2022

Cooperative Agricultural Pest Survey Report

MONTANA DEPARTMENT OF AGRICULTURE ESTABLISHED 1893

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TABLE OF CONTENTS

INTRODUCTION TO THE CAPS 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.

The 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/

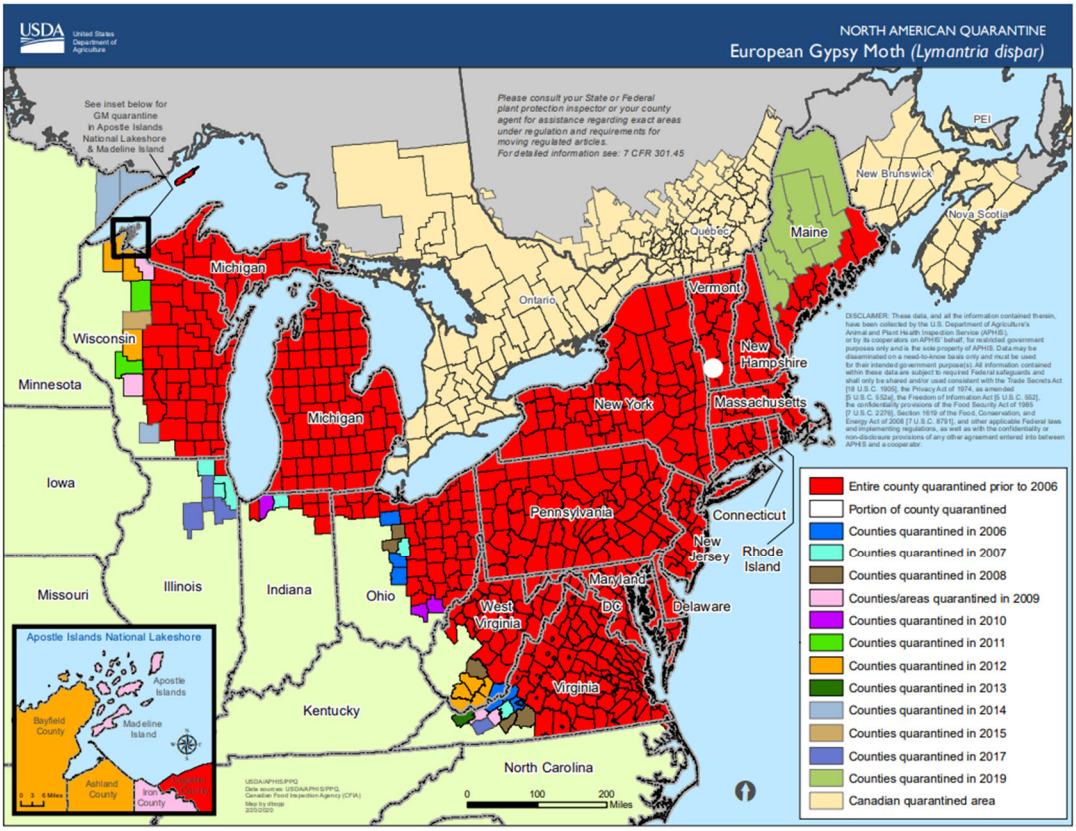
Hungry Pests: http://www.hungrypests.com/

Montana Wood Boring Insect Project: http://mtent.org/projects/woodboring/index.html

SPONGY MOTH DETECTION SURVEY
Lymantria dispar (L.)

The European strain of the Spongy Moth (SM) (formerly 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 SM larvae will also consume pine and spruce. In Montana, aspen and western larch are of particular importance as potential native tree host of the SM, especially in the western half of the state. Most landscape plants, urban trees and shrubs throughout the state would also be subject to SM 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 SM 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 SMs from Asia that are not known to occur in North America but are attracted to the same pheromone lure. Asian SM (ASM) pest pressure has increased in recent years due to increased populations in their native range and changes in international shipping logistics.



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

There have been several detections of ASM 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. The new common name was recently adopted and follows the French common name for the moth and reflects the spongy nature of the egg casing.

There have been several positive spongy moth traps in Montana counties in recent years: Cascade (1989, 1990), Fergus (2021), Flathead (2019), Gallatin (1988), Glacier (2001, 2003, 2007, and 2008), Lewis and Clark (1988), Lincoln (2009), Liberty (1992), Missoula (1996), Park (2001), 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. Additional support for this is that most, if not all, of these counties are major recreational destinations for the entire U.S. 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 Spongy Moth. Traps are baited with female sex-pheromone lures and only attract males.

Spongy Moth caterpillar. Via CT Dept. of Energy and Environmental Protection

In Montana, responsibility for the trapping of spongy 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). All traps were placed by early June and checked throughout the summer.

RESULTS: 150 traps were placed by MDA in 2022. Additional traps were placed by DNRC, USDA APHIS PPQ, and USFS. Three traps were positive for the presence of SM; one in Gallatin County (USFS) and two at a single location in Glacier NP. Delimitation surveys, conducted by USFS and USNPS, are planned for these locations in 2023. A delimitation survey of the 2021 Fergus Co. positive yielded no new specimens. No other traps were positive.

Karnal Bunt Detection Survey

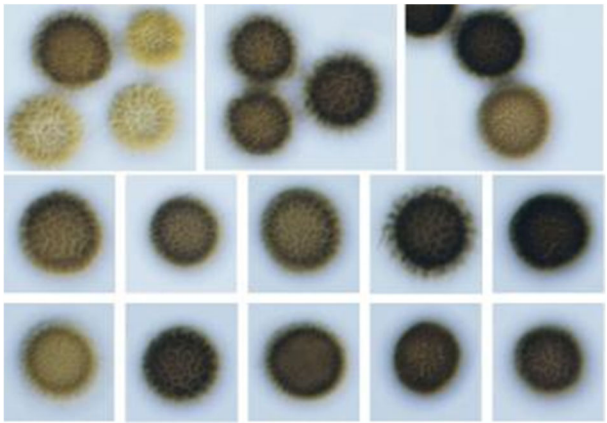
Tilletia indica Mitra

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 2022 harvest. A total of 95 samples were collected from 24 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.

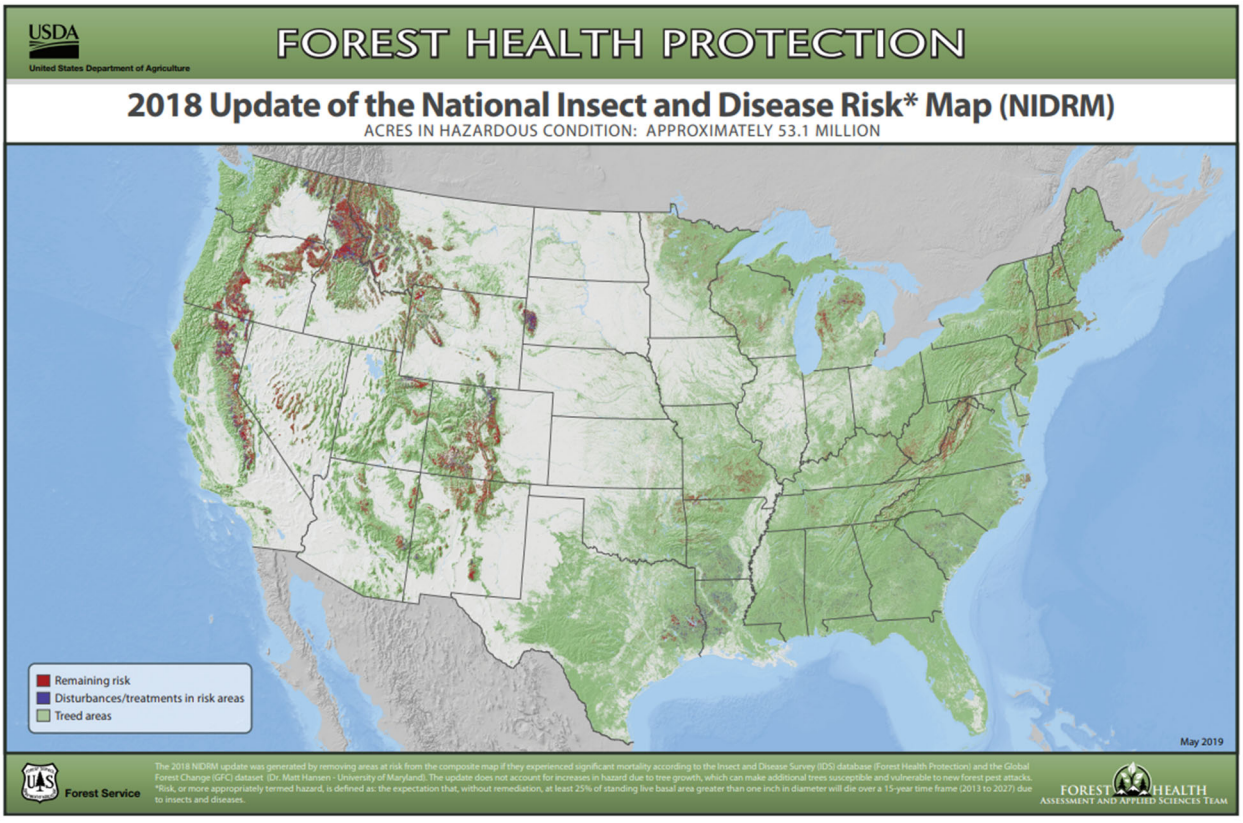
Bunted Wheat Credit: R. Duran, Washington State University www.forestryimages.org



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

Forest Pest Survey
Pest Detection Survey

Forest land occupies an estimated 25.9 million acres in Montana (USDA 2019). Seventy -three percent (18.9 million acres) is publicly owned and under the jurisdiction of federal and state agencies (MT DNRC 2010, USDA 2019). 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. The Forest Pest Survey is a yearly survey.



Pine Sawfly Detection Survey
Diprion pini (L.)

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: 25 pine sawfly traps were placed by MDA in 2022. 48 traps were placed by USDA PPQ in 2022. All traps were negative.

Rosy Spongy Moth (RSM) Detection Survey

Lymantria mathura Moore, 1866

Lymantria mathura, the rosy spongy moth, occurs in eastern Asia, from Northern India to the Russian Far East. Subspecies also occur in Japan, Korea, and Taiwan. It has been recorded as feeding on a broad range of host species and is considered a serious defoliator of deciduous trees. Unlike the European spongy moth, RSM females are capable of flight. There are one or two generations per year, with the latter occurring in warmer, southern parts of RSM's range. Larvae emerge early in spring, disperse, and attack buds, then leaves. Most feeding activity occurs at night. Mature larvae pupate in flimsy cocoons on the host tree. Population explosions can occur, called outbreaks, and during this time population densities can reach 1000 caterpillars per tree.

RESULTS: 18 Rosy Spongy moth traps were placed by USDA PPQ in 2022. All traps were negative.

Rosy Spongy Moth, female. Photo: David Mohn, Critters Page (Creatures Great and Small), Bugwood.org

Pine Beauty Moth (PBM) Detection Survey

Panolis flammea (Denis & Schiffermüller, 1775)

Panolis flammea is a colorful, nocturnal moth in the family Noctuidae native to Europe and Asia (Novak 1976). The species is considered a severe defoliator of *Pinus* species throughout many parts of Europe. Outbreaks in pine plantations in the United Kingdom and Continental Europe have caused damage to thousands of acres and resulted in significant mortality (Gilligan and Passoa 2014b). In the UK, adults are active from March through May. For Montana, lodgepole pines are especially at risk, as *P. flammea* has attacked these trees when planted in Scotland (Bradshaw et al. 1983, Sukovata et al. 2003). Monitoring for this species through CAPS pheromone traps and limiting the potential for establishment helps to ensure that Montana's characteristic pines are protected from possibly severe defoliation and any resulting impacts that could follow.

RESULTS: 25 traps were placed by the MDA. All traps were negative.

***Panolis flammea* resting, UK.** © 2011 Malcom Storey

Pine Processionary Moth (PPM) Detection Survey

Thaumetopoea pityocampa (Denis & Schiffermüller, 1775)

Thaumetopoea pityocampa, the Pine Processionary Moth, is a moth in the family Notodontidae native to the Mediterranean (Southern Europe, North Africa, and the Middle East). Larvae in the genus are known to form long lines, or processions, on their way to need feeding locations. The larvae are the main defoliators, feeding upon pine needles, and are a major economic pest of coniferous forests in southern Europe (Bonnet et al. 2008). Additionally, the larvae (caterpillars) are covered in long urticating setae (hairs) that contain a toxin, thaumetopoein. These hairs can lead to severe skin dermatitis and allergic reactions in both people and animals upon contact with the larvae, the nests that the larvae build, or wind-blown loose hairs (Gilligan et al. 2014). Adults are active from May to September.

***Thaumetopoea pityocampa* in typical resting position.**
Photo by Entomart.

RESULTS: 25 traps were placed by the MDA in 2022. All traps were negative.

Scots Pine Blister Rust (SPBR) Detection Survey

Cronartium flaccidum (Alb. & Schwein.) G. Winter 1880

Scots Pine blister rust (SPBR) is a heteroecious rust fungus native to Europe and Asia. The fungus can cause spotting on needles, and cankers on the stem that produce resin. These cankers can eventually lead to girdling of the stem, resulting in the death of the top or entire tree (Smith et al. 1988). Introduction of this disease to North America could have a major impact on Montana's forests and the health of our ecosystem.

RESULTS: 45 locations were visually surveyed for symptoms of the disease (Pine Detection and EWBB). No symptomatic plants were discovered. All surveys are part of the effort that goes into protecting Montana's forests for the future.

Pine Tree Lappet (PTL) Detection Survey

Dendrolimus pini Linnaeus, 1758

The Pine Tree Lappet is native to Europe and parts of Asia and North Africa. Their preferred host is the Scots Pine, but during outbreaks it can also feed on other conifer trees, such as firs, cedars, junipers, larches, and other pines. Adults emerge in mid-June to early July and live for around two weeks. Adults do not feed and both sexes are capable of flight. Larvae hatch within 16 to 25 days of the egg' being laid. These larvae feed on needles in the canopy before moving down the trunk to the base of the tree at the first frost. Larvae overwinter in leaf litter at the base of the tree. Migration to the canopy begins the following spring, where feeding resumes. Larvae undergo several molts until pupation begins in May and June. Spread is mostly through flight, although older larvae are known to move to other trees. Eggs, larvae and pupae can also be spread through human activity of moving infested wood.

Pine Tree Lappet. Photo: Stanislaw Kinelski Bugwood.org

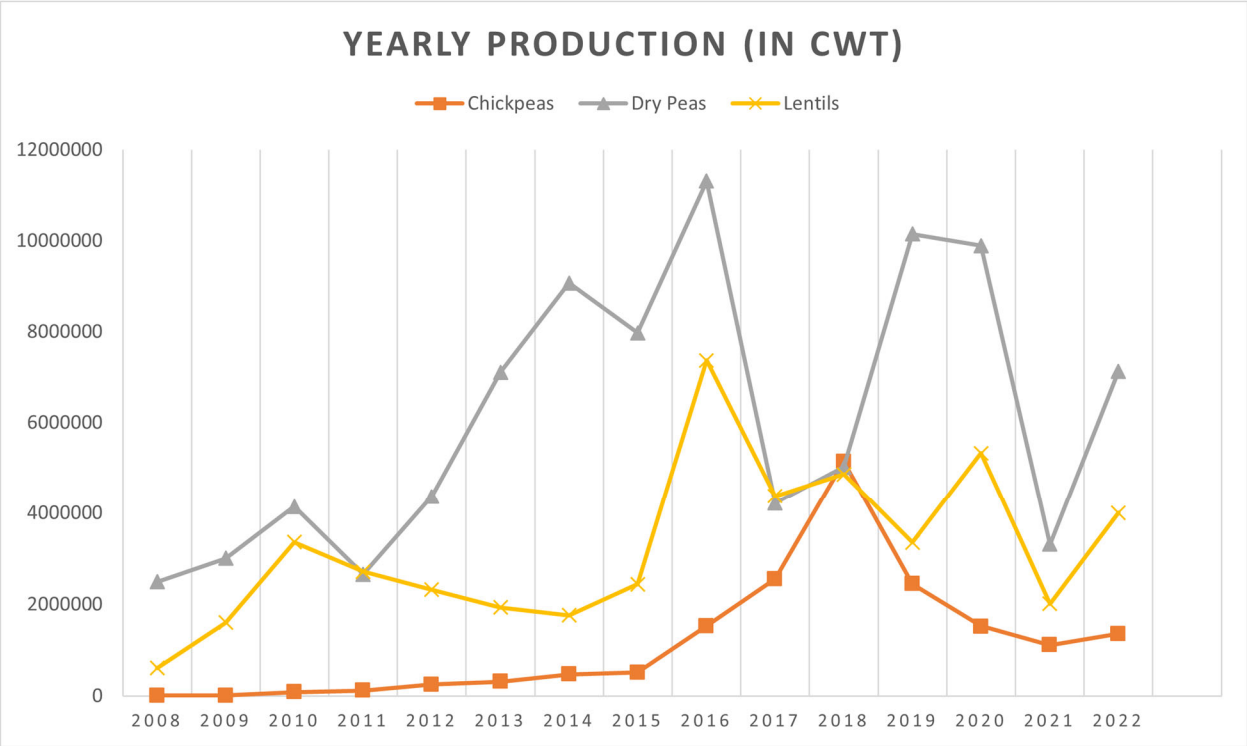
Results: 18 traps were placed by USDA APHIS in 2022. No Traps were positive.

Pine Commodity Survey			
Target Species	**Common Name**	**Approved Method**	**Sites**
Cronartium flaccidum	Scots Pine Blister Rust	Visual	45
Diprion pini	Pine Sawfly	Delta trap/lure 28 days	73
Dedrolimus pini	Pine Tree Lappet	Milk Carton trap/lure 28 days	18
Panolis flammea	Pine Beauty Moth	Bucket trap/ lure 42 days	25
Lymantria mathura	Rosy Spongy Moth	Wing Trap Kit/ lure 180 days	18
Thaumetopoea pityocampa	Pine Processionary Moth	Delta trap/lure 28 days	25

Pulse Crop Commodity Survey

Pest Detection Survey

Montana consistently ranks in the top five states for pulse crop production. In 2021, Montana was the number one state for both chickpea and lentil production, and the number 2 state for dry pea production. Production in 2021 was also severely impacted by record drought. Drought impacts were also seen in 2017 production. Pulse crops are an integral part of crop rotation in Montana's Agricultural production, so protecting these crops is essential. Having a clear understanding of pests is also essential, as over 80% of the pulse crops grown are exported.



In 2007, the USDA published guidelines for a commodity-based surveys. The idea behind commodity based surveys is to target export commodities rather than individual pests. Here, multiple survey methods are used to take samples from a single commodity or group of similar commodities over a longer period of time. In the pulse crop 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 2022 pulse crop survey targets six (6) different types of pests (see table below). These pests include 3 arthropods, 2 mollusks, and a nematode. In addition to the

6 exotic pests, samples were also screened for the cereal leaf beetle and a number of other economically important nematodes and plant diseases.

RESULTS: During the 2022 survey, 23 sweep net samples were collected, and 50 visual surveys were taken. 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 disease by the Schutter Diagnostic Lab at Montana State University. No infected plants were detected.

Pulse Crop Commodity Survey

Target Species	Common Name	Approved Method	Sites
Cernuella virgata	Maritime Garden Snail	Visual	25
Cochlicella spp.	Pointed Snail	Visual	25
Diabrotica speciosa	Curcubit beetle	Visual	23
Heterodera ciceri	Chickpea cyst nematode	Soil Sample	25
Mamestra brassicae	Cabbage Moth	Bucket Trap/ Lure 84 days	25
Spodoptera littoralis	Egyptian Cottonworm	Bucket Trap/ Lure 84 days	25

Cabbage Moth in resting position, Germany. Photo: ©2006 by Olaf Leillinger, licensed under CC BY-SA 2.5.

Exotic Woodborer and Bark Beetle (EWBB)

Detection Survey – PPA 7721

Wood boring insects are some of the most dramatically destructive invasive species introduced into the forest and urban landscapes of the United States. These include notorious pests, such as the Asian Longhorned Beetle and the Emerald Ash Borer. Some native wood boring insects, such as the mountain pine beetle, also cause significant damage to Montana's forest resources. However, the threat of exotic wood borers is significant for Montana's agriculture, wood products, tourism, and recreation industries, as these exotic pests are freed from predators and diseases found in their native ranges.

The exotic woodborer and bark beetle (EWBB) survey targets primarily three groups of insects; longhorned beetles (Cerambycidae), bark beetles (Curculionidae: Scolytinae), and wood wasps (Siricidae). Within these groups, six species were specifically targeted in 2022, including Asian Longhorned Beetle and European Spruce Bark Beetle. 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 range of non-target families. While not specifically targeted, flight intercepts do capture beetles in the family Buprestidae and have the potential to trap exotic buprestids such as the Emerald Ash Borer.

In 2022, 40 funnel traps and 20 vane 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, recreation sites with campgrounds, and high traffic tourism areas.

Exotic Woodboring Beetle Survey

Target Species	Common Name	Approved Method	Sites
Anoplophora glabripennis	Asian Longhorned Beetle	Visual	20
Cronartium flaccidum	Scots Pine Blister Rust	Visual	20
Hylobius abietis	Large Pine Weevil	Multifunnel Trap/ Lure EtOH, a-pinene UHR, Monochamol	20
Ips sexdentatus	Sixtoothed Bark Beetle	Multifunnel Trap/ Lure Ips, 3 dispenser	20
Ips typographus	European Spruce Bark Beetle	Multifunnel Trap/ Lure Ips, 3 dispenser	20
Monochamus urussovii	Black Fir Sawyer	Multifunnel Trap/ Lure EtOH, a-pinene UHR, Monochamol	20
Trichoferus campestris	Velvet Longhorned Beetle	Cross Vane Trap/ *Trichoferus campestris Lure*	20

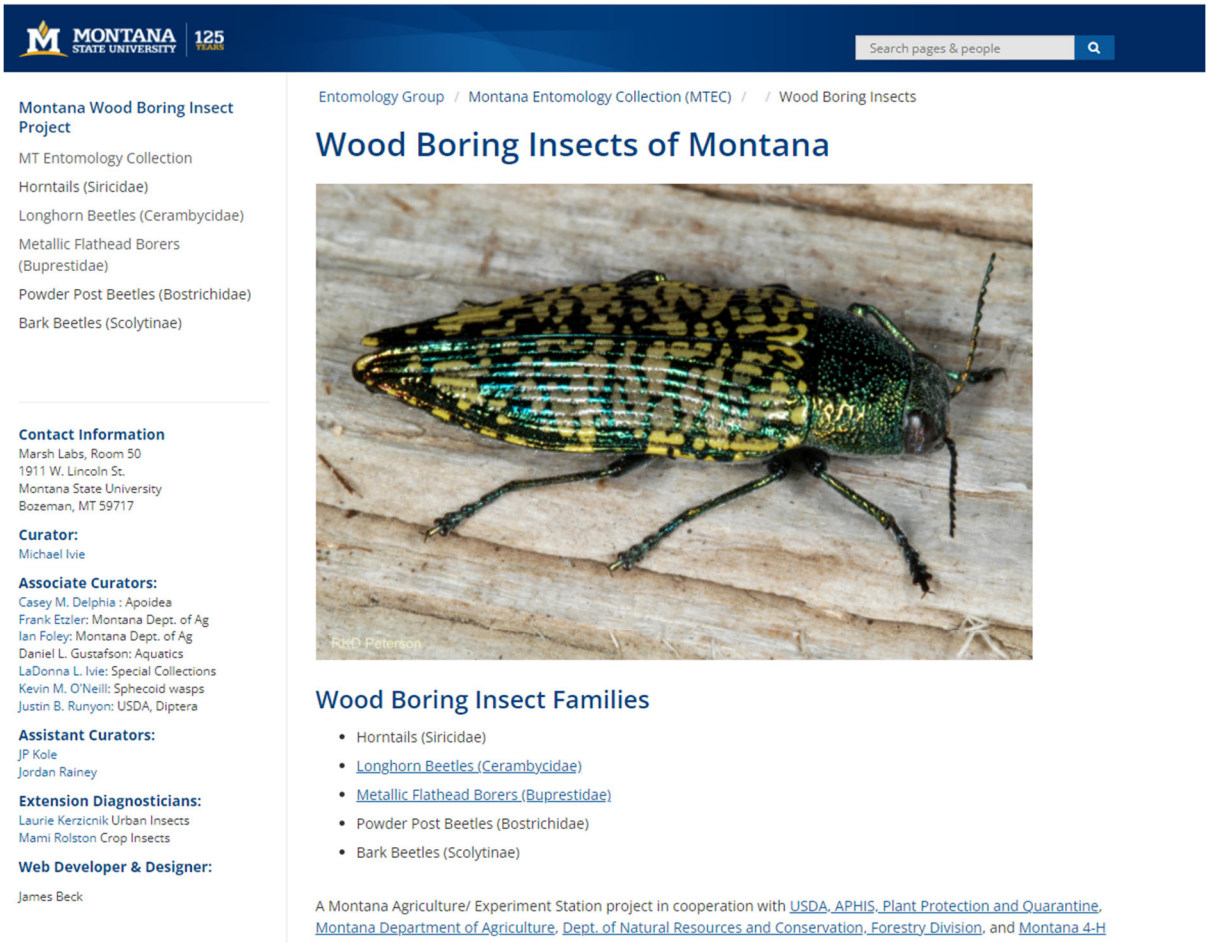
RESULTS: No target species (see table above) were collected. Due to the extreme drought this year in Montana and associated wildfires, a few localities were unable to be reached due to fires. These localities are planned to be surveyed in the future to help track changes to beetle fauna after burns and continue monitoring for potential invasive species.

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

Scolytinae: 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/projects/woodboring/index.html



Nursery Pest Detection Survey – PPA 7721

The nursery industry is important as it allows people to cultivate gardens for beauty and to produce food for personal consumption. However, due to the plant trade between states, this could create artificial pathways for the introduction of potential pests. By monitoring these pathways, we can ensure that Montana's green industry is free from any regulated pests and is protected from accidental introductions. In Montana, over 1000 businesses hold nursery licenses, so ensuring that they are protected is crucial to our green industry.

Part of the survey is to also survey the western portion of the state for Northern Giant Hornet (NGH, *Vespa mandarinia* Smith). This species was first discovered in Washington State in 2019. Since then, eradication efforts have been conducted to limit the spread and to attempt to eliminate the species from North America. The MDA's survey work ensures that NGH doesn't spread artificially or naturally into Montana, which could have serious impacts on Montana's Apiaries.

Another pest surveyed for is the Tomato Leaf Miner (*Tuta absoluta* Meryrick). This moth is native to South America and has spread globally in recent years and can oviposit on any plant in Solanaceae. Within Montana, the crop of concern are potatoes, which are grown for seed in Montana. Serious impacts could occur to Montana's Seed potato industry if this species was to become established.

Other pests, such as the Spotted Lanternfly, African Giant Landsnail, and the Christmasberry webworm, were monitored for as well, but economic impacts of these species is expected to be limited in Montana.

RESULTS: 25 nursery locations were sampled and inspected in Montana. No regulated pests were discovered.

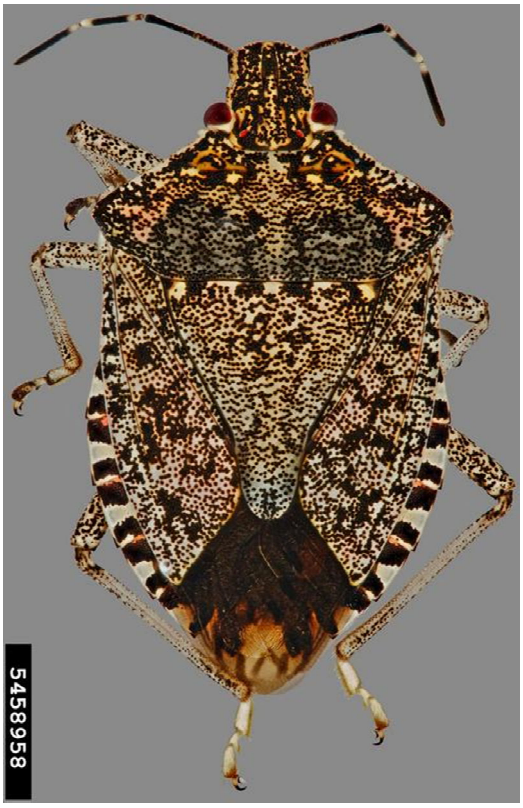
Tomato leafminer, *Tuta absoluta*. Credit: Marja van der Straten, NVWA Plant Protection Service, Bugwood.org.

Brown Marmorated Stinkbug (BMSB) Survey

Halyomorpha halys Stål

The Brown Marmorated Stinkbug (BMSB, *Halyomorpha halys* Stål) was first discovered in the US in Pennsylvania in 1998. Since then, the species has spread across North America. In January 2021, BMSB was discovered at a local residence in Billings, Montana. In May 2021, a second specimen was found flying within a personal vehicle in Flathead County. These two localities suggest a much larger distribution than currently known.

BMSB is a pest of concern as it has a large host range, and could affect crops, such as corn, and specialty crops, such as Flathead cherries, and personal gardens. BMSB overwinters in large aggregates, and is often considered a nuisance pest of residential homes in areas where it is established.



Brown Marmorated Stinkbug. Photo: Steven Valley, Oregon Department of Agriculture, Bugwood.Org

The MDA, along with Montana State University Extension services and a researcher from the University of Minnesota, surveyed across Montana in 2022 to determine distribution of BMSB within the state. The MDA placed baited sticky traps at five nursery locations around each of the following cities, Bozeman, Billings, Great Falls, Helena, Kalispell, and Missoula. Specimens have been collected at numerous locations in Billings, one location in Flathead Co., and one location in Ravalli Co. No MDA sticky traps detected any BMSB. More specifics have been published in Morey et al. 2022 “First Report of Halyomorpha halys (Hemiptera: Pentatomidae) in Montana, USA [https://doi.org/10.1093/jipm/pmac024].

Surveys will continue in 2023.

Terrestrial Mollusk Survey and Eastern Health Snail (EHS) Update

PPA 7721

BACKGROUND

Snail samples collected in Cascade County in late July of 2012 were confirmed as Eastern Heath Snail (EHS), *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).

MITIGATION EFFORTS

Since 2018, laboratory studies on Eastern Health Snail have been conducted at Montana State University by Jennie Birdsall, Jeff Littlefield, and Annie deMeij. These studies have focused on the development of EHS and determining suitable hosts for feeding. Studies are also being conducted to determine possible biological control of EHS.

SURVEY

Since initial detection, surveys for invasive terrestrial mollusks have occurred every year. 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. 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, with rates exceptionally high in 2020 and 2021. 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.

Eastern Heath Snail, *Xerolenta obvia.* Photo by Ian Foley

RESULTS: No additional invasive mollusk species were discovered in 2022. Unfortunately, additional localities of EHS were discovered in neighboring Judith Basin County. These are likely the result of accidental introductions by human activity from the Belt area. This highlights the need for continual monitoring and maintaining public awareness and education.

2022 National Honey Bee Survey

In an average year, Montana has about 275,000 beehives, of which about half are migratory. Montana has about 550 registered beekeepers, about one-fifth 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" (CCD) 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. Recent research has focused on pathogen load, pesticide exposure, stress, and habitat modification. The current hypothesis for CCD is that it may be a symptom of a complex of factors.

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.

Montana bee yard. Photo: A. Piccolomini

Varroa mites on a drone pupa. Photo I. Foley

RESULTS: 24 National Honey Bee Survey (NHBS) samples were collected in 2022 and submitted to laboratories at the University of Maryland. Some results are still pending. Nosema Disease (*Nosema* spp.) and Varroa Destructor Virus were found in all sampled apiaries with results on hand (14 of 24). Deformed Wing Virus, Israeli Acute Paralysis Virus, Lake Sinai Virus-2, and Varroa Destructor Virus were all detected in at least one sample. European Foulbrood was discovered in one of the NHBS samples, and chalkbrood was found in 4.

Honey bee Workers and Queen. Photo A. Piccolomini

Japanese Beetle (JB) Surveys

Popillia japonica Newman

Japanese Beetle, *Popillia japonica* Newman, was first discovered in North America in 1916. Since then, it has spread throughout much of eastern North America. Japanese Beetle (JB) was first discovered in Billings, Montana in 2001. In 2013, nursery stock infested with JB was brought into Montana, affecting 17 nurseries across the state. Due to rapid action by the nurseries and MDA, these localities were negative in 2014. The only area of Montana with a consistent population of JB is Billings, Montana, although the population has moved within city limits since first detection.

2022 also saw the continuation of a Specialty Crop Block Grant for community outreach and pesticide distribution for JB in Billings. This outreach effort aims to educate the public about JB and to provide tools for them to begin public control efforts to reduce the local JB population. Part of this effort was a radio educational campaign to raise public awareness of Japanese Beetle in the city.

RESULTS: The MDA put out over 130 traps, focusing on Flathead, Sanders, Ravalli, and Yellowstone Counties. The USDA placed 32 traps at airports in Cascade, Flathead, Gallatin, Lewis and Clark, Missoula, and Silver Bow Counties to ensure no accidental introductions to the state via air travel. In Billings (Yellowstone Co.), three trap locations were positive for JB, with a total of 1693 beetles collected from July to October across all three traps.

National Agricultural Pest Information System (NAPIS)

2022 Summary Report

Pest Common	Pest Scientific	Data Source	Counties	Positives	Negatives	Total
Acute Bee Paralysis (ABPV)	*Aparavirus Acute Bee Paralysis*	State Ag Dept.	10	0	14	14*
American Foulbrood	*Paenibacillus larvae larvae*	State Ag Dept.	10	0	14	14*
Asian Honeybee	*Apis ceranae*	State Ag Dept.	10	0	14	14*
Asian Longhorned Beetle	*Anoplophora glabripennis*	University/Extension	4	0	22	22
Black Fir Sawyer	*Monochamus urussovii*	University/Extension	4	0	22	22
Cabbage Moth	*Mamestra brassicae*	State Ag Dept.	12	0	25	25
Chalkbrood	*Ascosphaera apis*	State Ag Dept.	10	4	10	14*
Chickpea Cyst Nematode	*Heterodera ciceri*	State Ag Dept.	12	0	25	25
Christmasberry Webworm	*Cryptoblabes gnidiella*	State Ag Dept.	9	0	25	25
Chronic Bee Paralysis (CBPV)	Unassigned Chronic Bee Paralysis Virus	State Ag Dept.	10	0	14	14*
Curcubit beetle	*Diabrotica speciosa*	State Ag Dept.	12	0	23	23
Deformed Wing Virus (DWV)	*Iflavirus Deformed Wing Virus*	State Ag Dept.	10	9	5	14*
Eastern Heath Snail	*Xerolenta obvia*	State Ag Dept.	13	16	34	50
Eqyptian Cottonworm	*Spodoptera littoralis*	State Ag Dept.	12	0	25	25
European Foulbrood	*Melissococcus plutonius*	State Ag Dept.	10	1	13	14*
European Spruce Bark Beetle	*Ips typographus*	University/Extension	4	0	22	22
Giant African Snail	*Lissachatina fulica*	State Ag Dept.	9	0	25	25
Hygromiid Snails	*Cernuella spp.*	State Ag Dept.	13	0	50	50
Hygromiid Snails	*Monacha spp.*	State Ag Dept.	13	0	50	50
Israeli Acute Bee Paralysis (IAPV)	*Aparavirus Israeli Acute Paralysis*	State Ag Dept.	10	11	3	14*
Japanese Beetle	*Popillia japonica*	State Ag Dept.	4	3	129	132
Japanese Beetle	*Popillia japonica*	USDA APHIS	6	0	32	32
Japanese Pine Sawyer	*Monochamus alternatus*	USDA APHIS	13	0	41	41
Karnel Bunt	*Tilletia indica*	State Ag Dept.	24	0	95	95
Kashmir Bee Virus (KBV)	*Aparavirus Kashmir Bee Virus*	State Ag Dept.	10	0	14	14*
Lake Sinai-2	*Sinaivirus Lake Sinai Virus-2*	State Ag Dept.	10	8	6	14*
Large Pine Weevil	*Hylobius abietis*	University/Extension	4	0	22	22
Maritime Garden Snail	*Cernuella virgata*	State Ag Dept.	13	0	50	50
Moku Virus (MKV)	*Iflavirus Mokus Virus*	State Ag Dept.	10	0	14	14*
Northern Giant Hornet	*Vespa mandarinia*	State Ag Dept.	9	0	25	25
Nosema spores	*Nosema ceranae*	State Ag Dept.	10	14	0	14*
Parasitic Mite	*Trpilaelaps spp.*	State Ag Dept.	10	0	14	14*
Parasitic Mite Syndrome	Parasitic Mite Syndrome	State Ag Dept.	10	0	14	14*
Pine Beauty Moth	*Panolis flammea*	State Ag Dept.	8	0	25	25
Pine Processionary Moth	*Thaumetopoea pityocampa*	State Ag Dept.	8	0	25	25
Pine Sawfly	*Diprion pini*	State Ag Dept.	8	0	25	25
Pine Sawfly	*Diprion pini*	USDA APHIS	14	0	48	48
Pine Tree Lappet	*Dendrolimus pini*	USDA APHIS	4	0	18	18

Pest Common	Pest Scientific	Data Source	Counties	Positives	Negatives	Total
Pointed Snail	*Cochlicella spp.*	State Ag Dept.	13	0	50	50
Rosy Spongy Moth	*Lymantria mathura*	USDA APHIS	4	0	18	18
Sacbrood	*Morator aetatulas virus*	State Ag Dept.	10	1	14	14*
Scots Pine Blister Rust	*Cronartium flaccidum*	State Ag Dept.	8	0	25	25
Scots Pine Blister Rust	*Cronartium flaccidum*	University/Extension	4	0	22	22
Sixtoothed Bark Beetle	*Ips sexdentatus*	University/Extension	4	0	22	22
Slow Bee Paralysis (SBPV)	*Iflavirus Slow Bee Paralysis*	State Ag Dept.	10	0	14	14*
Small Hive Beetle	*Aethina tumida*	State Ag Dept.	10	0	14	14*
Spongy Moth	*Lymantria dispar dispar*	State Ag Dept.	12	0	150	150
Spongy Moth	*Lymantria dispar dispar*	State DNRC	1	0	50	50
Spongy Moth	*Lymantria dispar dispar*	USDA APHIS	14	0	221	221
Spongy Moth	*Lymantria dispar dispar*	USFS/ USNPS	30	2	304	306
Spotted Lanternfly	*Lycorma delicatula*	State Ag Dept.	9	0	25	25
Tomato Leaf Miner	*Tuta absoluta*	State Ag Dept.	9	0	25	25
Varroa Destructor Virus (VDV)	*Iflavirus Varroa Destructor Virus*	State Ag Dept.	10	13	1	14*
Velvet Longhorned Beetle	*Trichoferus campestris*	University/Extension	4	0	22	22
Totals with * means data incomplete	—————	—————	—	—	—	—
REPORT TOTAL				82	2008	2090

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