

a race for space, sunlight, nutrients and water. An extensive root system gives the plant a huge competitive advantage and makes consistent, long-term control difficult: Tap roots can exceed 20 feet in depth, storing reserves of nutrients to see the plant through hard times, while lateral roots form a network that enables the plant to rapidly reproduce and spread. And, perhaps worst of all, leafy spurge is highly adaptable and can invade – and thrive – in a variety of conditions and situations.

The economic and environmental impact of leafy spurge is significant. It invades grazing lands, reduces rangeland productivity and species diversity, threatens sensitive species, degrades wildlife habitat and reduces land values. Infestations in Wyoming, Montana and the Dakotas alone are estimated to cost agricultural producers and taxpayers more than **\$144 million a year** in production losses, control expenses and other impacts to the economy.

### Control Tools

A variety of tools can be used to manage leafy spurge. All of these tools can produce varying degrees of control; unfortunately, none offers “the perfect” solution.

**Herbicides** are the most commonly used control tool, and are the preferred tool for containing and preventing the spread of infestations. **Disadvantage:** Herbicides are expensive – the cost of treatment can exceed the value of the land and/or the economic return from the land. In addition, herbicides are not target specific and are subject to environmental restrictions.

**Multi-species grazing** can provide leafy spurge control while increasing ranch profitability by diversifying cattle grazing operations with sheep or goats. **Disadvantage:** Most ranchers do not have the equipment needed for sheep, or are not interested in sheep.

**Cultural & mechanical controls** such as reseeding, clipping and burning can be used to give desirable grasses and plants a competitive advantage while reducing leafy spurge’s dominance. **Disadvantage:** Cultural controls are generally not practical for large scale infestations, and no single tool offers the “perfect” solution.

### And in this corner...

Another tool that can be used to manage leafy spurge is biological control, which offers some advantages when

compared to “traditional” management tools.

- Biological control is **economically sustainable**. Leafy spurge biocontrol agents can usually be obtained or collected for free, and do not require a large investment of money or time to use or maintain. Other tools require a greater investment of resources.

- Biological control is **ecologically sustainable**. Once established, leafy spurge biocontrol agents are self-sustaining – they’ll always be there, working in the background to control leafy spurge. In addition, biocontrol agents are not known to cause any adverse ecological consequences. These factors make biocontrol an attractive alternative for long-term, sustainable leafy spurge management.

In addition, biocontrol works well when used with other tools in **Integrated Pest Management (IPM)** strategies. It can be used in areas that are environmentally sensitive or difficult to access with sprayers, and as such, can often provide the perfect compliment to other management tools.

But best of all, biological control is effective, affordable, sustainable, target specific and easy to use.

### Disadvantages

Biological control, like other management tools, is not a perfect solution to the leafy spurge problem.

The biggest drawback is that biological control is not a “quick fix.” In most cases, biocontrol agents will take several years to

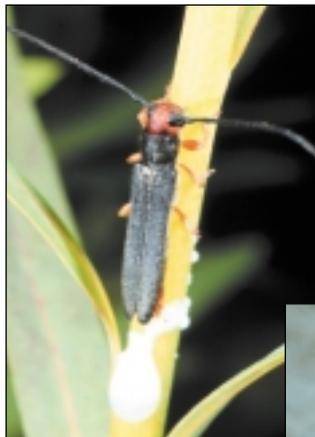
successfully establish a population and begin making a significant contribution to leafy spurge management.

In addition, no one biocontrol agent works in every situation. An agent that works well in one soil type, for example, may not work at all in another soil type. In the long run, more than one type of biocontrol agent may have to be used to achieve uniform control across a variety of different situations and land types.

### IPM, IPM and more IPM

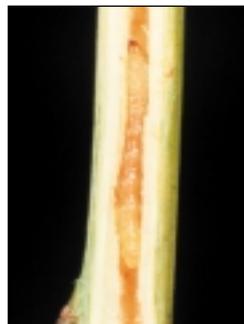
The best approach to controlling leafy spurge is **Integrated Pest Management**. It’s effective and affordable, and can be used anywhere.

IPM integrates, or combines, different management tools to provide more effective leafy spurge control than could be achieved by using any single tool. This integration offers the flexibility ranchers, landowners and land managers need to tailor management programs that fit their specific needs.



**The long horned beetle (*Obera erythrocephala*) could potentially be an important biocontrol agent in soil types where other agents do not seem to work.**

***Obera* causes damage in two ways: After the adult lays its eggs in leafy spurge stems (upper left), the larvae travels down the stem (upper right), weakening the stem, and into the root crown (lower right) where it feeds and causes additional damage. Researchers are now trying to establish populations throughout the four-state TEAM Leafy Spurge study area.**



**F**ifteen different insects have been tested and approved for leafy spurge, but the all-stars of the leafy spurge biocontrol effort have so far been *Aphthona spp.* flea beetles.

Adult flea beetles feed on leafy spurge leaves in the summer, but the most significant damage is caused by flea beetle larvae that feed on spurge roots. Feeding by both the adults and larvae stress the host plant. In addition, wounds created by the root-feeding larvae allow naturally occurring soil-borne plant pathogens to invade the plant and cause additional damage.

The combination of damage caused by the adults, larvae and pathogens results in thinner stands, shorter and weaker plants, delayed maturity and flowering, and decreased seed production. In short, the one-two punch provided by the insects and pathogens reduces the plant’s competitive advantage, causes increased plant mortality and gives native grasses and other desirable plants a chance to reestablish and thrive.

Flea beetles typically take several years to impact leafy spurge infestations, but the payoff can be well worth the wait. Researchers have documented leafy spurge canopy cover reductions of up to 95 percent and stem density reductions of 200-plus stems per square meter to fewer than five stems per square meter.



*Insect photos by R.D. Richard, USDA-APHIS*

**A**dult flea beetles, like *Aphthona lacertosa* (left) and *Aphthona nigricutis* (lower right), can be seen feeding on leafy spurge leaves in the summer. Most of the damage, however, is caused by root-feeding larvae (below). When flea beetles establish a population, the results can be impressive – this photo of

*A. flava* riddling a leafy spurge plant (lower left) is typical of what can be expected at a successful release site.

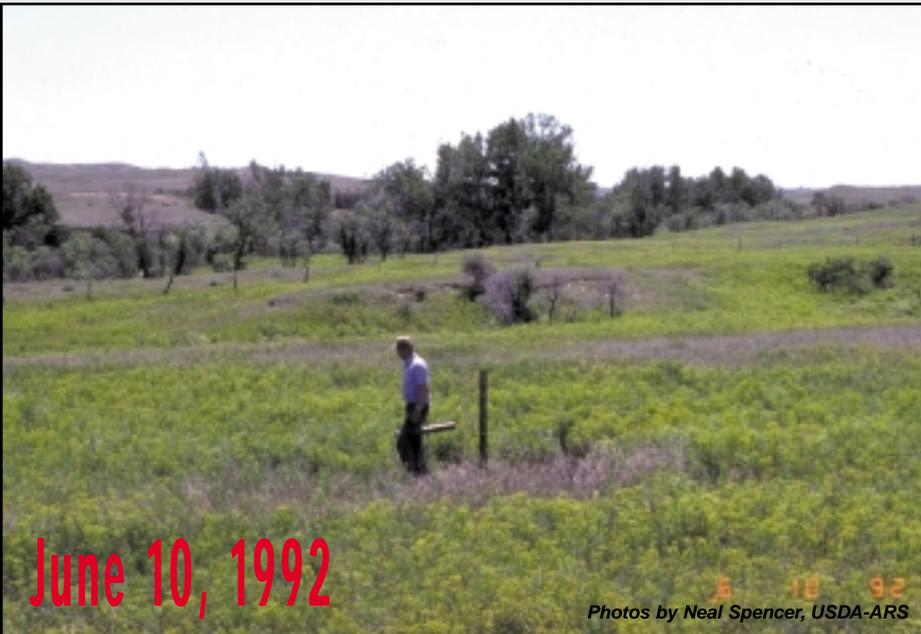
**B**iological control agents like the flea beetle form the cornerstone of TEAM Leafy Spurge’s **Integrated Pest Management** approach to controlling leafy spurge. By combining tools, ranchers,

landowners and land managers will be more likely to achieve effective, affordable and sustainable leafy spurge management.



**Bob Richard, director of the USDA-APHIS Biological Control of Weeds Laboratory in Bozeman, Montana, serves as TEAM Leafy Spurge’s Insect Biocontrol Operations team leader and as an ad hoc committee member. Bob’s efforts have helped bring biocontrol to the forefront of Integrated Pest Management of leafy spurge and other noxious weeds.**

Leafy spurge dominates this landscape one year after the release of *Aphthona* spp. flea beetles. A visible crater at the release stake, however, is evidence that the beetles are successfully establishing a population and beginning to work on spurge.



June 10, 1992

Photos by Neal Spencer, USDA-ARS



June 12, 1995

Three years later, native grasses and forbes are returning to the range as the flea beetles and spurge reach a natural balance. These photos are typical of the control that can be expected from successful releases of *Aphthona* spp. flea beetles.

Glenn Rugg, who runs cattle on a 14,000-acre spread in Fallon County, Montana, has tried it all when it comes to controlling leafy spurge.

After buying his ranch in 1941, Rugg

quickly recognized he had a serious problem with leafy spurge.

"When I looked down the road 20 or 30 years, I could see that spurge was going to take my place over," Rugg says. "I had to do something."

Now, after 50 years of fighting leafy spurge – the last 10 with leafy spurge flea beetles – Rugg is convinced that biocontrol is an essential component of any effort to effectively manage leafy spurge.

"I'm sold," he says. "A lot of people want spurge to disappear tomorrow, but that isn't going to happen. The flea beetles may take a while, but it's a permanent, long-term and low-cost solution."



## TEAM Leafy Spurge

is a USDA-Agricultural Research Service program focused on leafy spurge in the Little Missouri River drainage of Wyoming, Montana and the Dakotas. Its goal is to research, develop and demonstrate **ecologically based Integrated Pest Management** strategies that can be used to achieve **EFFECTIVE, AFFORDABLE** and **SUSTAINABLE** leafy spurge control.

TEAM Leafy Spurge is funded by ARS and managed cooperatively with the USDA-Animal & Plant Health Inspection Service. TEAM members include the U.S. Forest Service, National Park Service, Bureau of Land Management, Bureau of Reclamation, Bureau of Indian Affairs, U.S. Geological Service, state departments of agriculture and other state agencies, Cooperative Extension Services, land grant universities, county weed managers, and most important of all, private landowners and ranchers.

For more information about TEAM Leafy Spurge, IPM or biological control of leafy spurge, contact TLS program coordinator Chad Prosser, USDA-ARS Northern Plains Agricultural Research Laboratory, 1500 N. Central Ave., Sidney MT 59270 (406/433-9403; e-mail: [cprosser@sidney.ars.usda.gov](mailto:cprosser@sidney.ars.usda.gov)).

Written & designed by Steve Merritt, TEAM Leafy Spurge technology transfer specialist/Montana State University (406/433-9440; e-mail: [smerritt@sidney.ars.usda.gov](mailto:smerritt@sidney.ars.usda.gov)). Printed November, 1999.

USDA-ARS Northern Plains Agricultural Research Laboratory

# biological control and Leafy spurge

## What is Biological Control?

Biological control, or biocontrol, is defined as a reduction in the abundance or competitive advantage of a weed, insect or nematode pest through the action of natural enemies such as parasites, predators or pathogens.

The use of biological control is nothing new. The Chinese used predatory ants to control insect pests in stored foods and citrus groves 2,000 years ago, and numerous efforts of varied success followed. Biocontrol moved from Europe to the New World in the late 1700s, and was first used in the U.S. during the mid-1800s.

A lot has been learned about biological control over the years, but the reasons why people were interested way back then remain true today: Biocontrol is easy to use, inexpensive, self-sustaining and target specific.



Leafy spurge biocontrol agents

Fifteen biocontrol agents have been approved for use against leafy spurge. Different agents cause different kinds of damage to the plant.

*Spurgia esula* lays eggs in leafy spurge flowers, which produces a gall (upper left) that prevents seed production. In its larval stage, *C. carassicornus* (upper right) feeds on spurge roots. The colorful hawkmoth caterpillar (below) is a defoliator.



## Leafy Spurge

If you've had any experience with leafy spurge, you already know it's a pretty tough customer.

This exotic invader emerges early in the spring and gets a head start on other vegetation in (flip to next page)

TEAM Leafy Spurge: Working to Purge the Spurge