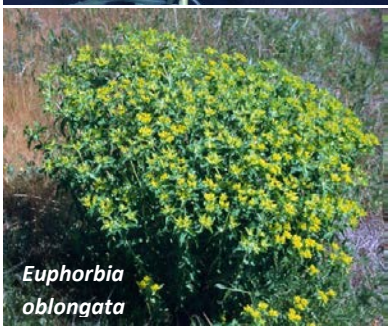
Euphorbia esula L.; leafy spurge
(= *E. virgata* Waldst. & Kit. [Jepson Manual 2012])
Euphorbia oblongata Griseb.; oblong spurge
Euphorbia terracina L.; carnation spurge

Leafy, oblong and carnation spurge



Family: Euphorbiaceae
Range: Leafy spurge is found in all western states, most central states (especially in the north), and northeastern states. Oblong spurge is found in the Pacific Northwest states (Washington, Oregon and California) and is expanding its range in California. Carnation spurge, a recent introduction, is known only in southern California.
Habitat: Waste areas, disturbed sites, roadsides, fields. Leafy spurge also infests pastures, rangeland, and riparian areas, from sub-tropic to sub-arctic climates and from semi-arid to mesic conditions; it can even tolerate flooding for 4 to 5 months if shoots can grow above the water surface. Carnation spurge has been reported in disturbed places, grassland, coastal bluffs and dunes, salt marsh, riparian areas, and oak woodlands.
Origin: All species are native to southern Europe.
Impacts: These plants can form dense patches that displace desirable vegetation. Leafy spurge, in particular, is one of the most tenacious weeds in the United States, forming dense clonal colonies that suppress both native plants and forage, resulting in reduced land values. Leafy spurge is especially problematic in the north-central states and adjacent parts of Canada. It infests nearly 3 million acres of rangeland in 29 states, causing estimated economic losses of $130 million per year. The milky sap of spurges is toxic and can irritate the skin, eyes, and digestive tracts of humans and other animals. Cattle avoid foraging spurge, but goats and sheep appear tolerant to its irritant properties.
Western states listed as Noxious Weed: *E. esula*, Arizona, California, Colorado, Idaho, Kansas, Montana, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, Wyoming
California Invasive Plant Council (Cal-IPC) Inventory: *E. esula*, High Invasiveness (Alert); *E. oblongata*, Limited Invasiveness; *E. terracina*, Moderate Invasiveness (Alert)

These spurges are erect perennials to nearly 3 ft tall (carnation spurge sometimes taller), with milky white sap and smooth, oblong to elliptical leaves. The leaves are alternate on the lower stems, but leaves and bracts may be whorled or opposite just under the flowering branches. Oblong and carnation spurges develop vertical taproots that can bud off new plants near the soil surface. Leafy spurge forms an extensive system of creeping roots that form adventitious root buds and generate new plants, as well as storing food reserves that enable roots to produce new shoots for many years under continuous grazing or mowing.

During summer, these spurges form umbel-like flower clusters at the stem tips, the flowers with yellow-green bracts (not petals). The flowers develop 3-chambered seed capsules with yellow-brown to grey seeds. Mature capsules rupture and eject seeds up to 16 ft from the parent plant, but some seeds disperse to greater distances with human and animal activities, water, and as hay or seed contaminants. These species generally start new infestations from seed. Leafy spurge populations also can expand vegetatively, by budding from

roots or from root fragments as small as 0.5 inch. Most seeds germinate in early spring, but germination may occur throughout the growing season. Seeds can remain viable for 8 years or more in the field.

NON-CHEMICAL CONTROL

Mechanical (pulling, cutting, disking)	Hoeing, grubbing, or hand pulling before seed production may be used for small patches. These control methods must be repeated several times over the growing season (2 to 3 week intervals), and for several years. Use gloves when handling leafy spurge due to the irritating effects of the latex. Mowing is generally not very effective for reducing perennial spurge infestations. However, mowing every 2 to 4 weeks can reduce seed production. Mowing may result in more uniform regrowth, which is more conducive to uniform and effective herbicide applications. Two cultivations in fall to a depth of at least 4 inches will help reduce infestations. (A single cultivation may only spread sprouting root fragments.) This should be conducted for 2 to 3 years. Cultivation twice each fall for 3 consecutive years completely controlled leafy spurge in North Dakota. In other habitats, heavy cultivation every 2 weeks during the growing season and every 3 weeks during the late summer and fall for 2 or more years will reduce top growth and regenerating buds, and eventually stress the root system. Clean equipment after cultivating to avoid transporting root fragments.
Cultural	Spurges are toxic to cattle and horses, but goats and sheep have been successfully used in control programs. Graze in spring when spurges emerge. Stock sheep at 3 to 6 head/acre month, or Angora goats at 12 to 16 head/acre month. These animals will not eradicate perennial spurges but can reduce the seedbank and allow grasses to become established. Animals should be held in a pen for 3 to 5 days before moving to a new area to prevent seed dispersal. Avoid overgrazing and excessive disturbance in pastures and rangelands, and reduce cattle stocking rates in areas of known infestations. An integrated strategy of early grazing followed by herbicide application to fall regrowth has proven more effective than either strategy alone. Burning does not significantly affect roots and typically stimulates the production of new shoots from root buds. Burning before release of biocontrol insects can help these insects to become established. Burning does not appear to harm biocontrol populations once established.
Biological	Fifteen non-indigenous insect species have been approved for release in the United States for the control of leafy spurge. Five flea beetles (*Aphthona* spp.) have been established in the Great Plains and Pacific Northwest. *Aphthona nigriscutis* and *A. czwalinae/lacertosa* impact the plant by ovipositing eggs at the base of the plant; the larvae feed on the roots, increasing plant morbidity, reducing plant health and creating pathways for the introduction of plant pathogens. Several moths (*Chamaesphecia* spp. and *Hyles euphorbiae*) and a stem-boring beetle (*Obera erythrocephala*) also are being tested. *Aphthona* spp. flea beetles have produced the greatest impact on leafy spurge, reducing stem densities by as much as 80 to 90% over large areas. This has not occurred in all areas. It is hoped that *Aphthona* spp. and other insects may eventually provide long term leafy spurge suppression over much of the western United States.

CHEMICAL CONTROL

The following specific use information is based on published papers and reports by researchers and land managers. The information here is primarily from information on the management of *E. esula*. It is considered that the same effects would also occur with *E. oblongata* and *E. terracina*. Other trade names may be available, and other compounds also are labeled for this weed. Directions for use may vary between brands; see label before use. Herbicides are listed by mode of action and then alphabetically. The order of herbicide listing is not reflective of the order of efficacy or preference.

GROWTH REGULATORS	
2,4-D Several names	**Rate:** 1 to 6 qt product/acre (0.95 to 5.7 lb a.e./acre) **Timing:** Postemergence at flowering in early summer, or on fall regrowth. **Remarks:** 2,4-D is broadleaf-selective and has no soil activity. It can prevent seed formation but does not provide complete kill and will require multiple treatments. One qt product/acre will suppress seed production, 6 qt will control shoots. Do not apply when outside temperatures exceed 80°F.
Aminocyclopyrachlor + chlorsulfuron *Perspective*	**Rate:** 4.75 to 8 oz product/acre **Timing:** Postemergence in spring up to flowering, or in fall rosette stage. **Remarks:** *Perspective* provides broad-spectrum control of many broadleaf species. Although

	generally safe to grasses, it may suppress or injure certain annual and perennial grass species. Do not treat in the root zone of desirable trees and shrubs. Do not apply more than 11 oz product/acre per year. At this high rate, cool-season grasses will be damaged, including bluebunch wheatgrass. Not yet labeled for grazing lands. Add an adjuvant to the spray solution. This product is not approved for use in California and some counties of Colorado (San Luis Valley).
Dicamba *Banvel*, *Clarity*	**Rate:** 1 to 2 qt product/acre (1 to 2 lb a.e./acre) **Timing:** Postemergence in spring to early summer. **Remarks:** Dicamba is a broadleaf-selective herbicide often combined with other active ingredients. May require 3 consecutive years of treatment.
Dicamba + 2,4-D amine	**Rate:** 1 qt/acre each product **Timing:** Postemergence in spring at flower emergence and/or to fall regrowth. **Remarks:** Add non-ionic surfactant at 0.25%. Do not apply when outside temperatures will exceed 80°F.
Fluroxypyr *Vista XRT*	**Rate:** 22 oz product/acre (7.7oz a.e./acre) **Timing:** Postemergence when weeds are small and rapidly growing. **Remarks:** This rate provides only suppression of leafy spurge.
Picloram *Tordon 22K*	**Rate:** 1 to 2 qt product/acre (0.5 to 1 lb a.e./acre) **Timing:** Applications postemergence at true flower stage are most effective but it can also be applied in fall. The 1 qt product/acre rate may need to be applied annually for 3 to 4 years. *Tordon 22K* at 2 qt/acre can be applied every other year. **Remarks:** Picloram is one of the most effective herbicides for this weed. Most broadleaf plants are susceptible, but relatively safe on established grasses. Use non-ionic surfactant at 0.25%. Picloram has a long residual activity and some have reported that it may injure young or germinating grasses. Do not apply near trees. *Tordon 22K* is a federally restricted use pesticide. Not registered for use in California.
Picloram + 2,4-D	**Rate:** 1 to 1.5 pt picloram product/acre + 2 to 3 pt 2,4-D product/acre **Timing:** Postemergence in spring, at true flowering. Apply for 3 to 5 consecutive years. **Remarks:** See picloram, 2,4-D.
AROMATIC AMINO ACID INHIBITORS	
Glyphosate *Roundup*, *Accord XRT II*, and others	**Rate:** 1 pt product (*Roundup ProMax*)/acre (0.56 lb a.e./acre) applied three times in a growing season, or 2 pt product (*Roundup ProMax*)/acre (1.1 lb a.e./acre) applied twice in a growing season **Timing:** Postemergence in split applications (June, July, August at low rate, or June and July at high rate), or apply a high rate in fall followed by spring treatment with glyphosate or 2,4-D. **Remarks:** Glyphosate is a nonselective herbicide. It has no soil activity. Its effectiveness is increased by addition of ammonium sulfate. Glyphosate is more effective when coupled with revegetation with competitive perennial grasses.
Glyphosate + 2,4-D	**Rate:** 1 pt glyphosate product /acre + 1.5 pt/acre of 2,4-D product (glyphosate at 6 oz a.e./acre + 2,4-D at 11 oz a.e./acre) **Timing:** Postemergence in late spring just before seed set. **Remarks:** This tank mix appears to provide synergistic control. Treatment should be repeated for 3 years. See remarks for glyphosate, 2,4-D.
BRANCHED-CHAIN AMINO ACID INHIBITORS	
Imazapic *Plateau*	**Rate:** 8 to 12 oz product/acre (2 to 3 oz a.e./acre) **Timing:** Preemergence or early postemergence in fall when plants begin to grow but before hard freeze. More than one treatment will likely be necessary. **Remarks:** Imazapic has mixed selectivity and some soil residual activity. It tends to favor members of the Asteraceae and some grasses. Use a methylated seed oil surfactant at 0.25%. Not registered for use in California.
Imazapyr *Arsenal*, *Habitat*, *Stalker*,	**Rate:** 1 to 1.5 pt product/acre (4 to 6 oz a.e./acre)

Chopper, *Polaris*	**Timing:** Postemergence at flowering. **Remarks:** Imazapyr has a long residual activity and leaves more bare ground than other treatments, even a year after application. It is nonselective.
Other products	Quinclorac (*Paramount*) is extremely selective from 8 to16 oz product/acre applied in spring at flowering. *Overdrive* in combination with the low rate of quinclorac is also effective.

RECOMMENDED CITATION: DiTomaso, J.M., G.B. Kyser et al. 2013. *Weed Control in Natural Areas in the Western United States*. Weed Research and Information Center, University of California. 544 pp.