

# 2010

## Cooperative Agricultural Pest Survey Report



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# Table of Contents

Introduction to the program.....	3
The interns and other survey assistants.....	3
Gypsy Moth (GM) <i>Lymantria dispar</i> (L.).....	4
Emerald Ash Borer (EAB) <i>Agrilus planipennis</i> Fairmaire.....	7
European Pine Shoot Moth (EPSM) <i>Rhyacionia buoliana</i> (Denis & Schiffermüller).....	10
Karnal Bunt (KB) <i>Tilletia indica</i> Mitra.....	13
Pulse Crop Nematodes.....	15
Potato Cyst Nematodes.....	18
Fruit Pest Survey.....	20
Riparian Area Invaders.....	22
Cereal Leaf Beetle (CLB).....	26
Japanese Beetle (JB) <i>Popillia japonica</i> Newmann.....	28
Intern Reports.....	30

## **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 introduced 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, and include not only the Department of Agriculture, but also Montana State University, the Montana Department of Natural Resources and Conservation, US-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 survey technicians. We also had the invaluable assistance of Margaret Rayda, Pest Survey Specialist for North Dakota and Montana with the USDA-APHIS-PPQ and Amy Gannon, Forest Entomologist with DNRC. In addition, several Montana Department of Agriculture Specialists, led by Velda Baltrusch of Great Falls, assisted in gathering Karnal bunt samples.

Interns for 2010 included Matt Lyon, Robert Wiltzen, and Peter Kraus. Matt Lyon is a student at Idaho State University in Pocatello. Robert Wiltzen is a Missoula native, veteran, and student at the University of Montana. Peter Kraus is a student at Luther College in Decorah, Iowa.

## Gypsy Moth (GM) Detection Survey

### *Lymantria dispar* (L.)

The Gypsy moth (*Lymantria dispar* (L.)) was initially introduced into the Eastern U.S in the mid 1800's. It established rapidly and became a serious defoliating pest of various deciduous trees. The females oviposit on various surfaces, covering the eggs with hairs or scales. This insect is frequently moved on a variety of objects, such as RV's, firewood, furniture and other recreational equipment that has been left outdoors. The gypsy moth is the most destructive forest pest in the Eastern United States and large areas of the Northeastern US are under a federal quarantine to prevent the spread of this pest.



[http://www.aphis.usda.gov/plant\\_health/plant\\_pest\\_info/gypsy\\_moth/downloads/gypmoth.pdf](http://www.aphis.usda.gov/plant_health/plant_pest_info/gypsy_moth/downloads/gypmoth.pdf)

Gypsy Moth larvae are voracious predators and feed on over 500 different species of plants. Important native potential tree hosts of the Gypsy Moth in Montana include Aspen and Western Larch. Older larvae will also actively feed on Pines and Spruce. Many landscape plants, urban trees and shrubs across Montana would be subject to GM defoliation. There have been several positive GM traps in Montana 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). All of these moths were certainly moved through anthropogenic means and this human caused movement of immobile egg masses and pupae represents the most significant entry pathway of the Gypsy Moth into Montana.



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

Major native Montana host plants are generally concentrated in the Western half of the state, e.g. Western larch and quaking aspen, but suitable landscape and urban gypsy moth host plants can be found across Montana.

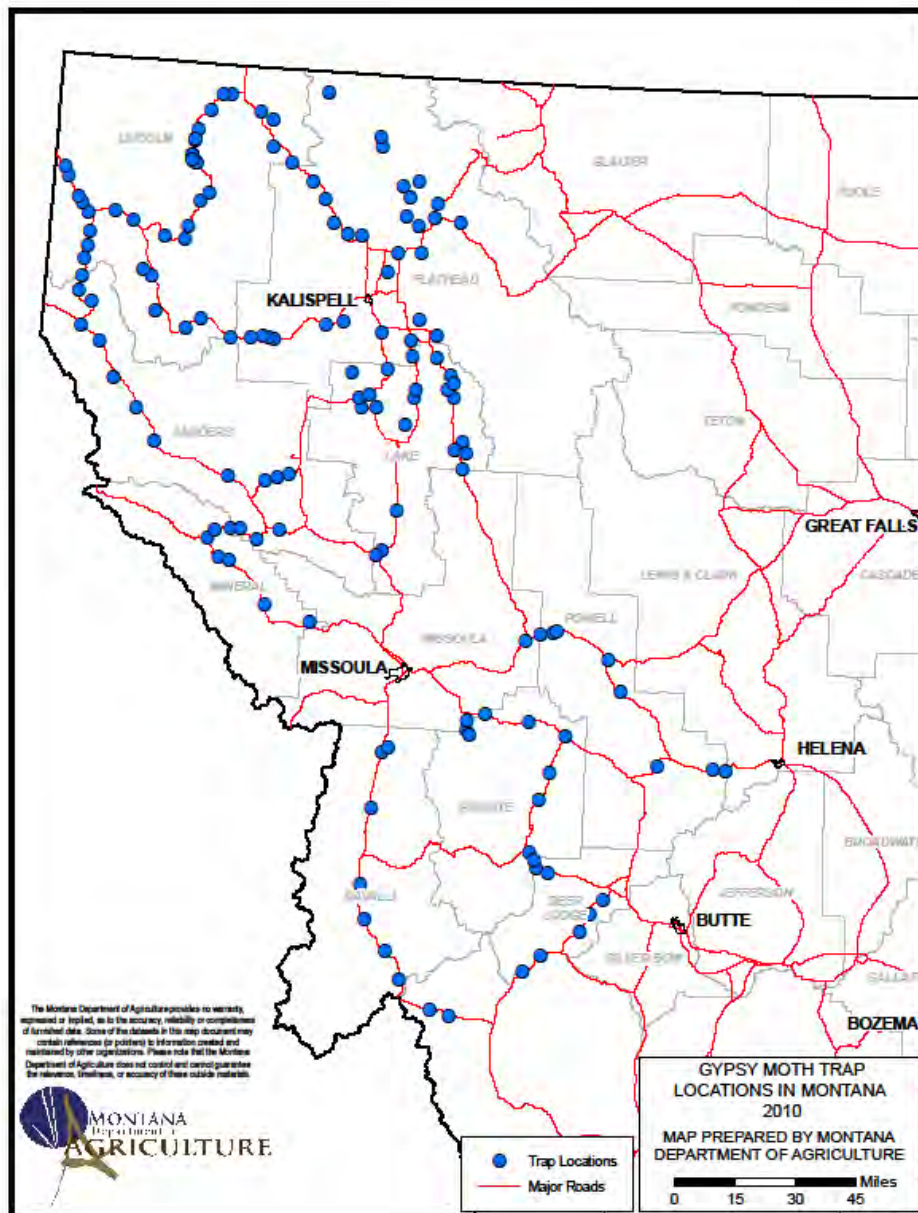


**Gypsy moth caterpillar**

In Montana, responsibility for the trapping of gypsy moth 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 is responsible for trapping in mainly the eastern portion of the state, while the MDA traps mainly in the western part of the state. The DNRC sets traps in Mineral and Missoula Counties, the USDA-FS sets traps in a large number of campgrounds, as well as other public recreation areas, and the Department of the Interior places traps in Glacier and

Yellowstone National Parks. All traps were placed by early June, and checked throughout the summer at two to three week intervals.

**RESULTS:** 163 Gypsy Moth traps were placed by MDA personnel in 2010. A delimitation survey was conducted around a campground on Lake Koocanusa in Lincoln County where positive detection traps were located in 2009. Due to the nature of the terrain the traps were irregularly spaced but at sufficient numbers to expect that an established population would have been detected. All Gypsy Moth traps in Montana were negative in 2010. Trapping levels in the Northwest portion of the state will remain at elevated levels in foreseeable years due to the recent positive traps in that portion of the state.



## **Emerald Ash Borer (EAB) Detection Survey**

### ***Agrilus planipennis* Fairmaire**

The emerald ash borer (EAB) is an exotic and extremely damaging pest that attacks and kills ash trees (*Fraxinus* sp.). In hardwood forests of the Eastern United States, this beetle is a severe threat to native forest ecosystems, as well as urban landscape trees. While native ash in Montana and the Intermountain West is limited to riparian areas, ash is a very significant urban landscape tree. Due to its hardy nature and cold tolerances, green ash has been planted in some Montana neighborhoods at densities approaching 100%.



**Emerald Ash Borer**

The emerald ash borer is native to Asia, but was introduced into the Eastern United States sometime in the 1990's. It was first discovered in southeastern Michigan in 2002. It is suspected to have arrived in North America in solid wood packing materials (SWPM) used to ship commodities in the international market. Since 2002, EAB has been detected in Indiana, Illinois, Iowa, Maryland, New York, Tennessee, Michigan, Ohio, Pennsylvania, West Virginia, Wisconsin, Missouri, and Minnesota. EAB attacks and kills both healthy and stressed or dying trees, with the time from infestation to tree mortality being 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.



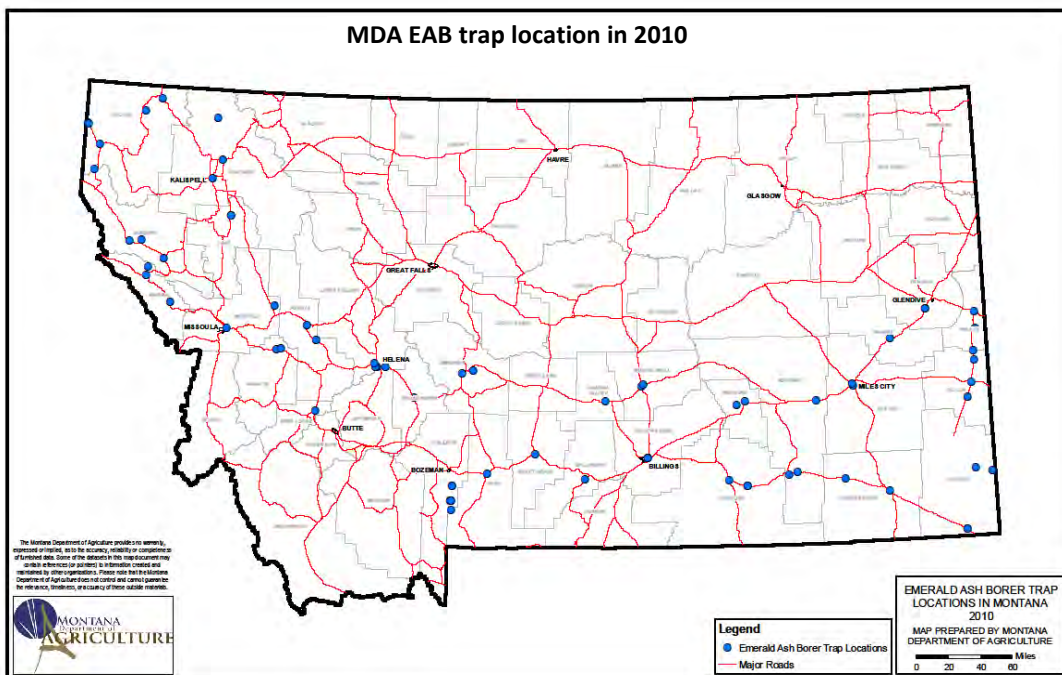


Emerald ash borer traps (image on left) are hung preferably in ash trees (*Fraxinus* sp.). The large purple trap, which is sticky on the outside, acts as a panel flight intercept trap, with insects that fly into the panels become irremovably stuck in Tanglefoot®. The trap is baited with a Manuka Oil lure that mimics the plant volatiles released by a damaged ash tree.



Declining ash due to EAB damage.  
[www.entomology.wisc.edu](http://www.entomology.wisc.edu)

Due to various outreach efforts across the state and nation regarding EAB and the general poor health of ash trees in Montana, the Department has started to receive reports from the public about suspect EAB in Montana. Each report is investigated on a case by case basis.



[illegible]

A dorsal view of a metallic green beetle, likely a jewel beetle (Chrysomelidae), showing its elongated body and iridescent sheen. The beetle is positioned horizontally, with its head to the right and its long, segmented elytra extending to the left. The elytra have a distinct longitudinal ribbing and a vibrant green color with hints of blue and purple iridescence. The head and thorax are also covered in a similar metallic green sheen. The legs are visible, showing a darker, more muted green color. The background is a plain, light-colored surface.

9



## European Pine Shoot Moth (EPSM)

*Rhyacoinia buoliana* (Denis & Schiffermüller)

### Quarantine Support Survey

Montana has had a quarantine for the European pine shoot moth (EPSM) since prior to 1962. This insect is a pest in the production of lumber, nursery trees and Christmas trees that are long-needled pines. Feeding by the larval stage in the growing tips causes death of leaders, resulting in trees with Y-shaped trunks, or other deformities, which are aesthetically unpleasing (lowering value in nursery and Christmas tree trade) or are not usable for major lumber markets due to a need for additional work to salvage merchantable trunks.

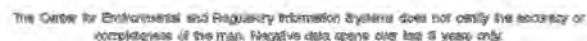


Adult European pine shoot moth, [www.padil.gov.au](http://www.padil.gov.au)

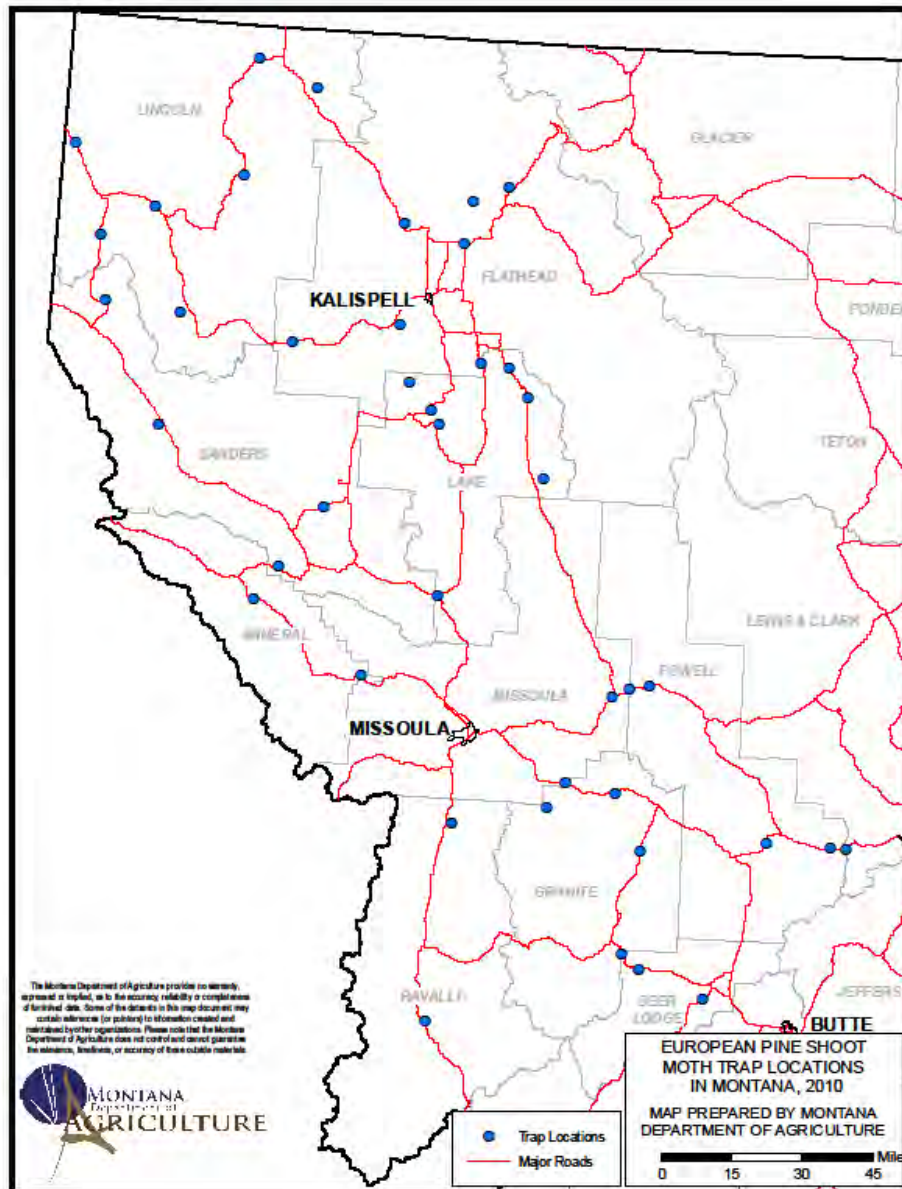
The insect itself is very small. The wingspan of the typical adult is under ¼ inch. However, the adult is very brightly colored, with orange and silver patterning on the wings. There are a number of native pine shoot moths with similar coloration, so identification is dependent on dissection of the male genitalia. The larvae initially feed in the tips of the branches in the new year's growth where they web the needles together for protection. Older larvae move to the needle sheath and mine into individual needles, after which they move on to the needle buds. They overwinter as larvae in the infested branch tips. Larvae emerge to feed again in the spring. This spring feeding is the most damaging, as it involves large larvae feeding on new foliage. The larvae pupate in the needle foliage in the tunnels and webbing they created while



Concern for EPSM are in the western

[illegible]





**RESULTS:** Fifty-nine pheromone baited European pine shoot moth traps were placed at high risk sites in Western Montana. All traps were negative for European pine shoot moth. *Rhyacionia zozana* (Tortricidae) and *Sitochroa chortalis* (Crambidae) were the most common non-target species caught in the traps.

## **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. KB was first detected in the United States in 1996, within the state of Arizona 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 by 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.



Credits: R. Duran, Washington State University [www.forestryimages.org](http://www.forestryimages.org)

### **Bunted Wheat**

#### **Montana's Grain Crop Production for 2009**

<b>ITEM</b>	<b>BUSHEL</b>	<b>RANK</b>	<b>% U.S. Total</b>
<b>All Wheat</b>	<b>176,625,000</b>	<b>3</b>	<b>8.0</b>
<b>Winter Wheat</b>	<b>89,540,000</b>	<b>4</b>	<b>5.9</b>
<b>Durum Wheat</b>	<b>16,585,000</b>	<b>3</b>	<b>15.2</b>
<b>Other Spring</b>	<b>70,500,000</b>	<b>3</b>	<b>12.0</b>
<b>Barley</b>	<b>41,040,000</b>	<b>3</b>	<b>18.0</b>

<http://usda.mannlib.cornell.edu/usda/nass/CropProdSu//2010s/2010/CropProdSu-01-12-2010.pdf>

**RESULTS:** Montana continued to sample for KB during the 2010 harvest. A total of 152 samples were collected from 34 counties across Montana. The USDA Laboratory in Olney, Texas 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 export markets.

## Wheat Production in Montana 2009

### 2010 Karnal Bunt Survey Numbers

	2009 Production Total Bushels	2010 KB Samples		2009 Production Total Bushels	2010 KB Samples
Chouteau	17,445,000	23	Flathead	990,000	1
Hill	15,904,000	14	Wheatland	966,000	1
Roosevelt	10,098,000	8	Custer	875,000	0
Sheridan	9,547,000	7	Lake	797,500	1
Liberty	9,335,000	7	Madison	796,000	0
Pondera	8,158,000	7	Petroleum	794,000	0
Daniels	6,963,000	5	Golden Valley	755,000	1
Teton	6,719,000	6	Wilbax	726,000	1
Toole	6,608,000	6	Treasure	471,000	0
Blaine	6,567,000	5	Prairie	462,000	1
Valley	6,467,000	7	Park	409,000	0
Fergus	6,438,000	7	Musselshell	291,000	0
Glacier	5,914,000	4	Lewis & Clark	186,000	0
Richland	5,307,000	4	Meagher	125,000	0
Cascade	5,218,000	6	Powder River	125,000	0
McCone	5,132,000	5	Sweetgrass	95,000	0
Dawson	4,861,000	3	Granite	90,000	0
Big Horn	4,225,000	4	Carbon	84,000	0
Phillips	3,791,000	3	Ravalli	76,000	0
Yellowstone	2,799,000	2	Missoula	28,000	0
Garfield	2,383,000	2	Sanders	17,000	0
Judith Basin	2,105,000	3	Beaverhead	-	0
Gallatin	1,992,000	3	Deer Lodge	-	0
Broadwater	1,663,000	1	Jefferson	-	0
Rosebud	1,655,000	1	Lincoln	-	0
Fallon	1,278,000	1	Mineral	-	0
Stillwater	1,217,000	1	Powell	-	0
Carter	1,175,000	1	Silverbow	-	0

[http://www.nass.usda.gov/Statistics\\_by\\_State/Montana/Publications/county/profiles/2009/c99names.htm](http://www.nass.usda.gov/Statistics_by_State/Montana/Publications/county/profiles/2009/c99names.htm)

## Pulse Crop Nematode Survey

### Export Support



William M. Brown Jr., [www.Bugwood.org](http://www.Bugwood.org), Howard F. Schwartz, Colorado State University

Damage to an alfalfa field caused by the stem and bulb nematode, *Ditylenchus dipsaci*.

Nematodes can cause dramatic reductions in pulse crop yields. The nematodes surveyed for are primarily of regulatory significance and could negatively impact agricultural export markets if detected within Montana.

Damage caused by the pea cyst nematode, *Heterodera goettingiana* results in patches of stunted, bright yellow plants. Yellowing begins at the base of the plant with the older leaves and continues to move up the plant affecting the entire plant. Some of the affected plants may also die prematurely due to lack of chlorophyll. The roots of affected plants develop abnormally and nitrogen deficiency typically occurs due to a lack of nitrogen fixing nodules on the roots. As a result, seed production is also significantly reduced. The nematodes can persist for an extended period of time within the soil without a known host, yet cause significant damage when crops are planted again.

Montana Department of Agriculture employees collected 40 soil samples throughout Dawson, McCone, Roosevelt, Daniels, Carter, Valley and Sheridan counties. Crops represented in the samples included chickpeas, lentils, green peas, yellow peas and fallow fields.

Soil was analyzed for over thirty five nematode species, sixteen species of regulatory concern and nineteen other plant-parasitic genera, including: *Globodera rostochiensis*, *Globodera pallida*, *Ditylenchus destructor*, *Ditylenchus dipsaci*, *Meloidogyne chitwoodii*, *Meloidogyne fallax*, *Meloidogyne hapla*, *Meloidogyne javanica*, *Meloidogyne artiellia*, *Nacobbus abberans*, *Heterodera glycines*, *Heterodera latipons*, *Heterodera goettingiana* and *Pratylenchus* sp.

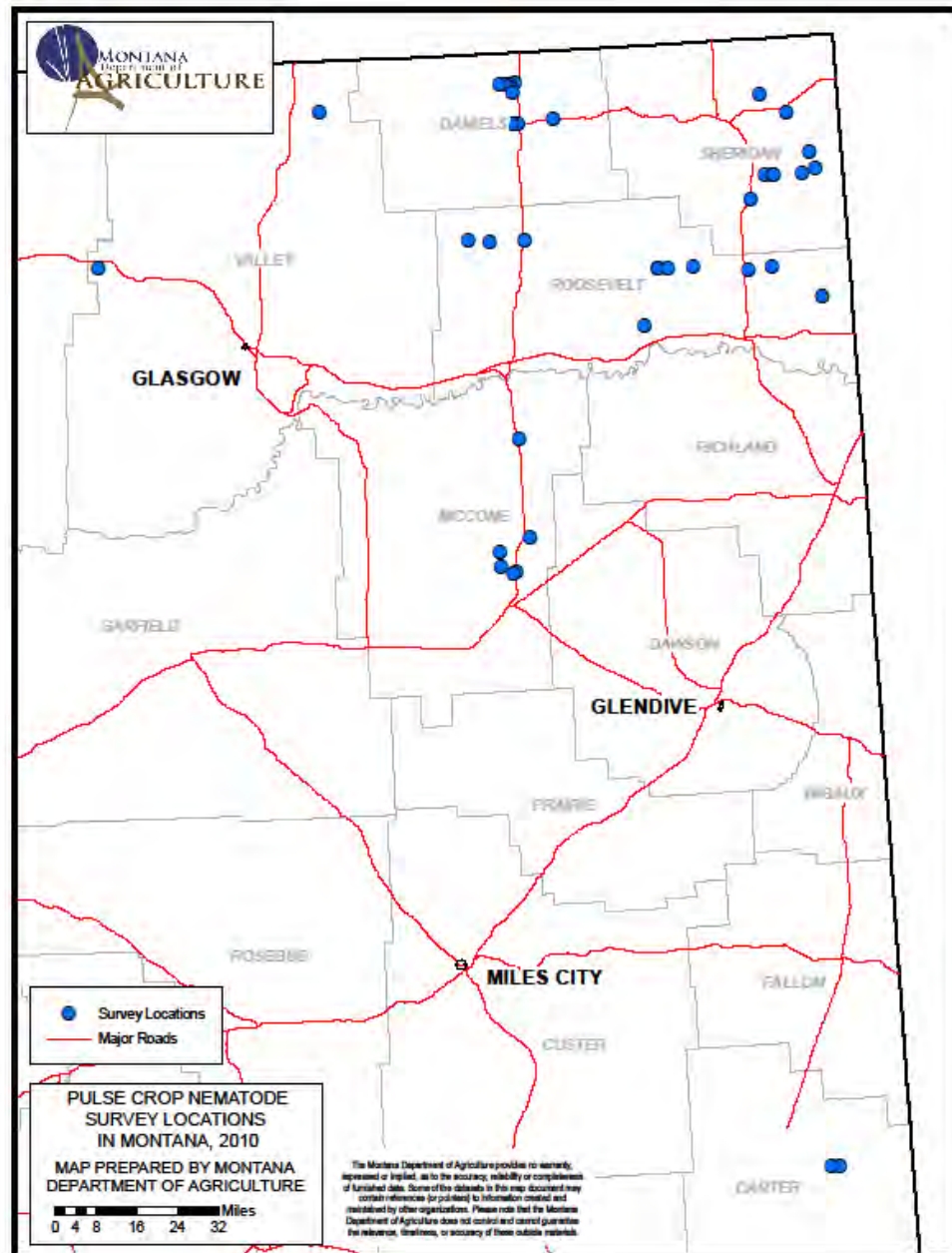


This information is important for Montana farmers in their management techniques and it also allows specific areas to be certified as free from some of these nematodes. This enables Montana producers to gain access to a wider agricultural export market for their crops. Montana growers plant over 500,000 acres of pulse crops (dry peas, dry beans, lentils, and garbanzo beans) annually; harvested crops are valued at over \$50 million. Montana pulse crops are exported to many Asian and Middle Eastern countries including China, India, Pakistan, Egypt, Nepal, and Turkey.

## RESULTS:

<b>2010 NEMATODE SURVEY RESULTS</b>		
<b>Species of Regulatory or Economic Concern</b>	<b>Group</b>	<b>POSITIVE/NEGATIVE</b>
<i>Bursaphelenchus xylophilus</i> (Steiner and Buhrer)	Pine wilt	NEGATIVE
<i>Ditylenchus destructor</i> Thorne	Potato rot	NEGATIVE
<i>Ditylenchus dipsaci</i> (Kühn)	Bulb and stem	NEGATIVE
<i>Globodera pallida</i> (Stone)	Potato cyst	NEGATIVE
<i>Globodera rostochiensis</i> (Wollenweber)	Potato cyst	NEGATIVE
<i>Heterodera glycines</i> Ichinohe	Soybean cyst	NEGATIVE
<i>Heterodera latipons</i> Franklin	Cereal cyst	NEGATIVE
<i>Meloidogyne arenaria</i> (Neal)	Root knot	NEGATIVE
<i>Meloidogyne artiellia</i> Franklin	Root knot	NEGATIVE
<i>Meloidogyne chitwoodi</i> Golden et al.	Root knot	NEGATIVE
<i>Meloidogyne fallax</i> Karssen	Root knot	NEGATIVE
<i>Meloidogyne hapla</i> Chitwood	Root knot	NEGATIVE
<i>Meloidogyne incognita</i> (Kofoed & White)	Root knot	NEGATIVE
<i>Meloidogyne javanica</i> (Treub)	Root knot	NEGATIVE
<i>Meloidogyne mayaguensis</i> Rammah and Hirschmann	Root knot	NEGATIVE
<i>Nacobbus aberrans</i> (Thorne)	False root knot	NEGATIVE
<b>Other Plant-Parasitic Genera</b>	<b>Group</b>	<b>POSITIVE/NEGATIVE</b>
<i>Anguina</i>	Seed gall	NEGATIVE
<i>Aphelenchoides</i>	Bud and leaf	NEGATIVE
<i>Belonolaimus</i>	Sting	NEGATIVE
<i>Cactodera</i>	Cactus cyst	NEGATIVE
<i>Ditylenchus</i> other species	Other	NEGATIVE
<i>Helicotylenchus</i>	Spiral	POSITIVE
<i>Heterodera</i> other species	Cyst	POSITIVE
<i>Hemicycliophora</i>	Sheath	NEGATIVE
<i>Hoplolaimus</i>	Lance	NEGATIVE
<i>Longidorus</i>	Needle	POSITIVE
<i>Mesocriconema</i>	Ring	NEGATIVE
<i>Paratrichodorus</i>	Stubby root	NEGATIVE
<i>Paratylenchus</i>	Pin	POSITIVE
<i>Pratylenchus</i>	Root lesion	POSITIVE
<i>Quinisulcius</i>	Stunt	POSITIVE
<i>Rotylenchulus</i>	Reniform	NEGATIVE
<i>Trichodorus</i>	Stubby root	NEGATIVE
<i>Tylenchorhynchus</i>	Stunt	POSITIVE
<i>Xiphinema</i>	Dagger	POSITIVE

All samples were processed in the lab of Dr. Thomas O. Powers at the Department of Plant Pathology, University of Nebraska. The *Heterodera* species detected was *H. trifolii* (Goffart) the clover cyst nematode which is likely causing economic damage on alfalfa. Root lesion nematodes, *Pratylenchus* sp., are probably causing yield losses for some growers. Other plant parasitic genera that were detected were not found in high enough numbers to indicate that they are causing yield losses. Typically, genera such as *Paratylenchus* and *Quinisulcius*, only are injurious to crops when numbers approach 500-1,000 individuals per 100 cc of soil.



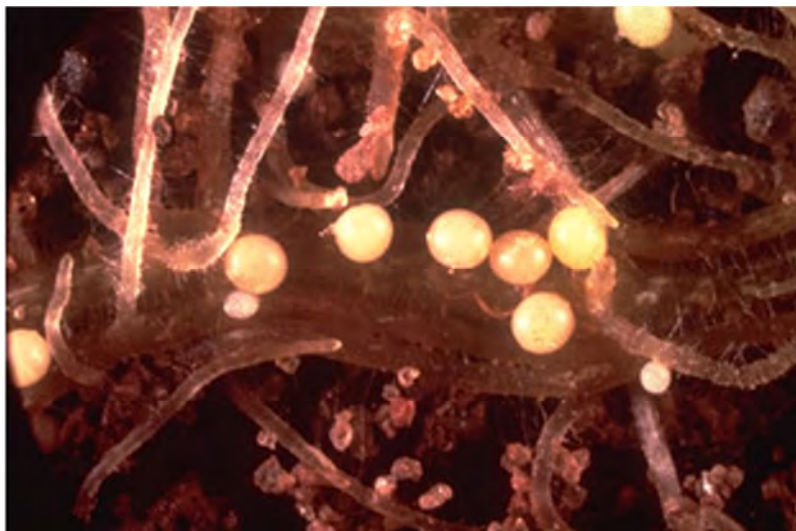
**Potato Cyst Nematodes**  
***Globodera pallida* (Stone) & *G. rostochiensis* (Wollenweber)**  
**Detection Survey**

**INTRODUCTION**

Montana is a supplier of seed potatoes for much of the Pacific Northwest. Because of this, it is imperative that the quality of Montana's potatoes, and their reputation, be maintained. Recently, *Globodera pallida* was found in Idaho, in commercial potato fields. In the aftermath of this find, several trading partners closed their doors not only to Idaho potatoes but also to other crops including nursery stock. In addition, farms in the "infested area" are undergoing treatments to eliminate the nematodes and operate under restrictions that create new challenges. If this organism were discovered on seed potatoes from Montana, there is a real possibility that it would destroy the seed potato industry. The Montana potato industry plants over 10,000 acres annually with crops valued at over \$30 million.

Shortly after the Idaho find, producers in Alberta (Canada) found golden cyst nematode (*Globodera rostochiensis*) in fields. This initiated international action again, with subsequent trace-forward action involving a Montana field.

The presence of either of these organisms in Montana would have devastating impacts on the seed potato industry. Action can be taken now to 1) systematically determine if these pests have invaded Montana and, 2) shield the potato industry by creating an internal quarantine system, so that if potato cyst nematodes were found in any area of the state, the remaining production areas could continue to ship.



*Globodera pallida* cysts, [www.eppo.org/](http://www.eppo.org/)



*Globodera rostochiensis* cysts, [www.eppo.org/](http://www.eppo.org/)

## PLAN OF ACTION

A statewide survey of seed potato producers was developed to adequately represent and sample potato production areas. Surveys in 2010 were conducted in several counties with potato crops identified as economically important to Montana's export markets. The counties sampled in 2010 were Beaverhead, Gallatin, and Madison.

Samples were collected using USDA protocols. Each sample consisted of five pounds of soil per acre of crop in field that were just harvested from potatoes. Data collected included date of collection, collector, potato variety, seed generation, and field number.

## RESULTS

Six grower operations were sampled for a total of 512 acres samples. Sample processing is ongoing, but so far, no positive samples have been found. This survey is planned to continue in the spring of 2011, prior to planting.



## Fruit Pest Survey

### Bundled Detection Survey

Montana has a small, usually unnoticed, fruit industry. Cherries from the Flathead Valley in northwestern Montana fill a niche market between 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 acreages in the Bitterroot Valley and small acres of other fruit production including grapes, apricots, and choke cherries.

Invasion of Montana orchards by any one of numerous new invasive organisms could bring disaster to these delicate industries. Various invasive moths pose a unique threat. These organisms are often overlooked because of their lifestyles (e.g., rolling up in leaves), and because of the relative blandness of their appearance. Many can be classified as “little brown moths” to the non-taxonomist community. These include such pests as the summer fruit tortrix (*Adoxophyes orana* (Fischer von Roslerstamm)), the false codling moth (*Thaumatotibia leucotreta* (Meyrick)), the plum fruit moth (*Cydia funebrana* (Treitschke)), European grape vine moth (*Lobesia botrana* Denis & Schifferrmüller) and last, but certainly not least, the light brown apple moth (*Epiphyas postvittana* (Walker)). These pests are all targeted in national "examples of bundled surveys" in addition to a number of other pests. The light brown apple moth and European grapevine moth have both recently been discovered in California.

While the above are all pests of (primarily) fruits that might be expected in Montana, the European grape vine moth (*Lobesia botrana*) is a pest that most people wouldn't think of as a pest in our state. However, there are a number of vineyards in the same general area as the other major fruit production areas. Pheromone baited traps were placed at high risk sites in the Flathead and Bitterroot areas, as well as a few other known fruit production sites.



From left to right, summer fruit tortrix, false codling moth, plum fruit moth and European grape vine moth. Images from [www.norfolkmoth.co.uk](http://www.norfolkmoth.co.uk), [www.ukmoths.org/uk](http://www.ukmoths.org/uk), and [cdfa.ca.gov](http://cdfa.ca.gov).

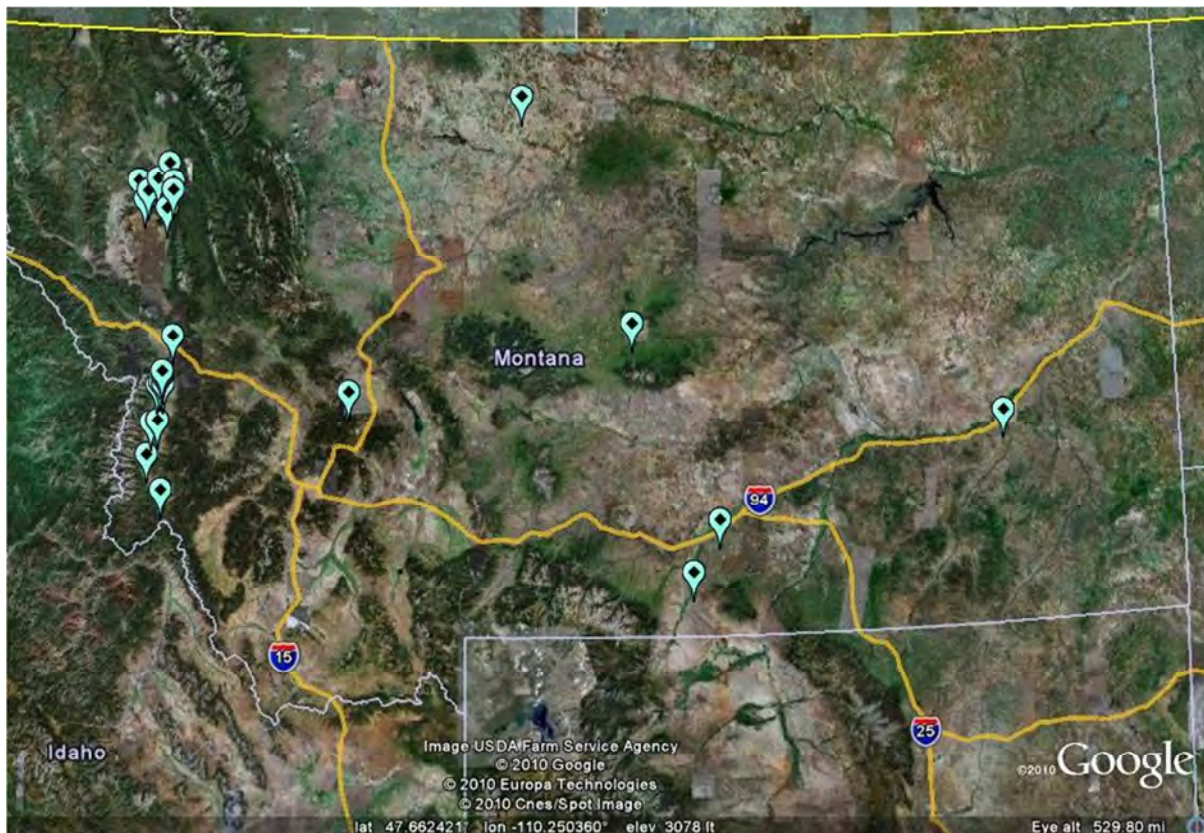
**RESULTS:** Fruit pest traps were placed at or near 27 high-risk fruit production areas across Montana.

County	Sites	County	Sites
LAKE	6	LIBERTY	1
FLATHEAD	4	CARBON	1
RAVALLI	6	YELLOWSTONE	1
PRAIRIE	4	CUSTER	1
MISSOULA	1	FERGUS	1

Fruit Pest Traps	Number
SFT	26
FCM	23
PFM	24
LBAM	27
EGVM	11

All traps were negative for target species. *Anthophila fabriciana* (L.) (Choreutidae) was caught in a number of plum fruit moth traps and superficially resembles that pest.

**Fruit pest survey locations in 2010.**



## **Invasive Organisms in Riparian Zones**

### **Bundled Detection Survey**

To say Montana's aquatic resources, and their surrounding lands, are important, is an understatement almost as vast as the Montana sky. The state contains the headwaters of not only the Missouri River, but also of the Columbia River, and the Red River of the North. At Triple Divide Peak in northwestern Montana, water moves to all three of these watersheds from a single mountain. These rivers, and the riparian areas around them, are, in Montana, mostly minimally impacted by human activity. However, recent discoveries of new aquatic and semi-aquatic pests and weeds have brought home the fact that size and dispersed population are not a protection against invasion by the armies of these enemies of agriculture. The rivers, their water, and their surroundings, have to be considered a commodity. In past years, it has been said that in the west, whiskey is for drinking and water is for fighting over. At this point, we are at the beginning of a war that may still be winnable, fighting the enemies selected for this survey, and others that may be incidentally found as a result of the survey. This group of invaders includes mollusks, terrestrial weeds, and aquatic weeds. New species of all of these groups are found almost every year in Montana, which is both disheartening, and challenging. The state is very large, and significant survey has not been possible at the present time.

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” runs from the Flathead Valley to the Bitterroot. This area has experienced a rapid influx of people, with concurrent building, frequently with high-value materials, such as imported tile, marble, and wood. The entire state is a Mecca for recreation including water 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., *Cerņuella* 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.





UGA2102092 *Cochlicella* sp. on grain



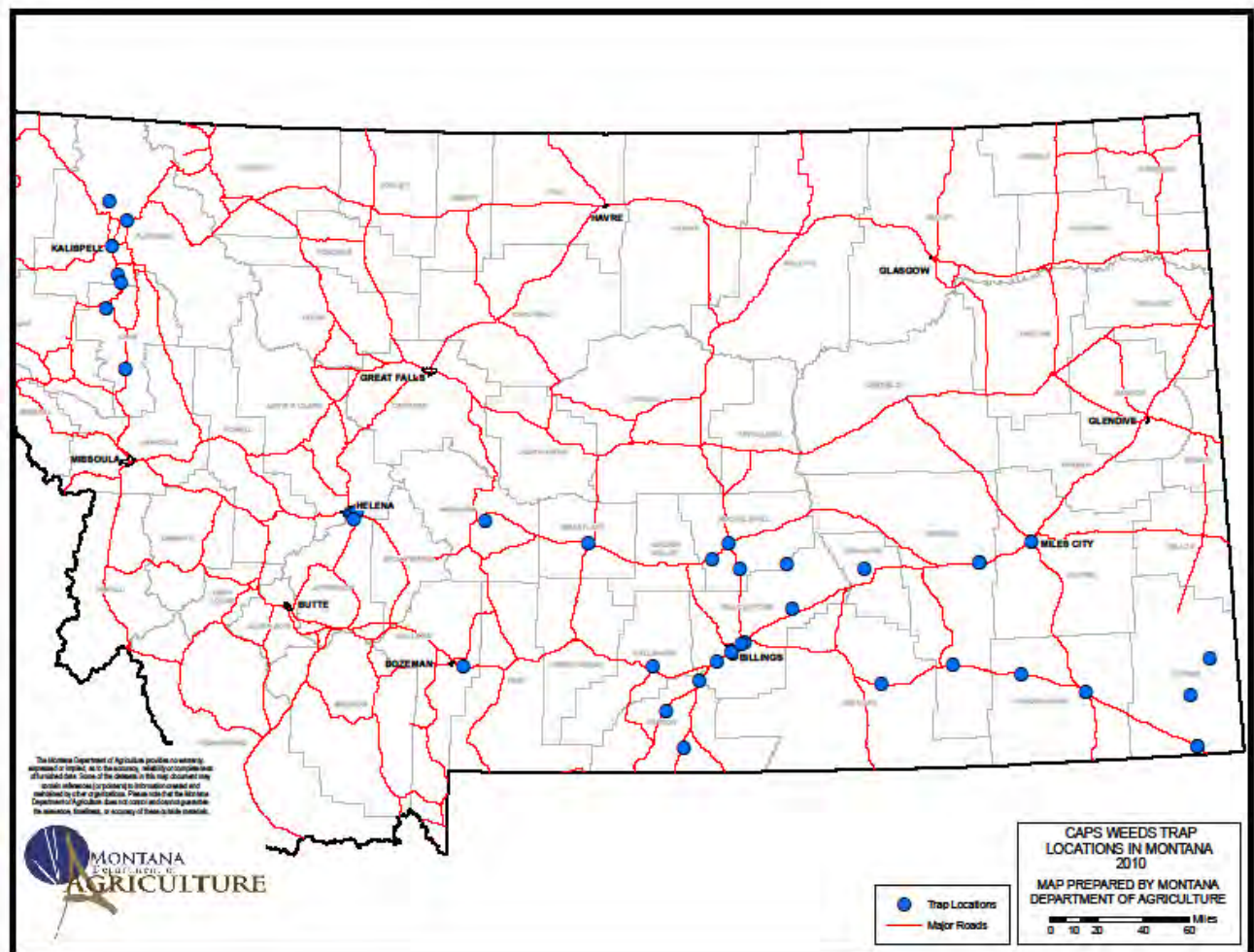
maritime garden snail, *Cerzuela virgata*

Invasive mussels can have a very strong effect on Montana agriculture, as they are capable (and have been known to) of covering or plugging essential structures, including intake valves, flumes, and other water control devices. Not only can they impact agriculture through this characteristic, but they can also have a strong, and undesirable, impact on such entities as cities and towns that get their water from dams or other water bodies that become infested with these mollusks. Additional information regarding the distribution of these species within the state is highly desirable.

Weeds were sight-identified in the field, and specimen collection of plants that could not be field identified. Among the weeds targeted for special attention are horse thistle (*Onopordum acaulus*), yellow star thistle (*Centaurea solstitialis*), dyer's woad (*Isatis tinctoria*), rush skeleton weed, (*Chondrilla juncea*), purple loosestrife (*Lythrum salicaria*), scotchbroom (*Cytisus scoparius*), Eurasian watermilfoil (*Myriophyllum spicatum*), salt cedar (*Tamarix* spp.), and hydrilla (*Hydrilla verticillata*). Other Montana noxious weeds surveyed for include: flowering rush (*Butomus umbellatus*), tansy ragwort (*Senecio jacobaea*), orange hawkweed (*Hieracium*



*aurantiacum*), members of the yellow hawkweed complex (other *Hieracium* spp.), tall buttercup (*Ranunculus acris*), yellow flag iris (*Iris pseudacorus*), blueweed (*Echium vulgare*), perennial pepperweed (*Lepidium*), and hoary alyssum (*Berteroa incana*).



Protecting Montana aquatic resources, which is used not only by traditional agriculture throughout Montana (and downstream states), but also for recreation, and last, but not least, for wildlife is vital to the health of the state. Replacement of native resources with invasive species can start a cascading effect through the ecosystem. In Montana, pest species in riparian areas pose a threat to numerous native organisms, some of which are already in an endangered state (e.g., the least tern, *Sterna antillarum*) or threatened (Water Howellia, *Howellia aquatilis*; Ute ladies' tresses, *Spiranthes diluvialis*).

This new invader surveillance project supports eradication programs that pose eminent threats to agriculture and natural areas in Montana. Interrupting new invader movement and eradicating new infestations while still possible, with the assistance of surveillance efforts, supports the APHIS priority to manage issues to protect the health of native plant communities

and U.S. plant resources. This project also supports the strategic goals of PPQ to protect plant resources from noxious weed introductions and improve plant health safeguarding activities.

Outreach regarding these pests is essential: a primary movement method for both the blatantly aquatic species, such as the snails and mussels, as well as some of the weeds, is on contaminated recreational equipment. While brochures and posters at heavily used areas can assist in communication with people using the areas, these small items frequently are overlooked, or more simply, ignored. Other methods of communication, such as posters, or larger items, at public places such as rest areas or boat launches, must be integrated into the outreach plan at this point. Participation of CAPS personnel in boat check/wash stations was desirable in 2010 - not only to add eyes to the system, but also as a way of personal outreach - speaking directly, individually or to small groups, to the public.

**RESULTS:** Survey work targeted high risk areas including tile/stone importers and riparian recreation areas. Surveys were conducted in Gallatin, Lewis and Clark, Yellowstone, Flathead, Lake, and several Southeastern Counties. Weeds that were detected included Canada thistle, cheatgrass, Dalmatian toadflax, field bindweed, leafy spurge, oxeye daisy, perennial pepperweed, spotted knapweed, and sulfur cinquefoil. No target mollusk or aquatic nuisance species were detected.

## **Cereal Leaf Beetle Detection Survey**

### ***Oulema melanopus* (L.)**

Cereal leaf beetle (CLB), pictured below, is an exotic quarantine pest of forage and cereal grains. It is commonly found on small grains, particularly wheat, barley, and oats. The adults and immatures feed on the developing plants, at times causing extreme defoliation.



**Adult cereal leaf beetle. Approximate length 1/8 to 1/4 inch long.**

Sweep net samples were taken during the survey and samples were screened specifically for CLB adults and larvae. Whole plants were also collected to check for the presence of eggs and larval feeding damage.

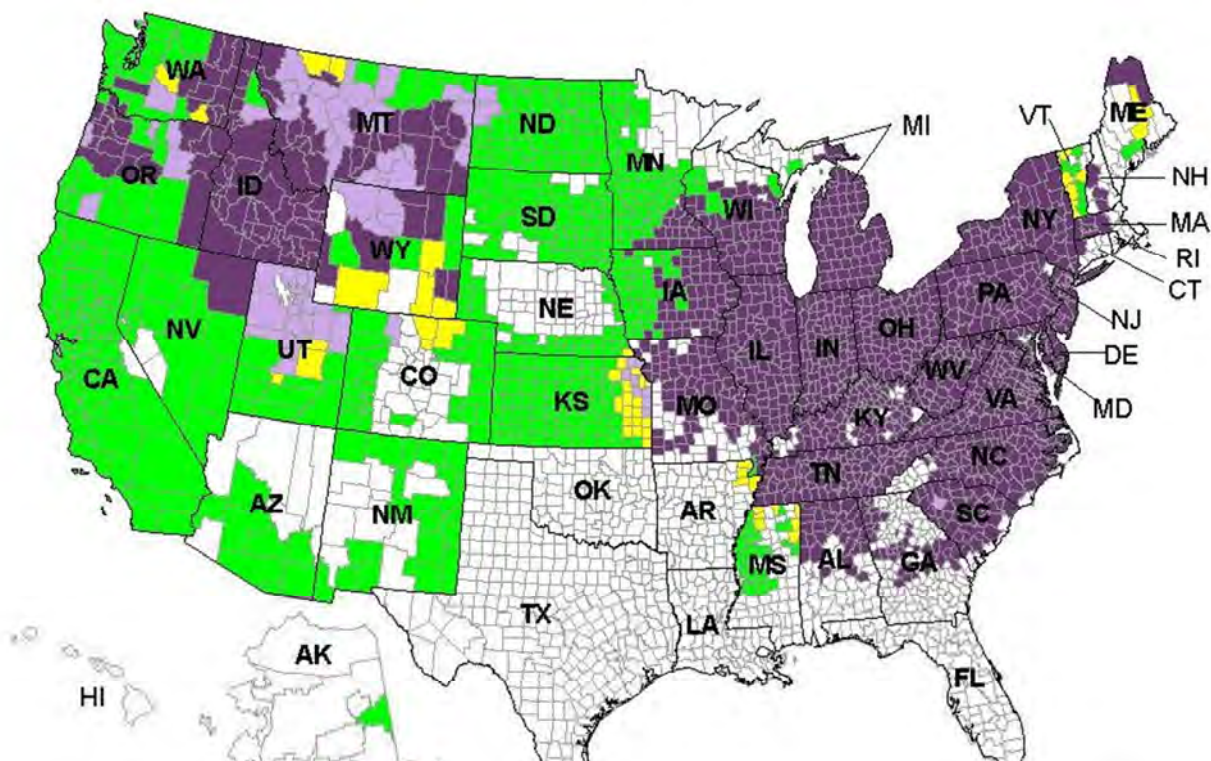
Eighty-eight sweep samples were taken across the state in 2010. Cereal leaf beetles were found in nine Montana counties during the 2010 sampling season. Counties that had been found positive for CLB in the past were not necessarily sampled during 2010. In total, 51 of Montana's 56 counties have had CLB detections since the discovery of the pest in the late 1980's. In 2010, cereal leaf beetle was detected for the first time in Liberty and Fallon Counties, the counties that remain free of CLB based on official survey are: Hill, Phillips, Valley, Daniels, and Sheridan.

# Reported Status of Cereal Leaf Beetle (CLB) - *Oulema melanopus*

Map views: [2007 to present](#) [alltime](#) [2010](#) [2009](#) [2008](#) [2007](#) [2006](#) [2005](#) [2004](#) [2003](#) [2002](#) [2001](#)

Download: [this map](#)

	Established by Consensus		Being Eradicated		Found
	Established by Survey		Eradicated		Not Found





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

### Billings, Montana 2010

Japanese beetles (JB) were discovered in Billings in 2001 near the Logan International Airport and spread into the city of Billings over the following years. Early delimitation surveys found that the JB were in the neighborhoods below the Rimrocks, a series of dry sandstone cliffs immediately south of the airport. Thus far JB have only been found in an area within a one mile radius of the campus of Montana State University – Billings, near the intersection of Montana State Highway 3 and Rimrock Road. 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 including many private homes and a few large landowners including MSU-B and Rocky Mountain College, the airport and other land managed by the City of Billings. Details of the State of Montana interior quarantine can be found here:

<http://agr.mt.gov/weedpest/pdf/quarantineJBeetle.pdf>

In 2010, a limited number of traps were placed in areas that were found to have JB in previous years in Yellowstone County. 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:** An additional 45 JB traps were placed at high risk sites across Montana. All traps outside of Yellowstone County were negative for JB in 2010.



## **Japanese Beetle Trapping, USDA APHIS PPQ, MONTANA AIRPORTS 2010**

The USDA APHIS PPQ traps for Japanese beetles at selected high risk airports within the state. Based on airport size, and number of flights from infested areas, traps are placed around the perimeter of the airports, and in any landscaping that might increase risk of JB infestation.

During 2010, the USDA APHIS PPQ placed and monitored 60 traps at seven airports. These were Billings (29 traps), Bozeman (5 traps), Butte (5 traps), Great Falls (5 traps), Helena (5 traps), Missoula (6 traps), and Kalispell (5 traps).

There were no detections of JB during the 2010 season in traps monitored by the USDA APHIS PPQ.

## **Montana Department of Agriculture**

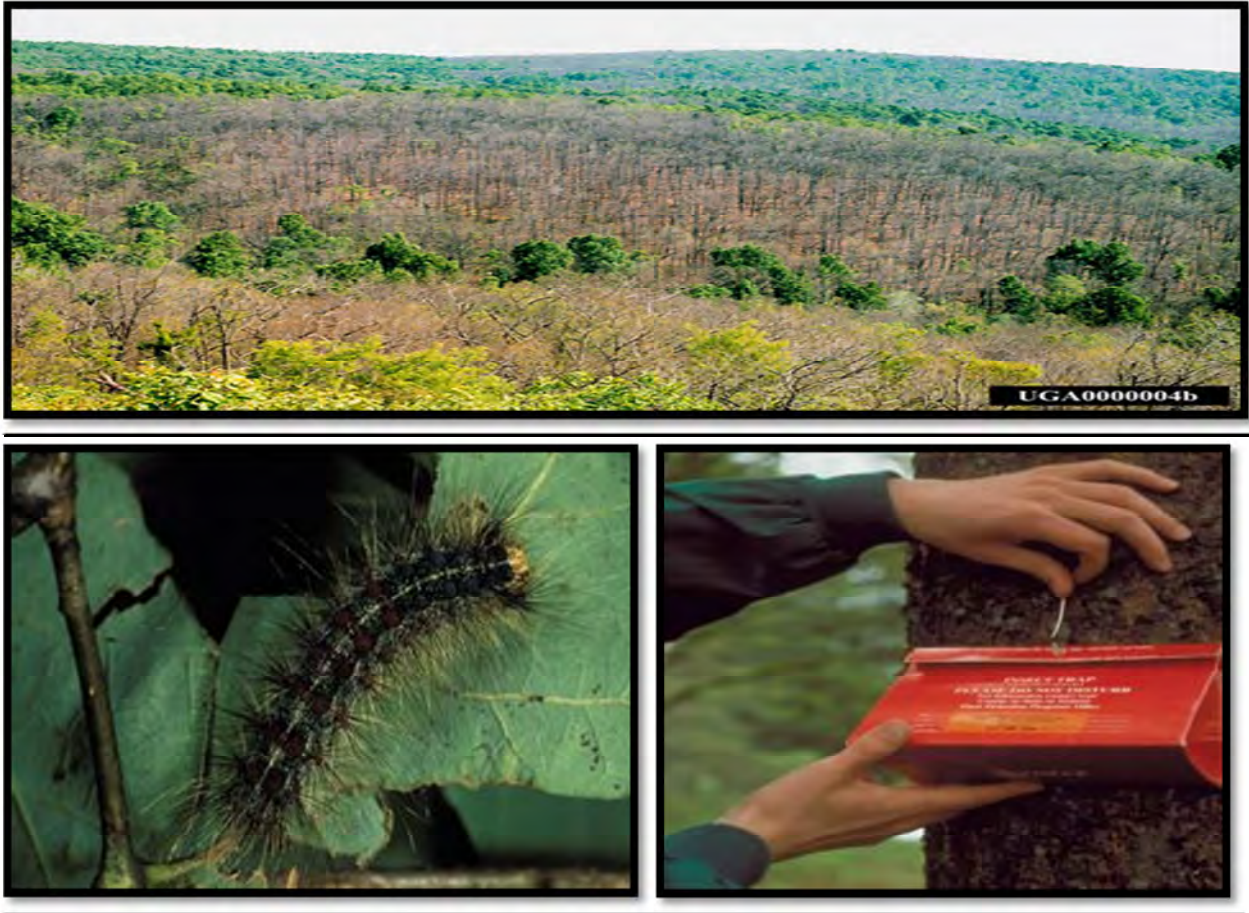
**Intern: Matthew R. Lyon**

### **Summer Season of 2010 Intern Report**



Montana is home to nearly 23 million acres of forest, dozens of state parks, and some of the most unique as well as spectacular views to be found in North America. In 2009 ten million people chose Montana as their destination for recreation and by doing so added 2.3 billion dollars to Montana's economy (Montana Office of Tourism 2010). Montana's great expanses of rugged untamable wild lands are beautified by the rich and immensely diverse plant and animal communities that exist there. The many great forested regions that so many Montana residents and visitors enjoy, however, are not guaranteed to retain the same natural beauty that we know so well today. Without adequate protections from exotic forest pests, Montana's beloved forests face the ever-present threat of invasions, defoliation and ecological devastation. The Montana Department of Agriculture (MDA), in collaboration with APHIS, PPQ, and the USDA, plays a proactive role in the monitoring of state and private lands for invasive species to provide a means of early detection of exotic pests. It is important to detect the presence of exotic pests at an early state to effectively organize a plan to eliminate isolated populations before their colonies grow beyond the scope of practical, and or, effective eradication efforts. For the summer of 2010 I took full advantage of the opportunity to monitor for some of these roving marauders, as an intern for the Montana Department of Agriculture in the Cooperative Agricultural Pest Survey (CAPS). My primary duty as an intern was to monitor for Gypsy Moth and European Pine Shoot Moth throughout the great western portion of the state. As the summer advanced I became very involved in monitoring orchards, vineyards, and nurseries statewide in an effort to locate a number of fruit pest moth species. My voyages were yet again broadened in the latter half of the summer as I eagerly took on the opportunity to travel to the far eastern portion of the state to participate in our invasive species boat check stations and nematode pulse-crop surveys. As I write this paper now I reminisce of my many adventures as an intern and recall what a valuable learning experience this summer has been for me.

## The Gypsy Moth, (*Lymantria dispar*)



As one might expect, I learned a great deal about *Lymantria dispar*, the Gypsy Moth, over the past few months. Since its introduction to the United States more than a hundred years ago, the Gypsy moth has well established itself in a vast range of territories throughout the eastern and Midwestern United States. Its range continually expands as it hitches rides to new regions on bundles of firewood, furniture, RVs, travel trailers and a variety of other hosts that enable this specie to travel great distances with little effort. While the adult moth does relatively little damage to our trees, its progeny, the larvae, feed voraciously on the tasty green leaves of more than 500 different plant species (MDA Cooperative Pest Survey Report 2009). This poses a great threat to not only the aesthetic beauty of our mountainous regions, but also to the shade trees that we benefit from in our own back yards. In knowing how this pesky little intruder reaches new frontiers, we are clued in to prospects of where we might first detect its presence. Places visited frequently by travelling recreationists, for example, may be a good place to begin our search. High traffic areas such as rest stops and weigh stations, where many moving and transportation vehicles stop daily, can also be considered likely places to find these travelling insects.

Boat launches, fishing access sites, trailheads, forest roads, historical sites, campgrounds, pullouts and rest stops; these are the places I monitored throughout the summer using sticky triangular traps baited

with pheromones designed to attract Gypsy Moths. After having set and baited all of my traps throughout western Montana, I regularly revisited each trap every two to three weeks to check for suspect moths. As of the summer of 2009 only one Gypsy moth has been found in the State of Montana which was located in the north western portion of the state on the western shore of Lake Kookanooska. We monitored this area heavily for the summer of 2010 placing more than 20 traps within a four mile radius. The MDA State Entomologist and I even conducted a black light survey in which black lights were used in the darkness of night to attract moths and beetles of all kinds. Though we found many interesting beetles and moths we did not find any Gypsy Moths. In the sticky traps, called Delta traps, I found a variety of moths, many of which were sent off to more qualified personnel to be identified. I was personally unable to positively identify any of the moths I trapped as the Gypsy moth. Official results pertaining to the identification of our targeted moth species have not yet been conveyed back to me. Further information may be available through the MDA at this time.





## **The European Pine Shoot Moth, (*Rhyacionia buoliana*)**



The European Pine shoot moth is yet another forest pest of great concern. This moth can be particularly devastating to Christmas tree plantations and nurseries where trees do not sell if they are deformed and to major lumber markets where deformed trees are not economically salvageable. At an early stage in their life as larva, these insects feed on the newly developing buds which damages and kills leading buds causing trees to grow in a deformed, often Y or L shaped fashion. I pursued this pest in the same manner as I pursued the Gypsy moth. At every third Gypsy Moth site I set out a Scentry wing trap and baited it with a pheromone designed specifically to lure in European Pine Shoot Moths. I found that the Scentry wing traps caught significantly greater quantities of moths compared to the Delta traps used in the Gypsy Moth survey. A few moth species that I found regularly and seemingly ubiquitously throughout the state became quite obvious and recognizable to me. Although the frequent sightings of these particularly wide spread species did raise questions of concern, the European Pine Shoot Moth seemed to be absent from all traps collected. All traps containing suspicious looking moths were sent off to be accurately identified by qualified personnel. Further results may be available through the Montana Department of Agriculture later this season.

## **Fruit Pests**

As part of my internship this summer I also took on the responsibility of monitoring for moth fruit pests at orchards, vineyards, and nurseries growing fruit. This was a job that required long hours on the road and frequent overnight stays since my boundaries were limited only by the borders of the state. Montana has a rather small, but fruitful, fruit market. Montana wineries and vineyards, seemingly growing in popularity, also fill a small niche in this fruit industry. There are a number of moth pests that threaten the vitality of these industries. Some of the moths that I monitored for at these locations were: the Light Brown Apple Moth, the Summer Fruit Tortrix, the False Coddling Moth, the European Grapevine Moth, and the Plum Fruit Moth. These fruit pest species love to feed on leaves, buds, and or fruit of the desired crop. I began my survey by calling fruit growers, orchards, and vineyards throughout the state to find private landowners who were willing to participate in the state wide survey. I recruited participants ranging from the Flathead Valley in the northwestern portion of the state to Miles City



found in the far south eastern locale of the state. Some of my greatest learning experiences during the fruit pest surveys came from the private land owners I met with. These landowners did more than grant me permission to place traps upon their land, they were a wealth of valuable information and contributed immensely to my education as an intern. I am grateful to have had the opportunity to meet some of these knowledgeable and charismatic landowners who were kind enough to pass down to me what they had learned firsthand through years of experience and hardships.

## **Mixing It Up!**

I was fortunate to have many projects throughout the summer. The diverse array of matters really kept things interesting and exciting as each new opportunity opened doors I had not yet seen behind. I was not restricted to duties relating only to moth surveys. I was granted the opportunity to participate in Cereal Leaf Beetle (CLB) surveys in which a typical bug catcher net was used to sweep wheat and barley fields. CLB adults or larvae, if found present, were then handpicked from the net and taken back to the office where I learned how to dissect the larvae in search of parasitoids. I also participated in an aquatic invasive species boat check station where I learned about a number of aquatic invasive species, their potential threats, and how and where these invasive species come aboard boats to take a trip. I spoke to many people who stopped at our boat check station just out of curiosity, wondering what invasive species we were looking for, and what they could do to prevent the spread of these invasive species. The boat check stations seemed to be a very effective means of public outreach and education. Lastly, I traveled far out to the eastern portion of the state to partake in a Nematode Pulse Crop Survey. This survey entailed soil core sampling using a simple soil probe to collect about a quart of soil from a pulse crop field (ie: peas, lentils, etc.). Soil core samples were then sent off to a lab to be microscopically examined.

## **In Summation**

It has been a summer of enlightenment, adventure and tourism. In a state that I had seen little of prior to this internship, I have developed a strong working knowledge of its geography, agricultural industries, and some of the biological and environmental factors that affect agricultural industries. I attribute much of my education as an intern to my co-workers, supervisors, and as I have mentioned, the proud Montana farmers that I have met along the way. Truthfully, I say I would do it 100 times over without a wince of regret.

## **References**

Montana Department of Commerce. Montana Office of Tourism 2010. Tourism and recreation industry fast facts. [http://travelmontana.mt.gov/faq/FASTFACTS\\_Aug10.pdf](http://travelmontana.mt.gov/faq/FASTFACTS_Aug10.pdf)

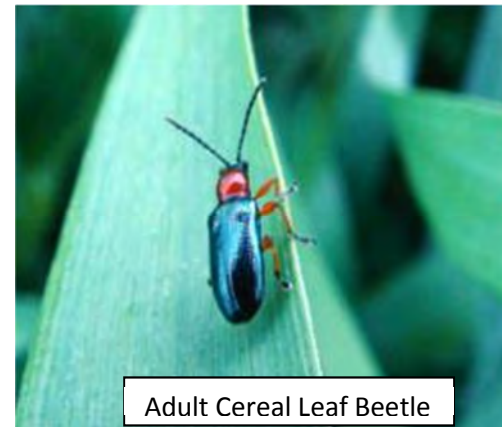
P. Denke, Puliafico K.P., Foley I. (2009). Montana Department of Agriculture Cooperative Pest Survey Report 2009; 8-25

**Robert Wiltzen**

**Montana Department of Agriculture**

**Internship Paper**

**Summer 2010**



Adult Cereal Leaf Beetle

This summer I had the opportunity to work as an intern for the state of Montana in the Pest Management Bureau. The Pest Management Bureau enforces laws pertaining to the monitoring and suppression efforts of pests by quarantines, weed control, import and export certifications, and conducts insect and disease surveys across Montana. As an intern, I was given various tasks that have much to do with the said efforts.

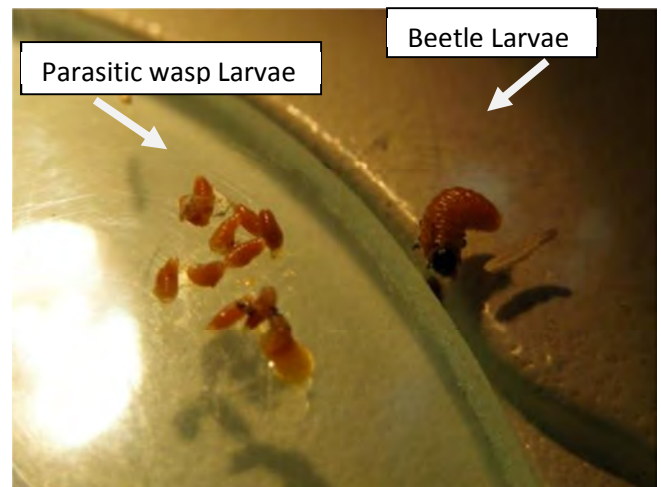
My primary work I did this summer dealt with the surveying for Cereal Leaf Beetles in grain fields across Montana. The Cereal Leaf Beetle is an invasive beetle from Eurasia that has become problematic to Montana farmers. Since this type of beetle feeds on the leaves of barley, oat, and wheat plants, the result is a significant decrease in annual crop yields. To combat the Cereal Leaf Beetle, the US Department of Agriculture introduced a wasp that parasitizes the beetle larva by laying eggs inside its host. The wasp eggs then develop into larva and slowly devour the host beetle. This technique of parasitizing the Cereal Leaf Beetle has resulted in biological control of the pest.



When I did surveys for Cereal Leaf Beetles, it often involved driving for long periods of time until I reached my destination of a large grain field. Armed with a bug net, I would walk in sweeping as if I were tracing a figure eight in the crops. Most times I would trace these figure eights for two-to-three hundred sweeps and then look in my net noting what I had found.

Doing these surveys had allowed a hands on understanding of the damages caused by these beetles as well as an in depth look at their characteristics. I found the adult beetles to have blue metallic shells and heads, while both the thorax and six legs have an orange to reddish brown color, with the entire body being a quarter of an inch in length. The CLB larvae are orange red in color and start out very small. However, they eventually do become bigger than mature adult beetles. Larvae also tend to coat themselves in fecal matter in which they become more of a shiny brown color, resulting in the resemblance of bird droppings. This acts as a defense mechanism from predators. During each beetle survey I would do my sweeps, then mark coordinates on a GPS device and note if any larvae or adult beetles were found. Any Larval specimens found would go back to the lab and be dissected to see if wasps had parasitized them.

After I felt comfortable with the search and capturing of beetles, I was given another primary duty. This duty involved the documentation of any



noxious plants I came across while doing other pest surveys. The sites I commonly chose to survey were rest areas, trailheads, monuments, and fishing access sites. The tools I used to accomplish this task were a rangefinder, GPS device, a notebook, and the identification bible for noxious weeds.

Upon reaching a site I would range out fifty meters in four directions of my current position and place orange flagging at these spots to create a circle 100 meters squared. I'd then go back to the center of this circle and write down GPS

coordinates for the site. Using the range finder helped to mark the distances of a noxious plants. When all was set up, I would identify the plants to complete these surveys. These written records of plants I created throughout the season would later be put into Microsoft excel spreadsheets that would then be uploaded to a NAPIS or ISIS websites. The data is of



great importance as it compares historical surveys to the present and shows how the plants densities have changed.

In the middle of summer I was also fortunate to work with other interns on their projects. These projects included placing traps all over Montana to capture other invasive invertebrates such as; the European pine shoot moth, emerald ash borer and Japanese beetles. The sites that we surveyed for these invasive insects were typically in riparian areas, fishing access sites and campgrounds. These areas are where such insects are commonly found and spread. Most of the trap designs that were used were similar with a triangular shape and a sticky surface, the only one different is the funnel trap. The funnel trap is made of a downward facing funnel that allows insects to fly in, but not out. Insects would get trapped in these funnels and fall down into a chamber of propylene glycol, which later we would collect. The final step to placing these traps would be to attach bait and pheromones packets to lure insects.



Another task as a part of my internship involved traveling to Wibaux and Glendive for two weekends to participate in boat check stations. The main goal of these check stations is to prevent the introduction of Zebra and Quagga Mussels into any freshwater body in Montana. Employees of the Bureau, along with me, accomplished this goal by inspecting all boats traveling into the state from the highway.

Before starting our inspections, we set up at our sites with cones and signs that would help lead travelers to our mobile sprayers. Once travelers had reached the mobile sprayer, we could then begin the inspection process of their boat. This involved inspecting all compartments in each boat along with noting where the boat had last been launched and where the owners planned on launching next. Most importantly we also handed out informational guides so boaters could become more knowledgeable about preventing the spread of species.

Upon finishing the boat check stations we also had to get soil samples from lentil fields in the surrounding regions. The purpose of doing these soil samples is to look for microscopic nematodes that are known to damage the roots of peas and lentils. Certain procedures had to be followed to accomplish the sampling of multiple sites without contaminating other fields. We donned rubber waders and carried a metal probe and bucket when entering the fields. When we had gotten enough of a sample we placed the soil in plastic bags. The bags were then noted with the location and date and were put into a cooler. After each field had been surveyed all of the equipment was then sprayed with a bleach solution to kill any possible microbes.



Some of the final tasks I had been given were the inspections of nurseries as well as stone importers. The main goal to achieve at these nurseries was the surveying of fruit trees to see if a disease called Plum Pox Virus (PPV) was present. To check for this virus I had to take five leaves randomly from every fifth tree and proceed down these rows of trees until I had ten percent of the total area sampled. I had only surveyed one nursery which had over five hundred plum trees. So this process was rather lengthy. The leaves I sampled for were then placed in labeled sandwich bags, and GPS coordinates were taken for each tree sample. Most importantly I had to use hand sanitizer after each sample so I didn't contaminate all of the other samples. This physical data was then transported back to the Pest Management Bureau to be sent to a lab for further inspection of PPV.



While being in urban areas for inspecting nurseries, I also took advantage of coordinating a list of stone importers to go check out. What I was surveying for here were exotic snails. These types of snails are invasive species that can attach to the crates used in transporting stone products. The type of businesses I wanted to target were mostly granite and marble importers that received their product directly from overseas. I found that by being in Montana, most local stone importers did not buy from overseas, but rather from other direct buyers on the west or east coast of the U.S. This meant that my chances of finding anything were slim, due to the fact that the product had been inspected multiple times. I however still inspected any crates that were used to import stone. During these inspections I was never able to find any snail samples. However, I did learn a lot about the stone and tile business.

Over the course of this internship I was able to learn a lot about agriculture, entomology, and botany. I'd say that the classes I've taken at the University of Montana that were relevant to this work are as follows; biology, general ecology as well as genetics and evolution. Although I have yet to take botany, I believe that such a course would have helped immensely when trying to identify specific plants.

As I reflect on this internship experience, I find that a lot of the skills I learned over the summer were not skills that I was able to learn in school. For one, my communication skills have increased substantially, as most of the internship deals with speaking to people of diverse backgrounds. One day you could be speaking to farmers about herbicide usage, and the next day are coordinating a work week with biologists. Also, I must say that my driving and logistical planning skills have become more efficient. Since Montana is so vast, I would drive six to eight

hours on average daily, while also planning surveys chronologically to my location and where I was going

The community of people I worked with was most enjoyable. Questions I had were answered, the atmosphere was always positive and any input I had was considered or added to meet objectives. The greatest aspect of the job hands down would have to be that I worked mostly on my own in the field, and that the job was never static or boring. I always found myself shifting gears whether it were sampling grain fields, identifying native plants and weeds, or dissecting insects and creating bug displays. I am very thankful for having this opportunity to jump into all of these different fields and discover that they are all somehow integrated with each other.

Here are some tips and tricks for future interns in my shoes:

-Finish your internship paper before the semester starts. Like college students need any more stress on top of our plate. Procrastination of your internship paper until finals can be deadly. It almost killed me.

-Acquire cassette tapes at garage sales or buy an mp3 adapter for your music preferences. Most state cars only have tape decks, with this said I had gotten a little too familiar with the lyrics to Madonna and the soundtrack of Aladdin and the Lion King.

-Ask Questions. The only dumb question is the one not asked. There were many times (because of my inexperience) I had questions, and I definitely didn't want to give the impression of being incompetent by asking so many. In the end I figured I'd rather ask questions and know what's going on, instead of being a space cadet further down the road.