Survey Objectives
1. determine if insects are established at the release site
2. measure the general size of biocontrol agent population
3. assess insects’ spread beyond the initial release site
4. quantify target weed species population and vegetation response at release site (measure changes over time)
5. note site characteristics at each location (identify characteristics which lead to insect population establishment/effectiveness)
6. establish permanent photo points at each release site (displays weed population changes over time)

Site Objectives
Choosing a site to monitor may be as easy as going to sites where releases have been made in the past or starting a new site. Your county weed coordinator will know where these sites are and where you can find access. It is best to take the person who released the insects with you to show you the exact release location. The release location is where you will set up and flag your photo points, and collect your data year after year.

Sampling
Site data is important because it reveals characteristics scientists use to compare diverse sites and learn which characteristics potentially lead to successful insect establishment. Site data includes information like which weeds are present, how much it rains each year, who owns the land, vegetation type (grassland, shrubland, cropland, coniferous forest, deciduous forest, riparian area, other), topography (valley bottom, ridge top, hillside with % slope), burn or treatment history, and the approximate size of target weed population (acres).

Establish or confirm the release site and flag it. Record GPS coordinates and legal description. All survey activities originate from these coordinates. Set up a photo point (see survey activities).

Measuring Noxious Weed Population
Three measuring activities are detailed on accompanying flash cards. Students will learn how to use two common measuring tools, the hoop ring to measure knapweed populations and the Daubenmire 20 x 50 cm frame to measure leafy spurge and Dalmatian toadflax.

Measuring Insect Population
Measuring insect populations requires a different method for each insect species surveyed. Insects are not all alike. They are not visible at all times of the year, nor are they visible at the same time of year every year. The time of year insects are visible is affected by biology, climate, precipitation, temperature, and site characteristics. Learn measuring methods using the survey activity flash cards for knapweed, spurge, and toadflax; and the Advanced Data Collection flash card.

Statewide Noxious Weed Awareness and Education Campaign
Montana State University Dept. of Land Resources and Environmental Sciences in cooperation with United States Department of Agriculture Animal and Plant Health Inspection Service Plant Protection and Quarantine

Why do we survey biological control release sites?

What tools do we need?

1-meter (36") diameter hoop ring

Sweep Net

Daubenmire frame (20 x 50cm)

What do we look at?

Site Characteristics
Insect Population
Weed Population
Photo Points
GPS coordinates

Why?

Invasion by plants such as spotted knapweed, leafy spurge, and Dalmatian toadflax, has been expanding and intensifying throughout the western United States. Biological control agents are one of the tools available to help manage these weeds. Once insects are released, follow-up surveys help us know if they survived and are doing their job, reducing weed populations.
When and what do we look for at release sites?

Spotted knapweed flower weevil
Larinus minutus

Leafy spurge flea beetle
The Aphthona species complex consists of six different species all with a smaller biology. The larval stage is the most destructive whereby the weevil on the plant are reportedly feeding no more than .5 cm (1.2 inches) and larvae tunnel within the stem as they feed, moving no more than .5 cm (1.2 inches) from where the egg was laid before pupating.

Dalmatian toadflax stem-mining weevil
Mecinus janthinus

Collect Site Data
(Enter your form for the field and collect this information)
Site Characteristics
Observe (your name)
Today’s date

Landowner (manager) ______
Permanent monitoring site? ___Yes ___No Site name
Target weed ______
Target biocontrol agent ______
Insect stage of growth ______
Location ______ Township ______ Range ______
Previous # of insects by species releases/dates ______

Hill Aspect (slope direction)
Topographic Type (valley bottom, ridge top, hill side, other) ______
Vegetation Type (shrubland, grassland, cropland, coniferous forest, deciduous forest, riparian, other) ______

Advanced Data Collection
Advanced Vegetation Cover
Measure vegetation in percentage of 100% cover inside the frame (round to .5%).
*T" means trace amounts less than 5%
__ frame (Daubenmire size, or loop diameter)
__ target weed percentage inside frame
__ other weed percentages by species
__ forb/shrub percentages
__ grass percentage
__ bare ground/plant litter percentage

Advanced Target Weed Size/Density
__ frame (which frame - Daubenmire size or loop diameter)
__ number of stems inside the frame
__ height of tallest stems (cm) inside the frame

Advanced Biological Control Agents

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Leafy spurge
Aphthona flava,
A. nigriscutis, A. lacertosa

Spotted knapweed
Larinus minutus

Dalmatian toadflax
Mecinus janthinus

Collect Site Data
Create your form for the field and collect this information
Site Characteristics
Observe (your name)
Today’s date

Landowner (manager) ______
Permanent monitoring site? ___Yes ___No Site name
Target weed ______
Target biocontrol agent ______
Insect stage of growth ______
Location ______ Township ______ Range ______
Previous # of insects by species releases/dates ______

Hill Aspect (slope direction)
Topographic Type (valley bottom, ridge top, hill side, other) ______
Vegetation Type (shrubland, grassland, cropland, coniferous forest, deciduous forest, riparian, other) ______

Advanced Data Collection
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Advanced Biological Control Agents

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How to survey leafy spurge/Dalmatian toadflax biocontrol agents!

Collect Site Data
(Creat your form for the field and collect this information)

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<th>Site Characteristics</th>
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<tbody>
<tr>
<td>Observer (your name)</td>
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</tr>
<tr>
<td>Today’s date</td>
<td></td>
</tr>
<tr>
<td>Landowner (manager)</td>
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<tr>
<td>Permanent monitoring site?</td>
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<td>Site name</td>
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<tr>
<td>Target weed</td>
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<td>Target biocontrol agent</td>
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<td>Insect stage of growth</td>
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<tr>
<td>Location: Sec., Township, Range,</td>
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Photo Points AND GPS

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Distance from release point

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Montana State University Dept. of Land Resources and Environmental Sciences
in cooperation with United States Department of Agriculture Animal and Plant Health Inspection Service Plant Protection and Quarantine

Weed Population

<table>
<thead>
<tr>
<th>Species</th>
<th>Adults</th>
<th>Feeding Damage</th>
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<tbody>
<tr>
<td>Aphthona lacertosa</td>
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<td></td>
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<tr>
<td>Aphthona nigricincta</td>
<td></td>
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<tr>
<td>Mecinus janthinus</td>
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</tbody>
</table>

Insect Population

Check for 5-minute timed plot (Mecinus)

Species | Adults | Feeding Damage |
---------|--------|----------------|
Aphthona lacertosa |      |                |
Aphthona nigricincta |    |                |
Mecinus janthinus |     |                |

Collect Site Data

Locations

- ___leafy spurge   ___Dalmatian toadflax

<table>
<thead>
<tr>
<th>Distance from release point</th>
<th>North</th>
<th>East</th>
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</table>

Aphthona nigriscutis
Aphthona lacertosa
Mecinus janthinus

What tools do we need?

- Photo Point Flags
- Camera
- Sweep Net
- Daubenmire frame (20 x 50cm)

STEP One

See Why do we survey biologic control agents

- Confirm the release site and flag it
- Set up a photo point
- Fill in “Site Characteristics” on the Card backside

STEP Two

- Measure leafy spurge along four transects radiating out from the release point
- Possible, place transects in cardinal directions (0, 90, 180 and 270 degrees)
- Drop the Daubenmire frame (20 x 50 cm) at 1, 5, 7, and 9 meters (total 20 measurement points per “mini-plot”) along each transect
- Collect leafy spurge plant measurements:
  - number of leafy spurge stems - (example, 14)
  - average leafy spurge plant height - (example, 4.5 cm)
  - percent of canopy covered by leafy spurge - (ex. 6%)

STEP Three

- Use the Alien Insect Flash Cards to identify the leafy spurge biological control agents: Aphthona flavia, A. nigricinctus, and A. lacertosa; or Dalmatian toadflax agent Mecinus janthinus
- Collect Aphthona spp. by sweep netting the adult beetles, where possible, along four 50-meter transects surrounding the insect release site at cardinal directions where possible
- Make four sweeps beginning one meter from the release point and repeated at two-meter intervals until five points have been sampled per transect
- Count the adult Aphthona spp. after each four-sweep sample
- Establish permanent photo points centered to each “mini-plot” along each transect
- Take photos from the plot center, two showing landmarks and four of weed populations, using cardinal directions where possible
- Be sure to show landmarks
- Collect Site Data
- SITE NAME ____________________________
- Forest/District/County ________________________
- Date ____________________________
- GPS POINTS AND PHOTO
  - Photo #      Degree               Comments
  -         |        |          |

STEP Four

- Collect Aphthona spp. by sweep netting the adult beetles, where possible, along four 50-meter transects surrounding the insect release site at cardinal directions where possible
- Make four sweeps beginning one meter from the release point and repeated at two-meter intervals until five points have been sampled per transect
- Count the adult Aphthona spp. after each four-sweep sample
- Count Mecinus janthinus adults by observation
- Observe the insects for five minutes at each “mini-plot” along all four transects
- For more advanced monitoring documentation go to the Advanced Data Collection flash card

Leafy spurge root/foliage weevils
Aphthona flavia, A. nigricinctus, A. lacertosa
Dalmatian toadflax stem-mining weevil
Mecinus janthinus

What tools do we need?

- Photo Point Flags
- Daubenmire frame (20 x 50cm)

Collect leafy spurge along four transects radiating out from the release point. Where possible, place transects in cardinal directions (0, 90, 180 and 270 degrees). Drop the Daubenmire frame (20 x 50 cm) at 1, 3, 5, 7, and 9 meters (total 20 measurement points per “mini-plot”) along each transect.

Collect leafy spurge plant measurements:
- number of leafy spurge stems - (example, 14)
- average leafy spurge plant height - (example, 4.5 cm)
- percent of canopy covered by leafy spurge - (ex. 6%)

Establish permanent photo points centered to each “mini-plot” along each transect. Take photos from the plot center, two showing landmarks and four of weed populations, using cardinal directions where possible.

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Count Mecinus janthinus adults by observation. Observe the insects for five minutes at each “mini-plot” along all four transects. For more advanced monitoring documentation go to the Advanced Data Collection flash card.

Site Name ____________________________
Forest/District/County ________________________
Date ____________________________
GPS POINTS AND PHOTO

Photo #      Degree               Comments
         |        |          |

Forest/District/County____________________
Site Name_____________________________
Date___________________

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</table>
How to survey spotted knapweed biological control agents!

What tools do we need?

**STEP One.** Confirm the insect release site and flag it. Set up photo points. Fill in “Site Characteristics” on the Card backside.

**STEP Two.** Spotted knapweed population is measured by dropping a “1-meter (36” if diameter) hoop ring at intervals of 2 and 5 meters (0° and 90°) along four transects radiating out from plot center. Where possible, run transects in cardinal (0, 90, 180, and 270°) directions from plot center. Collect plant data at each “mini-plot” identified by the ring, along all four transects.

- percent of ground covered by the target weed (spotted knapweed) - (example, 23%)
- average weed (knapweed) height - (example, 6.5 cm)
- total number of mature weed (knapweed) plants - (14)

**STEP Three.** Use the Alien Insect Flash Cards to identify three spotted knapweed biological control agents: Agapeta zoegana, Cyphocleonus achates, and Larinus minutus.

Collect Site Data

<table>
<thead>
<tr>
<th>Weed Population</th>
<th>Spotted Knapweed</th>
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<table>
<thead>
<tr>
<th>Species</th>
<th>Larvae Adults</th>
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<tr>
<td>Agapeta zoegana</td>
<td>Date</td>
</tr>
<tr>
<td>Cyphocleonus achates</td>
<td>Date</td>
</tr>
<tr>
<td>Larinus minutus</td>
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Insect Population

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<tr>
<th>Species</th>
<th>Larvae</th>
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<td>Larinus minutus</td>
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Weed Population

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</table>

Advanced Data Collection:

Use this card to experience using the loop for measuring and the sweep net for collecting and counting insects. Use the Advanced Data Collection Card instructions for collection and documentation when you want your data to conform with and be useful to other land management agencies.

Statewide Noxious Weed Awareness and Education Campaign

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