2014

Cooperative Agricultural Pest Survey Report

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Table of Contents

Cover photo: EAB awareness tag outside of Montana State Capitol building. I. Foley.

Introduction to the Program

The Cooperative Agricultural Pest Survey (CAPS) is a nationwide survey effort initiated by the USDA Animal Plant Health Inspection Service (APHIS) Plant Protection and Quarantine (PPQ), to detect and/or monitor the spread of invasive plant pests. To achieve this goal, the USDA APHIS PPQ enlists the assistance of state cooperators. In Montana, state cooperators are coordinated through the Montana Department of Agriculture (MDA), and include not only the Department of Agriculture, but also Montana State University, the Montana Department of Natural Resources and Conservation, USDA Forest Service, and others.

The Interns and Other Program Assistants

The Montana Department of Agriculture conducts several of the surveys. This would not be possible without the assistance of a group of dedicated people who join the department for the summer as interns and/or survey technicians. We also have the invaluable assistance of Montana USDA-APHIS-PPQ and Amy Gannon, Forest Entomologist with DNRC. In addition, several MDA Agricultural Specialists assist in gathering Karnal bunt samples.

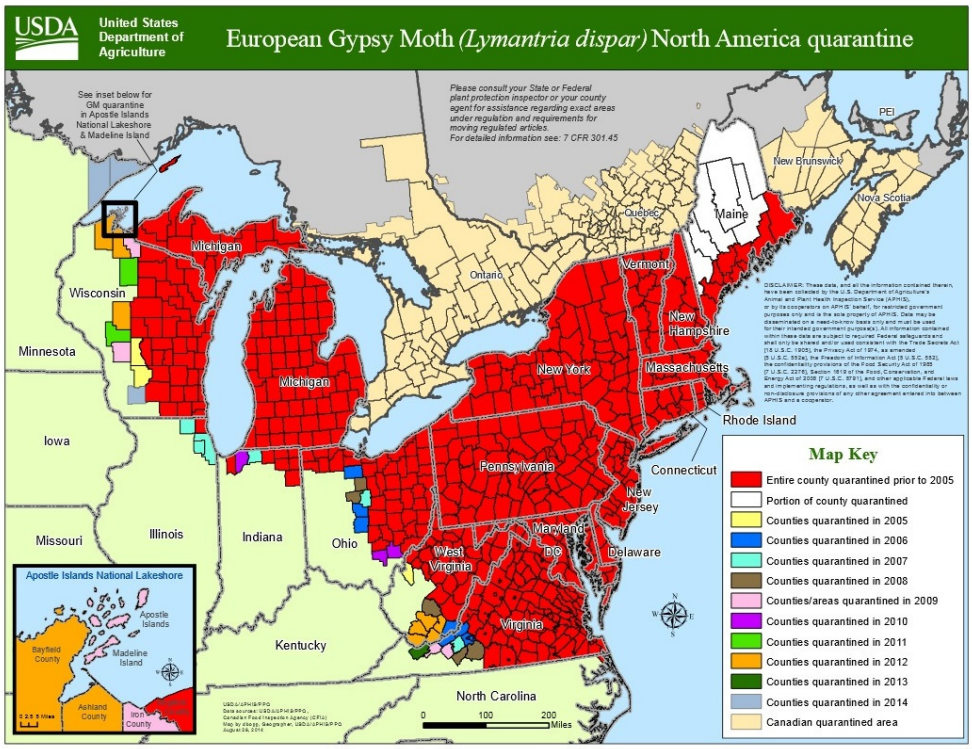
In 2014, the CAPS program hired Patricia Wherley as a Survey Technician; the program could not have gone forward without her assistance.

Gypsy Moth (GM) Detection Survey

Lymantria dispar (L.)

The European strain of the gypsy moth (*Lymantria dispar* (L.)) was initially introduced into the eastern United States in the mid-1800s. It established rapidly and became a serious defoliating forest pest. Over 500 susceptible host plants have been identified. Most are deciduous trees and shrubs, but older gypsy moth larvae will also consume pine and spruce. In Montana, aspen and western larch is a particularly important potential native tree host of the gypsy moth, especially in the western half of the state. Most landscape plants, urban trees and shrubs throughout the state would also be subject to GM defoliation.

Females of the European strain are flightless but crawl actively as they seek out oviposition sites. The egg masses are brownish clumps covered with scales and hairs, and have been found on Christmas trees, boats, RVs, outdoor furniture, RV's, firewood, and virtually any other object that might be left outdoors in an infested area. They are thus readily transported to new areas by human activity. The gypsy moth is the most destructive forest pest in the eastern United States and large areas of the northeastern and Midwestern US are under a federal quarantine to prevent the spread of this pest. There are several other species of closely related gypsy moths from Asia that are not known to occur in North America but are attracted to the same pheromone lure.



http://www.aphis.usda.gov/plant_health/plant_pest_info/gypsy_moth/downloads/gypmoth.pdf

There have been several positive gypsy moth traps in Montana counties in recent years: Cascade (1989, 1990), Gallatin (1988), Glacier (2001, 2003, 2007, and 2008), Lewis and Clark (1988), Lincoln (2009), Liberty (1992), Missoula (1996), Park (2001), and Yellowstone (1993 and 2011). Given the distance between Montana and the quarantined portions of the US and eastern Canada, it is almost certain that these introductions were the result of human activity. Isolated detections result from the movement of egg masses and pupae on contaminated vehicles and equipment or adult moths "hitchhiking" with vehicles or other conveyances.

Male Gypsy Moth. Traps are baited with a female sex-pheromone lures and only attract males.

Gypsy moth caterpillar

In Montana, responsibility for the trapping of gypsy moths is a multi-agency cooperative effort between the USDA APHIS PPQ, the Montana Department of Agriculture (MDA), the Montana Department of Natural Resources & Conservation (DNRC), and the USDA Forest Service (USDA FS). The USDA APHIS PPQ placed traps mainly in the eastern portion of the state, while the MDA trapped in the western part of the state. The DNRC put out traps in Mineral and Missoula Counties. The USDA Forest Service, US Fish and Wildlife Service, Bureau of Indian Affairs, and other agencies coordinate trapping at a large number of campgrounds and other public recreation areas. The Department of the Interior placed traps in Glacier and Yellowstone National Parks. All traps were placed by early June, and checked throughout the summer.

RESULTS: 150 traps were placed by MDA in 2014. All traps were negative in 2014.

Emerald Ash Borer (EAB) Detection Activities

Agrilus planipennis Fairmaire

The emerald ash borer (EAB) is an exotic wood-boring pest that attacks and kills ash trees (*Fraxinus* sp.). In the eastern United States it is a severe threat to ash trees in hardwood forest ecosystems and the urban landscape. While native ash in Montana and the intermountain west is limited to riparian areas, *F. pennsylvanica* or green ash (due to its rapid growth, hardiness, and cold tolerance) has been planted in some Montana urban neighborhoods at densities approaching 75%.

Emerald Ash Borer

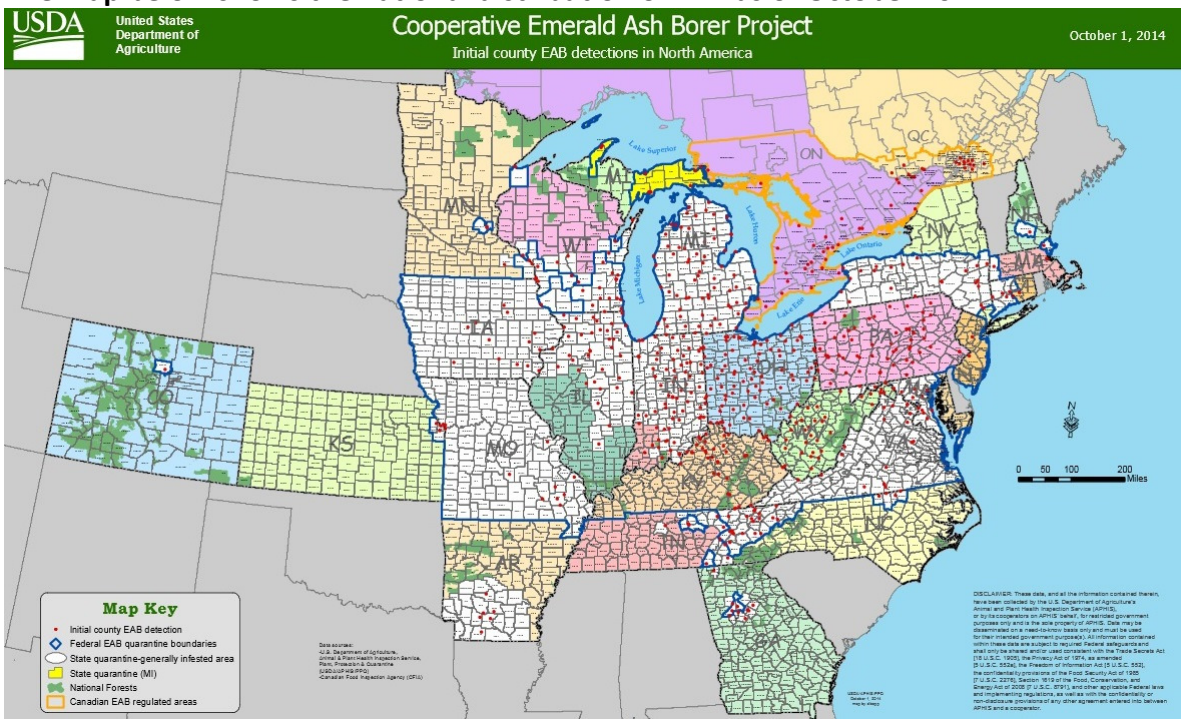
The emerald ash borer is native to Asia, but was introduced into the eastern United States through international trade sometime in the 1990s, most likely in solid wood packing materials. It was first discovered in southeastern Michigan in 2002 and has spread to most states and provinces of eastern North America. In 2013, EAB was detected for the first time in the western US in Boulder, Colorado. EAB larvae consume the cambium layer of ash trees, preventing the flow of nutrients and water up and down the tree. The insect will attack and kill both healthy and stressed trees; the average time to mortality, even for a healthy tree, is only two to three years. It is estimated that EAB has killed 40 million ash trees in Michigan alone, with tens of millions more having been killed in other adjacent states.

The success of outreach efforts regarding EAB is indicated by the increasing number of inquiries we receive each year about this insect. Unfortunately, the increasing number of reports also suggests a general decline in the health of Montana's ash trees. Each report is investigated on a case by case basis. **So far, EAB has not been found in Montana.**

Purple panel trap being placed in an ash tree (left) and stressed Montana green ash trees (right). Photos by I. Foley

Emerald ash borer traps are hung in ash trees (*Fraxinus* sp.). The large purple trap is sticky on the outside and acts as a panel flight intercept trap. The trap is baited with a Manuka oil and/or Hexanol lure that mimics the volatile compounds released by a damaged ash tree. Many ash trees in Montana are highly stressed because of site conditions, old age, other insect pests, and a variety of abiotic factors. Damaged or poorly growing ash trees should be inspected for emerald ash borer damage.

The map below shows the national distribution of EAB as of October 2014.

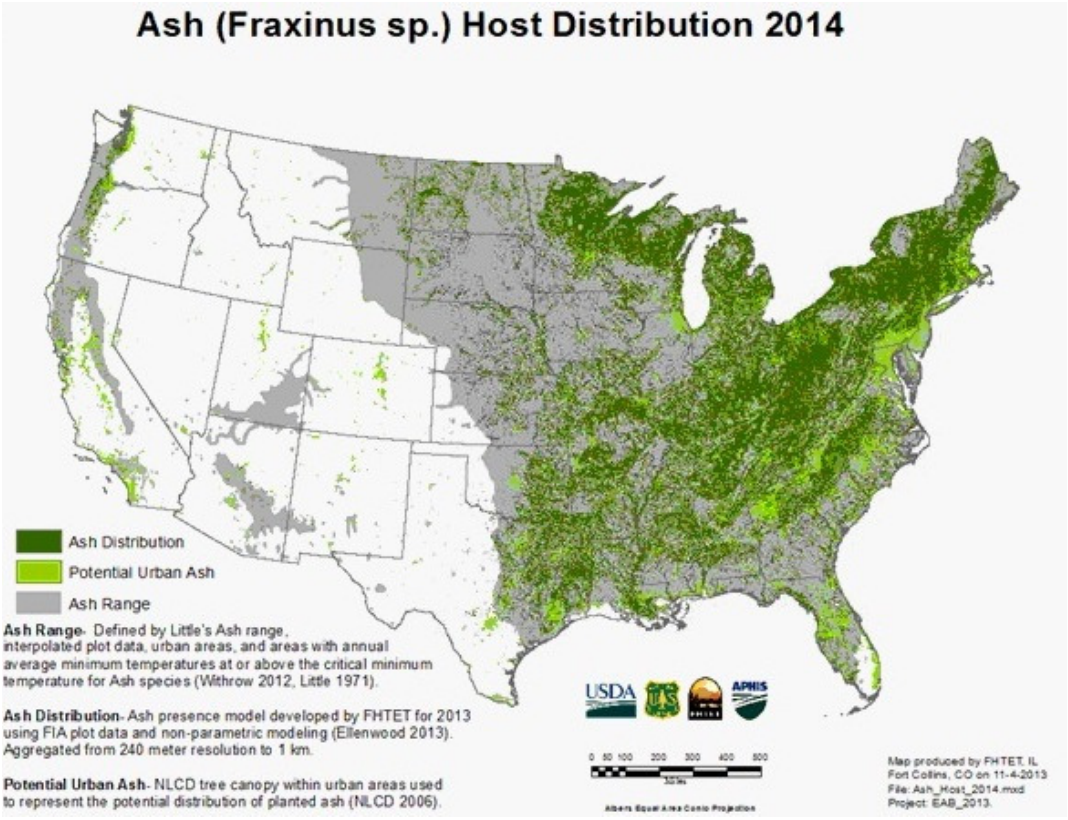


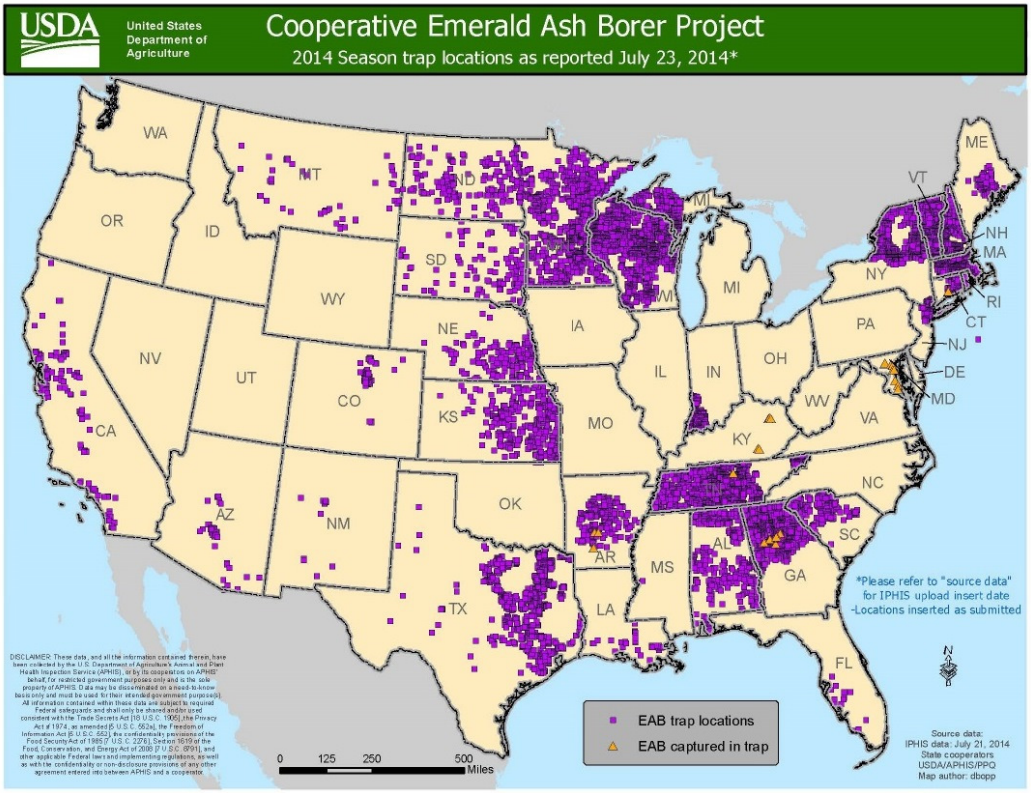
EAB trapping in Montana has focused on highways, campgrounds, and urban areas where the insect is most likely to be introduced. Starting in 2012, the majority of traps in the eastern part of the state followed a risk based model developed by the USFS Forest Health Technology Enterprise Team (FHTET).

Purple (left) and green (right) funnel traps designed to attract EAB first used in Montana in 2014. Photos by I. Foley

RESULTS

The EAB National Survey Program is being modified based on the widespread establishment of this pest in the US, pest prioritization, and decreased funding available to USDA-APHIS-PPQ for emerald ash borer. The Montana Department of Agriculture remains concerned about the potential impacts of this pest in Montana, particularly on ash trees in Montana urban communities. In 2014, MDA placed 10 purple prism traps and two purple and green funnel traps designed to attract EAB in the Helena area. In addition to trapping, MDA has been cooperating with the Montana Urban and Community Forestry Association to sample ash branches that have been pruned from urban trees for the presence of EAB larvae or galleries. This so called “destructive sampling” method is another tool for the early detection of EAB in Montana. Through the Montana Urban and Community Forestry Association, branch sampling has been completed in Billings, Bozeman, Townsend, Sidney, Miles City, Glasgow, Ekalaka, and Lewistown.


Ash (Fraxinus sp.) Host Distribution 2014
Ash Distribution
Potential Urban Ash
Ash Range
Ash Range- Defined by Little's Ash range, interpolated plot data, urban areas, and areas with annual average minimum temperatures at or above the critical minimum temperature for Ash species (Withrow 2012, Little 1971).
Ash Distribution- Ash presence model developed by FHTET for 2013 using FIA plot data and non-parametric modeling (Ellenwood 2013). Aggregated from 240 meter resolution to 1 km.
Potential Urban Ash- NLCD tree canopy within urban areas used to represent the potential distribution of planted ash (NLCD 2006).
0 50 100 200 300 400 500
Albers Equal Area Conic Projection
Map produced by FHTET, IL
Fort Collins, CO on 11-4-2013
File: Ash_Host_2014.mxd
Project: EAB_2013.


USDA
United States Department of Agriculture
Cooperative Emerald Ash Borer Project
2014 Season trap locations as reported July 23, 2014*
WA
OR
CA
ID
NV
MT
WY
UT
AZ
CO
NM
ND
SD
NE
KS
OK
TX
MN
IA
MO
AR
LA
WI
IL
MS
MI
IN
KY
TN
AL
OH
WV
GA
FL
SC
NC
VA
PA
NY
ME
VT
NH
MA
RI
CT
NJ
DE
MD
*Please refer to "source data" for IPHIS upload insert date -Locations inserted as submitted
EAB trap locations
EAB captured in trap
0 125 250 500 Miles
Source data:
IPHIS data: July 21, 2014
State cooperators
USDA/APHIS/PPQ
Map author: dbopp

EAB OUTREACH AND EDUCATION

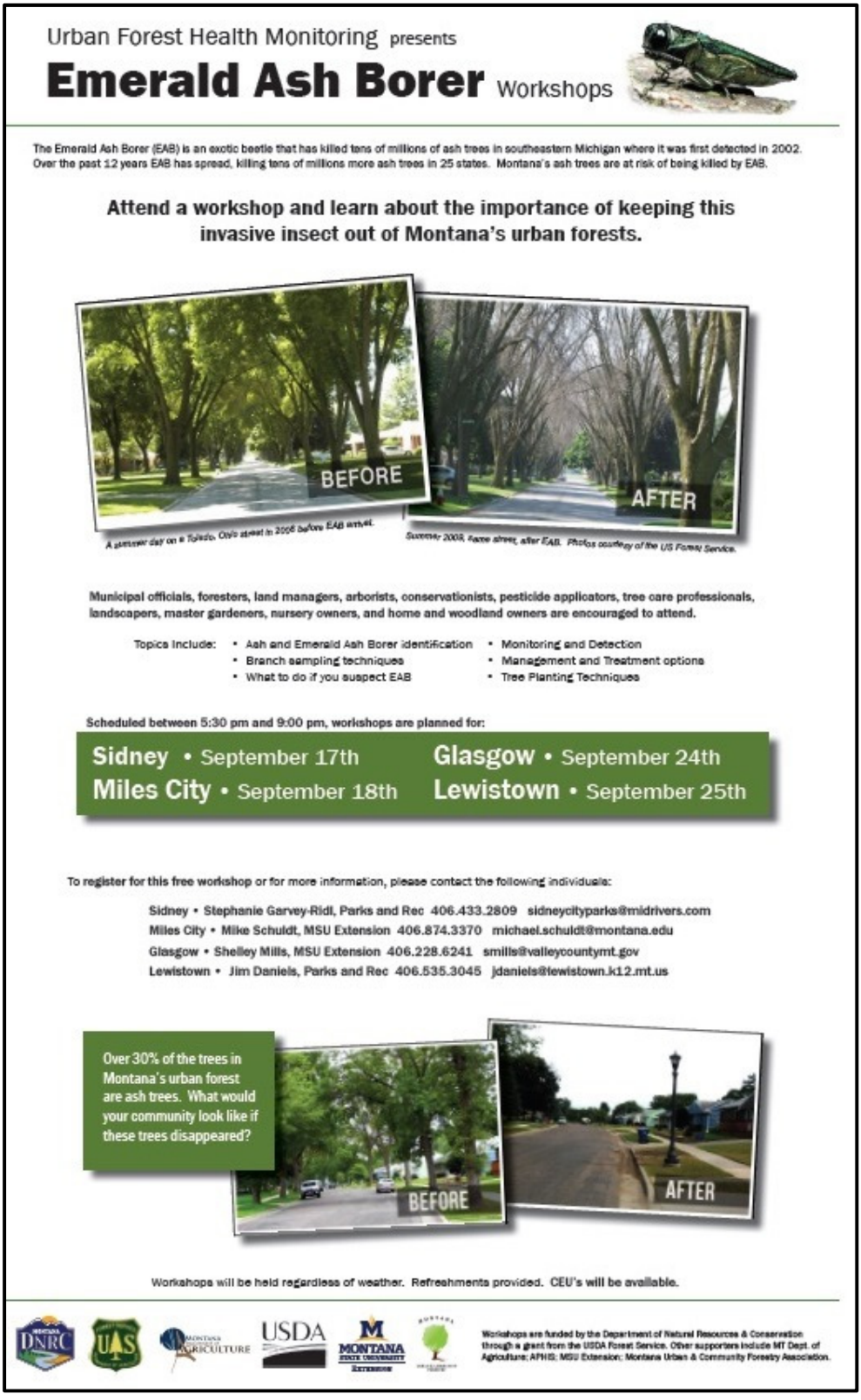
In an ongoing effort to increase awareness of the threat of emerald ash borer (EAB), *Agrilus planipennis* Fairmaire, the Montana Department of Agriculture and Montana Urban and Community Forestry Association tagged ash trees that are at risk if the invasive pest is discovered within the state. The tagging and awareness efforts coincided with Emerald Ash Borer Awareness Week from May 19 - 25, 2014 and included ash trees on the Montana Capitol Complex and in Townsend, MT. Approximatley 300 green ash trees were tagged.

The Montana Urban and Community Forestry Association, Montana Department of Natural Resources and Conservation, Montana Department of Agriculture, Montana State University, Montana State University Extension, USDA Forest Service and USDA APHIS PPQ collaboratively presented four emerald ash borer works shops in eastern Montana in September of 2014. The communities of Sidney, Miles City, Glasgow, and Lewistown were selected as host workshop locations because these towns are located in areas with native green ash trees and they are also towns with many urban-planted green ash trees.

The workshops focused on teaching rural Montana about the emerald ash borer. Topics that were covered include: Montana ash, what's at stake?; EAB biology and symptoms; native Montana ash pests and look-a-likes; EAB regulatory actions; destructive sampling methods; Montana's EAB response plan; EAB treatment options for landowners; what are some Montana towns doing now to prepare for EAB?; perspective impact video from a Midwestern city forester; how and who to submit suspect specimens to in MT; and a tree planting demo.

The goal is to prepare Montanan's in eastern Montana to help detect EAB early. Increased activities and traffic in eastern Montana due to the Bakken oil boom also increase the likelihood that EAB will first be found in the same part of the state where Montana's native ash trees are located. Our hope is to have well-attended workshops made up of participants from the general public, tree care professionals, pesticide applicators, master gardeners, arborists, landscapers,

municipal officials, urban foresters, nursery owners, and local/state/federal government agencies.



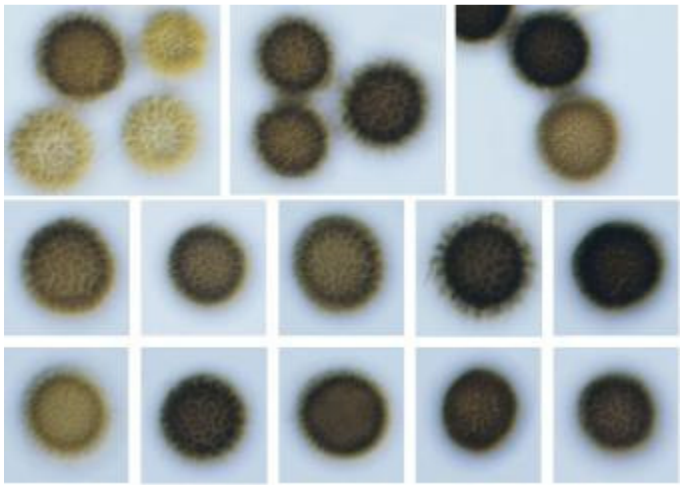
Karnal Bunt Detection Survey
Tilletia indica Mitra

Karnal Bunt (KB) is a fungal disease that affects wheat, durum wheat and triticale. The disease was discovered near Karnal, India in 1931, hence the name. The first detection of KB in the United States was in Arizona in 1996, in durum wheat seed. Subsequently, the disease was found in portions of Southern California and Texas. The disease has never been detected in Montana field production. KB thrives in cool, moist temperatures as the wheat is starting to head out.

Karnal Bunt spores are windborne and can spread through the soil. Spores have the ability to survive within the soil for several years. Grain can also become contaminated through equipment. Therefore, controlling the transportation of contaminated seed is essential in preventing the spread to Montana production areas. In addition, early detection is essential if any type of control or eradication is to be attempted. Montana's participation in the annual karnal bunt survey is part of the early detection grid set out across the United States.

RESULTS: Montana continued to sample for KB during the 2014 harvest. A total of 157 samples were collected from 34 counties across Montana. The APHIS Arizona State Plant Health Director's (SPHD) office, Karnal bunt lab conducted the testing. All samples tested negative for the presence of KB. This sampling is critical for wheat growers in Montana. It confirms our wheat is free from KB, ensuring access to international export markets.

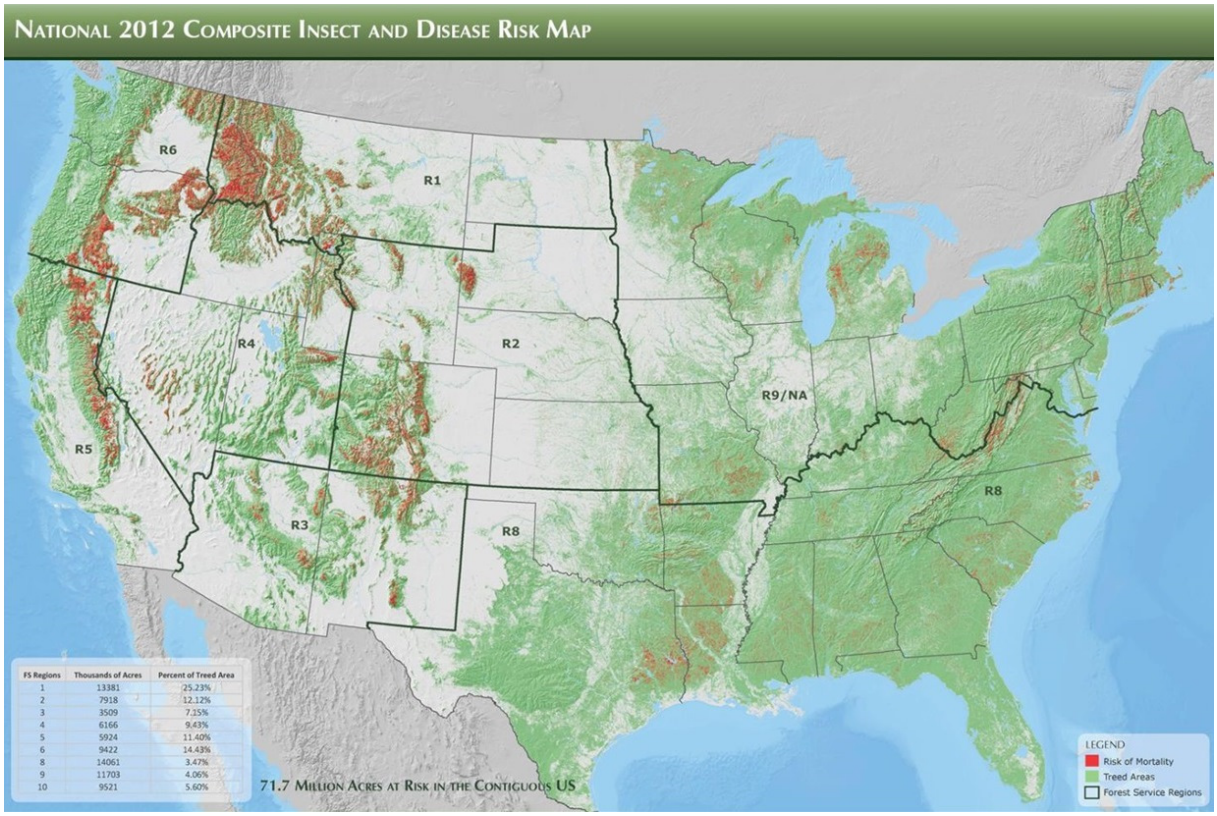
Credits: R. Duran, Washington State University
www.forestryimages.org **Bunted Wheat**



Credits: Teliospores of Tilletia indica (Karnal bunt of wheat) showing surface ornamentation patterns. EPPO.

Forest Pest Survey
Pest Detection Survey

Forest land occupies an estimated 23 million acres in Montana. Seventy-one percent (16.3 million acres) is publicly owned, under the jurisdiction of federal and state agencies (MT DNRC, 2010). Ecologists recognize 10 different major forest types in Montana. Douglas-fir (*Pseudotsuga menziesi* var. *glauca*), lodgepole pine (*Pinus contorta*), and ponderosa pine (*Pinus ponderosa*) predominate on the forest landscape, and are the most commercially important species (MT DNRC, 2010). Montana forests provide a wide variety of commercial and recreational benefits that are at risk from both native and invasive forest pests.

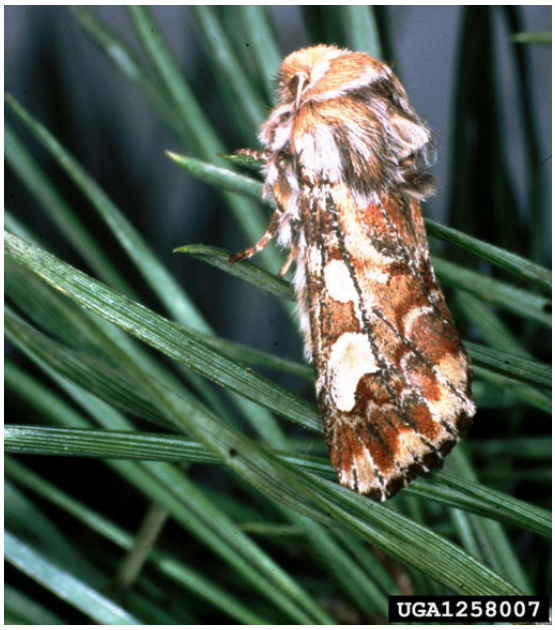


USFS National forest insect and disease risk map. http://www.fs.fed.us/

Pine Beauty Moth (PB) Detection Survey
Panolis flammea (Denis & Schiffermüller)

The pine beauty moth is considered a severe defoliator of certain *Pinus* spp. throughout many parts of Europe. Larvae can be observed feeding on new growth at the base of developing needle pairs (Hicks et al., 2001). Larval feeding on young buds can be very damaging to the host trees (Kolk and Starzyk, 1996). Complete defoliation of host plants can occur in serious outbreaks of this pest. When outbreaks occur, they usually last from two to three years. This species is found throughout Europe and Asia (Novak, 1976). The Pine Beauty Moth has caused

serious damage to *Pinus contorta* (lodgepole pine) in Scotland (Hicks et al., 2001). Lodgepole pine is native to North America and is abundant in Montana.



Pine beauty moth in Poland. Stanislaw Kinelski, Bugwood.org

RESULTS: 50 pine beauty traps were placed by MDA in 2014. All traps were negative.

Pine Sawfly Detection Survey
Diprion pini (Linnaeus)

Diprion pini is considered one of the most serious pests of pine in Russia, Ukraine, and Belarus. In Russia, outbreaks usually occur in 3 - 6 year intervals after hot and dry summers (Sharov, 1993). Larvae are gregarious feeders and attack the shoots as well as mine the needles from the side. Larvae may also eat the bark of the shoots and may sometimes consume the shoots completely. Sawflies, including *D. pini*, highly prefer pine stands on infertile and well-drained soils as well as stands that are affected by unfavorable climatic or anthropogenic factors (Augustaitis, 2007).

A native sawfly, *Neodiprion* sp. (male), caught in a pine sawfly trap. Photo: I. Foley

RESULTS: 19 pine beauty traps were placed by MDA in 2014 due to low availability of lure. All traps were negative.

Rosy Gypsy Moth (RGM) Detection Survey
Lymantria mathura Moore

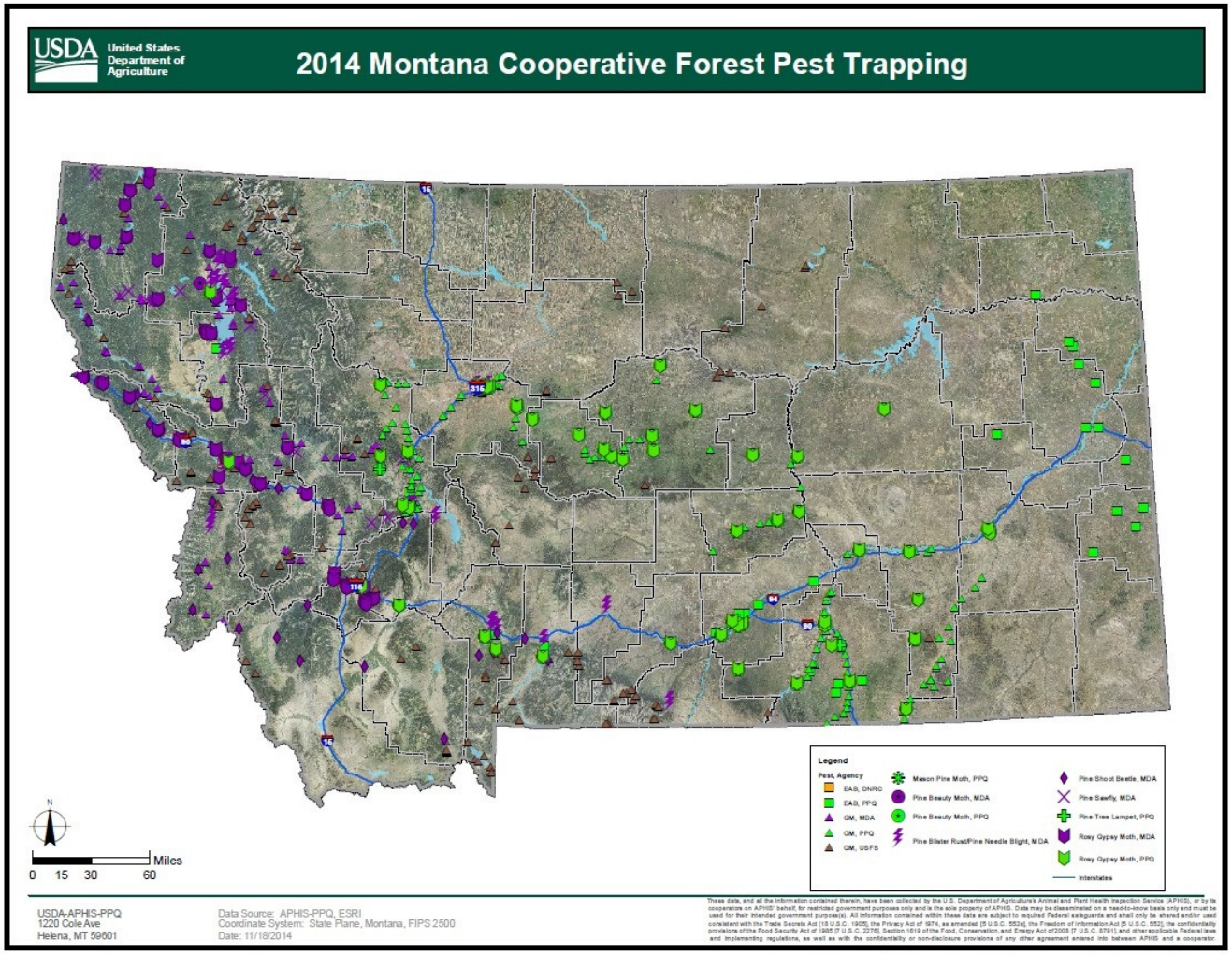
Both the gypsy moth and the rosy gypsy moth are members of the moth family Lymantridae. This family includes several native tussock moth forests pests. Many members of the family are serious plant defoliators.

Images from http://www.padil.gov.au

Female (left) and male (right) rosy gypsy moth

Rosy gypsy moth larvae are polyphagous and feed on a diverse range of deciduous trees. Hosts include oak, willow, fruit trees, birch, and ash. Larvae can feed on some conifers, but those hosts are generally not preferred and result in lower levels of survivorship. This moth is native to China, Bangladesh, India, Japan, Korea, Pakistan, Taiwan, and the Russian Far East and is not established anywhere in North America. The rosy gypsy moth and other exotic gypsy moths in the CAPS surveys are considered to have a higher risk of introduction in the western portion of the state, and also to pose a higher risk to that area should they be introduced.

RESULTS: A total of 50 rosy gypsy moth traps were placed in Montana. No RGM or suspects were trapped or submitted. These traps were concentrated west of the Continental Divide and placed during different trips than Europeangypsy moth traps because the pheromone lures have been shown to have antagonistic affects (CAPS approved methods, 2013).



Location of forest pest traps across Montana placed by MDA, MSU, Montana APHIS-PPQ, USFS, and MT DNRC.

Fruit Pest Survey
Farm Bill 10007

Montana has a small, often unnoticed, fruit industry. Cherries from the Flathead Valley in northwestern Montana fill a niche market between the ripening of California cherries and Pacific Northwest cherries, and are also exported to markets in Europe and Asia. A portion of the cherry orchards in this area operate organically, and are certified organic by the USDA. In addition to Flathead cherries, Montana also has some apple orchards in the Bitterroot Valley and small acreages of other fruit production including grapes, apricots, and choke cherries.

There are several invasive fruit pests whose arrival in Montana could bring disaster to these delicate industries. Invasive moths pose a particular threat. These organisms, "little brown moths" to the non-taxonomist, are often overlooked because of their appearance and lifestyle (they are generally small, bland, and have cryptic habits such as rolling up in leaves).

In 2014, pheromone baited traps were placed at 10 high risk sites in the Flathead and Bitterroot areas, for the summer fruit tortrix (*Adoxophyes orana* (Fischer von Roslerstamm)), the false codling moth (*Thaumatotibia leucotreta* (Meyrick)), the plum fruit moth (*Grapholita funebrana* (Treitschke)), and the Cherrybark Tortrix (*Enarmonia formosana* (Scopoli). In addition to pheromone trapping, visual surveys were conducted for several insect pests and plant diseases listed below.

RESULTS: All traps were placed and monitored by Montana State University. All traps were negative for target species at fruit pest survey sites.

Brown marmorated stink bug has not yet been detected in Montana. Suspect samples of native species of *Holcostethus* and *Euschistus* stink bugs are frequently submitted as BMSB suspects.

From left to right, summer fruit tortrix, false coddling moth, and cherry bark tortrix. Images from www.ukmoths.org/uk, cdfa.ca.gov, www.bugguide.net (Sean McCann).

Target Species	Common Name	Approved Method
Tortricidae		
Adoxophyes orana (F. v. Roslerstamm)	summer fruit tortrix	Delta trap/ADOX/lure 84 days
Grapholita funebrana Treitschke	plum fruit moth	Wing trap/PFM/lure 28 days
Enarmonia formosana Scopoli	Cherry bark tortrix	Delta Ttrap/CBT/lure 28 days
Thaumatotibia leucotreta Meyrick	false coddling moth	Wing trap/FCM/lure 56 days
Diptera		
Rhagoletis cerasi Linnaeus	European cherry fruit fly	Yellow sticky card 60 days
Drosophila suzukii (Matsumura)	spotted w ing drosophila	Apple cider vinegar trap
Coccidae		
Ceroplastes japonicus Green	Japanes w ax scale	Visual
Chrysomelidae		
Diabrotica speciosa Germar	Cucurbit beetle	Visual
Scarabaeidae		
Popillia japonica New man	Japanese beetle	Yellow vane/JB
Pentatomidae		
Halyomorpha halys (Stal)	brow n marmorated stink bug	Visual
Diseases		
Candidatus Phytoplasma prunorum	European Stone Fruit Yellow s (ESFY)	Visual (symptomatic plants)
Monilia polystroma (anamorph)	Asiatic brow n rot	Visual (symptomatic plants)
Potyvirus : Potyviridae	Plum Pox Virus	Visual (ELISA)

2014 Plum Pox Virus Survey
Farm Bill 10007 National Detection Survey

Plum pox virus (PPV) is a devastating disease of stone fruit tree species such as cherries, peaches, and plums. PPV can be spread throughout live nursery stock in grafts and budwood of infected plants. It is transmitted from one plant to another by the feeding of several species of aphid. PPV poses a special threat in Montana due to the cherry industry around Flathead Lake. Many nurseries in the area also produce various types of ornamental *Prunus.* There are native populations of *Prunus virginiana,* or chokecherry, throughout the state that are susceptible to PPV.

Sampling is done in the early summer months because as temperatures increase the PPV virus in infected trees is harder to detect. Samples are collected from throughout the tree canopy and are immediately sent to the diagnostic lab for testing.

During the survey in 2014, 125 *Prunus* samples were collected from Flathead and Sanders Counties. The samples were tested by personnel at the Schutter Diagnostic Laboratory at Montana State University using the ELISA (enzyme-linked immunosorbent assay) method.

RESULTS: All samples were found negative for all strains of PPV.

Plum pox potyvirus: spots on apricot stones (left).

2014 Status Report
Japanese Beetle (*Popillia japonica* Newmann)

Japanese beetles (JB) were discovered in Billings in 2001 near Logan International Airport. Early delimitation surveys found Japanese beetles in the neighborhoods below the "Rimrocks," a series of dry sandstone cliffs immediately south of the airport. In 2008 an official regulated area was established to prevent the spread of infested material out of this area. The regulated area includes over 650 properties, ranging from private single family homes to a few large landowners (MSU-Billings, Rocky Mountain College, the airport and other large parcels managed by the City of Billings). Details of the State of Montana interior quarantine can be found here:
http://agr.mt.gov/agr/Programs/PestMgt/quarantines/PDFs/MTQ_2008-003.pdf
In 2013, there was a significant increase in the number of beetles brought into Montana associated with regulated nursery stock importation. In response, the Department re-instated an exterior JB Quarantine in July of 2013. Details can be found here:
http://agr.mt.gov/agr/Programs/PestMgt/quarantines/PDFs/JB_MTQ-2013-01.pdf
In 2014, a limited number of traps were placed in areas that were found to have had JB in previous years, as well as at several high-risk nursery sites. Plastic JB traps baited with a floral scent and female sex pheromones were used to survey for JB adults (Figure 1).

Figure 1. Japanese beetle trap placed below Virginia creeper vines on the Leavens pumping station fence. This trap yielded more than 400 adult JB in 2009. The fence encloses a large area of well irrigated turf grass, some of which appears to be damaged by wild turkeys foraging for JB larvae.

RESULTS: In 2014, MDA placed JB traps at nurseries and other high-risk sites located in Kalispell, Columbia Falls, Bozeman, Belgrade, Big Sky, Big Fork, Big Timber, Billings, Great Falls, and Helena. JB adults were trapped in Billings and at two nursery locations (Kalispell and Helena) outside of the Yellowstone County regulated area in 2014. The other 16 nursery locations that were positive in 2013 were negative this year. These results indicate that the 2013 detections were single events associated with the movement of nursery stock and do not represent established Montana populations in these areas. The Department is evaluating the results and planning a course of action for 2015. Landowners of positive locations are being encouraged to treat susceptible turf-grass areas and monitor for grubs.

2014 National Honey Bee Survey
Farm Bill 10007

In an average year Montana has about 150,000 to 160,000 beehives, of which the majority are migratory. Montana has about 150 registered beekeepers, about half of whom are commercial operators. Most of these provide commercial pollination services outside Montana. Migratory beekeepers typically travel to California in the early spring for almond pollination, then move to fruit crops in Washington and Oregon before moving back to Montana for the summer. Ranked by revenue, beekeeping is the 10th largest agricultural industry in Montana; pollination fees make up the majority of that income.

Pests of honey bees are a serious threat to the agricultural economy of Montana as well as to the states where Montana-based bees provide pollination. USDA estimates that honey bee pollination adds some $15 billion to the value of American agriculture. In 2006 beekeepers began reporting unexplained and unexpected losses of 30% or more of their hives. What eventually came to be called "colony collapse disorder" was characterized by the rapid disappearance of worker bees from apparently healthy hives. Despite a considerable increase in honey bee research, the cause of colony collapse remains unknown, and unexplained losses continue at about 30% per year.

Montana bee yard, photo C. Lay

A healthy frame of brood, photo C. Lay

In 2009 the USDA-APHIS initiated the National Honey Bee Pests and Diseases Survey in all 50 states. The primary objectives of the survey are to confirm the absence of tropical bee mites in the genus *Tropilaelaps*, the absence of the Asian honey bee *Apis ceranae*, and the absence of slow paralysis virus, a honey bee disease associated with *A. ceranae*. Secondary objectives include evaluating the overall health of the apiaries sampled to establish a baseline for future research. Samples submitted from the survey will be evaluated for their mite loads (*Varroa,* tracheal mites, and other parasitic mites) and the degree to which viruses and other pathogens are present (particularly *Nosema ceranae*, a more virulent *Nosema* species associated with tropical honey bees). Viruses will be identified at the molecular level by the USDA "bee lab" in Beltsville, MD.

Varroa mites on a drone pupa, photo I. Foley

RESULTS: Eight (8) samples were collected in the fall of 2014 and submitted to the USDA approved laboratories at the University of Maryland. Results are pending analysis. This survey will be completed in 2015.

2014 Khapra Beetle National Survey

Farm Bill 10007

The khapra beetle (*Trogoderma granarium* Everts) is one of the world's most destructive pests of grain products and seeds. It damages far more product than it actually eats because of its habit of feeding only slightly on multiple seeds or particles. Infestations of even small numbers of khapra beetles can result in 30% to 50% of stored products being unusable.

The cosmopolitan distribution of most stored-product pests makes it difficult to pinpoint their origins. The khapra beetle is thought to have originated in southern Asia; its native range is the area from 35° N to the equator, between Thailand and western Africa. It is considered established throughout most of Southeast Asia, Africa, the Middle East, and Uruguay and Venezuela in South America.

Figure 1. Khapra beetle adult, larvae, and cast skins.

As one would expect from its specific epithet, grains and seeds are the most common commodities infested with khapra beetles. Processed commodities can also be infested, including grain-based pet foods. Wheat, rice, and legumes for human consumption (peas and lentils) are the most common imports to the US that are found to be infested. Lentils and rice are particularly problematic due to their cultural significance and near-ubiquity in the daily diet of most of the khapra beetle's native range; a majority of airport and passenger-carried interceptions of khapra beetle are associated with small quantities of lentils or rice in luggage, gifts, and household goods.

Khapra beetles are also exceptionally difficult to control. Even among the Dermestidae, a difficult group of stored product pests to begin with, it stands out. Khapra beetles can survive for several months without food or water; even longer if temperatures drop enough to allow

them to enter diapause. They can successfully develop in materials with as little as 2% moisture content. While they prefer grain, they have also been observed completing their development on animal products and carrion. They are exceptionally resistant to insecticides, requiring treatment rates (even for fumigants) at the upper limits of allowable levels.

Khapra beetle and associated host material are regulated by the USDA under authority of 7 CFR 319.75. Isolated infestations of khapra beetle have been discovered and eradicated from California and Texas through Maryland, New York, and other eastern States. While there are no known infestations currently in the U.S., interceptions at ports of entry have dramatically increased recently and the pest risk potential of khapra beetle is high. The goal of the national survey is to determine if the U.S. remains free from khapra beetle.

Montana depends on the export of cereal grains for much of its agricultural income (wheat alone was valued at $1.3 Billion in 2011, National Ag Statistics Service). The incursion of this pest into Montana would be a significant concern for the Montana Department of Agriculture and the grain industry.

RESULTS: A total of 257 khapra beetle traps were placed at sites in 15 Counties across Montana. Traps were placed at grain handling facilities, seed dealers, plant pest laboratories, and other high risk locations. All traps were negative for khapra beetle. There are several native species of *Trogoderma* in Montana.

Images from left to right: *Trogoderma variabile* (Ballion), *Trogoderma sternale* Jayne, *Trogoderma glabrum* (Herbst), Images by I. Foley.

2014 Nursery Pest Survey
Pest Detection Survey

Montana is a major exporter of agricultural commodities (small grains, pulses, timber, etc.) but a primary importer of nursery stock and horticultural plants for planting. The "green industry", is comprised of a variety of businesses involved in production, distribution and services associated with ornamental plants, landscape and garden supplies and equipment. Segments of the industry include wholesale nurseries, greenhouse and sod growers, contractors and maintenance firms, retail garden centers, home centers, mass merchandisers or "box stores" with lawn and garden departments, and a variety of retails outlets from grocery stores to coffee shops that sell cut flowers and/or seasonal potted plants. The value added impacts of the green industry in Montana are ranked 46th in the US ahead of only Vermont, North Dakota, Wyoming, and Alaska. The green industry that imports plants and plants parts for planting represents a high-risk pathway for the movement of plant pests. Many plants imported for horticultural or other aesthetic purposes have alternate hosts that can be severe agricultural pests (e.g. black stem rust), can become pests themselves (e.g. many noxious weeds), and act as a pathway for many "hitch-hiking" species (e.g. snails, slugs, earthworms, etc.).

Nursery Commodity Survey Target pests			
Pest	**Common Name**	**Approved Method**	**Montana Risk**
Cronartium flaccidum	Scots Pine Blister Rust	Visual	Medium
Otiorhynchus dieckmanni	Wingless Weevil	Visual or pit fall trap	Unknown
Ceroplastes japonicus	Japanese Wax Scale	Visual	Low
Phytophthora alni	Alder Root and Collar Rot	Visual	High
Ditylenchus angustus	Rice Stem Nematode	soil sample	Low
Veronicellidae	Leather Leaf Slugs	Visual	Low
Chalara fraxinea	Ash Dieback	Visual	Low for Native, High Urban
Meghimatium pictum	Chinese Slug	Visual	Unknown
Monacha spp.	hygromiid snails	Visual	Medium
Mycosphaerella gibsonii	Needle Blight Of Pine	Visual	Medium
Popillia japonica	Japnese Beetle	JB Trap/lure	High
Agrilus planipennis	Emerald Ash Borer	Visual	Low for Native, High Urban
Xerolenta obvia	Heath Snail	Visual	High
Lobesia botrana	European grapevine moth	Trap/lure	Low
Noxious Weeds	Noxious Weeds	Visual	High

RESULTS: Visual surveys were completed, soil samples collected, and traps placed at 25 nursery location across Montana. No target pests were detected in any samples. High numbers of non-native species established in the horticulture industry were detected at multiple locations. These pests included amber snails, black vine weevils, and garden slugs.

Eastern Heath Snail Update
***Xerolenta obvia* Menke**
Farm Bill 10007

Background

Snail samples collected in Cascade County in late July of 2012 were confirmed as eastern heath snail, *Xerolenta obvia*, one of twelve USDA listed invasive terrestrial snails of national concern. The Montana Department of Agriculture and Montana PPQ conducted survey work in August and September of 2012 to delimit the infested area, determine whether eastern heath snail was present in grain and alfalfa production areas in the state, and to support export of Montana agricultural commodities and products. Survey work confirmed the presence of snails in the Belt area along transportation corridors, residential areas, rangeland, and hay fields and yards. Extensive survey work outside the infested area showed that snails were not yet present in grain production areas. Through discussion with individual Belt area landowners and residents, it was determined that the snails have been present in the area for at least 25 years, perhaps much longer. Pathways of introduction include rail, mining, travel, and trade/commerce. There is a strong correlation between rights-of-way activities and local distribution of the snail. In 2013, two additional populations of *Xerolenta obvia* were confirmed in Cascade County (in the city of Great Falls and near Monarch).

2014 Activities

Education and Awareness

The department is working on adding eastern heath snail to the EDDMapS platform as an early detection and distribution system for invasive species. The App allows upload of photos and records location information of species submitted, which are then verified by a designated expert. The App is expected to assist with reporting of snails by the public and verification by the department.

Containment and Mitigation

The department secured Farm Bill 10201 funding for treatment of infested areas. In 2013, small scale trials were completed that showed pesticides containing metaldahyde and iron phosphate caused mortality in *Xerolenta obvia*. To utilize these tools in Montana potential environmental impacts were reviewed following state and federal law. In April of 2014, a Record of Categorical Exclusion Determination was filed by USDA APHIS to meet National Environmental Policy Act (NEPA) requirements and a final draft checklist Environmental Assessment was published for public comment by the Montana Department of Agriculture as required by the Montana Environmental Policy Act (MEPA).

Survey

The department had also received funding to conduct a broad invasive snail and slug survey across Montana. Survey sites included high-risk transportation areas, recreational areas, and nurseries.

Survey work was focused on presence or absence of snails and no attempt was made to quantify the snail population. Survey work appears to indicate that snails have not spread beyond the infested boundaries identified in 2012. However, little is known about the biology or invasive behavior of this snail and a prediction of future population growth or spread cannot be made with any certainty with current information and data. It remains important to conduct survey work in the future to monitor the snail population in the Belt area and determine presence or absence to support Montana's export market.

***Cochlicella* sp. on grain**

Maritime garden snail, *Cernuella virgata*

Mollusks have only recently been identified as a threat in Montana. Movement of various materials protected by solid wood packing material into and through Montana increases the risk of introduction of pests – not only through standard commerce, but also through the movement of materials from the seaport inland. Interstate 90, a major route across the U.S., travels the entire width of Montana, from a point just west of Missoula to east of Glendive. The Montana "banana belt," a region of milder climate, runs from the Flathead Valley to the Bitterroot. This area has experienced a rapid influx of people and an increase in the building of higher-value homes. These properties often include high-value imported materials such as tile, marble, and wood.

The entire state of Montana is a Mecca for recreation including activities of all types. All of these serve as routes of entry into the state for organisms such as the various Veroncellid snails, as well as *Monacha* spp., *Cernuella* spp., and *Cochlicella* spp. These snails could, if established, not only out-compete native species, but also eliminate portions of the food web that are currently supporting the state's famous trout fisheries, become mechanical obstacles to field crop harvest, and directly damage desirable plant species including wheat.

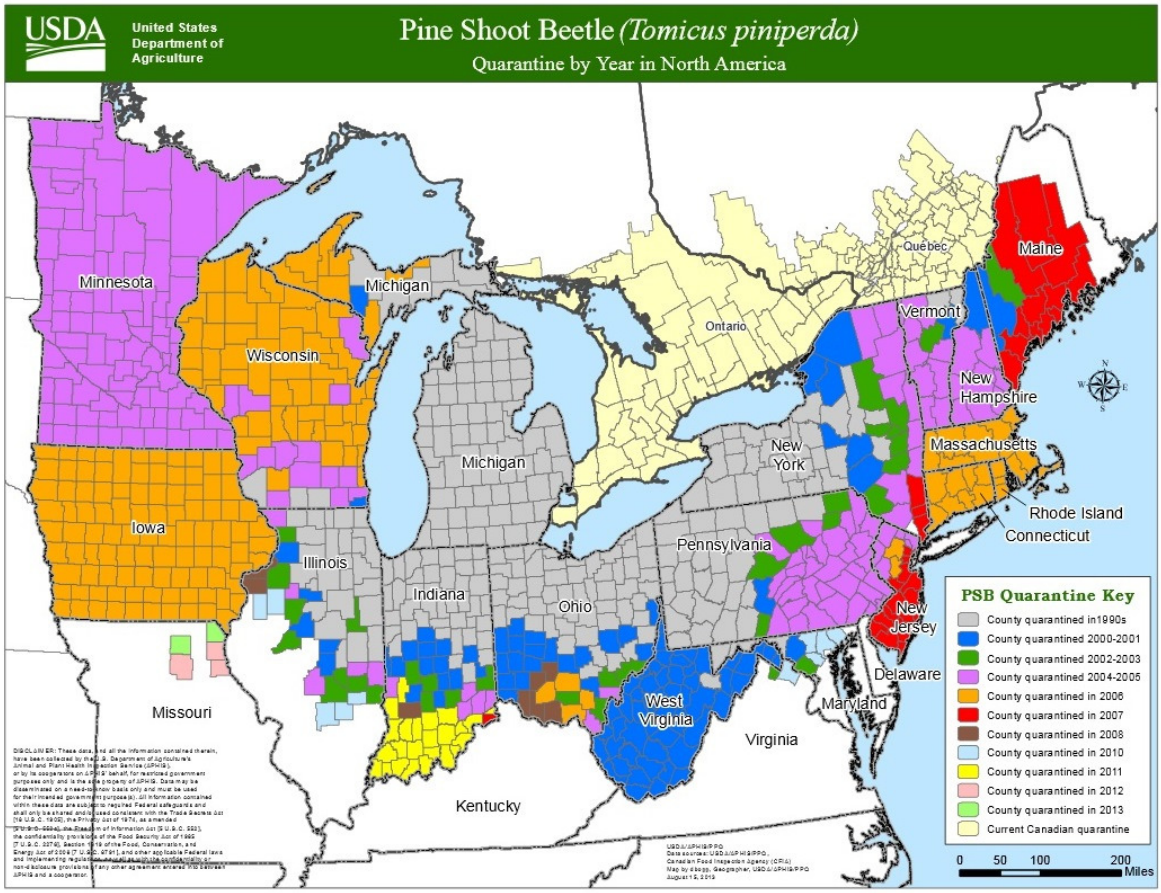
RESULTS: No additional invasive mollusk species were discovered in 2014.

Pine Shoot Beetle (PSB) Detection Survey

Tomicus piniperda (Linnaeus)

Tomicus piniperda, the pine shoot beetle, is a member of the economically important bark beetle sub-family Scolytinae. There are approximately 101 species of bark beetle known to occur in Montana (Gast et al., 1989). These include many economic species of forestry and wood products. The principal hosts of *T. piniperda* are pines (CABI, 2004). It will attack the stem of weakened trees during breeding and the shoots of weakened or healthy trees during sexual maturation (Haack and Kucera, 1993). *Tomicus piniperda* is considered a major forest pest in Europe and China (CABI, 2004; Ye, 1991). *Tomicus piniperda* and other bark beetles are also a trade concern because it will readily move in dunnage and solid wood packing materials.

In 1992, *T. piniperda* was detected in a Christmas tree plantation near Cleveland, Ohio (Haack and Kucera, 1993). Since then it has been detected in 14 states and resulted in 473 regulated U.S. counties due to natural spread, human movement of infested commodities in the regulated area and increased surveys (Haack and Poland, 2001; Heilman et al., 2005; NAPIS, 2005; USDA-APHIS, 2005). The purpose of the survey in Montana is to continue to document that Montana is free from this pine pest.



The presence of *T. piniperda* in the U.S. has resulted in quarantines on the movement of potentially infested articles (CFR, 2003, 2005). Regulated pine articles include: 1) Christmas trees, 2) nursery stock, 3) logs with bark, 4) lumber with bark, 5) stumps and 6) bark nuggets.

Montana has concentrated areas of suitable hosts for PSB that are often stressed by fires and drought and could be at risk for establishment (CABI, 2004; Swetnam, 2001). However, the west in general may also be the easiest region to protect from *T. piniperda* introduction with regulatory methods. This is because a lack of concentrated host material in the plains states and a lack of effective aggregation pheromones may mitigate the natural movement of *T. piniperda* to at risk Montana pine resources (Haack and Kucera, 1993; USDA-USFS, 1991).

RESULTS: Lindgren funnel traps with lures designed for Pine Shoot Beetle were placed at 30 sites in 14 counties across Montana. Traps were placed cooperatively by the Montana Department of Agriculture and Montana State University. The traps were screened by Montana State University and non-target bark beetles were added to the ongoing Montana wood-Boring insect project at MSU. No Pine Shoot Beetles were detected in 2014.

Image, Pest and Diseases Image Library, www.forestryimages.org

National Agriculture Pest Information System (NAPIS)

2014 Summary Report

Pest Common	Pest Scientific	Survey Method	Data Source	Counties	Positives	Negatives	Total
Alder Root and Collar Rot	Phytophthora alni	General Nursery Inspection	State Ag Dept.	12	0	25	25
Ash Dieback	Hymenoscyphus pseudoalbidus	General Nursery Inspection	State Ag Dept.	12	0	50	50
Asian Gypsy Moth	Lymantria dispar asiatica	Trap;Delta Pheromone (Paper)	State Ag Dept.	13	0	150	150
Asian Gypsy Moth	Lymantria dispar asiatica	Trap;Delta Pheromone (Paper)	U.S. Forest Service	32	0	284	284
Asiatic Brown Rot	Monilia polystroma	General Nursery Inspection	University/Extension	4	0	10	10
Brown Marmorated Stink Bug	Halyomorpha halys	General Nursery Inspection	University/Extension	14	0	40	40
Cherry Bark Tortrix	Enarmonia formosana	Trap;Delta Pheromone (Paper)	University/Extension	4	0	10	10
Chinese Slug	Meghimatium pictum	Terrestrial Mollusk Plot Survey	State Ag Dept.	12	0	25	25
Cucurbit Beetle	Diabrotica speciosa	General Nursery Inspection	University/Extension	4	0	10	10
Eastern Heath Snail	Xerolenta obvia	Terrestrial Mollusk Plot Survey	State Ag Dept.	28	4	107	111
Eastern Heath Snail	Xerolenta obvia	Terrestrial Mollusk Plot Survey	USDA-APHIS	56	0	2351	2351
Emerald Ash Borer	Agrilus planipennis	General Nursery Inspection	Municipal/City	4	0	29	29
Emerald Ash Borer	Agrilus planipennis	General Nursery Inspection	Private/Commercial	1	0	2	2
Emerald Ash Borer	Agrilus planipennis	General Nursery Inspection	University/Extension	1	0	2	2
Emerald Ash Borer	Agrilus planipennis	Trap;EAB Purple Prism	USDA-APHIS	18	0	55	55
European Cherry Fruit Fly	Rhagoletis cerasi	Trap;Yellow Sticky	University/Extension	4	0	10	10
European Grapevine Moth	Lobesia botrana	Trap;Delta Pheromone (Paper)	State Ag Dept.	12	0	25	25
European Gypsy Moth	Lymantria dispar dispar	Trap;Delta Pheromone (Paper)	U.S. Forest Service	32	0	284	284
European Stone Fruit Yellows	Candidatus Phytoplasma prunorum	General Nursery Inspection	University/Extension	4	0	10	10
False Codling Moth	Thaumatotibia leucotreta	Trap;Wing Pheromone;Pherocon 1c	University/Extension	4	0	10	10
Golden Nematode	Globodera rostochiensis	PCN National Survey	State Ag Dept.	2	0	7	7
Gypsy Moth	Lymantria dispar	Trap;Delta Pheromone (Paper)	State Ag Dept.	13	0	150	150
Gypsy Moth	Lymantria dispar	Trap;Delta Pheromone (Paper)	USDA-APHIS	12	0	178	178
Hokkaido Gypsy Moth	Lymantria umbrosa	Trap;Delta Pheromone (Paper)	State Ag Dept.	13	0	150	150
Hokkaido Gypsy Moth	Lymantria umbrosa	Trap;Delta Pheromone (Paper)	USDA-APHIS	12	0	178	178
Hygromiid Snails	Cernuella sp./spp.	Terrestrial Mollusk Plot Survey	State Ag Dept.	26	0	88	88
Hygromiid Snails	Monacha sp./spp.	General Pest Observation; Lab Confirmed	State Ag Dept.	26	0	88	88
Japanese Beetle	Popillia japonica	Trap;JB;Trece Catch Can Floral/Pheromone	State Ag Dept.	8	5	177	182
Japanese Beetle	Popillia japonica	Trap;JB;Trece Catch Can Floral/Pheromone	USDA-APHIS	6	0	31	31
Japanese Gypsy Moth	Lymantria dispar japonica	Trap;Delta Pheromone (Paper)	State Ag Dept.	13	0	150	150
Japanese Wax Scale	Ceroplastes japonicus	General Nursery Inspection	State Ag Dept.	12	0	25	25
Japanese Wax Scale	Ceroplastes japonicus	General Nursery Inspection	University/Extension	4	0	10	10
Karnal Bunt	Tilletia (Neovossia) indica	Karnal Bunt Field Survey; 4 Lb. Sample	State Ag Dept.	32	0	157	157
Khapra Beetle	Trogoderma granarium	Trap;Vertical Wall Mount Trogo	State Ag Dept.	15	0	257	257
Leatherleaf Slugs	Veronicella sp./spp.	General Pest Observation; Lab Confirmed	State Ag Dept.	26	0	88	88
Masson Pine Moth	Dendrolimus punctatus (punctata)	Trap;Wing Pheromone;Pherocon 1c	USDA-APHIS	19	0	56	56
Needle Blight of Pine	Pseudocercospora pini-densiflorae	General Nursery Inspection	State Ag Dept.	12	0	75	75
Okinawa Gypsy Moth	Lymantria albescens	Trap;Delta Pheromone (Paper)	State Ag Dept.	13	0	150	150
Okinawa Gypsy Moth	Lymantria albescens	Trap;Delta Pheromone (Paper)	USDA-APHIS	12	0	178	178
Pale Cyst Nematode	Globodera pallida	Soil Sample;Select.Area;1 Smpl/5+acr.	State Ag Dept.	2	0	7	7
Pine Beauty Moth	Panolis flammea	Trap;Plastic Bucket (Unitrap)	State Ag Dept.	9	0	50	50
Pine Beauty Moth	Panolis flammea	Trap;Plastic Bucket (Unitrap)	USDA-APHIS	19	0	55	55
Pine Sawfly	Diprion pini	Trap;Delta Pheromone (Large Plastic)	State Ag Dept.	6	0	19	19
Pine Shoot Beetle	Tomicus piniperda	Trap;Lindgren Multi-Funnel EWB/BB	State Ag Dept.	2	0	4	4
Pine Shoot Beetle	Tomicus piniperda	Trap;Lindgren Multi-Funnel EWB/BB	Univ.-Extension	12	0	26	26
Pine-tree Lappet	Dendrolimus pini	Trap;Milk Carton Pheromone (Modified)	USDA-APHIS	19	0	56	56
Plum Fruit Moth	Grapholita (Cydia) funebrana	Trap;Wing Pheromone;Pherocon 1c	University/Extension	4	0	10	10
Plum Pox	Potyvirus plum pox virus	National Plum Pox Virus Survey	State Ag Dept.	2	0	125	125
Rosy Moth	Lymantria mathura	Trap;Wing Pheromone;Pherocon 1c	State Ag Dept.	9	0	50	50
Rosy Moth	Lymantria mathura	Trap;Wing Pheromone;Pherocon 1c	USDA-APHIS	19	0	56	56
Scots Pine Blister Rust	Cronartium flaccidum	General Nursery Inspection	State Ag Dept.	12	0	25	25
Small Hive Beetle	Aethina tumida	General Pest Observation; Lab Confirmed	State Ag Dept.	6	0	8	8
Snail	Succinea sp./spp.	General Pest Observation; Lab Confirmed	State Ag Dept.	26	0	88	88
Summer Fruit Tortrix Moth	Adoxophyes orana	Trap;Delta Pheromone (Paper)	University/Extension	4	0	10	10
Vetch; Broadbean Rust	Uromyces viciae-fabae	General Pest Observation; Lab Confirmed	University/Extension	1	5	0	5
White Garden Snail	Theba pisana	General Pest Observation; Lab Confirmed	State Ag Dept.	26	0	88	88
White-winged Gypsy Moth	Lymantria postalba	Trap;Delta Pheromone (Paper)	State Ag Dept.	13	0	150	150
White-winged Gypsy Moth	Lymantria postalba	Trap;Delta Pheromone (Paper)	USDA-APHIS	12	0	178	178
Wingless Weevil	Otiorhynchus dieckmanni	General Pest Observation; Lab Confirmed	State Ag Dept.	12	0	25	25
REPORT TOTAL					14	6712	6726