

Managing Leafy Spurge

Tina Kadrmas, Undergraduate Research Assistant, University of Nevada, Reno
Wayne S Johnson; Associate Professor, Applied Economics and Statistics, College of Agriculture
Biotechnology and Natural Resources; IPM Specialist, University of Nevada Cooperative Extension

Leafy spurge (*Euphorbia esula*) is a deep-rooted perennial that originated in Eurasia. It was introduced to northeast North America as an ornamental in the early 1800's. It has spread very quickly and is now one of the most invasive weeds in the northern United States. Leafy spurge is capable of adapting to various environments. It has been found along riverbanks, in flood plains, pastures, vacant lots, on ridges and mountain slopes. It tolerates dry or moist climates and hot or cold temperatures.

Description and Habitat

In Nevada, leafy spurge is present in Elko, Humboldt, Washoe and White Pine Counties and is spreading rapidly. The plant grows from one to three feet tall. It goes dormant in late summer and winter, but resumes growth in fall and spring during favorable conditions. It is very deep rooted and persistent.



Figure 1. Bracts and flowers form in branched clusters at the ends of long, upright stems.

Leafy spurge survives in many soil types, especially after soil disturbance (Sheley et al., 1999). A single plant's root system can reach depths and widths of 30 feet or more. It spreads vegetatively, one to three feet a year. Secretions from the root called allelopathic chemicals slow or stop the growth of other plants. This allows leafy spurge to flourish. If the root is tilled or cut, each part of the root may grow into a new, independent plant. Leafy spurge seeds germinate in the early spring. Eradication of leafy spurge is difficult because its seeds can survive in soil up to ten years.

An adult leafy spurge plant has showy, yellow-green bracts that are often mistaken for the smaller flower located inside these bracts (Figure 1). Clusters of flowers are borne on erect stems that are branched at the top. Each stem originates from the crown of the plant. The stems contain a milky sap that is irritating to the eyes and skin.

Leafy Spurge Problems

Leafy spurge's adaptability to various climates, its extensive root system and its ability to produce many long-lived seeds make it difficult to control and eradicate. Its survival abilities and a lack of control have allowed leafy spurge to infest approximately three million acres in North America (Figure 2). Millions of dollars in forage and agriculture production are lost each year. In addition, lost recreation opportunities, damaged plant communities, reduced wildlife habitats and reduced species diversity are costly on the local and regional level.



Figure 2. Leafy spurge on rangeland

Leafy spurge withstands cultivation, mowing and grazing because of the food stored in its roots. Stored reserves allow for rapid recovery of the plant or, after tilling and cultivation, they allow the root pieces that are spread about to produce many new plants.

Cattle and horses avoid grazing leafy spurge unless it has replaced the native vegetation, leaving the animals with no other choice. Cattle and horses can experience scours or physical weakness and sometimes die as a result of ingesting large amounts of leafy spurge. In contrast, both sheep and goats eat leafy spurge, apparently without adverse affects.

As leafy spurge becomes more prevalent, wildlife is also affected. Native herbivores do not eat it. In addition, leafy spurge contributes to the decline or loss of native plants essential for wildlife forage and shelter.

The seeds of leafy spurge have great viability and longevity. Animals do not digest the seed. Consequently, seeds are spread through the dung of sheep, goats and wildlife, promoting the spread of leafy spurge.

Control Strategies

Many control methods are available to weed managers. Unfortunately, no single method eradicates or controls leafy spurge in one treatment. Management strategies must be conducted regularly and persistently over many years. By applying integrated control strategies, one can contain, reduce and eradicate leafy spurge.

Prevention of leafy spurge infestations is the most effective strategy available to the manager. This step in weed management is often overlooked until more costly control methods are needed. To

prevent seeds or plants of leafy spurge from entering an uninfested area, managers and landowners should:

- Purchase and use only certified weed-free seed and feed products. Use only grain, forage and feed mixes free of leafy spurge and encourage neighbors to do the same.
- Quarantine for three days and supply weed-free feed to animals before they are allowed an uninfested area.
- Clean all vehicles, including recreational, utility, and farm vehicles and equipment that move into uninfested lands or enter a property from places unknown. Insist that others managing and working in rights-of-way on, or adjacent to, uninfested areas do likewise.
- Monitor perimeter and susceptible lands yearly for infestations and eliminate them immediately. Coordinate with neighboring managers to detect and destroy early infestations.
- Seek legislative mandates for area-wide programming that includes education, detection and control of leafy spurge.

Biological weed control uses natural enemies of weed species. Much has been done in biological control of leafy spurge, but it takes years to produce results. Although biological agents feed on leafy spurge, they do not completely eradicate it.

Insects, pathogens and grazing animals, such as sheep and goats, have been used to manage leafy spurge. While costly to start, once biological control agents are established, they become a low cost, long-term means of management. Permits may be required to release biological control agents such as insects and pathogens.

Eight leaf beetles, four moths and five fly species are being tested or already have been released in the United States to manage leafy spurge. Three insects have been successfully used in Nevada with the goal of weakening leafy spurge, reducing root sprouting, and preventing seed production (Figure 3). Unfortunately, several of these predators only reproduce on specific biotypes of spurge, and not every predator will live on and infest every biotype. Likewise, environmental conditions may not favor the establishment of a particular predator at a site.

Figure 3. Minute spurge flea beetle (top).
Brown-legged leafy spurge beetle (center).
Defoliating moth (bottom).

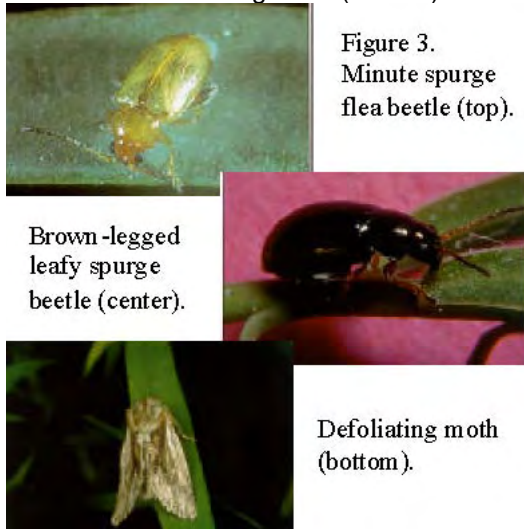


Figure 3.
Minute spurge
flea beetle (top).

Brown-legged
leafy spurge
beetle (center).

Defoliating moth
(bottom).

Photos courtesy USDA-ARS EBCL

- The minute spurge flea beetle (*Aphthona abdominalis*) has been released in Elko County and the brown-legged leafy spurge beetle (*Aphthona lacertosa*) has been released in Humboldt County. The larvae of both insects feed on the roots of leafy spurge, and the adults attack the foliage and flowers.
- A defoliating moth (*Simyra dentinosa*) has been released in Elko County. Moths feed on the leaves and flowers of the weed.

How well these species become established across Nevada, reproduce, and infest leafy spurge is yet to be determined.

The use of pathogens has been researched in other states. A native basidiomycete fungus inhibits root growth and makes the roots of leafy spurge more vulnerable to pathogenic soil organisms (Figure 4). In combination with leaf beetles, this fungus successfully controls leafy spurge in Montana. Various types of fungi, mildews and foliar pathogens are still being sought out and tested.

Grazing with goats and sheep can be effective if continued for more than five years. They prefer to graze on the soft spring plants. In many instances, grazing does not reduce an infestation, but keeps it from spreading. Grazing, combined with leaf beetle releases, has been effective in many locations.

Intense cultivation is effective. Light, periodic cultivation stimulates additional plants from the roots resulting in a denser stand. Cultivation every

two to three weeks for two years is quite effective in depleting the stored food reserves in the roots and killing the plants. A duckfoot cultivator adjusted to a depth of four to five inches, with the sweeps overlapping three to four inches, is recommended for cultivation. Cultivate every two weeks during the growing seasons and every three weeks when the plant is dormant.

Cultivation, followed by planting of competitive grasses, has been partially successful in some areas. Combine soil-stabilizing plants, including legumes, in the seed mix to prevent reinfestation of leafy spurge.

Burning has had little effect on the root system of leafy spurge. However, it does reduce the amount of seed available for germination. Spring or fall burns are best when trying to control seed production. Burning is most effective when used in conjunction with herbicides or grazing.

Mowing is ineffective when used alone. However, it does reduce seed production and dispersal and disrupts root vigor, making the plants more susceptible to pathogens. Mowing increases the effectiveness of herbicides by making the stand of leafy spurge more uniform, improving the coverage of the chemical treatment.

Herbicides should be applied with other methods of control such as grazing, mowing, burning or the use of biocontrol agents. For example, systemic herbicides that slowly kill the plant from the top down and not all at once as most contact products do, allow the leaf beetles to survive. Eventually the herbicide controls the root system too. This approach works best when applied in the early fall.



Figure 4. Biological control in action, leafy

Consult the label of any chemical for application rates, times and locations. Follow the label; it is the law. When applying herbicides to a leafy spurge stand, spray the product in a 15-foot radius outside the perimeter of the stand to kill any root seedlings present.

Picloram (Tordon 22K®) or formulations of picloram + 2, 4-D are the most commonly used chemicals on leafy spurge. Tordon 22K® is a restricted-use herbicide. A tank mix of picloram (1 pint per acre) with 2, 4-D (1 quart of a 4 pounds ai (active ingredient)/gallon product) applied during flowering (two weeks after development of yellow bracts) in the spring, repeated annually, is effective. In the fall, a mix of picloram + 2, 4-D (each at one quart per acre) results in greater control. This increased concentration may be more effective and reduce the need for multiple retreatments. Dicamba (Clarity®) may be used, but provides less control. Glyphosate (Roundup Ultra®) + 2, 4-D controls leafy spurge but unfortunately, grasses die too. Amine formulations of 2, 4-D are recommended for treatment among trees.

Do not apply herbicides in areas where non-target plants may be affected. Be cautious when treating stream banks and other areas near water. Follow the label instructions for applications near water. The following treatments are recommendations and should not be used if they conflict with label instructions. Always consider local environmental factors before applying chemicals.

- Aquatic Applications: Rodeo® can be applied at a rate of 0.75 lb ae (acid equivalent)/acre. Use 0.5-1% non-ionic surfactant for best results. Apply it as a split application 30 days apart in June and again in July when the plants are actively growing. Use a directed spray as Rodeo® nonselectively controls cattails, grasses, broadleaf weeds and shrubs. The 2,4-D amine formulation, Weedar 64®, can be applied next to water at the rate of 2 lb ai/acre when the plant is in the bud to early bloom stage.
- Pasture and Rangeland Applications: Apply Banvel® or Clarity® (4S) (dicamba) at a rate of 1 to 3 quarts of product/acre. Most 2, 4-D products are applied at a rate of 2 quarts of a 4EC 2, 4-D/acre or 2.7 pints of a 6EC formulation/acre. Perhaps the most effective, but restricted herbicide is Tordon 22K® (2EC).

This is effectively applied at a rate of 1 to 3 quarts product/acre. Apply Plateau® (2EC) (imazapir) at 8 to 12 fl oz/acre to control leafy spurge on rangelands. Apply Roundup® (4SC) at 1 pint (0.38 ae) + 1 pint 2,4-D (4EC) with 0.5 to 1% non-ionic surfactant/acre or Landmaster BW® (2.4SC) at 54 oz/acre. Roundup® (4SC) applied at 2 pints/acre, 30 days apart, in June and July is effective. The 1-pint treatment should be applied at 30-day intervals, June 1, July 1 and August 1. Roundup® is a nonselective herbicide, but the 1pint application may not kill some perennial grasses; the 2-pint application will. For dense monocultures of leafy spurge, make the application at the higher recommended rate.

Revegetation of areas that were inhabited by leafy spurge is essential. Including plants in the seeding that grow in the spring, summer and fall is necessary to out compete leafy spurge for nutrients and water. In a North Dakota study, the following species were competitive with leafy spurge (Table 1). Unfortunately, similar trials have not been conducted in Nevada. Whether or not these or other grass varieties will help manage leafy spurge in the Great Basin is not known.

Name	% Control of Leafy Spurge
'Bozoisky' Russian wildrye (Psathyrostachys juncea)	40
'Manska' pubescent wheatgrass(Agropyron intermedium subsp. barbulatum)	70
'Rebound' smooth brome(Bromus inermis)	80
'Rodan' western wheatgrass (Pascopyrum smithii)	70
'Arthur' Dahurian wildrye(Elymus dahuricas)	80

Cooperative Extension County Offices:

Carson City/Storey County

2621 Northgate Lane, Ste. 15
Carson City, NV 89706
(775) 887-2252

Churchill County

111 Sheckler Road
Fallon, NV 89406-8951
(775) 423-5121

Clark County

2345 Red Rock St. Suite 100
Las Vegas, NV 89146-3160
(702) 222-3130

Northeast Clark County

1897 N. Moapa Valley Blvd.
P.O. Box 126
Logandale, NV 89021-0126
(702) 397-2604

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P.O. Box 338
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1329 Waterloo Lane, Gardnerville
(775) 782-9960

Elko County

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Elko, NV 89801-5032
(775) 738-7291

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701 South Main Street
P.O. Box 613
Eureka, NV 89316-0613
(775) 237-5326

Humboldt County

1085 Fairgrounds Road
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(775) 623-6304

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815 North Second Street
Battle Mountain, NV 89820
(775) 635-5565

Lincoln County

360 Lincoln Street
P.O. Box 728
Caliente, NV 89008-0728
(775) 726-3109

Lyon County

504 South Main Street
P.O. Box 811
Yerington, NV 89447-0811
(775) 463-6541

Mineral County

314 5th Street
P.O. Box 810
Hawthorne, NV 89415
(775) 945-3444

No. Nye County

Old Court House
#1 Frankee St.
P.O. Box 231
Tonopah, NV 89049-0231
(775) 482-6794

So. Nye County

1651 E. Calvada Blvd.
Pahrump, NV 89048
(775) 727-5532

Pershing County

810 6th St.
P.O. Box 239
Lovelock, NV 89419-0239
(775) 273-2923

Washoe County/Incline Village

P.O. Box 8208
865 Tahoe Blvd., Ste 110
Incline Village, NV 89452
(775) 832-4150

Washoe County/Reno

5305 Mill Street
P.O. Box 11130
Reno, NV 89520-0027
(775) 784-4848

White Pine County

995 Campton
Ely, NV 89301-0210
(775) 289-4459

References

- 1) Bossard, C.C., J.M. Randall, and M.C. Hoshovsky. 2000. Invasive Plants of California's Wildlands. University of California Press. Berkeley, CA. pp. 188-193.
- 2) Bussan, A.J., S.A. Dewey, M.A. Trainor and T.D. Wilson (eds). 2001. Weed Management Handbook 2001-2002. Extension Services of Montana, Utah and Wyoming. pp. 209, 265- 266.
- 3) Sheley, R.L. and J. K. Petroff. 1999. Biology and Management of Noxious Rangeland Weeds. Oregon State University Press. Corvallis, OR. pp. 249-260.
- 4) Knight, J.B., T. Stevenson, and R.E. Wilson. 1997. Biological Control of Invasive Range Weeds in Nevada. University of Nevada Cooperative Extension. Special Publication 97-03.

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