2015

Cooperative Agricultural Pest Survey Report

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Cover photo: Spotted lanternfly (*Lycorma delicatula*) by Lawrence Barringer, Pennsylvania Department of Agriculture, Bugwood.org

Introduction to the Program

The Cooperative Agricultural Pest Survey (CAPS) program conducts science-based national and state surveys targeted at specific exotic plant pests, diseases, and weeds identified as threats to U.S. agriculture and/or the environment. These activities are accomplished primarily under USDA funding that is provided through cooperative agreements with state departments of agriculture, universities, and other entities. Surveys conducted through the CAPS Program represent a second line of defense against the entry of harmful plant pests and weeds. These surveys enable the program to target high-risk hosts and commodities, gather data about pests specific to a commodity, and establish better baseline data about pests that were recently introduced in the United States. The mission of the CAPS program is to provide a survey profile of exotic plant pests in the United States deemed to be of regulatory significance through early detection and surveillance activities.

Cooperative Agricultural Pest Survey 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.

CAPS Program Internet Resources

CAPS Website: https://caps.ceris.purdue.edu/home

National Agricultural Pest Information System (NAPIS): http://pest.ceris.purdue.edu/

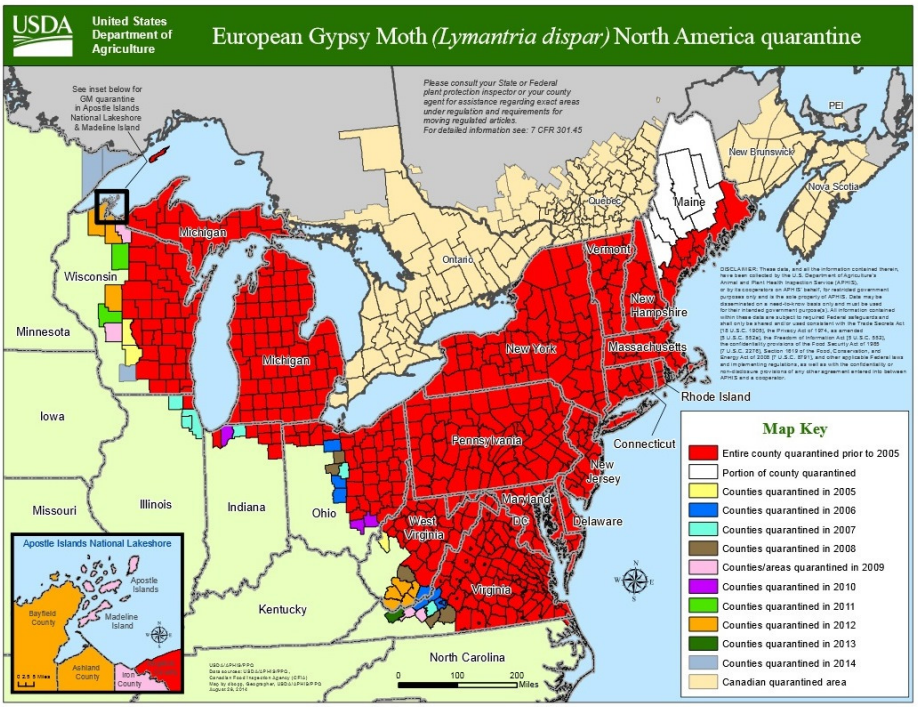
Hungry Pests: http://www.hungrypests.com/

Montana Wood Boring Insect Project: http://mtent.org/WoodBor.html

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 are of particular importance as 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, 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 sub-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. Asian Gypsy Moth (AGM) pest pressure has increased in recent years due to increased populations in the native range and changes in international shipping logistics. There have been several detections of AGM sub-species adults in the Pacific Northwest. In this sub-species, the female moths can fly and the caterpillars are more likely to feed on coniferous trees.



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 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 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). In 2015 the USDA APHIS PPQ placed traps mainly in the eastern portion of the state, the MDA placed traps in the western portion of the state, and DNRC placed 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.

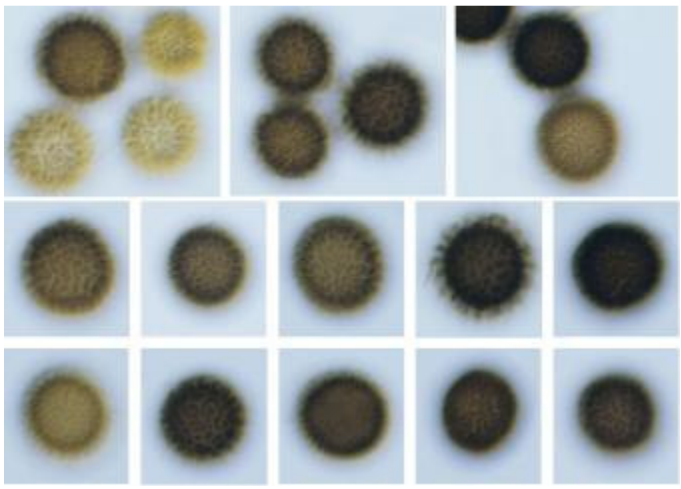
RESULTS: 150 traps were placed by MDA in 2015. All traps were negative in 2015.

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 2015 harvest. A total of 163 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.

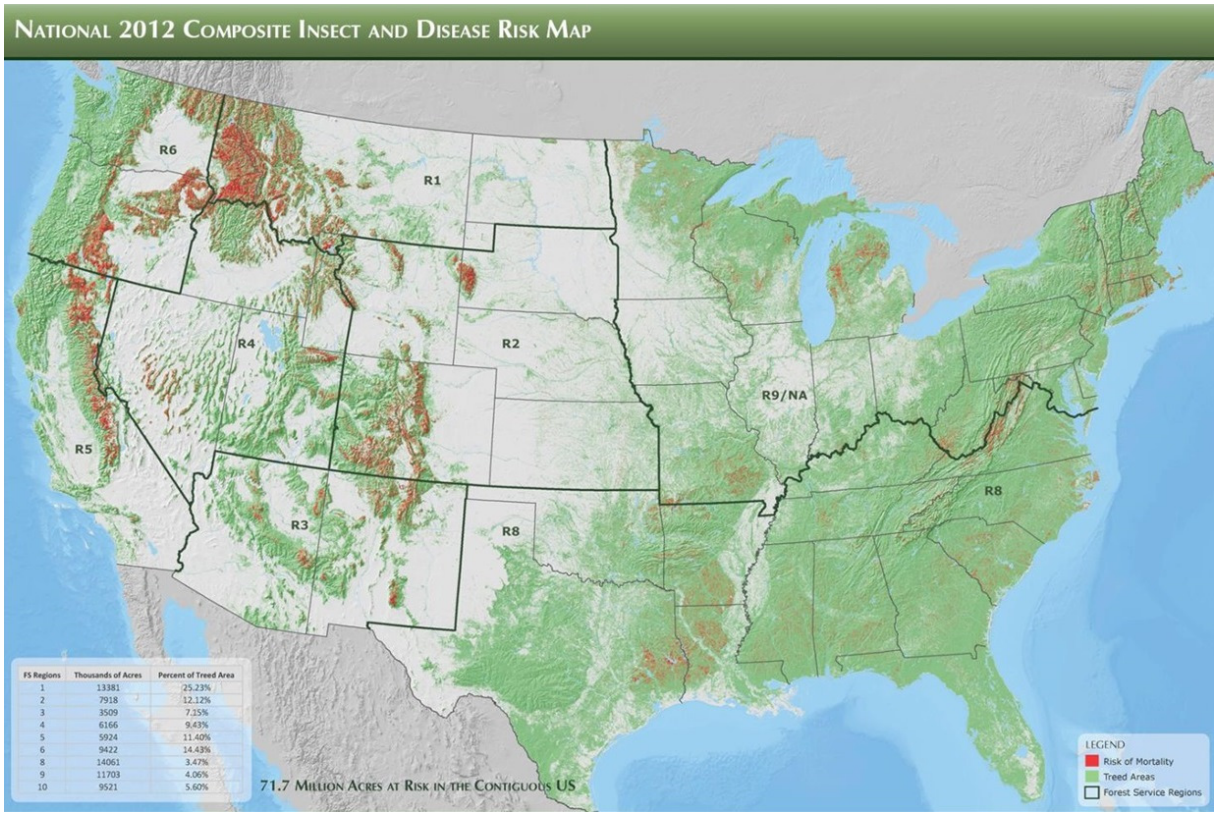


Credits: Teliospores of Tilletia indica (Karnal bunt of wheat) showing surface ornamentation patterns. EPPO.

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

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 and 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 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: 50 pine sawfly traps were placed by MDA in 2015. All traps were negative.

Rosy Gypsy Moth (RGM) Detection Survey
Lymantria mathura Moore

Both the gypsy 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 pose a higher risk to the 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 European gypsy moth traps because the pheromone lures have been shown to have antagonistic affects (CAPS approved methods, 2013).

Siberian Silk Moths (SSM) Detection Survey
Dendrolimus sibiricus (Chetverikov), *D. superans* (Butler), *D. punctatus* (Walker), *D. pini* (L.)

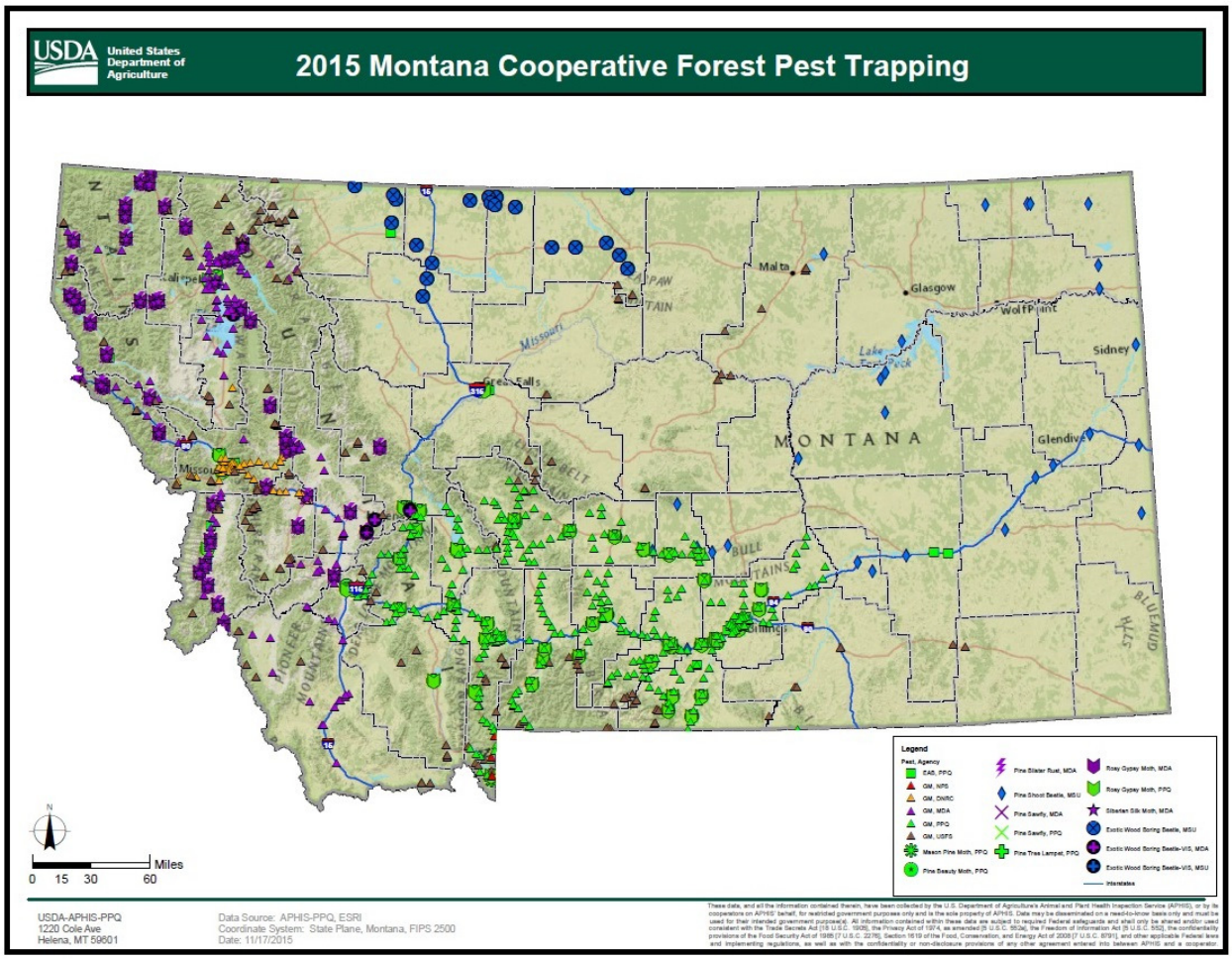
The Siberian silk moths are polyphagous defoliators of conifers with confused taxonomic histories and species concepts. Laboratory tests in the US have indicated that Douglas Fir would be a highly preferred host in the western states. In its native range (Russia, Kazakhstan, North and South Korea and Mongolia) SSM is responsible for damage similar to that done by the European gypsy moth in outbreak areas of eastern North America.

SSM adult male, Image from http://www.padil.gov.au

If established in western North America, the impact on forest health would probably be greater than that of the gypsy moth on northeastern forests because conifers are more prone to mortality when repeatedly defoliated. Infestations can lead to slower overall forest growth as well as the death of repeatedly or heavily infested trees. In addition, infested forests are unsightly and unattractive for tourism and other recreation, a major issue in Montana and other western states. Trapping for this moth involves green gypsy moth milk carton traps that are modified to capture a larger moth (40-80mm).

RESULTS: A total of 50 traps were placed for *Dendrolimus punctatus* the "masson pine moth" in Montana in 2015. No suspect moths were trapped or submitted. The most commonly collected moth in the traps was the western forest tent caterpillar, *Malacosoma californicum* (Packard).

Visual Surveys for Plant Pathogens
Samples of symptomatic plant tissue were collected at several sites. All samples were negative for target pathogens and most damage was the result of draught stress or other abiotic damage.



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

Pine Commodity Survey				
Target Species	**Common Name**	**Pest list**	**Approved Method**	**Sites**
Cronartium flaccidum	Scots Pine Blister Rust	AHP #2	Visual	50
Phytophthora alni	Alder Root and Collar Rot	AHP #12	Visual	50
Lymantria mathura Moore	Rosy Gypsy Moth	AHP #15	Wing trap/lure 84 days	50
Monochamus sutor (L.)	small white-marmorated longhorned beetle	AHP #26	Visual	50
Dendrolimus punctatus (Walker)	masson pine moth	AHP #28	Wing trap/lure 21 days	50
Candidatus Phytoplasma pini 16SrXXI-A	Pine Witches' Broom	AHP #36	Visual	50
Monacha spp.	hygromiid snails	AHP #38	Visual	50
Monochamus saltuarius (Gebler)	Sakhalin Pine Sawyer	AHP #42	Visual	50
Mycosphaerella gibsonii	Needle Blight of Pine	AHP #46	Visual	50
Diprion pini (L.)	Pine Sawfly	AHP #47	Large Delta/lure 28 days	50
Monochamus alternatus (Hope)	Japanese pine sawyer	Pine Commodity	Multi-Funnel/lure	5

Small Grains Commodity Based Survey (SG)
Detection Survey

The USDA published guidelines for a small grains commodity based survey in 2007. The idea behind commodity based surveys is to target export commodities rather than individual pests. When undertaking a commodity based survey, multiple survey methods are used to take samples from a single commodity or group of similar commodities over a longer time period. In the small grains survey, MDA used sweep net samples, visual surveys, soil samples for nematodes, and whole plant samples for diseases. This methodology allows the survey to maximize the potential for pest detection and minimize the cost compared to several different surveys for individual pests.

The small grains survey targets 14 different types of exotic pests (see table 1 below) that could potentially damage small grains crops and negatively impact Montana exports. These pests include 8 arthropods, 2 mollusks, 3 nematodes, and 1 fungus like pathogen. In addition to the 14 exotic pests, samples were also screened for cereal leaf beetle and a number of other economically important nematodes and plant diseases.

Montana generally ranks in the top 5 nationally in the value of both wheat and barley crop production. Chouteau County, Montana is one of only two counties in the U. S. that produced over 20 million bushels of wheat annually.

Since the initiation of the Small Grains Commodity Based survey, two of the target pests have been detected in North America for the first time. The cereal cyst nematode was detected in Oregon (Union County) in 2008 (Smiley et al. 2008), Washington in 2009, and Montana in 2014. The grape berry moth was detected in California (Napa County) in 2010.

Table 1. List of target species of the Small Grains Commodity Based Survey

Small Grains Commodity Survey				
Target Species	**Common Name**	**Pest list**	**Approved Method**	**Sites**
Veronicella spp.	Veronicellid Slugs	AHP #21	Visual	25 (50 samples)
Spodoptera littoralis (Boisduval)	Egyptian Cottonworm	AHP #23	Bucket Trap/lure 84 days	25
Nysius huttoni (White)	wheat bug	AHP #29	Visual	25 (50 samples)
Monacha spp.	Helicid Snail	AHP #38	Visual	25 (50 samples)
Diabrotica speciosa Germar	cucurbit beetle	AHP #45	Visual	25 (50 samples)
Succinea spp.	amber snail	TTG #15	Visual	25 (50 samples)
Theba pisana Müller	Mediterranean snail	TTG #2	Visual	25 (50 samples)
Cernuella virgata (daCosta)	Vineyard snail	TTG #4	Visual	25 (50 samples)
Xerolenta obvia (Menke)	Eastern heath snail	TTG #6	Visual	25 (50 samples)
Heterodera cajani	pigeonpea cyst nematode	Cyst Nematode	Soil sample	25
Heterodera latipons	Mediterranean cereal cyst	Cyst Nematode	Soil sample	25
Heterodera filipjevi	cereal cyst nematode	Cyst Nematode	Soil sample	25
Ditylenchus dipsaci	stem and bulb nematode	export concern	Soil sample	25

New Zealand Wheat Bug

Results: During the 2015 survey, 50 sweep net/visual survey samples were submitted. Soil samples for nematode detection analysis were sent to the University of Nebraska in Lincoln. No suspect target pests were detected in any of the samples.

Whole plant samples were screened for diseases by Montana State University. The following non-regulated pathogens were detected; Wheat Streak Mosaic Virus, *Blumeria graminis*, *Alternaria*, *Rhizoctonia*, and *Fusarium* root rot, *Cochliobolus*, and *Bipolaris sorokiniana*.

Exotic Woodborer and Bark Beetle Survey (EWBB)
Detection Survey

Wood boring insects are some of the most dramatically destructive invasive species introduced into the forest and urban landscape of the United States (e.g. Asian longhorned beetle, emerald ash borer). Some native wood boring insects (e.g. mountain pine beetle) also cause significant damage to Montana's forest resources, but the threat of exotic wood borers is significant for Montana agriculture, wood products, tourism, and recreation industries.

The Exotic Woodborer and Bark Beetle (EWBB) survey targets primarily three groups of insects; longhorned beetles (Cerambycidae), bark beetles (Scolytinae), and wood wasps (Siricidae). Within these groups more than 20 species are specifically targeted including the Asian longhorned beetle, Japanese pine sawyer, European spruce bark beetle, brown spruce longhorned beetle, and spruce engraver. This survey is conducted by using Lindgren funnels and panel traps baited with various ultra-high release (UHR) ethanols, bark beetle pheromone, and plant volatile lures. Funnel traps also have passive flight intercept capabilities, and the resulting trap catches include many native wood-boring beetles and a wide range of non-target families. While not specifically targeted, flight intercept traps do capture beetles in the family Buprestidae and have the potential to trap exotic buprestids such as the Emerald Ash Borer.

In 2015, 60 funnel traps were placed and monitored across the state cooperatively by MDA and Montana State University. Trap sites focused on forested areas near the Canadian border and recreation sites with campgrounds, and high traffic tourism areas.

Target Species	Common Name	Approved Method	Lure	Sites
Chlorophorus strobilicola	slender-banded pinecone longhorn beetle	Visual	N/A	20
Ips sexdentatus	six-toothed Ips	Black Multi-Funnel Trap	Ips sp. Lure	20
Ips typographus	European spruce bark beetle	Black Multi-Funnel Trap	Ips sp. Lure	20
Monochamus alternatus	Japanese pine sawyer	Black Multi-Funnel Trap	Monochamol, Alpha Pinene UHR, Ethanol	20
Monochamus saltuarius	Sakhalin pine sawyer	Visual	N/A	20
Monochamus sutor	small white-marmorated longhorn beetle	Visual	N/A	20
Tetropium castaneum	black spruce beetle	Cross Vane Panel Trap	Spruce Blend, Geranyl Acetol, Ethanol	20
Tetropium fuscum	brown spruce longhorn beetle	Cross Vane Panel Trap	Spruce Blend, Geranyl Acetol, Ethanol	20
Tomicus minor	lesser pine shoot beetle	Visual	N/A	20

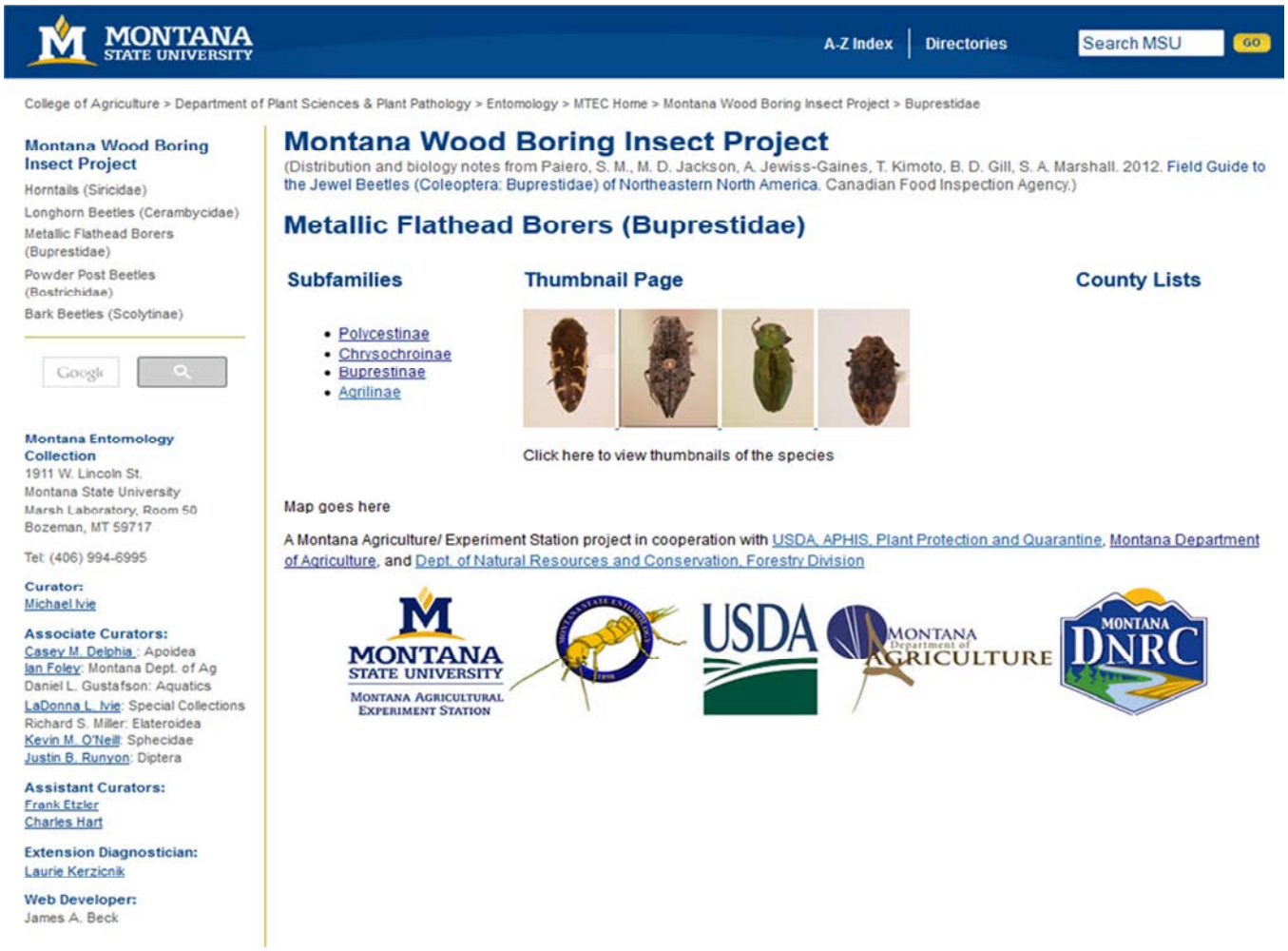
RESULTS: No target species were collected.

Cerambycidae: There are 152 species of longhorned beetles recorded from Montana (Hart et al. 2013). The most common species in funnel traps include *Asemum striatum* (Linnaeus), *Arhopalus asperatus* (LeConte), *Neandra brunnea* (Fabricius), *Neospondylis upiformis* (Mannerheim), *Xylotrechus longitarsis* Casey, *Acmaeops proteus* (Kirby in Richardson), *Monochamus scutellatus* (Say), *Rhagium inquisitor* (Linnaeus), and *Tetropium velutinum* LeConte.

Solytinae: There are approximately 100 species of bark beetles recorded from Montana (Gast et al. 1989, NAPIS 2012).

Montana Wood Boring Insect Project

Montana State University through the Montana Agricultural Experiment Station (MAES) and Montana Entomology Collection (MTEC) has developed an online portal for the "Montana Wood Boring Insect Project". This website contains county level distribution data and images of all of the long-horned and metallic wood boring beetles known to occur in Montana. Many of the non-target species collected through the CAPS program have been incorporated into this project and are maintained in the MTEC. The project website can be found at: http://mtent.org/WoodBor.html



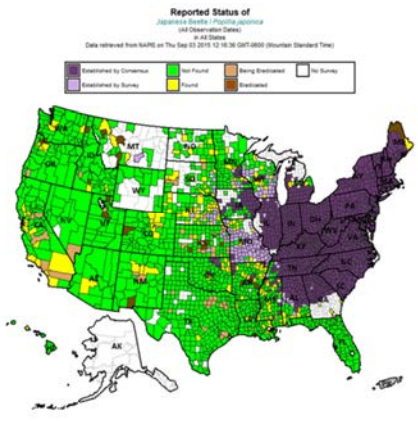
2015 Status Report
Japanese Beetle (*Popillia japonica* Newmann)

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 2015, a limited number of traps were placed in areas where JB had been trapped in previous years, and also in 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.

RESULTS: A total of 13 adult beetles were trapped in 2015; eleven (11) in Billings and two (2) at a nursery in central Montana.

Year	Billings	Flathead Area	Other MT
2002	5	-	-
2003	3*	-	-
2004	3*	-	-
2005	40*	-	-
2006	29	-	-
2007	20	1	-
2008	97	2	-
2009	1,902	-*	-
2010	1*	-	-
2011	43*	7	-
2012	25	58*	-
2013	24	133	59
2014	10'	6	4
2015	11'	0^	2



2015 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 and to the states where Montana-based bees provide pollination. USDA estimates honey bee pollination adds approximately $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 are identified at the molecular level by the USDA "bee lab" in Beltsville, MD.

Varroa mites on a drone pupa, photo I. Foley

RESULTS: 31 National Honey Bee Survey samples were collected in 2015 and submitted to laboratories at the University of Maryland. Some results are pending analysis. Nosema Disease (Nosema spp.), Lake Sinai-2 virus, Kashmir Virus, Israeli Acute Bee Paralysis, Chronic Bee Paralysis Virus, Deformed Wing Virus, and Black Queen Cell Virus were all detected in at least one sample.

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, hay fields, and yards. Extensive survey work outside the infested area showed snails were not yet present in grain production areas. Through discussion with individual Belt area landowners and residents, it was determined 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).

2015 Activities

<u>Education and Awareness</u>

The eastern heath snail was added to the EDDMapS mobile application ecosystem in 2015 for additional early detection and distribution information. The app allows upload of photos and 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. It is highly desirable to use a system the public is already familiar with and is already utilizing to report sightings of other invasive species, such as noxious weeds.

The departments Ag Literacy Program developed an interagency invasive species (including X*erolenta obvia*) lesson plan for deployment to classrooms across Montana. The invasive species outreach materials were completed and printed in May of 2015. An image of the packet of resources is below.

The department published a “Grown in Montana” magazine in March of 2015. The magazine included a “See Me, Report Me” page for distribution to various region wide agriculture interested parties. The initial printing of the magazine totaled 15,000 copies. A copy of the page is below.

The department worked with the Montana State University Entomology Collection (MTEC) to add a permanent mollusk collection storage cabinet. This has allowed the curation and the storage of many species of mollusk found in Montana. This resource is available to all cooperating agencies and has been valuable for the non-target mollusks found during ongoing terrestrial snail detection surveys. See images below of the snail collection at the MTEC.

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).

There are currently four known *Xerolenta* infested areas in the state of Montana: 1) 25 miles of the Belt Creek Valley, 2) a single residential block in Great Falls located between 17th Ave S and Hylande Dr., 3) a small forested area near Monarch, and 4) an area of highway 226 near Highwood. Treatments were completed by department personnel or the landowner at locations within the Belt Valley and the City of Great Falls. Treated parcels were owned by the City of Belt, State of Montana, and 59 different private landowners. Heavily infested high risk areas were treated multiple times in both 2014 and 2015.

There currently is no quantitative tool available to measure the effectiveness of the treatments. Anecdotal, population level observations suggest that *Xerolenta* numbers were extremely high in 2013 and have fallen in both 2014 and 2015 due to unknown factors. Populations are still very high but appear to be below the levels seen in 2013. It is likely that *Xerolenta* populations were extremely high in 2013 due to widespread flooding in the area during 2012 which provided additional areas and a longer duration for reproduction. Belt and Great Falls area residents have reported success in excluding *Xerolenta* individuals from gardens and backyard areas after repeated treatments. It is unclear if the iron phosphate product is causing widespread mortality or if continued applications are providing a barrier to migration into treated areas. Observation of the populations at two areas identified as high-risk for movement from recreation vehicles (Belt Fairgrounds and the informal fishing access on North Belt Creek) have been significantly reduced by multiple chemical and mechanical treatments. It appears that after initial widespread treatments at the Belt fairgrounds to reduced *Xerolenta* populations, perimeter treatments adjacent to unmanaged vegetation areas of only 30 feet in

width are an effective barrier to prevent snail migration into the rodeo, turf grass, pool, and managed recreation areas of the fairgrounds.

Survey

The department received Farm Bill 10007 funding to conduct a broad invasive snail and slug survey across Montana. Survey sites included high-risk transportation areas, recreational areas, and nurseries.

Target Species	Common Name	Pest list	Approved Method	Number of Sites
Monacha spp.	Helicid Snail	AHP #33	Visual	50
Veronicella spp.	Veronicellid Slugs	AHP #22	Visual	50
Theba pisana Müller	Mediterranean snail	TTG #2	Visual	50
Cernuella virgata (daCosta)	Vineyard snail	TTG #4	Visual	50
Succinea spp.	amber snail	TTG #15	Visual	50
Xerolenta obvia (Menke)	Eastern heath snail	TTG #6	Visual	50

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 predictions 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 in other areas to support Montana's export markets.

***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 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

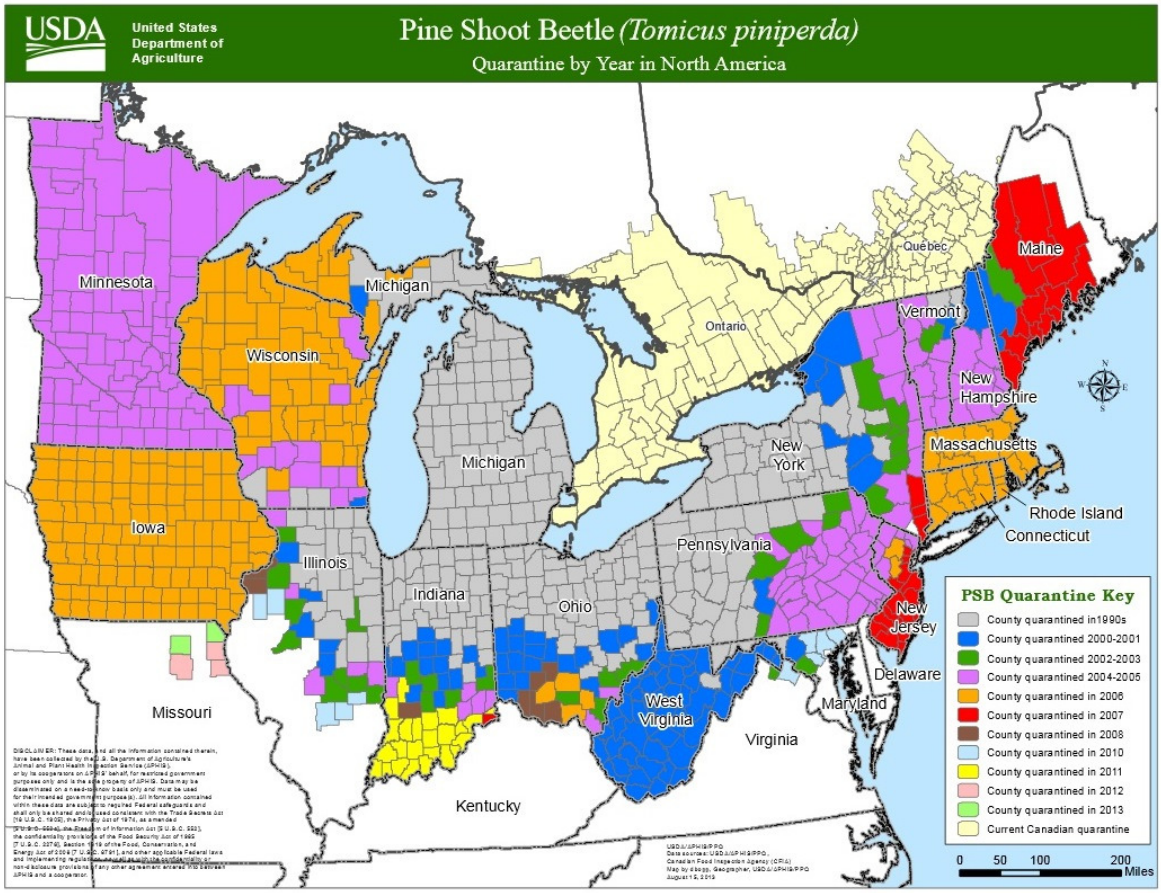
snails, as well as *Monacha* spp., *Cernuella* spp., and *Cochlicella* spp. These snails could, if established, not only out-compete native species, but also eliminate portions of the food web that are currently supporting the state's famous trout fisheries, become mechanical obstacles to field crop harvest, and directly damage desirable plant species including wheat.

RESULTS: No additional invasive mollusk species were discovered in 2015.

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 2015.

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

National Agriculture Pest Information System (NAPIS)
2015 Summary Report

Pest Common	Pest Scientific	Survey Method	Data Source	Counties	Positives	Negatives	Total
Acute Bee Paralysis	Acute Bee Paralysis Virus	National Honey Bee Survey	State Ag Dept.	17	0	31	31
Africanized Honey Bee	Apis mellifera scutellata	National Honey Bee Survey	State Ag Dept.	17	0	31	31
Alder Root and Collar Rot	Phytophthora alni	General Pest Observation; Lab Confirmed	State Ag Dept.	11	0	50	50
American Foulbrood	Paenibacillus larvae larvae	National Honey Bee Survey	State Ag Dept.	10	0	16	16
Asian Gypsy Moth	Lymantria dispar asiatica	Trap;Delta Pheromone (Paper)	State Ag Dept.	10	0	150	150
Asian Gypsy Moth	Lymantria dispar asiatica	Trap;Delta Pheromone (Paper)	State Conservation/	2	0	52	52
Asian Gypsy Moth	Lymantria dispar asiatica	Trap;Delta Pheromone (Paper)	U.S. Forest Service	33	0	320	320
Asian Gypsy Moth	Lymantria dispar asiatica	Trap;Delta Pheromone (Paper)	USDA-APHIS	13	0	335	335
Asian Honey Bee	Apis ceranae	National Honey Bee Survey	State Ag Dept.	17	0	31	31
Black Queen Cell	Black Queen Cell Virus (BQ	National Honey Bee Survey	State Ag Dept.	17	0	31	31
Black Spruce Beetle	Tetropium castaneum	Trap;Intercept/Cross Vane Panel	State Ag Dept/Univ	5	0	20	20
Brown Spruce Longhorned Be	Tetropium fuscum	Trap;Intercept/Cross Vane Panel	State Ag Dept/Univ	5	0	20	20
Cape Honey Bee	Apis mellifera capensis	National Honey Bee Survey	State Ag Dept.	17	0	31	31
Cereal Cyst Nematode	Heterodera filipjevi	Soil Sample;Select.Area;1 Smpl/5+acr.	State Ag Dept.	19	0	50	50
Chalk Brood	Ascosphaera apis	National Honey Bee Survey	State Ag Dept.	17	0	31	31
Chronic Bee Paralysis	Chronic Bee Paralysis Virus	National Honey Bee Survey	State Ag Dept.	10	2	14	16
Cucurbit Beetle	Diabrotica speciosa	General Pest Observation; Lab Confirmed	State Ag Dept.	19	0	50	50
Deformed Wing	Iflavirus Deformed Wing V	National Honey Bee Survey	State Ag Dept.	10	0	16	16
Eastern Heath Snail	Xerolenta obvia	General Pest Observation; Lab Confirmed	State Ag Dept.	29	5	133	138
Eastern Heath Snail	Xerolenta obvia	General Pest Observation; Lab Confirmed	State Ag Dept/Univ	8	0	25	25
Eastern Heath Snail	Xerolenta obvia	General Pest Observation; Lab Confirmed	University/Extensic	19	0	29	29
Egyptian Cottonworm	Spodoptera littoralis	Trap;Plastic Bucket (Unitrap)	State Ag Dept.	11	0	25	25
Emerald Ash Borer	Agrilus planipennis	General Nursery Inspection	Municipal/City	1	0	1	1
Emerald Ash Borer	Agrilus planipennis	Trap;EAB Purple Prism	USDA-APHIS	13	0	41	41
European Foulbrood	Melissococcus plutonius	National Honey Bee Survey	State Ag Dept.	10	0	16	16
European Gypsy Moth	Lymantria dispar dispar	Trap;Delta Pheromone (Paper)	State Ag Dept.	10	0	150	150
European Gypsy Moth	Lymantria dispar dispar	Trap;Delta Pheromone (Paper)	State Conservation/	2	0	52	52
European Gypsy Moth	Lymantria dispar dispar	Trap;Delta Pheromone (Paper)	U.S. Forest Service	33	0	320	320
European Gypsy Moth	Lymantria dispar dispar	Trap;Delta Pheromone (Paper)	USDA-APHIS	13	0	335	335
European Spruce Bark Beetle	Ips typographus	Trap;Lindgren Multi-Funnel EWB/BB	State Ag Dept/Univ	5	0	20	20
Greater Wax Moth	Galleria mellonella	National Honey Bee Survey	State Ag Dept.	10	0	16	16
Hokkaido Gypsy Moth	Lymantria umbrosa	Trap;Delta Pheromone (Paper)	State Ag Dept.	10	0	150	150
Hokkaido Gypsy Moth	Lymantria umbrosa	Trap;Delta Pheromone (Paper)	State Conservation/	2	0	52	52
Hokkaido Gypsy Moth	Lymantria umbrosa	Trap;Delta Pheromone (Paper)	U.S. Forest Service	33	0	320	320
Hokkaido Gypsy Moth	Lymantria umbrosa	Trap;Delta Pheromone (Paper)	USDA-APHIS	13	0	335	335
Honey Bee Mite	Acarapis woodi	National Honey Bee Survey	State Ag Dept.	17	0	31	31
Hygromiid Snails	Monacha sp./spp.	General Pest Observation; Lab Confirmed	State Ag Dept.	20	0	75	75
Israeli Acute Bee Paralysis	Israeli Acute Paralysis Viru	National Honey Bee Survey	State Ag Dept.	10	5	11	16
Japanese Beetle	Popillia japonica	Declaration Of Pest Eradication	State Ag Dept.	3	0	3	3
Japanese Beetle	Popillia japonica	Trap;JB;Trece Catch Can Floral/Pheromone	State Ag Dept.	5	4	20	24
Japanese Beetle	Popillia japonica	Trap;JB;Trece Catch Can Floral/Pheromone	USDA-APHIS	6	0	32	32
Japanese Gypsy Moth	Lymantria dispar japonica	Trap;Delta Pheromone (Paper)	State Ag Dept.	10	0	150	150
Japanese Gypsy Moth	Lymantria dispar japonica	Trap;Delta Pheromone (Paper)	State Conservation/	2	0	52	52
Japanese Gypsy Moth	Lymantria dispar japonica	Trap;Delta Pheromone (Paper)	USDA-APHIS	13	0	335	335
Japanese Pine Sawyer	Monochamus alternatus	Trap;Lindgren Multi-Funnel EWB/BB	State Ag Dept/Univ	8	0	25	25
Karnal Bunt	Tilletia indica	National Karnal Bunt Survey;Optical Scan	State Ag Dept.	38	0	169	169
Kashmir Virus	Kashmir Virus	National Honey Bee Survey	State Ag Dept.	10	1	15	16
Lake Sinai-2	Lake Sinai Virus-2	National Honey Bee Survey	State Ag Dept.	10	10	6	16
Leatherleaf Slugs	Veronicella sp./spp.	General Pest Observation; Lab Confirmed	State Ag Dept.	19	0	50	50
Lesser Pine Shoot Beetle	Tomicus minor	General Pest Observation; Lab Confirmed	State Ag Dept/Univ	8	0	25	25
Maritime Garden Snail	Cernuella virgata	General Pest Observation; Lab Confirmed	State Ag Dept.	19	0	50	50
Masson Pine Moth	Dendrolimus punctatus	Trap;Wing Pheromone;Pherocon 1c	State Ag Dept.	11	0	50	50
Masson Pine Moth	Dendrolimus punctatus	Trap;Wing Pheromone;Pherocon 1c	USDA-APHIS	18	0	57	57
Mediterranean Cereal Cyst Ne	Heterodera latipons	Soil Sample;Select.Area;1 Smpl/5+acr.	State Ag Dept.	19	0	50	50
Needle Blight of Pine	Pseudocercospora pini-der	General Pest Observation; Lab Confirmed	State Ag Dept.	11	0	50	50
Nosema Disease	Nosema sp./spp.	National Honey Bee Survey	State Ag Dept.	10	12	4	16
Okinawa Gypsy Moth	Lymantria albescens	Trap;Delta Pheromone (Paper)	State Ag Dept.	10	0	150	150
Okinawa Gypsy Moth	Lymantria albescens	Trap;Delta Pheromone (Paper)	State Conservation/	2	0	52	52
Okinawa Gypsy Moth	Lymantria albescens	Trap;Delta Pheromone (Paper)	U.S. Forest Service	33	0	320	320
Okinawa Gypsy Moth	Lymantria albescens	Trap;Delta Pheromone (Paper)	USDA-APHIS	13	0	335	335

Parasitic mite	Tropilaelaps sp./spp.	National Honey Bee Survey	State Ag Dept.	10	0	16	16
Parasitic Mite Syndrome	Parasitic Mite Syndrome (P	National Honey Bee Survey	State Ag Dept.	10	0	16	16
Pigeonpea Cyst Nematode	Heterodera cajani	Soil Sample;Select.Area;1 Smpl/5+acr.	State Ag Dept.	19	0	50	50
Pine Beauty Moth	Panolis flammea	Trap;Plastic Bucket (Unitrap)	USDA-APHIS	18	0	55	55
Pine Sawfly	Diprion pini	Trap;Delta Pheromone (Large Plastic)	State Ag Dept.	11	0	50	50
Pine Sawfly	Diprion pini	Trap;Delta Pheromone (Large Plastic)	USDA-APHIS	18	0	55	55
Pine Shoot Beetle	Tomicus piniperda	Trap;Lindgren Multi-Funnel EWB/BB	University/Extensic	19	0	29	29
Pine Witches' Broom	Candidatus Phytoplasma p	General Pest Observation; Lab Confirmed	State Ag Dept.	11	0	50	50
Pine-tree Lappet	Dendrolimus pini	Trap;Milk Carton Pheromone (Modified)	USDA-APHIS	18	0	57	57
Rosy Moth	Lymantria mathura	Trap;Wing Pheromone;Pherocon 1c	State Ag Dept.	11	0	50	50
Rosy Moth	Lymantria mathura	Trap;Wing Pheromone;Pherocon 1c	USDA-APHIS	18	0	55	55
Sackbrood	Sackbrood Virus	National Honey Bee Survey	State Ag Dept.	10	0	16	16
Sakhalin Pine Sawyer	Monochamus saltuarius	General Pest Observation; Lab Confirmed	State Ag Dept.	11	0	50	50
Sakhalin Pine Sawyer	Monochamus saltuarius	General Pest Observation; Lab Confirmed	State Ag Dept/Univ	8	0	25	25
Scots Pine Blister Rust	Cronartium flaccidum	General Pest Observation; Lab Confirmed	State Ag Dept.	11	0	50	50
Siberian Silk Moth	Dendrolimus sibiricus	Trap;Milk Carton Pheromone (Modified)	USDA-APHIS	18	0	57	57
Sixtoothed Bark Beetle	Ips sexdentatus	Trap;Lindgren Multi-Funnel EWB/BB	State Ag Dept/Univ	5	0	20	20
Slender-Banded Pinecone Lor	Chlorophorus strobilicola	General Pest Observation; Lab Confirmed	State Ag Dept/Univ	8	0	25	25
Slow Bee Paralysis	Slow Bee Paralysis Virus (S	National Honey Bee Survey	State Ag Dept.	17	0	31	31
Small Hive Beetle	Aethina tumida	National Honey Bee Survey	State Ag Dept.	17	0	31	31
Small White-marmorated Lon	Monochamus sutor	General Pest Observation; Lab Confirmed	State Ag Dept.	11	0	50	50
Small White-marmorated Lon	Monochamus sutor	General Pest Observation; Lab Confirmed	State Ag Dept/Univ	8	0	25	25
Snail	Succinea sp./spp.	General Pest Observation; Lab Confirmed	State Ag Dept.	19	0	50	50
Stem and Bulb Nematode	Ditylenchus dipsaci	Soil Sample;Select.Area;1 Smpl/5+acr.	State Ag Dept.	19	0	50	50
Trypanosome	Trypanosoma sp./spp.	National Honey Bee Survey	State Ag Dept.	10	0	16	16
Varroa Mite	Varroa destructor	National Honey Bee Survey	State Ag Dept.	10	11	5	16
Wheat Bug	Nysius huttoni	General Pest Observation; Lab Confirmed	State Ag Dept.	19	0	50	50
White Garden Snail	Theba pisana	General Pest Observation; Lab Confirmed	State Ag Dept.	19	0	50	50
							6550