# Eastern Heath Snail

*Xerolenta obvia* (Menke)

USDA United States Department of Agriculture

Montana Department of Agriculture


Slide curtesy of D. Robinson

USDA

United States Department of Agriculture

Animal and Plant Health Inspection Service

Plant Protection and Quarantine

# New Pest Response Guidelines

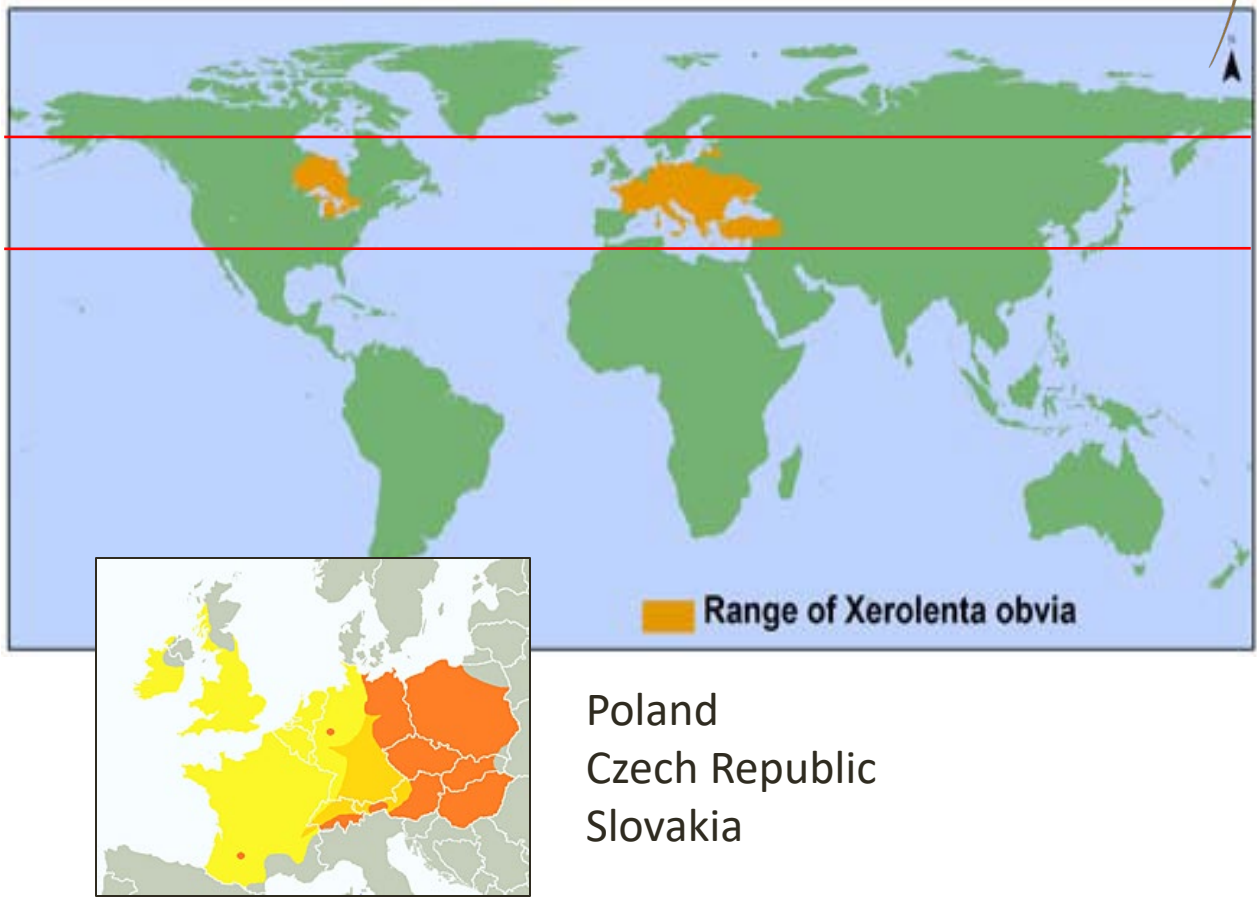
## Temperate Terrestrial Gastropods

**Table 2-2 Species of Temperate Terrestrial Gastropods in the Families Arionidae, Cochlicellidae, Helicidae and Hygromiidae Included in the *Guidelines***

| Family | Species |
|---|---|
| Arionidae | *Arion vulgaris* (Moquin-Tandon) (=*Arion lusitanicus* of authors, *non* Mabille) |
| Cochlicellidae | *Cochlicella acuta* (Müller)<br>*Prietocella barbara* (Linnaeus) |
| Helicidae | *Theba pisana* (Müller) |
| Hygromiidae | *Candidula intersecta* (Poiret)<br>*Cernuella virgata* (da Costa)<br>*Hygromia cinctella* (Draparnaud)<br>*Microxeromagna lowei* (Potiez and Michaud)<br>*Monacha cantiana* (Montagu)<br>*Monacha cartusiana* (Müller)<br>*Monacha syriaca* (Ehrenberg)<br>*Xerolenta obvia* (Menke)<br>*Xeropicta derbentina* (Krynicki)<br>*Xeropicta krynickii* (Krynicki)<br>*Xerotricha conspurcata* (Draparnaud) |

## Ranking of Exotic Snail and Slug Pests

Inclusion of species of temperate climate pest snails and slugs in the *Guidelines* was based on the following criteria used by Cowie *et al.* (2002):




Poland
Czech Republic
Slovakia

Range and Distribution

# EASTERN HEATH SNAIL

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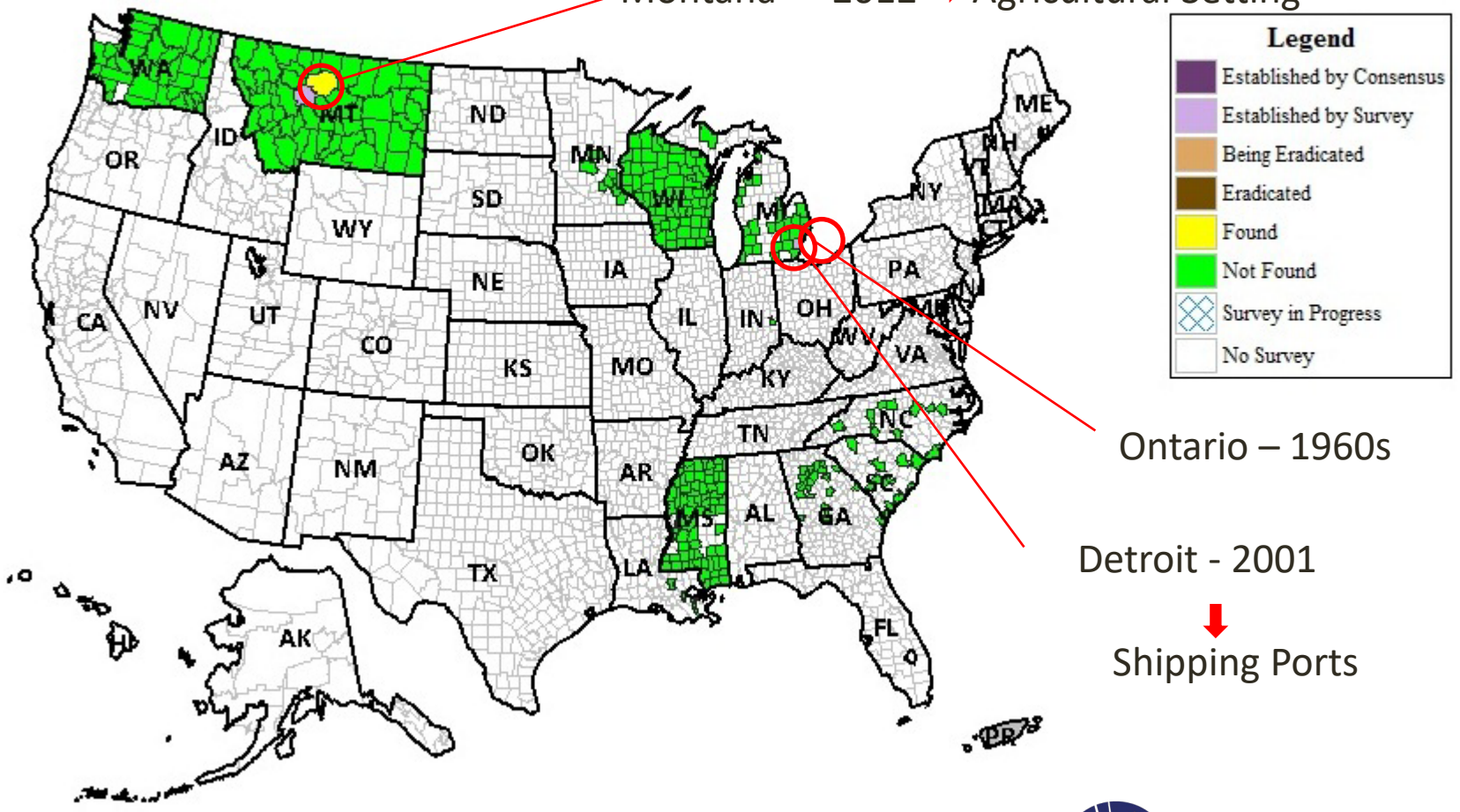
## Survey Status of Eastern Heath Snail - *Xerolenta obvia*

**All years**




Montana Department of Agriculture


1896

# Introduced species: *Xerolenta obvia* (Menke, 1828) – (continued)


Variation of *X. obvia* in Montana
[photos courtesy of P. Marquez)

Compare with
*X. obvia* from
Detroit, MI

Populations of *X. obvia* in Montana

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# Eastern Heath Snail

Terrestrial Snail

• Generally •

1 – 2 year life cycle
Reproduce in the fall
Eggs overwinter in the soil
Newly hatched feed primarily on detritus
Aestivate when it's hot & dry

Highly Adaptive!

# Massing Behavior

- Many exotic snails exhibit massing behavior.
  - Native North American snails should not “mass”
- Climb up grasses, other vegetation, or other hard surfaces in large numbers.
- “Aestivate”, moisture event, then descend once again to feed.
- Under some conditions, the snails will reach such high numbers as to interfere with harvesting, resulting in serious contamination, downgrading of the quality of the grain, and even complete rejection of the crop.

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# Agricultural Damage & Impacts

- Known to actively feed on alfalfa, clover, lupine, sanfoin, peas, lentils, milkweed, snowberry, and other plants.
- Is NOT known to feed on large wheat or barley plants or kernels.
- May feed on seedlings of a large number of plants.

- Calcium/lime
- Scavenger
- Only feed on algae/yeast for first month of life.

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# Agricultural Damage & Impacts


- Primarily a contaminate in grain/hay production
- Contaminate of fruits and vegetables
- Can transmits the spores of:
  - *Alternaria* sp.
  - *Fusarium* sp.
  - *Phytophthora* sp.
- Can vector animal diseases:
  - *Protostrongylus rufescens* (sheep lungworm)
  - *Davainea proglottina* (cestode)
  - *Dicrocoelium dendriticum (trematode)*

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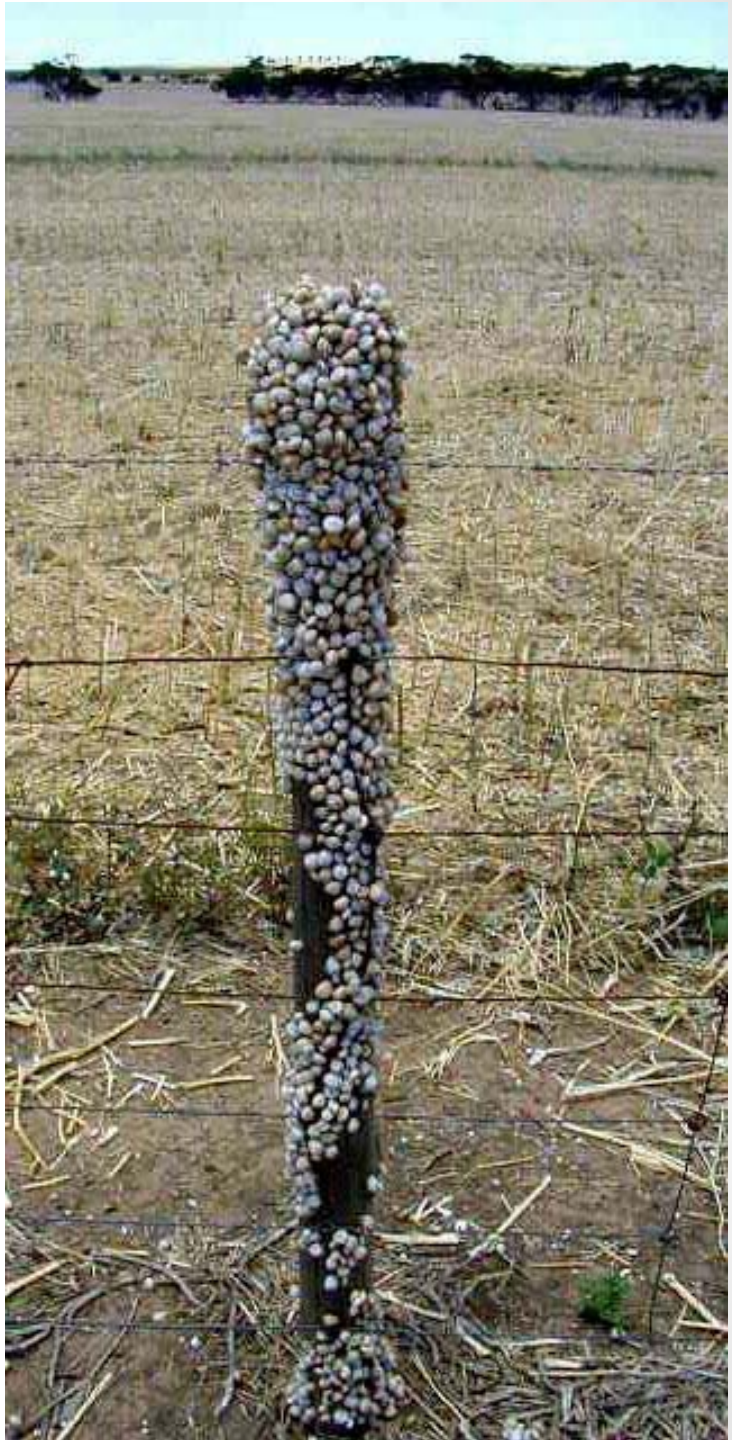
# In Australia



# AUSTRALIA

http://www.abc.net.au/news/2012-05-04/snails-farmers-pests-yorke-peninsula/3991336

Eastern Heath Snail | Montana Invasive Species (mt.gov)

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Montana Department of Agriculture

# Montana Exports

- 3rd nationally in wheat production.
- 2nd in Barley production.
- 1st in lentils and dry peas.
- ~80% of total grain production is exported.
- MDA alone certifies about 500 million pounds of grain exports annually.

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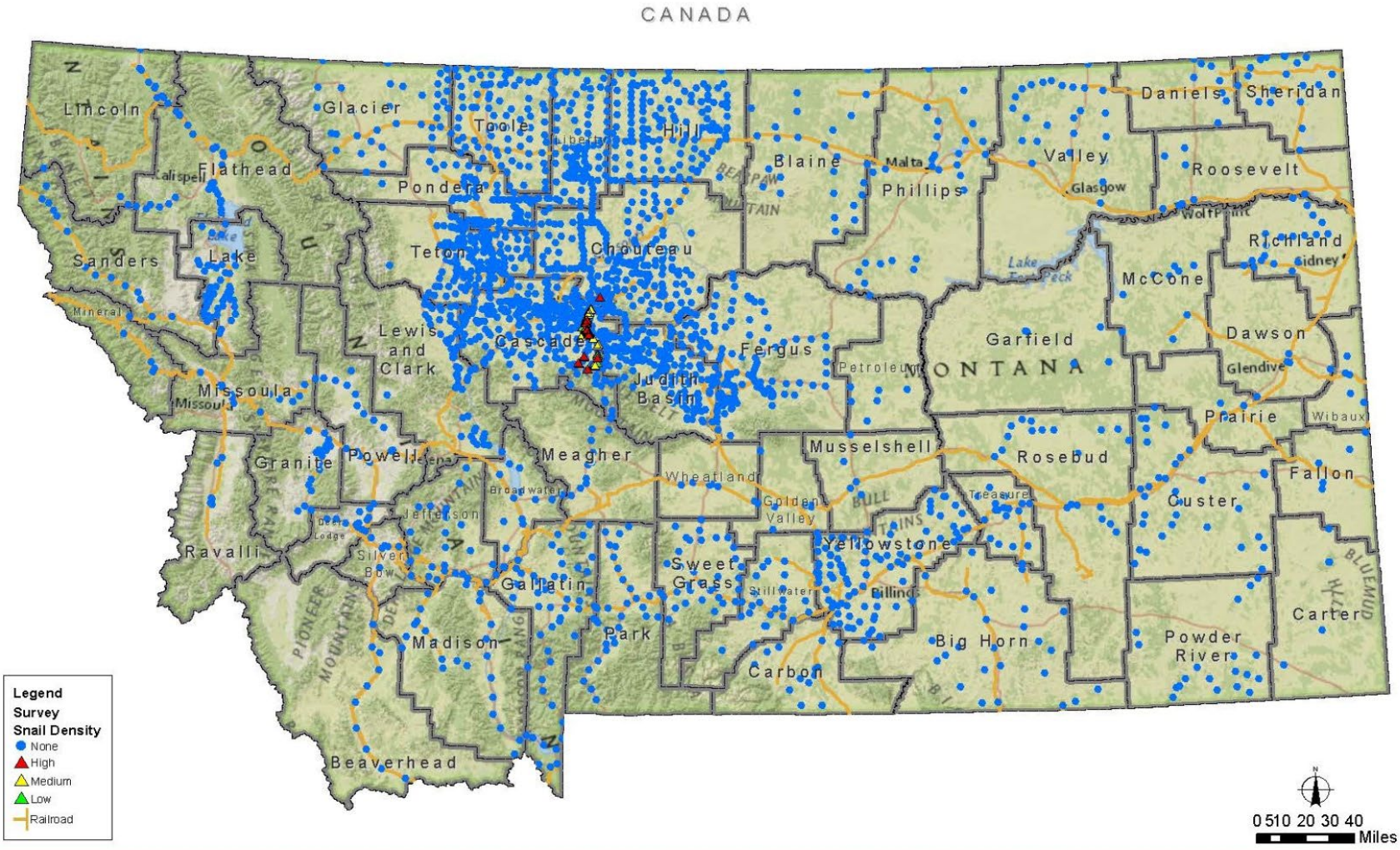
# *Xerolenta obvia* Montana 2012 - October 2, 2012

Animal and Plant Health Inspection Service

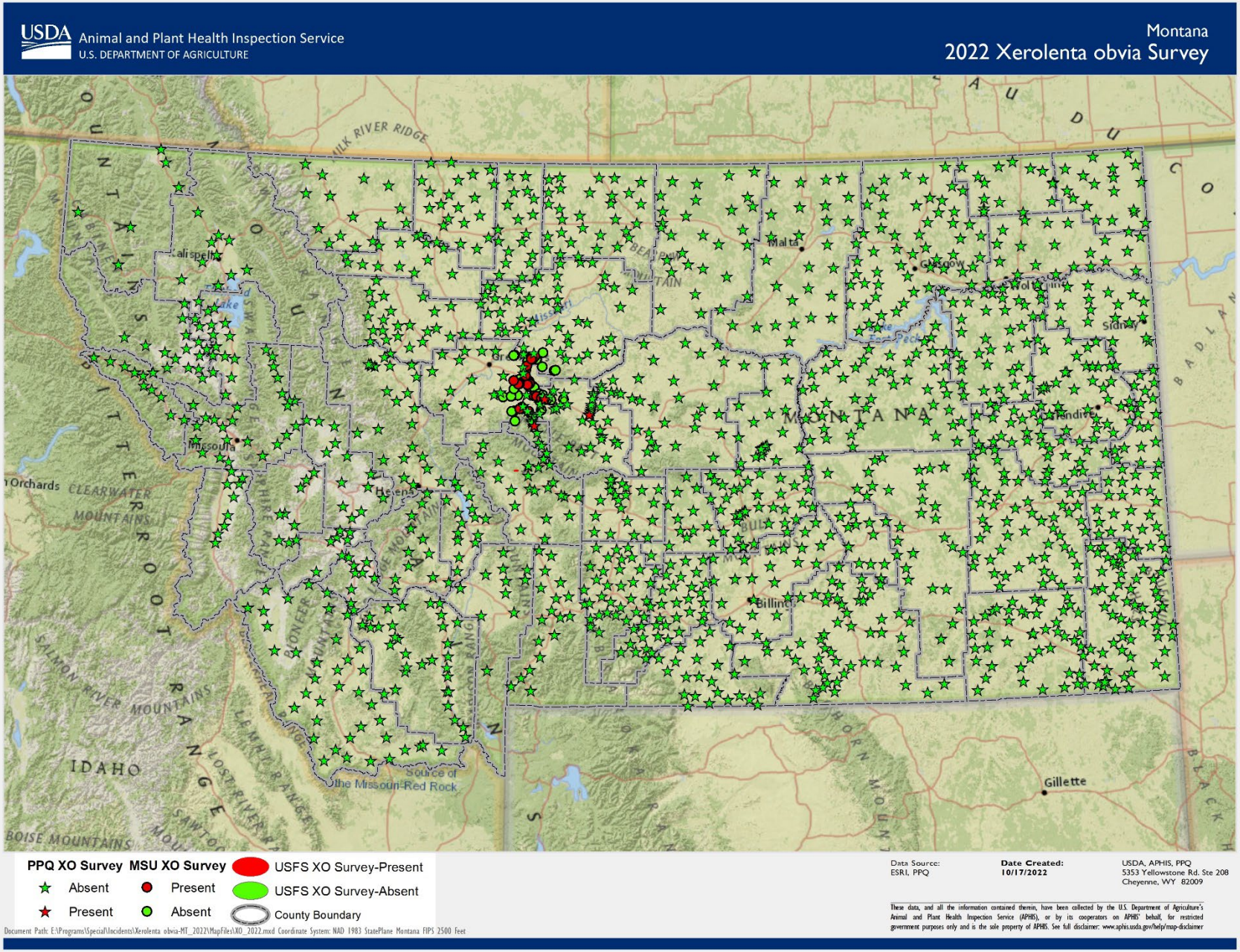


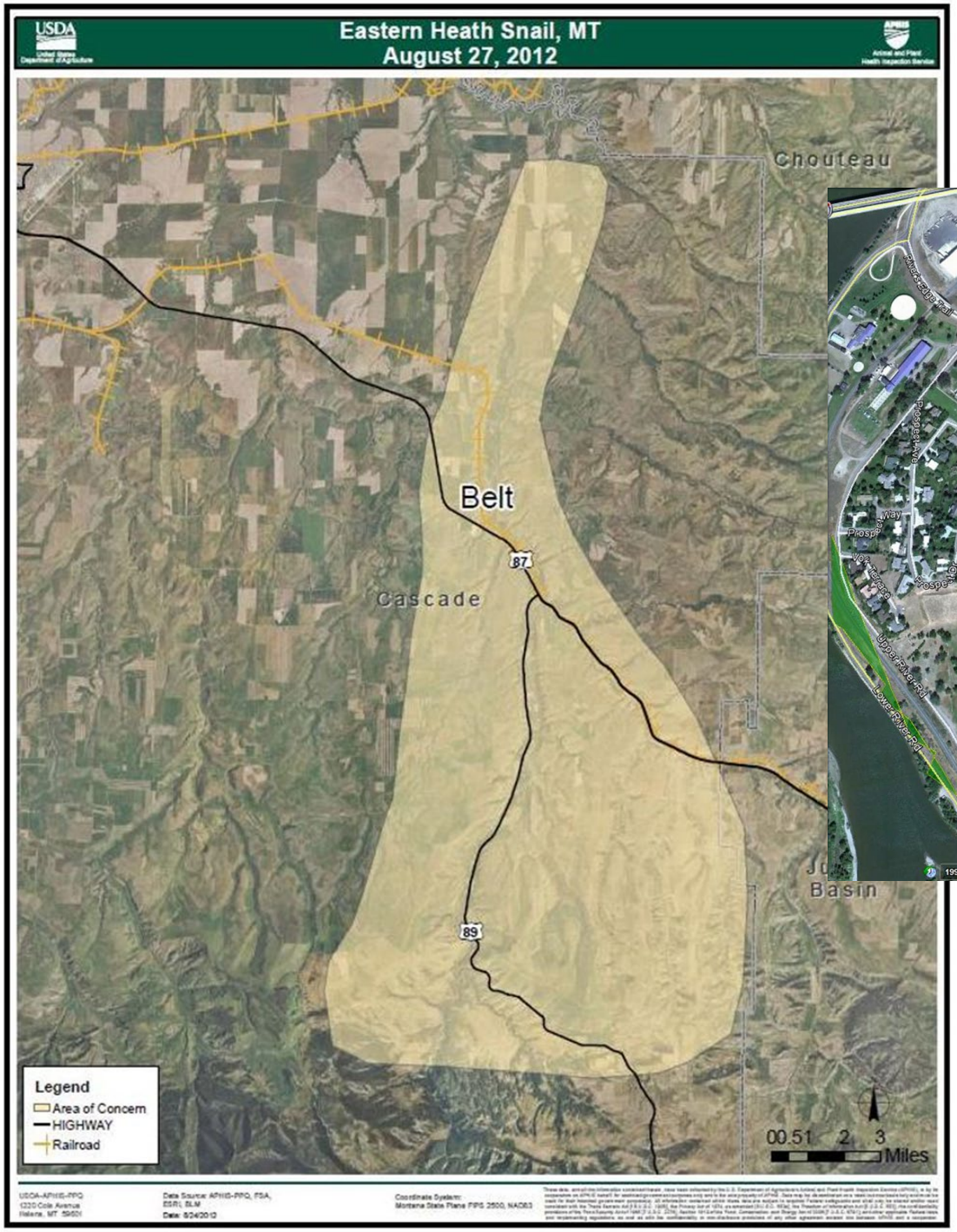


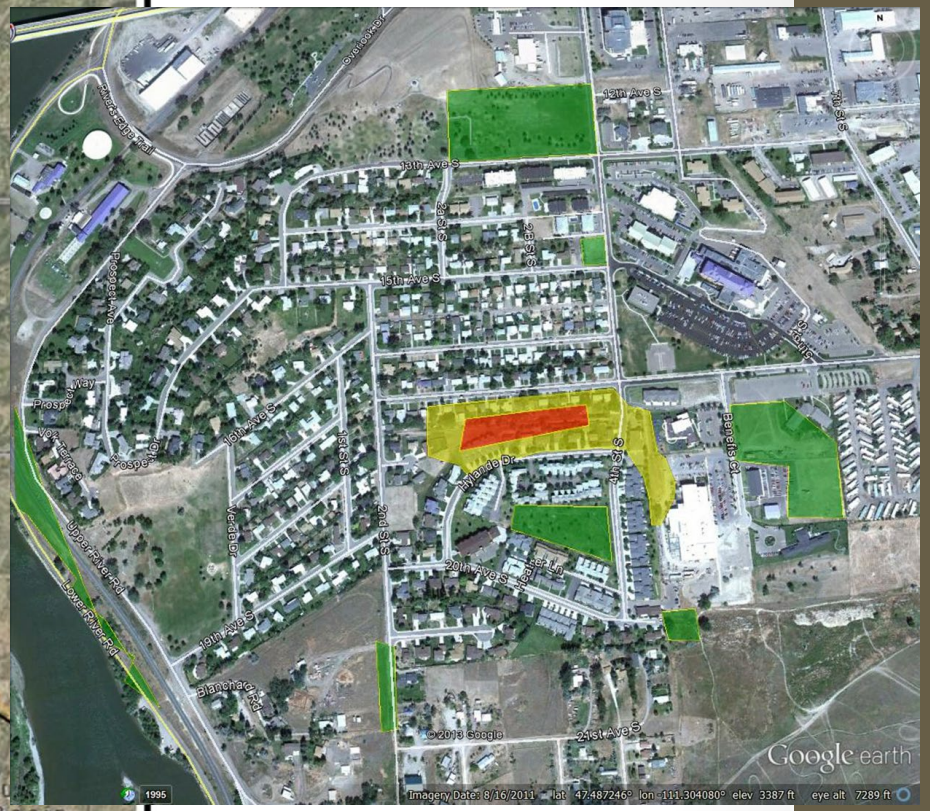
USDA-APHIS-PPQ
1220 Cole Avenue
Helena, MT 59601


Data Source: APHIS-PPQ, FSA, ESRI, BLM
Date: 10/2/2012

Coordinate System:
Montana State Plane FIPS 2500, NAD83


USDA
Animal and Plant Health Inspection Service
U.S. DEPARTMENT OF AGRICULTURE
Montana
2022 Xerolenta obvia Survey
MONTANA
IDAHO
Missoula
Helena
Billings
Malta
Glasgow
Sidney
Glendive
Gillette
Source of the Missouri-Red Rock
PPQ XO Survey
Absent
Present
MSU XO Survey
Present
Absent
USFS XO Survey-Present
USFS XO Survey-Absent
County Boundary
Data Source:
ESRI, PPQ
Date Created:
10/17/2022
USDA, APHIS, PPQ
5353 Yellowstone Rd. Ste 208
Cheyenne, WY 82009
These data, and all the information contained therein, have been collected by the U.S. Department of Agriculture's Animal and Plant Health Inspection Service (APHIS), or by its cooperators on APHIS' behalf, for restricted government purposes only and is the sole property of APHIS. See full disclaimer: www.aphis.usda.gov/help/map-disclaimer
Document Path: E:\Programs\Special\Incidents\Xerolenta obvia-MT_2022\MapFiles\XO_2022.mxd Coordinate System: NAD 1983 StatePlane Montana FIPS 2500 Feet


USDA
United States Department of Agriculture
Eastern Heath Snail, MT
August 27, 2012
APHIS
Animal and Plant Health Inspection Service
Chouteau
Belt
87
Cascade
89
Basin
Legend
Area of Concern
HIGHWAY
Railroad
0 0.5 1 2 3
Miles
USDA-APHIS-PPQ
1220 Cole Avenue
Helena, MT 59601
Data Source: APHIS-PPQ, FSA, ESRI, BLM
Date: 8/24/2012
Coordinate System:
Montana State Plane FIPS 2500, NAD83


13th Ave S
14th Ave S
15th Ave S
19th Ave S
20th Ave S
21st Ave S
Prospect Ave
Overlook
Upper River Rd
Lower River Rd
Blanchard Rd
Verde Dr
Parade Dr
Bandits Ct
1st St S
2nd St S
3rd St S
Google earth
Imagery Date: 8/16/2011 lat 47.487246° lon 111.304080° elev 3387 ft eye alt 7289 ft

# Belt Area Snail Roundup

$2,500 in Cool Prizes

**August 12 – 16, 2013**

Roundup Kick-off, August 12th
2 pm Belt Fairgrounds Pavilion

Daily Snail Weigh-in Station
August 13th-15th from 11 am-3pm

Roundup Finals, August 16th
11 am Final Weigh-in
2 pm Championship Awards

Let's Round 'em Up

Prizes will be awarded in two age categories (5-10 and 11-18). Grand Prizes include bike gift cards, iPad mini, Nintendo3DS, iPod's, and local gift cards.

Prize Recipients Must Be Under 19 Years Of Age • Waiver of Liability by Legal Guardian Required For Participation

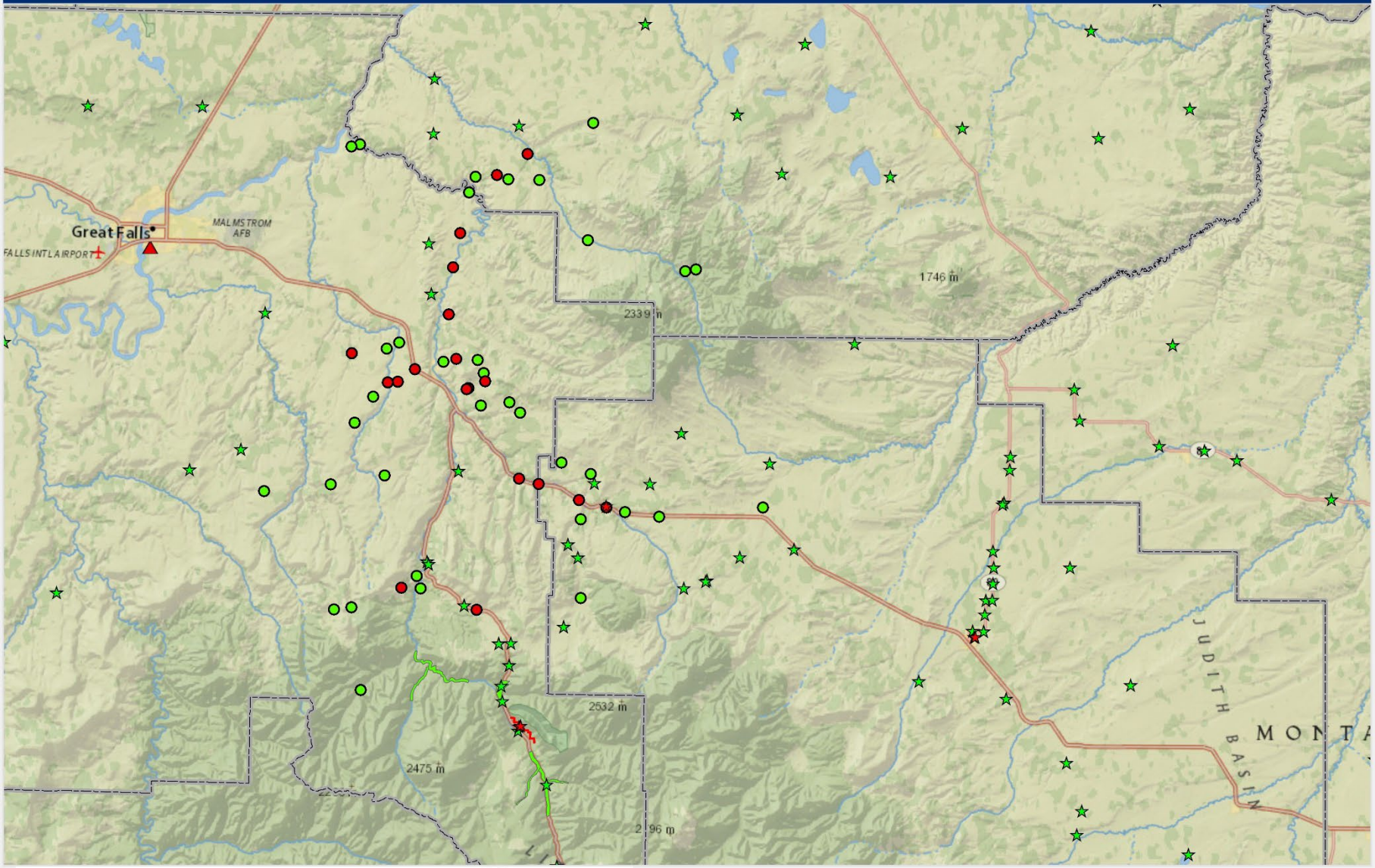
Montana Department of Agriculture
406-444-3790
agrpmb@mt.gov


Belt Area
Weigh Station


- 524.5 lbs of snails collected and destroyed
- ~ 625,000

USDA Animal and Plant Health Inspection Service
U.S. DEPARTMENT OF AGRICULTURE

Montana
# 2022 Xerolenta obvia Survey




**PPQ XO Survey**
Absent
Present

**MSU XO Survey**
Present
Absent

MDA Survey Present
USFS XO Survey-Present
USFS XO Survey-Absent
County Boundary

Data Source:
ESRI, PPQ

**Date Created:**
**10/20/2022**

USDA, APHIS, PPQ
5353 Yellowstone Rd. Ste 208
Cheyenne, WY 82009



Document Path: E:\Programs\Special\Incidents\Xerolenta obvia-MT_2022\MapFiles\XO_2022.mxd Coordinate System: NAD 1983 StatePlane Montana FIPS 2500 Feet

# Bash'Em Burn'Em Bait'Em

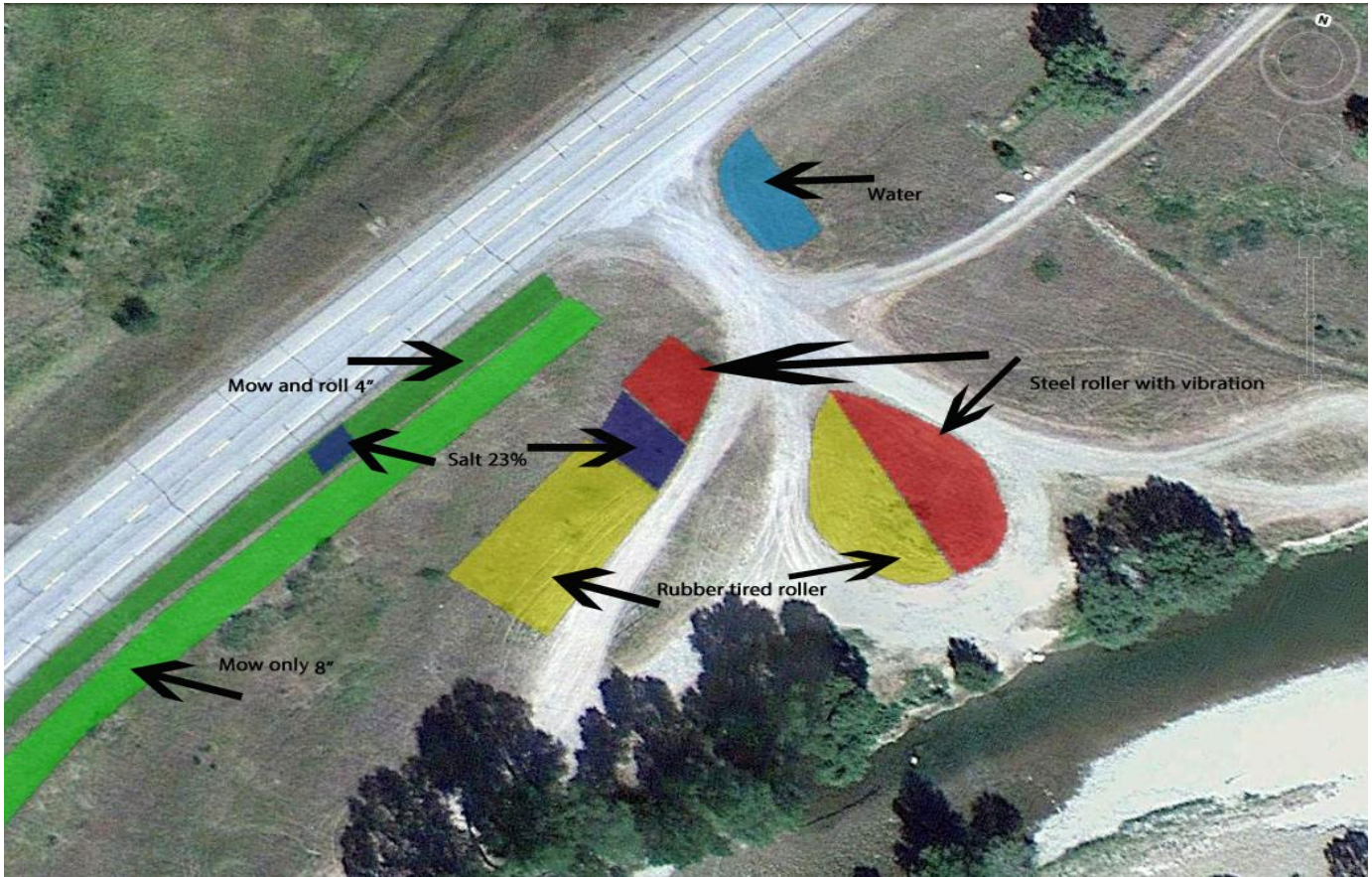
*Integrated snail management in crops and pastures*

# Treatment & Control

- Chemical Control (Molluscicides)
  - Iron Phosphate (organic) – limited affects
    Metaldahyde (liquid and baits)
  - Since Montana has few mollusk pests, most formulations are NOT labeled for use in the state (yet)
- Hand picking
- Mechanical:
  - rolling,
  - mowing,
  - cabling,
  - burning

# Treatment & Control

## Montana DOT mechanical treatment tests 9/20/2012 at Armington Junction



# Mowing and Rolling

4” cut and roll

8” cut

BEFORE AFTER

# STEEL ROLLER

# BEFORE AFTER

# Rubber tired roller


BEFORE AFTER

Artificial rain event

23% salt solution

# Inspect Equipment

# Planning

- MDA and Montana PPQ
- Assessing the distribution of the known population
  - Negative survey data to support export
- Montana State University Extension: basic biology, risk to Ag
- Outreach and Education
- Area landowners including DOT, DEQ and USFS, FWP
- MISC
- All actions are voluntary

# MSU Hilites.

- **Biology** is variable with time and location.
- **Climate** not a barrier.
  - Current habitat suitability models (Montana) could be refined and be made more predictive with additional information.
- **IPM** for management:
  - Prevention
  - Chemical,
  - Vegetation management,
  - Mechanical.)
- **Eradication** of outlining populations may be difficult.
  - Would require persistent effort.
  - Current management recommendations need refinement.
- **Education and outreach**
  - New populations,
  - Reduce its dispersal.
  - Partner with other invasive species outreach.
    - For example: cleaning equipment & vehicles to prevent the transports of snails to new areas is also pertinent to preventing the spread of noxious weeds.
- **Nuisance** now….
- **However**, as the snail increases its distribution, additional cropping systems may be exposed (e.g. pulse crops or canola).
- **Funding** (Sustainable long-term) for outreach and management for mollusk pests is limited and a low priority.

# Best Practices Guide

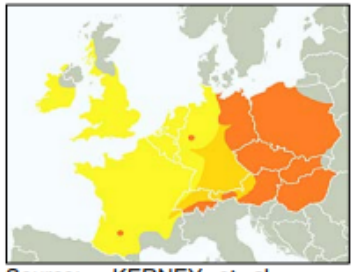
## Eastern Heath Snail

Terrestrial snail in the Hygromiidae family
Scientific Name: *Xerolenta obvia* (Menke)

**Description**: a little smaller than a dime (0.63" (16 mm) - 0.75 (19 mm) in diameter); white with dark brown spiral brown bands

**Hosts**: feeds on a wide range of plant species (254 genera). Is a known pest of alfalfa, clover, lupine, sanfoin, serradella (a legume), wheat, and barley. Observed locally on a wide variety of plant materials, e.g., grasses, ornamentals, trees (including fruit), shrubs and weeds.

**Biology & Behavior**: found in vegetation, under rocks, boards, and refuse. Known for climbing on vegetation, fence posts and other upright objects to escape high ground temperatures and will aggregate in enormous numbers in a behavior called massing. Snails survive long periods of dry conditions by withdrawing into their shells and sealing the opening with a mucous membrane. Reproduces in the fall in Europe (typically October and early November) but has been observed to have a spring and fall reproductive cycle in North America. Overwinters in the soil.



Source: KERNEY et al.

**Distribution**: southeastern and eastern Europe (Bulgaria, Czech Republic, Poland, Slovakia) and isolated populations in western Germany and southern France (depicted in orange). Established population in southern Ontario (Bethany in 1969 and 1972) and detected in Detroit, Michigan in 2001. Introduction and spread of snail populations is largely by anthropogenic means (man). Snails readily attach themselves to a variety of materials.

**Damage/Impacts**: feeds on plant material, reducing yields and lowering crop quality

- Contaminant in grains; products may be downgraded (e.g., malting barley to feed barley) or may be unacceptable to grain handling authorities
- Contaminate of fruits and vegetables
- Transmits spores of *Alternaria* sp., *Fusarium* sp., and *Phytophthora* sp. (plant diseases)
- Vector of animal diseases: *Protostrongylus rufescens* (sheep lungworm), *Davainea proglottina* (cestode), and *Dicrocoelium dendriticum* (trematode).

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# Best Practices Guide

- Description
- Hosts
- Biology and Behavior
- Damage/Impacts
- Sanitation
- Artificial Movement and Inspection
- Site/Vegetation management/Modification
- Treatments

# MISC

- **Science Advisory Panel**
  - Key Findings
  - Full Report
  - Recommendations from Panel
- **Economic Report**

# MISC

- **Science Advisory Panel**
  - Key Findings
  - Full Report
  - Recommendations from Panel

## Eastern Heath Snail - *Xerolenta obvia*

**Resources**

- Eastern Heath Snail Fact Sheet and Best Management Practices
- Science Advisory Panel Information
  - Key Findings
  - Full Report
  - Recommendations from Panel
- Eastern Heath Snail Economic Report
- Videos
  - MISC - Eastern Heath Snail
  - Snails in Australia

64 pages

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# MISC

- Science Advisory Panel
  - Key Findings
  - Challenges
    - Established
    - Spreading
    - Low priority
    - Research limited
    - Long-term
    - Moluscicides
    - Outreach

- **Science Advisory Panel**
  - **Key Findings**
  - **Recommendations.**
    - Research
    - Management Options
    - Treatment Options/labelling
    - Cooperative management Plan
    - Economic Impact Analysis
    - Outreach
    - Gravel
    - Funding
    - Non-Insect Importance

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# Next steps:

**Distribute information** generated from the scientific advisory panel to all interested parties including outreach networks, neighboring states, and impacted industries

**Engage regional coordinating bodies** for both impacted industries and invasive species coordinating bodies to assist in the promotion/implementation of the next steps identified by the panelists

**Support research** on both the biology of this pest and possible control strategies

Conduct an **economic impact analysis** and develop **education and outreach** materials

Encourage and support the **development of funding and regulations** for invasive gastropods (slugs and snails)

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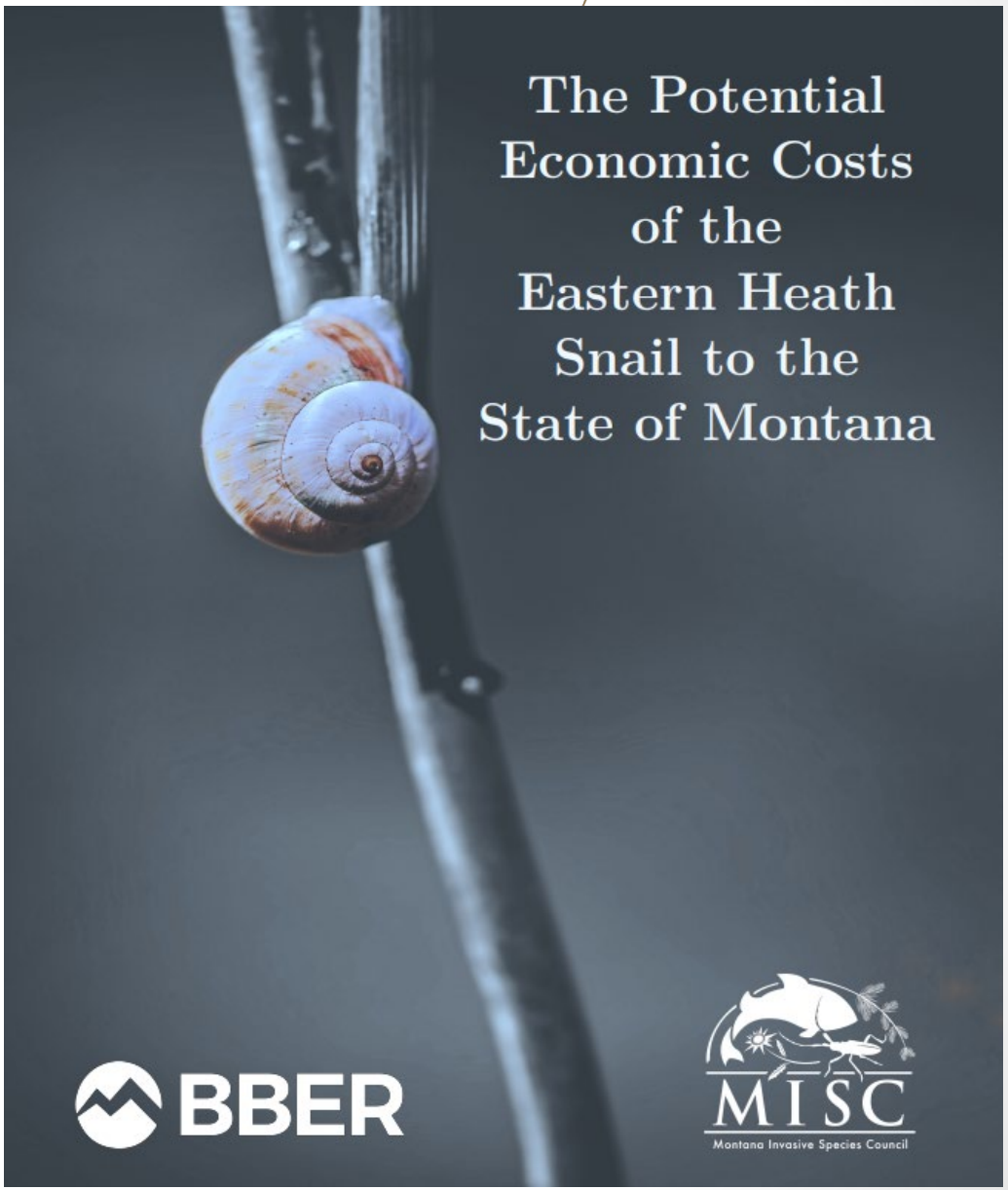
# MISC

## Economic Report



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# Estimating Populations

Figure 2.1: Submitted Observations: total 128

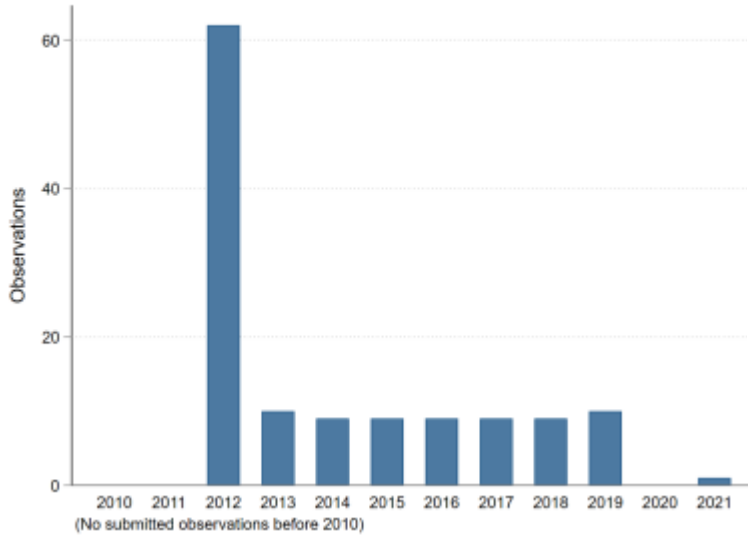
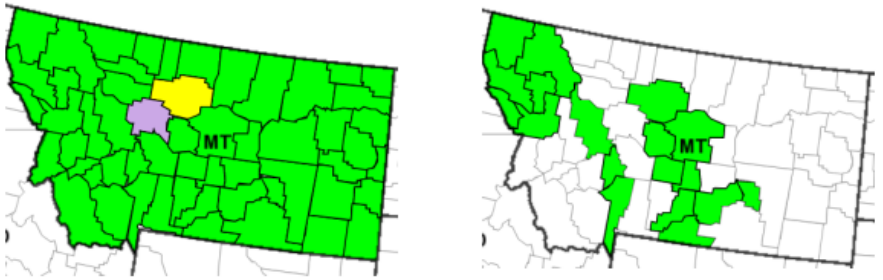



Figure 2.3: USDA Cooperative Agricultural Pest Survey

(a) 2012 (b) 2021




Note: Green = not found, purple = established by survey, yellow = found
(Source: Cooperative Agricultural Pest Survey (Center for Environmental and Research Information Systems (CERIS), 2012, 2020))

Figure 2.2: Observations in Montana Natural Heritage Program

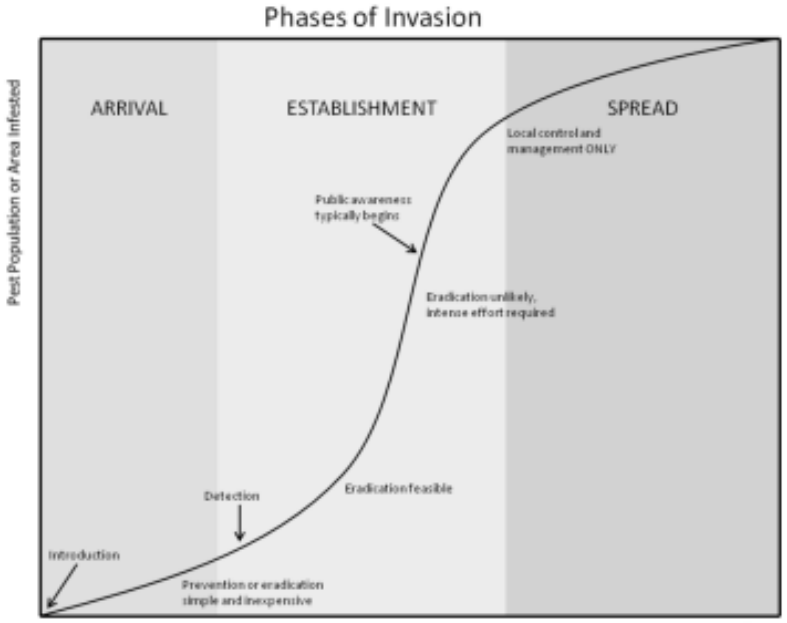
(a) Recency (b) Relative Density


(Source: Montana Natural Heritage Program, Montana Fish, Wildlife and Parks Montana Natural Heritage Program (2022))

## 2.1 Estimating the EH snail's habitat

### Phases of Invasion

Figure 2.4: Invasion function




Source: Alvarez (2016); Alvarez and Solís (2018)

### Logistics Growth Model

Figure 2.5: Snail population function

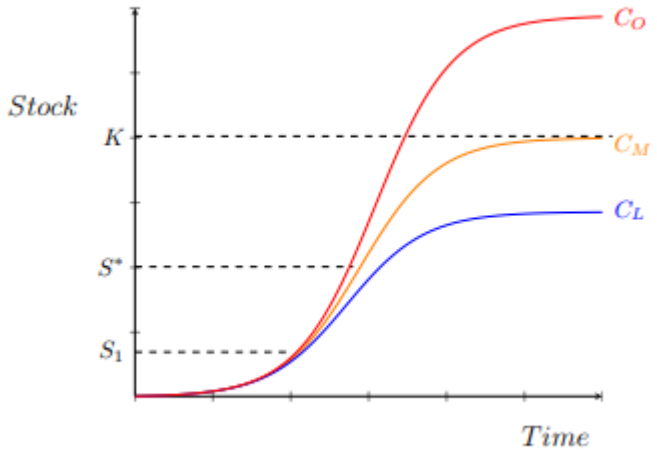
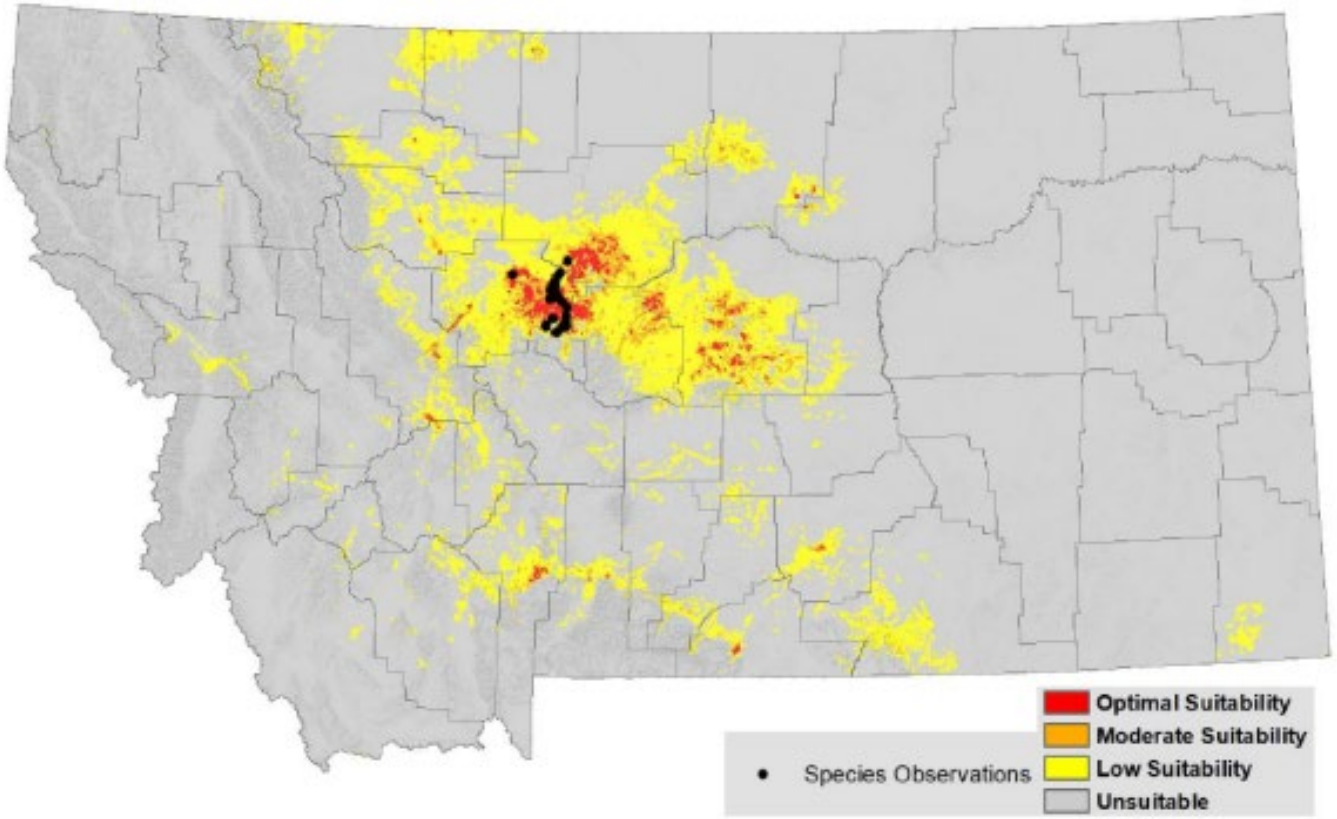


Figure 2.6: Statewide model output classified into habitat suitability

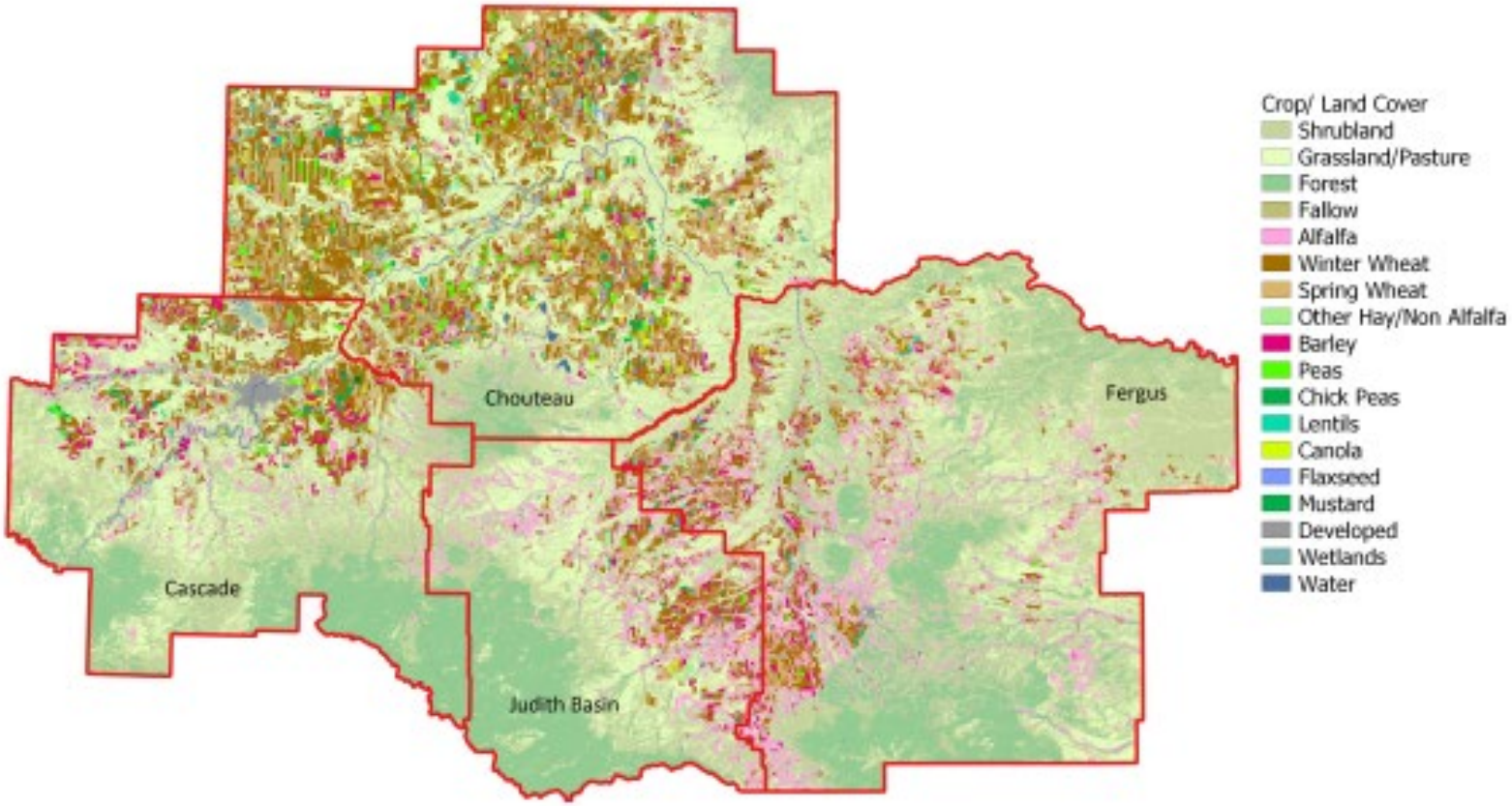



(Source: Burkholder (2022a))

Table 2.2: Habitat Suitability Logistic Thresholds

| | |
|---|---|
| Optimal ..... | 0.162 |
| Moderate ..... | 0.066 |
| Low ..... | 0.0003 |

Figure 2.8: Cropland in the four county region




(Source: USDA National Agricultural Statistics Service (2022) and BBER)

Figure 2.9: Cropland Snail Suitability

(a) Statewide Model

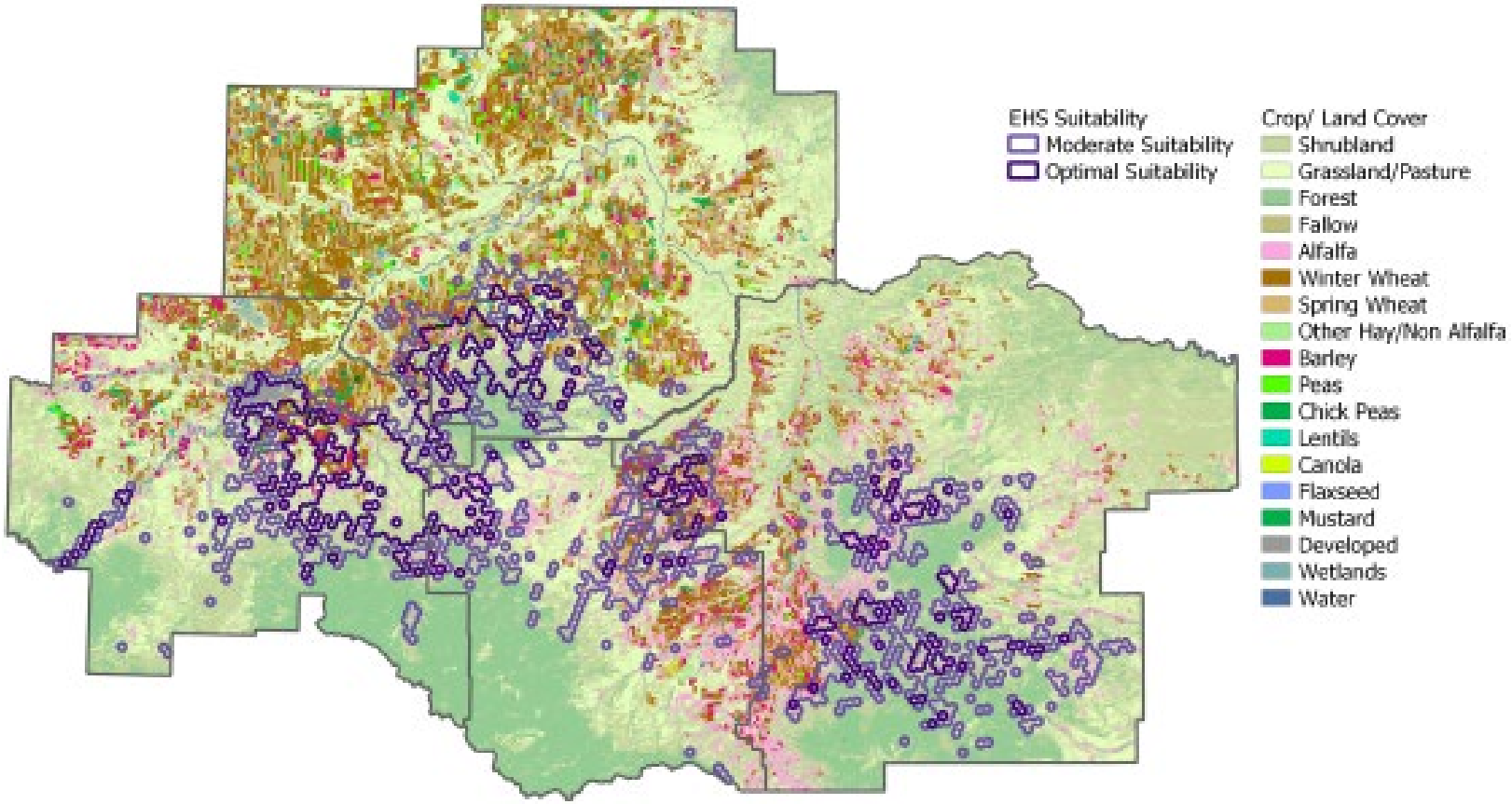
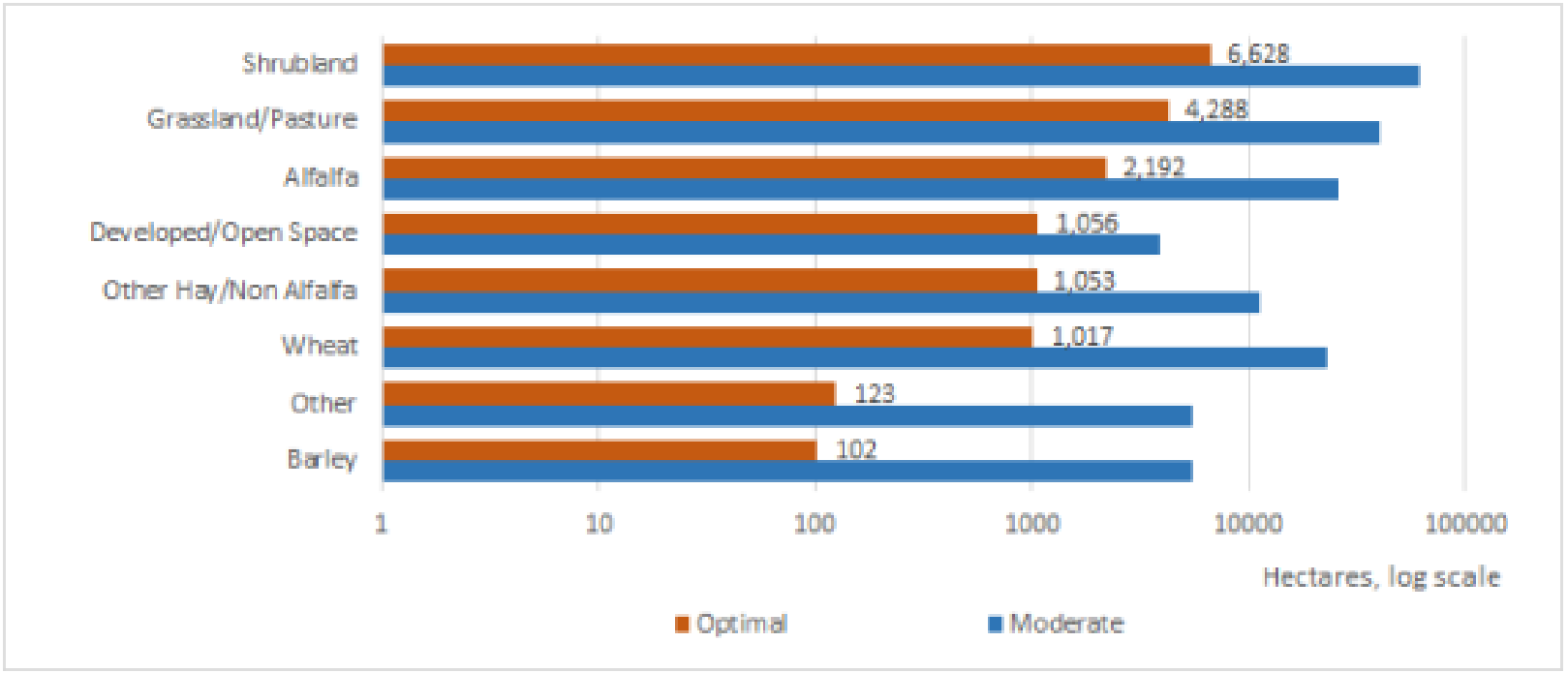


Figure 2.11: Habitat Suitability by Crop




(Note: Low suitability is excluded for clarity.)

Table 3.1: Potential average loss *per hectare*

| | AUD in 2013 | USD in 2021 | Percent of Canola | Cost of control 2021 USDs |
|---|---|---|---|---|
| Canola† | $5.51 | $4.78 | 100.0% | $27.19 |
| Lupine | $2.06 | $1.79 | 37.4% | $10.17 |
| Barley | $1.95 | $1.69 | 35.4% | $9.62 |
| Wheat | $1.86 | $1.61 | 33.8% | $9.18 |
| Oats | $1.41 | $1.22 | 25.6% | $6.96 |
| Cost pesticide | $12.00 | $10.41 | | |

(Source: Murray et al. (2013), FRED II, BBER. † numeraire crop.)

Table 3.2: Estimated costs of Eastern Heath Snail to Montana Agriculture

| Crop | Optimal | Moderate | Low | Total | Total less low suitability |
|---|---|---|---|---|---|
| | Hectares by crop | | | | |
| Barley | 101.9 | 5,504.9 | 23,923.1 | 29,529.9 | 5,606.8 |
| Other | 123.4 | 5,554.7 | 25,255.4 | 30,933.4 | 5,678.1 |
| Wheat | 1,016.6 | 22,841.0 | 103,754.1 | 127,611.7 | 23,857.7 |
| Other Hay | 1,053.1 | 11,340.9 | 27,195.3 | 39,589.3 | 12,394.0 |
| Alfalfa | 2,191.5 | 26,065.7 | 89,025.8 | 117,283.0 | 28,257.2 |
| **Total** | 4,486.5 | 71,307.3 | 269,153.6 | 344,947.3 | 75,793.7 |
| | Cost at USD27.19/hectare | | | | |
| Barley | $980 | $52,977 | $230,226 | $284,184 | $53,958 |
| Other | $1,254 | $56,472 | $256,758 | $314,484 | $57,726 |
| Wheat | $15,018 | $337,422 | $1,532,719 | $1,885,159 | $352,440 |
| Other Hay | $10,706 | $115,297 | $276,480 | $402,483 | $126,003 |
| Alfalfa | $59,593 | $708,800 | $2,420,860 | $3,189,253 | $768,393 |
| **Total** | $87,552 | $1,270,967 | $4,717,043 | $6,075,562 | $1,358,519 |

# Conclusion of Economic Analysis

- Four-county area: Cascade, Chouteau, Judith Basin, Fergus.
- Estimates across a range of crops and habitat suitability.
- $87,552: Loss to cropland in snail optimal habitat
- $6,075,000. Loss in all three types of habitat suitability. *

*This the projected cost of mitigation if the EHS reaches the habitat carrying capacity and represents an upper bound of the costs

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# Work Session #2: Quantify the Impacts of Invasive Species