



## VEGETATION MANAGEMENT GUIDELINE

Leafy Spurge (*Euphorbia esula* L.)

### SPECIES CHARACTER

#### DESCRIPTION

Leafy spurge is a deep-rooted, erect, branching perennial that can be up to 0.9 m (3 feet) tall, but is often unbranched and shorter. The cauline or stem leaves are linear or lance-shaped, 3 – 7 cm (1 1/8 – 2 3/4 inches) long and rounded at the distal end. The greenish-yellow inflorescence of leafy spurge is borne in an umbel and typically blooms from May-October. Each umbel supports 7 - 10 groups of inconspicuous flowers subtended by conspicuous large petal-like greenish-yellow bracts. The pale green or bluish-green leaves of leafy spurge are linear to lance-shaped, 3 – 8 cm (1 1/8 - 3 1/8 inches) long, 3 – 8 mm (1/8 – 3/8 inch) wide and usually alternate on the stem in a spiral arrangement. Leaves turn reddish-bronze in the fall. Leafy spurge has a sticky, milky white sap that can cause blisters in humans, horses, and cattle.

#### SIMILAR SPECIES

The features that distinguish leafy spurge from other plants are the greenish-yellow inflorescence, leaves with a bluish-grey cast, and milky-white sap that flows readily upon injury to the plant. Cypress spurge (*Euphorbia cyparissias*) has similar flowers and characteristics, but cypress spurge is generally a shorter plant and has narrower linear leaves. Cypress spurge can also be aggressive and should be controlled early if possible. Leafy spurge should be accurately identified before attempting any control measures. If identification of the species is in doubt, the plant's identity should be confirmed by a knowledgeable individual and/or by consulting appropriate manuals or keys.

#### DISTRIBUTION

Native to Europe and temperate Asia, leafy spurge currently is found throughout the world with the exception of Australia. It was probably introduced into the United States as a contaminant in imported grain. Since its invasion, the plant has become a serious management problem, particularly for the north and central plains states. It currently inhabits about three million acres of rangeland in the U.S. It is considered a Noxious Weed in 21 states. This plant is recorded from at least 21 counties in the northern half of Illinois.

#### HABITAT

This deep-rooted perennial plant is adapted to a wide range of open habitats ranging from flood plains and riverbanks to grasslands, ridges and mountain slopes and a variety of soil moisture conditions from moist to very dry. However, leafy spurge is especially aggressive in very dry situations where competition from native species is less intense. Areas most vulnerable to leafy spurge infestation include pastures, roadsides, abandoned fields, railroad ballasts, and disturbed and undisturbed mesic to dry prairies. It has even been known to encroach upon wet prairie communities.



## LIFE HISTORY

Leafy spurge reproduces readily from seed and seeds remain viable in the seedbank for an average of eight years. Peak period of seed germination occurs from late May to early June in northern climates, but some germination can occur any time adequate soil moisture is available. Optimal temperatures for seed germination are from 20° to 30° C (68° to 86° F). Leafy spurge seedlings are poor competitors with mortality around 80 percent, but survivors grow rapidly, becoming highly competitive within four months. Seedling roots can grow downward as much as one meter (three feet) and spread laterally up to 102 cm (40 inches) in only four months.

In established stands, leafy spurge emerges in the early spring when temperatures fluctuate around freezing. New growth at this time may be deep red or purplish in color. As the temperature rises, the stems grow rapidly and, if the plant is over a year old, flowers may appear as early as May. Flowering is usually completed by mid-July with seeds developing 20 to 30 days later. Each stalk may produce and disperse over 200 seeds.

When the seeds are mature, leafy spurge disperses them by explosive ejection from the seed capsules that can expel seeds up to 15 feet from the plant. Seeds can also spread after becoming attached to individuals' clothing or muddy boots, the coats and muddy feet of animals, or after ingestion by animals. The seeds float on water, often resulting in new infestations along ditches, rivers and in areas that are periodically flooded. Seeds and sometimes pieces of roots can contaminate crop seed and feed grain or hay.

In spite of this impressive germination rate (60 - 80%), the key reproductive capabilities of leafy spurge remain underground. Roots are woody, tough, and can reach depths up to 4.5 m (15 feet), with a lateral spread of up to 11 m (35 feet). Vegetative reproduction from both crown buds and root buds explain not only the persistence of this weed, but the difficulties encountered in eradicating it as well. Even if the foliage of the plant is removed or destroyed, the living root tissue will regenerate new shoots that can emerge from buds located anywhere along the length of the root. It apparently has the ability to purge undesirable chemicals from the root system in approximately the top 45 cm (18 in) of the soil, allowing the remaining portion of the root system to regenerate as soon as the effect of the chemical in the soil has dissipated.

## EFFECTS UPON NATURAL AREAS

Leafy spurge is an aggressive invader and once present can completely overtake large areas of open land. In natural areas, leafy spurge quickly displaces native vegetation, reduces species diversity, and degrades habitat for wildlife. It has the ability to displace native grasses and forbs in the course of only a few years. It also appears to be allelopathic (roots produce chemicals that suppress adjacent vegetation). 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.

## CURRENT STATUS

Leafy spurge has not yet heavily invaded Illinois. However, it is an aggressive invader in Wisconsin and infests highway and utility right-of-ways just north of the Illinois border. Scattered populations (some very large and dense) have been documented along highways and in natural areas in some portions of northern Illinois and pose a serious threat if left unchecked. Early detection and control will reduce the need for large-scale, expensive control in the future.

## CONTROL RECOMMENDATIONS

Leafy spurge is well established and tenacious in the central plains states. The best defense is prevention or early detection and immediate control. Most agree that the key to stopping this pest revolves around the ability to destroy its extensive root system. The most effective management scheme seems to be a combination of early summer mowing to prevent seed production, followed by a fall herbicide application, and enhancement of the grass population. It is important to remember that the sooner you attack leafy spurge, in its first year if possible, the better the chances of controlling it. Small patches and edges of larger infestations should be treated first to prevent further spread. Early infestations of leafy spurge can be controlled in one or two years, but long established populations require long-term persistent management. NOTE: When trying to control this plant, it's important to remember that if it has been present in an area for a number of years, re-sprouting will occur from fragments of root stock and the seed bank. Re-application of herbicide is likely to be necessary. This is NOT an indication that the treatment has failed. A rule of thumb is that for every year the plants have been there, 2 years of herbicide control will be needed.

## RECOMMENDED PRACTICES IN HIGH QUALITY NATURAL COMMUNITIES

### Chemical control

Timing is critical to the success of herbicide control. Fall applications should be preceded by spring mowing to prevent seed production. Often, there are several small non-flowering plants scattered around patches of flowering plants which are difficult to see. Since these are probably connected via an extensive root system, management activity should extend beyond the area of obvious infestation.

Personal experience indicates imazapic (trade name Plateau) effectively controls leafy spurge in one application in small, new infestations, but will take repeated annual application in long established infestations. It is selective and should not kill cool season grasses if applied correctly. Plateau is not available except through state contract due to manufacturer's restrictions. State (IDNR, INPC, IDOT), county, and municipal agencies can get this product through the state contract and may have a supply for use in natural areas. If available, apply Plateau at 0.2% active ingredient solution in water with 0.5% (0.6oz / gal.) methylated seed oil. Plateau should be applied in mid-September for best results as control may drop 50 percent or more if Plateau is applied in August or late October. Plateau should be applied when the plant is still green but nearing the winter period of natural dieback. When using Plateau, be careful not to overlap spray or over-spray as brown-outs and non-target damage will result. NOTE: Plateau is NOT approved for over water application.

A foliar application of 0.4% active ingredient triclopyr (Garlon 3A, Tahoe 3A) in the spring prior to seed production will top kill the plants and prevent seed production but will not kill the extensive root system. Repeated applications will be necessary to achieve only limited control.

Do not treat under poor growing conditions such as drought stress or insect damage as reduced control may result. Try to avoid contacting non-target species as native non-target plants will be important in re-colonizing the site after leafy spurge is controlled. Apply the herbicide with a hand-sprayer until the spray coverage is uniform and complete, but **do not**

**spray so heavily that herbicide drips off the target species.** The herbicide should be applied while backing away from the area to avoid walking through wet herbicide. By law, herbicides may only be applied as per label instructions and by licensed herbicide applicators or operators when working on public properties.

#### Burning

Burning alone will not eradicate leafy spurge. Leafy spurge stem density may increase after burning as stems will sprout from buds along the extensive rhizome and root system after top-kill by fire. However, burning can be effective if used in conjunction with other control methods. Burning can result in uniform regrowth that may make herbicide applications more effective and stimulate stem development from root buds to make the colony more susceptible to herbicides. Burning can also reduce litter making leafy spurge plants easier to find and increase vigor and competitiveness of native species.

#### Seeding with native non-invasive plants:

Seeding with native grasses will help reduce available space for leafy spurge to establish and will assist in the long-term control of the plant. When seeding in high quality areas, seed should be collected from site where the seeding will occur. Do not seed directly into areas recently treated with herbicide.

#### RECOMMENDED PRACTICES ON BUFFER AND SEVERELY DISTURBED SITES

Same as above with additional recommendations as noted below.

#### Chemical

The non-selective herbicide glyphosate (Roundup or equivalent), sprayed on leafy spurge foliage as a 2.5% active ingredient solution will provide 80 to 90% top growth control if applied between mid-August and mid-September. For areas near water, glyphosate formulations, such as Rodeo, are approved for use over water is necessary. Rodeo will provide 80 to 90 percent leafy spurge control when applied from mid-July to mid-September. A non-ionic surfactant approved for aquatic sites should be added to the spray solution for best results. Keep in mind, this will only top-kill the plant and the late season application is too late to stop seed production. Glyphosate will not eliminate older infestations.

An evaluation of the combined effect of herbicide and prescribed fire was conducted in Minnesota. Application of picloram (trade name Tordon) in a 0.1% active ingredient solution + 2, 4-D (0.1% active ingredient) followed by burning resulted in 100% control after two years. After two years, the burned plots were dominated by annual grasses yellow bristlegrass (*Setaria pumila*) and witchgrass (*Panicum capillare*). In western rangelands, picloram (trade name Tordon 22K), a dicot selective, has been effective in controlling leafy spurge when applied as a 0.1% active ingredient solution, but is not recommended in sandy soils or in high quality natural areas because of persistence in soils, off-target movement and non-target damage. Journey, a non-selective herbicide formulation that contains imazapic and glyphosate applied as a 0.04% active ingredient solution can be effective for controlling leafy spurge.

### Mowing

Mowing will not eradicate leafy spurge because its deep, extensive root system. However, these treatments can be effective if used in conjunction with other control methods. In buffer and disturbed areas, mowing every two or four weeks during the growing season can prevent seed production. Mowing will also result in uniform regrowth that may make herbicide applications more effective. Burning can stimulate stem development from root buds and make the colony more susceptible to herbicides. Burning can also reduce litter making leafy spurge plants easier to find and can increase vigor and competitiveness of native species.

Fall application of herbicide is too late to prevent seed production, so mowing before seed production (usually between May 10 and June 1<sup>st</sup> in northern Illinois) is recommended. Mowing will slow flowering, but will not kill the plant. If conducted after the plant develops seed, mowing will spread the infestation by dispersing the seed. Avoid mowing infested areas with visible flowers or seeds. After mowing areas infested with leafy spurge that may have seed, mower decks should be cleared of all plant debris (on the site where the infestation already exists) before moving on to the next location. A second mowing may be necessary if compensatory growth produces new flowers, but often it is not.

### **Biological Control**

When infestations are too big for herbicide treatment to be feasible, biological control may be the most viable option. Several species of *Apthona* flea beetles have been tested and approved for release in North America. The adult beetle feeds on the leaves, but the most significant damage is caused by the root feeding larvae. Biological control will not eliminate leafy spurge. At best it will reduce it to a “tolerable” component of the plant community. Biological control has been successfully implemented in some areas in Wisconsin. However, many factors such as plant density, soil chemistry, climate, and general habitat characteristics can influence the success of this strategy. Permitting is also required to transport insects across state lines so careful research prior to the initiation of any biological control is essential. For further information refer to the USDA web site Team Leafy Spurge at <http://www.team.ars.usda.gov> or Contact the Midwest Invasive Plant Network - (MIPN).

### Fire

Burning alone has not been an effective control strategy. Leafy spurge sprouts from the root crown and roots after top-kill by fire. Fire may increase leafy spurge density by promoting sprouting buds along the extensive rhizome and root system. Some studies suggest increased vegetative growth after burning while other studies suggest that burning after the application of herbicide helps control leafy spurge. An evaluation of the combined effect of herbicide and prescribed fire was conducted in Minnesota. Application of Picloram (trade name Tordon) + 2,4-D followed by burning resulted in 100% control after 2 years. After 2 years the burned plots were dominated by the annual grasses yellow bristlegrass (*Setaria pumila*) and witchgrass (*Panicum capillare*).

### FAILED OR INEFFECTIVE PRACTICES

Mowing, hand cutting, or burning alone are not effective because the root remains undamaged and new sprouts will reappear rapidly. Also, mowing may have to be done multiple times throughout the growing season because it stimulates development of flowering and seed production on lateral branches.

Hand-pulling, digging, or tilling is not effective because the entire root system must be excavated for complete control of leafy spurge. Pulling and digging can rip or cut the root into smaller pieces, leaving portions to re-sprout. This method could actually increase the number of plants.

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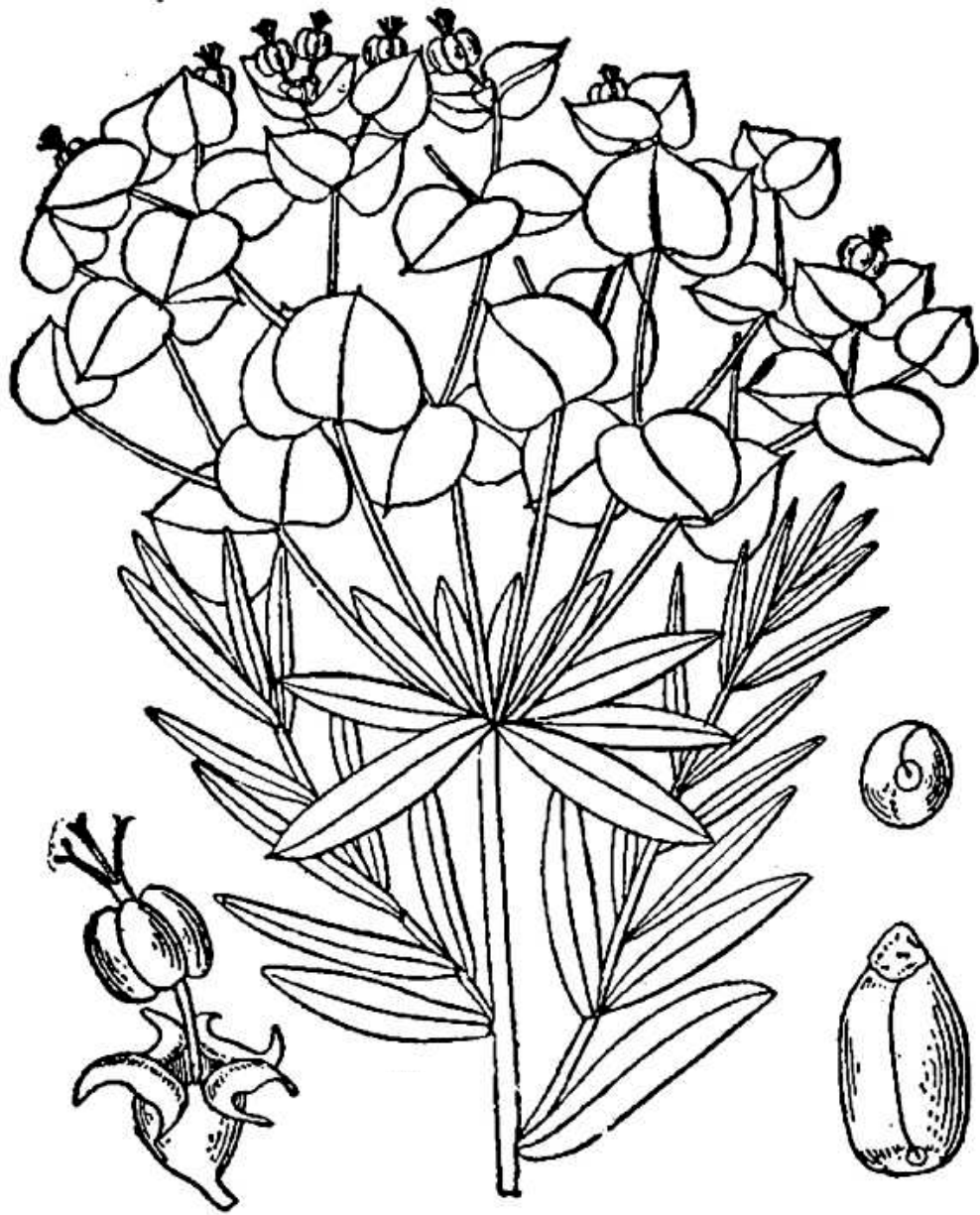
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