Biological Control of Noxious Weeds

Using insects to manage invasive weeds

By Tim Seastedt, Ph.D.

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There are two types of biological controls out there. There are the fuzzy loveable kinds and then there is the kind I use.

Diffuse knapweed covers 3.2 million acres in the west. It is the target of extensive chemical use by public and private land managing agencies. In 1997, I went to the local county commissioners and said, in response to an aerial spray program, "Yes, you can kill this weed, but all the literature says it just comes back; so it is pretty much just treating the symptoms." They responded by challenging me to coordinate a test plot and show there is a way to control diffuse knapweed without chemicals, essentially telling me to prove that alternative activities work. As a field scientist, I said okay. We got 160 acres for our test plot and attempted a variety of non-chemical techniques. The one I want to briefly discuss is the addition of biological control insects.

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The gall fly, *Urophora quadrifasciata* and its sibling species, *U. affinis*, are probably responsible for 70% of seed mortality in diffuse knapweed. That is a lot but not enough to stop the weed. It was introduced by the Colorado Department of Agriculture in about 1988 in the Front Range and was essentially already out there when we started our study.

We introduced a beautiful little bronze beetle, *Sphenoptera jugoslavica*. It is a root feeder and attacks the rosettes of the knapweed plant. The combination of *Sphenoptera* and the gall flies elsewhere occasionally slows the growth of this plant; however, once you have a developed knapweed population, these two alone do not seem to reduce the populations of knapweed.

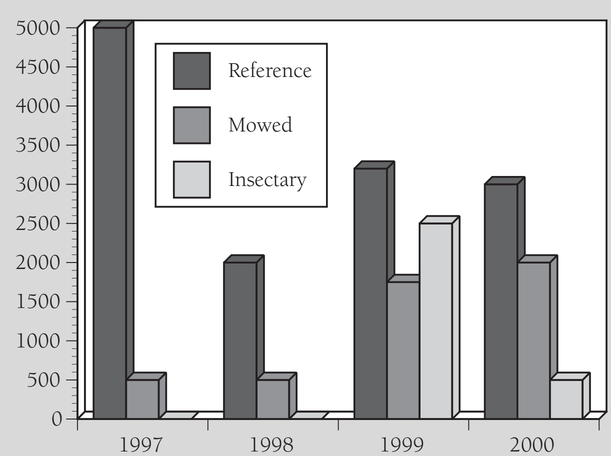
Therefore, we added *Cyphocleonus achates*. This insect is death to the plant and probably death to itself, as it eats it way out of food and home. *Cyphocleonus* has been established in low numbers. At these levels, we are still uncertain exactly how useful it is in stopping knapweed.

The last bug we added was the seed head feeder, *Larinus minutus*. This weevil makes its living by attacking and totally consuming the seed head. We added 200 of these in 1997. We estimate that there were about 20 million of these seed head feeders last year.

So how are we doing? The white bars (*see figure 1*) represent the insectary. We do have a reference or a control, but unfortunately, we were not quite smart enough to put our reference far enough from the insectary. Now our reference is being attacked by the insects as well. Nonetheless, if you use the reference data in the year 2000 we had fewer than 25% of the weed population that we had in 1997.

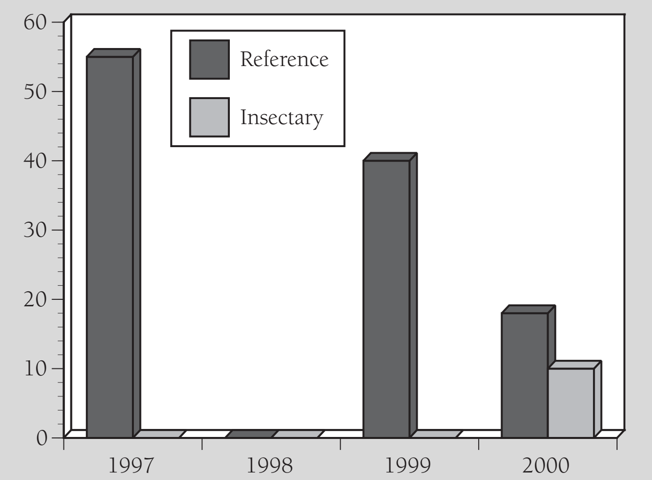
The insects are doing quite well. Rosette densities, which are an index of the future abundance of the plant, also showed remarkable reduction (*see figure 2*). Things are looking quite good.

Figure 1. Diffuse Knapweed



This and the following article is from Dr. Seastedt and Mrs. Lamming's transcript of the Alternative Weed Strategies *presentations at the Nineteenth National Pesticide Forum,* Healthy Ecosystems, Healthy Children, *Boulder, Colorado, May 18-20, 2001. For a videotape please send $12 to Beyond Pesticides, 701 E Street, S.E., Washington DC 20003.*

Figure 2. Rosette Densities



Here is what I predict in June of 2002. Our 20 million *Larinus minutus* are going to find only one million knapweed plants. The adults feed on the flowering knapweed before they begin laying eggs within the seed heads. These seed heads will then produce new weevils rather than knapweed seed. I have high hopes we will demonstrate control of this weed as of this year. There is an anecdotal account that says this is what is going to happen, but we are waiting to prove it.

This provides you with an example of how to develop a specific insect biological control program. The approach is particularly relevant to weeds that now occupy large areas and cannot be effectively controlled by other methods. We add a biological control food web, in this case a group of non-natives, and we want that group to stay and attack the invasive plant species, diminishing that population, allowing competition of the natives to become enhanced and slowly returning the system to some semblance of balance. You probably want to eradicate that species but in terms of threats to native biological diversity and loss of ecosystem values, if we can knock it back down we would succeed.

This summer we have two students to check the dash line (*see figure 3*) between the biological control food web and native plant species, to assess the extent to which the biological control might attack the native plant species. Because of the unique chemistry of diffuse knapweed, we doubt this will happen. Elsewhere, these insects have been around for an average of 20 years and have not been reported to harm other plant species. One student will check to see if these insects use other plants. The second student will study how native insect predators such as spiders feed on the introduced insects.

Summary

To briefly summarize this technique, biocontrol of invasive plant species is the only practical, feasible and sustainable solution that seems to be out there. "To claim that no risks are involved would be irresponsible, but these risks are small and must be weighed against those of alternative control methods, in a context in which ecosystems and livelihoods are being destroyed." (R.E. Cruttwell McFadyen, 1998)

Epilogue: *Dr. Seastedt and his students evaluated the plots this summer and found that the knapweed had totally disappeared from portions of the area. Overall, knapweed now constitutes less than 5% of plant cover. Knapweed seed production in 2001 was 2% of 1997 values. None of the introduced insects have shown interest in feeding on native plants. All five of the insects are doing well and are moving into adjacent pastures that were previously treated with herbicides that failed to control the knapweed.*

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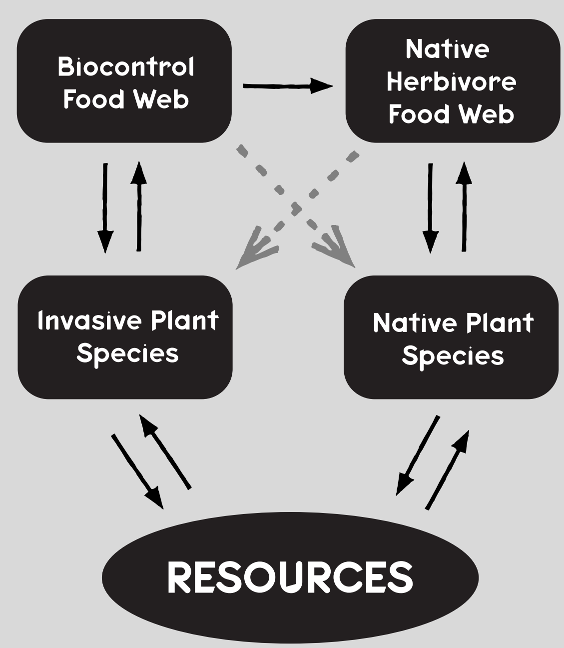
Figure 3: Biological Control Program



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