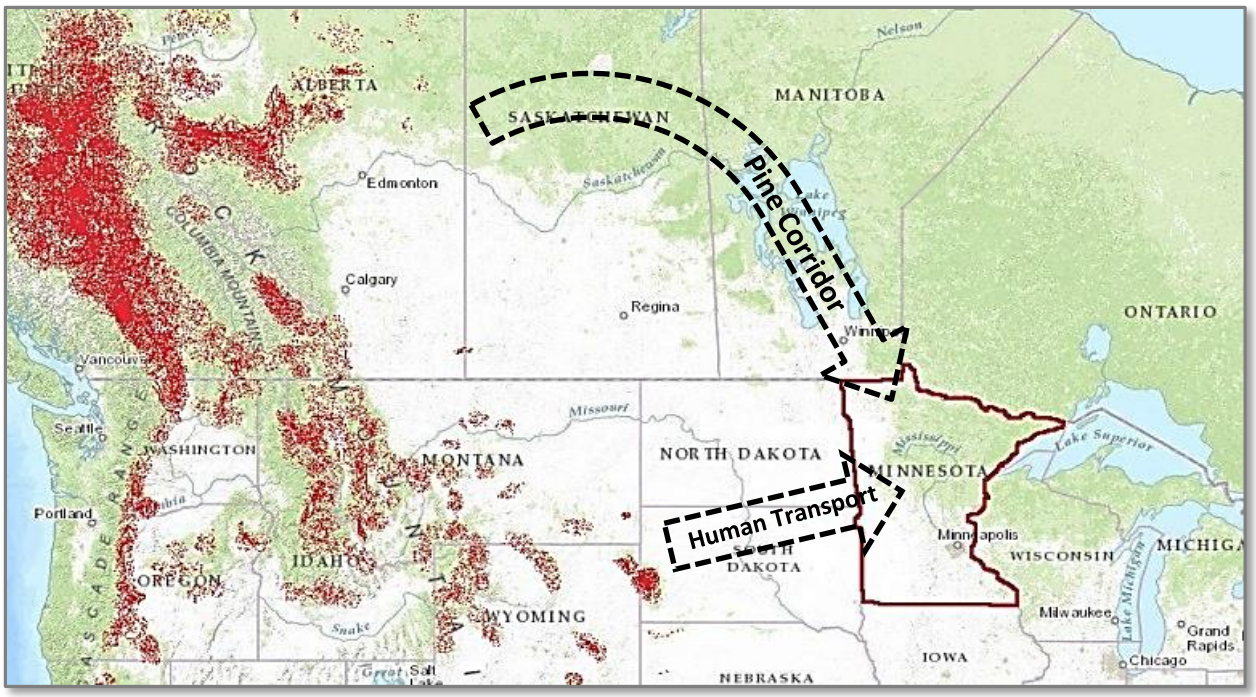
An area over twice the size of Minnesota has been affected to our west but we don't know how it will respond to our pine species.

OBJECTIVE 2: Has it reached us yet?

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

GOAL

Informed rapid response to this invasive threat



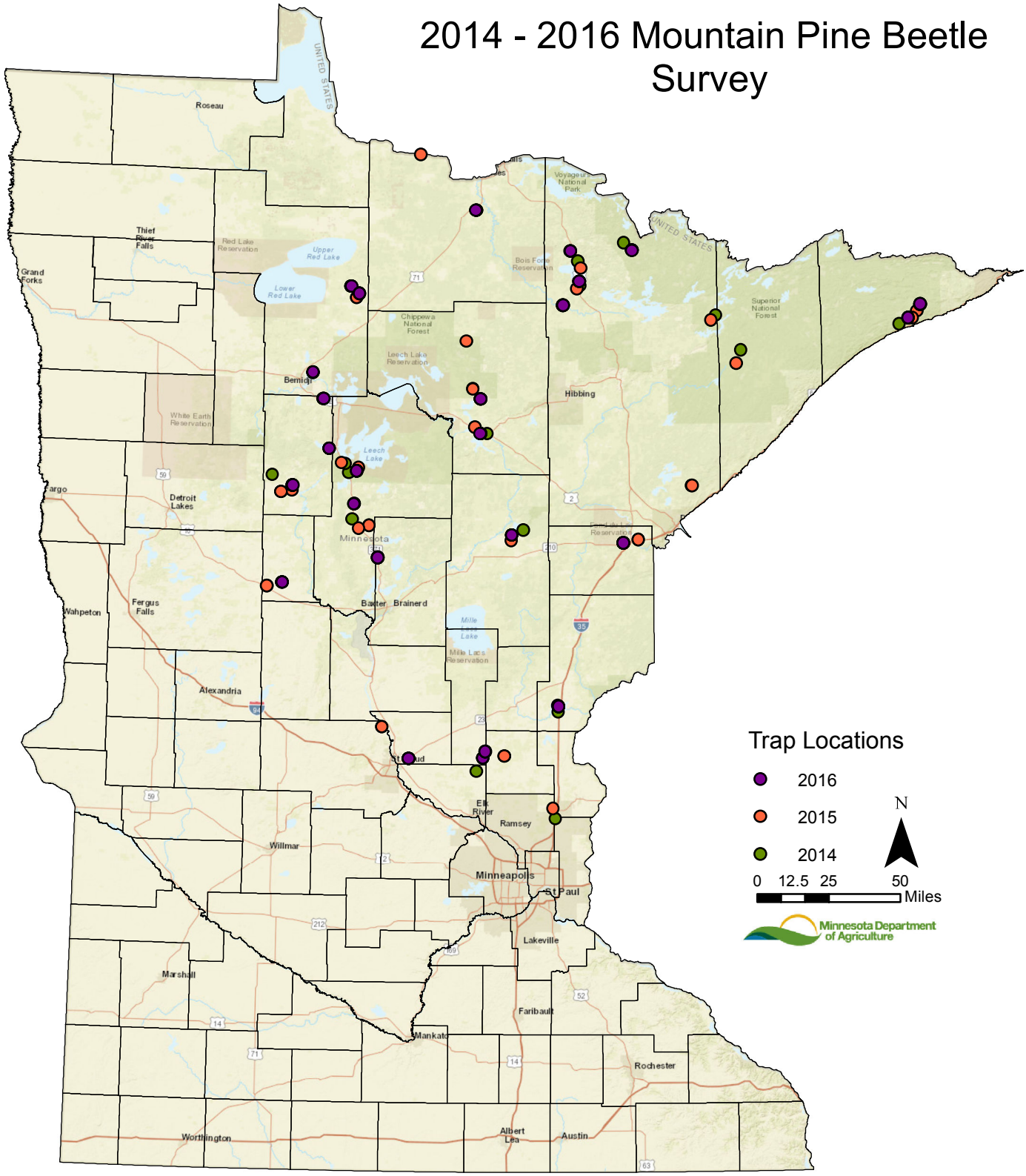
Shaded areas indicate conifer forest. The current extent of forests impacted by mountain pine beetle is shown in dark on the left. The dashed arrows indicate routes to Minnesota.

MINNESOTA DEPARTMENT OF AGRICULTURE

FOREST SERVICE U.S. DEPARTMENT OF AGRICULTURE

UNIVERSITY OF MINNESOTA

2014 - 2016 Mountain Pine Beetle Survey



Service Layer Credits: Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

Minnesota Department of Agriculture

Invasive Pest Alert

Mountain Pine Beetle

Figure 1. Side view of adult MPB. Note gradually rounded wing covers. Photo credit: Erich Valley, USDA FS.

Figure 2. Side view of adult engraver beetle. Note spined wing covers. Photo credit: Ken Walker, Museum Victoria Bugwood.org.

Figure 3. MPB caused popcorn-like pitch tubes. Photo credit: Scott Tunnock, USDA FS.

Scientific name: *Dendroctonus ponderosae*

History

- Mountain pine beetle (MPB) is native to the western United States, British Columbia, Canada and northern Mexico where it infests most species of pine.
- MPB is currently not present in Minnesota. The Minnesota Department of Agriculture has documented two cases (2012 and 2014) where MPB infested wood has been imported into the state. In both instances the adult beetles were dead.
- Periodic outbreaks of MPB are common throughout its natural range. However, in recent decades, climatic shifts and other factors have allowed for unprecedented outbreaks resulting in the loss of millions of acres of trees.
- MPB is currently killing large amounts of trees as far to the east as the Black Hills of South Dakota and has recently expanded its range across Alberta, Canada, where it is now infesting jack pine (*Pinus banksiana)*.
- There is concern that MPB could naturally expand its range into Minnesota or be introduced through the movement of infested wood.

Description and Life Cycle

- Adult beetles are typically oval shaped and black, 4-7.5 mm in length (Figure 1).
- MPB has a one year life cycle in most of its range. Overwintered adults emerge from infested trees in July or August to colonize new host trees. At high elevations, two years may be required to complete the life cycle.
- Females attack a pine first and release chemicals into the air called aggregation pheromones that attract more females and males to the tree.
- MPB prefer stands of densely packed trees that range from 8 to 12 inches in diameter.
- Female beetles lay eggs along the sides of vertical galleries, within the inner bark of the tree. Newly hatched larvae mine horizontally away from the egg galleries. These larval beetles continue feeding over the winter, through spring. They become pupae mid-summer, and then emerge as adults.
- Mountain pine beetles and related bark beetles in the genus *Dendroctonus* can be distinguished from other bark beetles in pines by the shape of the hind wing cover. From the side view, MPB's wing covers are gradually curved (Figure 1). Wing covers of *Ips,* or engraver beetles, another common group of bark beetles attacking conifers, are sharply spined (Figure 2).

Minnesota Department of Agriculture

Invasive Pest Alert

Mountain Pine Beetle

Figure 4. MPB infested trees exhibiting foliage discoloration.
Photo credit: USDA FS R2-RMR

Figure 5. Characteristic galleries of MPB caused by adult and larval tunneling and discoloration of sapwood caused by blue stain fungi. Photo credit: Ladd Livingston, Idaho Department of Lands

Signs of Infestation

- Popcorn-like masses of resin, called "pitch tubes," appear on the trunk where beetle tunneling begins. Pitch tubes may be brown, pink or white (Figure 3). In particularly dry years, infested trees may also have boring dust but no apparent pitch tubes.
- Presence of boring dust caused by the beetles tunneling in bark cracks and at the base of infested trees.
- Discolored foliage. Needles will fade from green to yellow to run red throughout the entire crown. This occurs the summer (8-10 months) after infestation (Figure 4).
- Presence of live life stages (eggs, larvae and pupae) in galleries under the bark (Figure 5).
- Presence of blue stained sapwood: a fungus introduced into the tree by the beetle (Figure 5).

When to Suspect MPB

In Minnesota it is common to find pine trees infested with native bark beetles. Our native bark beetles are less aggressive than MPB and typically only infest trees that are declining or under severe drought stress. It is uncommon to find pitch masses above 6 feet in Minnesota, however it is not certain how pines in Minnesota will respond to MPB attack and any trees exhibiting pitch tubes must be examined more closely.

Regulations

Minnesota currently has regulations in place to prevent the introduction of mountain pine beetle. The regulations prohibit the movement of all pine wood with bark into Minnesota from areas where mountain pine beetle occurs.

For questions, or if you suspect you have seen this pest in Minnesota, contact the Minnesota Department of Agriculture
Arrest.the.Pest@state.mn.us
1-888-545-6684 (Voicemail)