Host specific *Aphthona* flea beetles feed only on leafy spurge, and have been documented to reduce infestations by as much as 95 percent. Adults (left) feed on spurge leaves, but the most significant damage is caused by root-feeding larvae (below). The impact is obvious (right). Biological control is the foundation of TEAM Leafy Spurge's IPM approach – it's effective, affordable, ecologically sustainable, and easy to use and integrate with other management tools.

used and the results produced.

Research projects generally focus on gaining a better understanding of biological control agents. These studies will hopefully yield information on how biocontrol agents work, why they work in some situations but not others, how insects and pathogens can be used together, and how biocontrol agents can be best integrated with other control tools. Additional research is being conducted overseas, where entomologists are looking for new insects and pathogens to use against leafy spurge.

Results

• **Awareness**: By distributing information and participating in numerous public events (meetings, tours, etc.), TEAM Leafy Spurge has increased public awareness of the problem, the economic and environmental consequences, and possible solutions.

• **Understanding**: Ranchers, landowners and land managers are beginning to understand that no one tool will solve the problem and how available tools can best be integrated.

• **Networking**: One of TEAM's most enduring achievements is the creation of a vast network of "partners." This network has provided TEAM participants with a better understanding of how different management programs (local, state and federal) work and how they can best interact with one another.

• **Biological Control:** TEAM Leafy Spurge is proving that biological control **WILL** work, that it is an effective, affordable and ecologically sustainable way to manage leafy spurge. Flea beetles have reduced leafy spurge canopy cover and stem densities by as much as 95 percent at some sites; researchers are confident leafy spurge will never again be a problem at these sites.

Biological control takes time, but is clearly the preferred management tool of the new millennium. With that in mind, TEAM Leafy is working hard to distribute biocontrol agents, improve distribution systems and establish new release sites. More than 22 million leafy spurge flea beetles have been distributed to ranchers, landowners and land managers from 50 counties in seven states during the past two years, with more distributions planned for the future. These insects are being used to establish insectaries that can be harvested, redistributed and used to establish populations at new locations.

Expected outcomes

• Increased awareness and understanding.
• Increased implementation of IPM and biological control.
• Introduction of new biological control agents.
• Reduced reliance on expensive and environmentally taxing chemicals, and the subsequent development and distribution of information on alternatives to chemical control.
• Increased ranch profitability, and the subsequent protection of local and regional economies.
• The creation of relationships that will last beyond the life of TEAM Leafy Spurge and enable "partners" to more effectively combat other invasive weed and insect pests.
• A "library" of informational tools that can be used by ranchers, landowners, land managers and researchers.
• A user-friendly decision support system that can be used to determine reductions in range productivity, estimated costs and returns of various management strategies, and expected outcomes of using various management strategies.
• Database: The development of a comprehensive leafy spurge database that will allow researchers to plan strategies and quantify the reduction of leafy spurge infestations.

The "TEAM"

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• Lloyd Wendell, USDA-APHIS Mission Plant Protection Center (Mission, Texas)

USDA-ARS National Program Staff
• Robert Faust and Ernest Delfosse, USDA-ARS National Program Staff (Beltsville, Maryland)

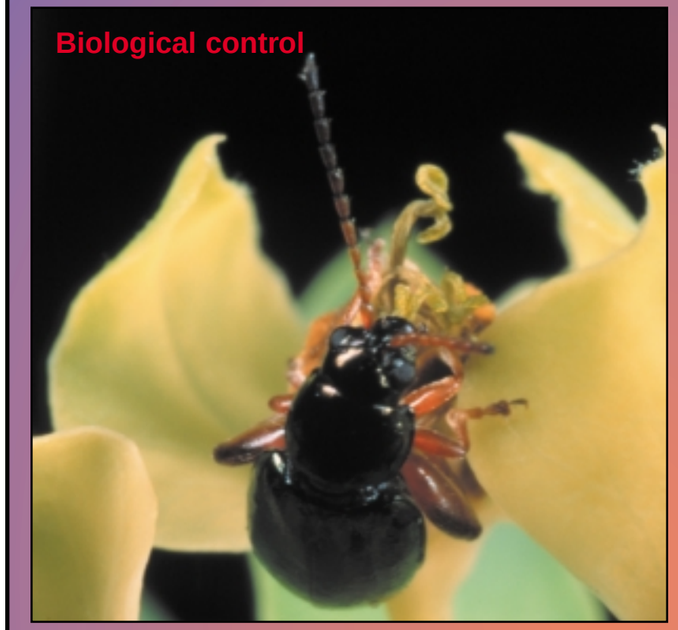
LEAFY SPURGE

Program Partners
• USDA-ARS
• USDA-APHIS
• National Park Service
• Bureau of Land Management
• U.S. Forest Service
• U.S. Geological Service
• Bureau of Reclamation
• Montana State University
• North Dakota State University
• South Dakota State University
• University of Wyoming
• Central Missouri State University
• State Departments of Agriculture (Montana, North Dakota, South Dakota & Wyoming)
• State Cooperative Extension Services
• State & local weed managers
• Private groups & organizations

And most of all...
• Private landowners & ranchers

For additional information...
Call 406/482-9403 or 406/433-2020, or see the TEAM Leafy Spurge website at www.team.ars.usda.gov

TEAM Leafy Spurge



An overview of the USDA-ARS TEAM Leafy Spurge area-wide program.

Area Wide

INTEGRATED PEST MANAGEMENT

A Success Story in Progress

Spurge timeline

1827 – First documentation of leafy spurge in U.S. (Massachusetts).
1876 – Leafy Spurge found in New York & identified as a "rare plant."
1881 – Leafy Spurge found in Michigan.
1913 – Leafy spurge recognized in at least four states and Canadian provinces.
1921 – Leafy spurge first labeled as a "weed" in a *New York Herald* editorial.
1933 – Leafy spurge occupies 19 states and several Canadian provinces.
1949-50 – Leafy spurge occurs in all Canadian provinces except Newfoundland.
1950s – Efforts to manage leafy spurge with herbicides begin.
1960s – Efforts to manage leafy spurge with biological control begin.
1964 – First leafy spurge biocontrol agent in U.S. (the *Hyles* hawk moth) is released.
1970 – Leafy spurge occupies 26 states.
1979 – First Leafy Spurge Symposium. Much of the framework for today's local, state and federal leafy spurge management programs was constructed at these annual meetings.
1979 – Leafy spurge occupies 30 states.
1985 – First *Aphthona* flea beetle (*A. flava)* released.
1988 – USDA-APHIS begins leafy spurge biological control program.
1989 – *Aphthona nigriscutis* approved and released.
1990 – Researchers determine that leafy spurge infestations double in acreage every 10 years.
1991 – Agricultural economists at North Dakota State University estimate direct and indirect economic impacts of leafy spurge at $144 million for North and South Dakota, Montana and Wyoming, or $167 per each lost AUM.
1993 – *Aphthona lacertosa* approved and released.
1996 – Proposal for TEAM Leafy Spurge area-wide program submitted.

1997

- TEAM Leafy Spurge is selected as a USDA-ARS area-wide program.
- Funding for the project is approved.
- TEAMwork: First agreements with program participants are signed.
- Leafy spurge occupies 35 states and several Canadian provinces; movement to the south and east is widely documented.
- Agricultural Economists at North Dakota State University estimate that leafy spurge infestations in the Dakotas, Montana and Wyoming will peak at 1.865 million acres, and that biological control programs could potentially control 65 percent of the estimated infestation.

1998

- TEAMwork: Fiscal agreements with 13 "partners" helps ensure teamwork, cooperation, and the sharing of data and resources. Seventy-three percent of TLS's total funding is spent on research and demonstration projects outside of the USDA-ARS.
- Extensive inventory and assessment data is collected at TLS research & demonstration sites.
- More than two million leafy spurge flea beetles are collected and redistributed to ranchers, landowners and land managers in the Little Missouri River drainage.
- TEAM Leafy Spurge "spreads the word" by participating in numerous meetings, tours and demonstrations.

1999

- TEAMwork: Fiscal agreements with 24 partners helps ensure teamwork, cooperation, and the sharing of data and resources. Sixty-eight percent of TLS's total funding is spent on research and demonstration projects outside of the USDA-ARS.
- TEAM Leafy Spurge hosts a major public awareness event, "Spurgefest '99," in Medora, N.D. Co-hosts include the USDA-ARS, USDA-APHIS, the National Park Service/Theodore Roosevelt National Park, the U.S. Forest Service, the Bureau of Land Management, the state of North Dakota and North Dakota State University.
- More than 20 million *Aphthona spp*. flea beetles are collected and redistributed to ranchers, landowners and land managers at Spurgefest and tours of TLS research & demonstration sites. Collectively, insects were distributed to more than 200 people from 50 different counties in seven states. Some people drive several hundred miles, spending as much as 13 hours on the road, to get flea beetles.
- Despite management efforts, data collected via GIS and GPS technologies suggests that leafy spurge is doubling in acreage every five years, more than twice as fast as previously documented.

The problem

Leafy spurge (*Euphorbia esula*) is an invasive exotic weed that infests more than five million acres of land in 35 states and the prairie provinces of Canada. It causes significant problems in the northern Great Plains by invading grazing lands for cattle and horses, reducing rangeland productivity and plant diversity, degrading wildlife habitat, displacing sensitive species and drastically reducing land values.

A native of Eurasia, where it is controlled by natural enemies, leafy spurge readily adapts to a variety of situations. It infests, and if not aggressively managed, can dominate landscapes ranging from open prairie and hillsides to riparian areas and lowlands. The deep-rooted and prolific perennial has doubled in acreage every 10 years since the early 1900s, and is expanding beyond its foothold in the western United States.

With a head start of more than 100 years before control efforts were initiated, leafy spurge is a tenacious opponent that cannot be eliminated or managed by any single entity or control tool. A collaborative, integrated, area-wide approach is essential to solving this costly weed problem.

So, does biological control really "control" leafy spurge?

These before-and-after pictures show what host-specific *Aphthona spp.* flea beetles, the most effective leafy spurge biocontrol agent to date, can do to leafy spurge infestations. TEAM Leafy Spurge promotes **INTEGRATED PEST MANAGEMENT** strategies that combines biological control with other leafy spurge management tools to provide effective, affordable and ecologically sustainable leafy spurge control.

The costs

The economic impact of leafy spurge is staggering. Infestations in the Dakotas, Montana and Wyoming alone are estimated to cost agricultural producers and taxpayers **$144 million a year** in production losses, control expenses and other impacts to the economy. **Every AUM (the amount of grazing required to sustain a cow/calf pair, or six sheep, for one month) lost to leafy spurge infestations costs $167 in lost economic activity.** Leafy spurge has literally forced some ranchers out of business.

Its impact, however, cannot be measured in dollars alone. Leafy spurge crowds out native vegetation, resulting in a monoculture that reduces biodiversity and threatens both abundant and sensitive species. The invasion of exotic weed species in national parks, wildlife refuges and other lands set aside for wildlife and recreation has, in fact, reached epidemic proportions. In addition, the most commonly used control tool – herbicides – often have adverse environmental consequences.

In short, leafy spurge is an economic and environmental catastrophe for ranchers, land managers and taxpayers in the U.S. and Canada.

A crucial component in TEAM Leafy Spurge's success is the ability to effectively **COMMUNICATE** and transfer technologies. Here, Jack Butler (right), a member of the TLS assessment & inventory team, explains range ecology and biological control to a cattle rancher from Montana.

The solution

TEAM Leafy Spurge is a USDA-Agricultural Research Service area-wide program focused on the Little Missouri River drainage of the Dakotas, Montana and Wyoming. Its primary goal is demonstrating ecologically based **Integrated Pest Management** (IPM) strategies that can be used to achieve effective, affordable leafy spurge control.

TEAM Leafy Spurge is built on three important concepts:

- Regional approach: As a USDA-ARS area-wide program, TEAM Leafy Spurge is evaluating the leafy spurge problem on a regional rather than a local, or place-by-place, basis. This area-wide approach ensures that techniques developed to manage leafy spurge will work across a wide area and not in just a single place.
- Integrated Pest Management: IPM combines different management tools to provide more effective leafy spurge control than could be achieved by using any single tool. Biological control is the foundation for TEAM's IPM approach: Biocontrol agents, like the host-specific leafy spurge flea beetle, are integrated with other management tools, such as herbicides, multi-species grazing programs, reseeding, tillage, burning and clipping, to achieve leafy spurge control. IPM offers the flexibility needed by landowners and land managers to devise different management strategies for different situations.
- Teamwork: TEAM Leafy Spurge has assembled an experienced group of researchers and land managers into a focused, goal-oriented team. The program's collaborative effort enables participants to share resources and expertise and more effectively work towards a common goal.

TEAM's team

TEAM Leafy Spurge is managed by the USDA-ARS in cooperation with the USDA-Animal & Plant Health Inspection Service. Team members include the Bureau of Land Management, U.S. Forest Service, National Park Service, Bureau of Indian Affairs, Bureau of Reclamation, U.S. Geological Service, state departments of agriculture and other state agencies, Cooperative Extension Services, land grant universities, county weed managers, landowners and ranchers. Several other cooperators also participate in the program by providing technical expertise and other essential resources.

A non-partisan ad hoc committee consisting of state and federal researchers, land managers, representatives from local, state and federal entities, and private landowners/ranchers provides management and direction.

How it works

TEAM Leafy Spurge gets funding from the USDA-ARS, which it invests in research and demonstration projects conducted by TEAM members.

Each year, potential program partners submit leafy spurge research and demonstration proposals to the ad hoc committee. Special consideration is given to projects that build on existing data and/or explore innovative methods of integrating control strategies. The committee discusses the proposals, offers suggestions or recommendations, then decides if funding should be allocated to proposed projects. About 80 percent of TEAM's annual funding is distributed to research and demonstration efforts being conducted at land grant universities and by local, state and federal researchers. Program participants often supplement the funding they receive from TEAM Leafy Spurge with additional funds from their own organizations.

Specific projects

TEAM Leafy Spurge research and demonstration projects are designed to build on existing data and explore promising areas of leafy spurge research. These projects cover a wide range of disciplines, including biological control with insects and naturally occurring plant pathogens, multi-species grazing and other range management techniques, the judicious use of herbicides, and the integration of various control tools.

Demonstration projects are geared towards showing ranchers and land managers how to use a certain management tool or combination of tools. Demonstration sites established at TEAM study areas give ranchers and land managers a hands-on opportunity to see the techniques being