Standardized Impact Monitoring Protocol (SIMP) for Knapweed Seed Head Weevils (SHW) and Spotted Knapweed:

Overview:
A critical part of successful weed biological control programs is a monitoring process to measure populations of biological control agents and the impact that they are having on the target weed. Monitoring should be conducted on an annual basis for a number of years. The Idaho State Department of Agriculture, in conjunction with the University of Idaho, Nez Perce Biocontrol Center, and federal land management agencies, has developed the Standard Impact Monitoring Protocol (SIMP) below to enable land managers to take a more active role in monitoring the progress and weed control ability of the knapweed seed head weevils (SHW), which include *Larinus* spp. and *Bangasternus fausti*, in efforts to control spotted knapweed, *Centaurea maculosa*. This monitoring protocol was designed to be implemented by land managers in a timely manner while providing data which will enable researchers to better quantify the impact of SHW on spotted knapweed throughout the state.

Spotted Knapweed:
Spotted knapweed is an herbaceous, short-lived, perennial reproducing entirely by seed, producing up to 25,000 seeds per plant can remain viable in the soil up to 8 years. Flowers range in color from pink to light-purple and bloom from July to October. The bracts of the flower heads are black-tipped, giving the plant its characteristic "spotted" appearance. Seeds are brown to black in color, smooth, and less than 0.25 inch long. Stems are typically 2 to 4 feet tall with lower leaves that are deeply lobed and upper leaves that are more linear. Spotted knapweed prefers moist rangeland habitats, but is common in waste areas, along roadsides, and in pastures. To date, thirteen biological control agents have been approved for release for the knapweed complex, which includes spotted knapweed.

Knapweed Seed Head Weevils:
Knapweed Seed Head Weevils are abundant biological control agents that can utilize spotted, diffuse, and squarrose knapweeds. SHW overwinter as adults which emerge in the spring when they begin to feed on knapweed foliage. Females produce between 28 and 130 eggs which they lay in clusters in open flowers. Eggs hatch and larvae feed on seeds and receptacle tissue for about a month. Larvae construct cocoons within the seedheads using pappus hairs and pupate. Emerging

adults chew a characteristic round hole in the top of the cocoon that is visible when viewed from above (see picture).

Monitoring:
SIMP is based upon a permanent 20 meter vegetation sampling transect randomly placed in a suitable (at least 1 acre) infestation of spotted knapweed and sweep net samples of SHW. Annual vegetation sampling will allow researchers to characterize the plant community and the abundance and vigor of spotted knapweed. Sweep net samples of SHW adults will provide researchers with an estimate of SHW population levels.

Permanent Site Set-up:
To set up the vegetation monitoring transect, you will need: 1) a 25 x 50 cm Daubenmire frame made from PVC (preferred) or rebar, 2) a 20 m tape measure for the transect and plant height, 3) 10 permanent markers (road whiskers and 16 penny nails – see picture below), 4) a post (stake or piece of rebar) to monument the site (see pictures for examples of field equipment), and 5) 30-45 minutes at the site during the **3rd week of June**. To set up the transect, place the 20 m tape randomly within the infestation. Mark the beginning of the transect with a post. Place permanent markers every 2 m (for a total of 10 markers) beginning at the 2 m mark and ending with the 20 m mark on the tape measure. Place the Daubenmire frame parallel to the tape on the 50 cm side with the permanent marker in the upper left corner starting at 2 m (see pictures). **Refer to the data collection sheet for how to conduct monitoring.** Repeat the frame placement at 2 m intervals for a total of 10 measurements (one at each permanent marker).