This WEED REPORT does not constitute a formal recommendation. When using herbicides always read the label, and when in doubt consult your farm advisor or county agent.

This WEED REPORT is an excerpt from the book *Weed Control in Natural Areas in the Western United States* **and is available wholesale through the UC Weed Research & Information Center (wric.ucdavis.edu) or retail through the Western Society of Weed Science (wsweedscience.org) or the California Invasive Species Council (cal-ipc.org).**

Carduus acanthoides L.; plumeless thistle
Carduus nutans L.; musk thistle
Carduus pycnocephalus L.; Italian thistle
Carduus tenuiflorus Curtis; slenderflower thistle

Plumeless, musk, Italian, and slenderflower thistle

Family: Asteraceae
Range: Musk thistle is found in all western states. Plumeless thistle is found in most western states, except Oregon, Nevada, Utah and Arizona. Italian and slenderflower thistle are most common in west coast states, Washington, Oregon and California. Italian thistle is also found in Idaho.
Habitat: Disturbed open sites, roadsides, pastures, annual grasslands, and waste areas. These thistles can tolerate a relatively wide range of soil types but prefer fertile, well-drained soils.
Origin: All species are native to Europe and the Mediterranean region.
Impacts: These thistles can dominate sites and crowd out native species and forage plants. The spines inhibit grazing and discourage livestock and wildlife from entering infested areas.
Western states listed as Noxious Weed: *C. acanthoides*, Arizona, California, Colorado, Oregon, South Dakota, Washington, Wyoming; *C. nutans*, California, Colorado, Idaho, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, Wyoming; *C. pycnocephalus*, California, Oregon, Washington; *C. tenuiflorus*, California, Oregon, Washington
California Invasive Plant Council (Cal-IPC) Inventory: *C. acanthoides* and *C. tenuiflorus*, Limited Invasiveness; *C. nutans* and *C. pycnocephalus*, Moderate Invasiveness

The weedy *Carduus* thistles are winter annuals or biennials with prickly leaves and stems with prickly wings. Plumeless thistle and musk thistle grow to 5 ft tall. They are closely related and may hybridize. Italian thistle and slenderflower thistle are also closely related and can grow to 6.5 ft tall. All these thistles form deep taproots. Plants may grow as a biennial, germinating in winter to early spring and existing as a rosette until flower stems develop in spring to summer of the following year. After bolting, stems branch near the top. Stem leaves taper down the stem as spiny wings.

All these thistles produce purple to pink, rarely white, flowers in summer. Plumeless and musk thistle have typical hemispherical thistle flowers, while Italian and slenderflower thistle flowers are more cylindrical in shape. Musk thistle flowers are often nodding on long stalks. Reproduction in all these species is only by seed. Seeds typically fall near the parent plant or are disperse to greater distances with wind. Seeds that germinate in late summer to fall often behave as winter annuals and flower in the following summer. Seeds rarely persist in the soil seedbank for more than a few years.

NON-CHEMICAL CONTROL

Mechanical (pulling, cutting, disking)	These thistles can be cultivated or manually removed when small. To control by cutting, use a sharpened shovel at the top of the root crown. Grubbing hoes must cut the plants 2 to 4 inches below ground level to prevent resprouting from dormant axillary buds.

	Mowing the plant during flowering can greatly reduce seed production, though a single mowing is seldom sufficient due to the wide differences in the maturity of plants in a natural population. For mowing, wait till plants bolt and are about to flower. This may require repeated visits at weekly intervals over the 4 to 7 week blooming period, because not all plants bloom simultaneously. Plants will regrow if mowed before they are fully bolted. Plants cut 4 days after the first flowers open can produce viable seed.
Cultural	Large livestock tend to avoid grazing on thistles, although horses and cattle have been known to eat the flowerheads. Sheep will eat the rosettes. Goats like the flowerheads and are able to digest the seed. Depending on timing, the soil seedbank, the plant community, and other factors, fire may help control thistles or may promote their invasion. Grass fires may not be hot enough to kill the root crown of thistle rosettes, but a flamer can be used to kill individual plants. In general, thistles compete poorly with healthy established grasses and other vegetation. Establishment of selected, aggressive grasses can be an effective cultural control of thistles.
Biological	The thistle head weevil (*Rhinocyllus conicus*) is an introduced biocontrol agent that attacks *Carduus* species and several other thistles. It is established in much of the northwestern and north central United States. The weevil gives effective control of musk thistle in parts of Montana, less so in other areas. The crown weevil (*Trichosirocalus horridus*) and thistle crown fly (*Cheilosia corydon*) also are locally established. The fungus musk thistle rust (*Puccinia carduorum*) may soon be approved as a biocontrol agent.

CHEMICAL CONTROL

The following specific use information is based on published papers and reports by researchers and land managers. 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 2 qt product/acre (0.95 to 1.9 lb a.e./acre) **Timing:** Postemergence in the rosette stage. **Remarks:** 2,4-D is broadleaf-selective and has no soil activity. It may require repeat application. It is not the most effective treatment, but is widely used because of low cost. Do not apply ester formulations when outside temperatures exceed 80°F.
Aminocyclopyrachlor + chlorsulfuron *Perspective*	**Rate:** 3 to 4.5 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).
Aminopyralid *Milestone*	**Rate:** 4 to 5 oz product/acre (1 to 1.25 oz a.e./acre) **Timing:** Preemergence in winter to early spring and postemergence to seedling treatments in spring up to flower bud stage. Can be applied in fall in cold-winter areas. Apply when plants are at the late bolt through early flowering stages. For late applications starting at the late bud stage, 2,4-D at 1 lb ae/acre should be tank-mixed with *Milestone*. **Remarks:** Aminopyralid is one of the most effective herbicides for thistles. It is a broadleaf herbicide like picloram, but more selective and with a shorter soil residual activity. Aminopyralid is generally safe on grasses. It has longer soil residual and higher activity than clopyralid.
Aminopyralid + 2,4-D, *Forefront HL*; Aminopyralid + metsulfuron, *Opensight*; Aminopyralid + triclopyr, *Capstone*	**Rate:** 1.5 to 2 pt *Forefront HL*/acre; 1 to 3 oz *Opensight*/acre; 4 to 6 pt *Capstone*/acre **Timing:** Postemergence in rosette to bolting stages. **Remarks:** These combinations are broadleaf-selective. *Opensight* is not registered for use in California.
Clopyralid	**Rate:** 0.25 to 1.33 pt product/acre (1.5 to 8 oz a.e./acre)

Transline	**Timing:** Postemergence in spring, up to the flower bud stage. **Remarks:** Clopyralid is a broadleaf herbicide that is more selective to some broadleaf plants than picloram. It is very safe on grasses.
Clopyralid + 2,4-D *Curtail*	**Rate:** 2 to 4 qt product/acre (use higher rate if plants are drought-stressed) **Timing:** Postemergence to rapidly growing weeds from full rosette to early flower bud. **Remarks:** The combination is broadleaf-selective with a wide range of susceptible species.
Dicamba *Banvel*, *Clarity*	**Rate:** 0.5 to 2 pt product/acre (0.25 to 1 lb a.e./acre); 8 to 16 oz product/acre for rosettes, up to 2 pt product/acre for bolting plants **Timing:** Postemergence to rapidly growing plants up to bolting. Application to smaller plants gives better control. **Remarks:** Dicamba is a broadleaf-selective herbicide often combined with other active ingredients. It is effective earlier in the season than 2,4-D. It is also effective when tank-mixed with 2,4-D (0.75 lb a.e./acre 2,4-D + 0.25 lb a.e./acre dicamba). Dicamba has very limited soil residual. Avoid drift to sensitive crops. Do not apply when outside temperatures exceed 80°F. Dicamba is available mixed with diflufenzopyr in a formulation called *Overdrive*. The combination is broadleaf-selective, but safe on most grasses. This has been reported to be effective on plumeless and musk thistle, and may have a similar effect on other members of the genus *Carduus*. Diflufenzopyr is an auxin transport inhibitor which causes dicamba to accumulate in shoot and root meristems, increasing its activity. *Overdrive* is applied postemergence at 4 to 8 oz product/acre on rapidly growing plants. Higher rates should be used on large annuals and biennials or when treating perennial weeds. Add a non-ionic surfactant to the treatment solution at 0.25% v/v or a methylated seed oil at 1% v/v solution.
Fluroxypyr *Vista XRT*	**Rate:** 22 oz product/acre (7.7 oz a.e./acre) **Timing:** Postemergence to rapidly growing weeds. **Remarks:** Fluroxypyr is broadleaf-selective and safe on most grasses.
Picloram *Tordon 22K*	**Rate:** 0.67 to 1 qt product/acre (0.33 to 0.5 lb a.e./acre) **Timing:** Postemergence from flower bud stage to senescence. Most effective in fall treatments. **Remarks:** Picloram is one of the most effective herbicides for this weed and can provide 2 years of control. Most broadleaf plants are susceptible, but it is relatively safe on established grasses. It can injure young or germinating grasses. Picloram is also effective when mixed with dicamba or 2,4-D. It has long soil residual activity. Picloram can be used in a premix with 2,4-D (*Grazon P+D*) or fluroxypyr (*Surmount*) for the control of *Carduus* species. Picloram is a restricted use herbicide. Picloram and its formulations are not registered for use in California.
Triclopyr *Garlon 3A, Garlon 4 Ultra*	**Rate:** 1.33 to 2.66 qt *Garlon 3A*/acre or 1 to 2 qt *Garlon 4 Ultra*/acre (1 to 2 lb a.e./acre) **Timing:** Postemergence to rapidly growing weeds. **Remarks:** Triclopyr is broadleaf-selective and safe on most grasses. It is most effective on smaller plants. *Garlon 4 Ultra* is formulated as a low volatile ester. However, in warm temperatures, spraying onto hard surfaces such as rocks or pavement can increase the risk of volatilization and off-target damage. Rates are based on those reported for Canada thistle.
Triclopyr + 2,4-D *Crossbow*	**Rate:** 2 to 4 qt product/acre **Timing:** Postemergence during the rosette stage. **Remarks:** Include non-ionic surfactant at 1 qt/100 gal water (0.25% v/v).
AROMATIC AMINO ACID INHIBITORS	
Glyphosate *Roundup*, *Accord XRT II*, and others	**Rate:** 1.33 to 2.67 qt product (*Roundup ProMax*)/acre (1.5 to 3 lb a.e./acre) **Timing:** Postemergence to rapidly growing plants in bud stage. **Remarks:** Glyphosate has no soil activity and is nonselective. Repeat applications may be necessary. It is more effective with the addition of ammonium sulfate.
BRANCHED-CHAIN AMINO ACID INHIBITORS	
Chlorsulfuron *Telar*	**Rate:** 1 to 2.6 oz product/acre (0.75 to 1.95 oz a.i./acre) **Timing:** Postemergence in fall to new rosettes, or to rosettes in spring before bolting. Chlorsulfuron

	or metsulfuron applied from the bolting through very early bud stage eliminated viable achene development. **Remarks:** Chlorsulfuron has mixed selectivity, but is generally safe on grasses. Use a surfactant. It can be used in late season applications to reduce seed production and has fairly long soil residual activity. Fall application may injure desirable bromes.
Imazapic *Plateau*	**Rate:** 8 to 12 oz product/acre (2 to 3 oz a.e./acre) **Timing:** Preemergence or early postemergence. Only suppression of musk thistle when applied preemergence. **Remarks:** Imazapic has mixed selectivity and some soil residual activity. Although the label indicates that musk thistle can be controlled with imazapic, it generally tends to favor members of the Asteraceae and some grasses. Use a methylated seed oil surfactant at 0.25% v/v. Not registered for use in California.
Imazapyr *Arsenal*, *Habitat*, *Stalker*, *Chopper*, *Polaris*	**Rate:** 3 to 4 pt product/acre (0.75 to 1 lb a.e./acre) **Timing:** Preemergence or postemergence. **Remarks:** Imazapyr is a nonselective herbicide. Rates are based on those reported for bull thistle.
Metsulfuron *Escort*	**Rate:** 0.5 to 1 oz product/acre (0.3 to 0.6 oz a.i./acre) **Timing:** Postemergence to young, rapidly growing weeds in spring before flowering, or in fall to new rosettes. Chlorsulfuron or metsulfuron applied from the bolting through very early bud stage eliminated viable achene development. Metsulfuron seemed to work a bit better than chlorsulfuron. **Remarks:** Metsulfuron has mixed selectivity and is generally safe on grasses. Use a surfactant. It can be tank-mixed with aminopyralid (*Opensight*), 2,4-D and/or dicamba. Metsulfuron has some soil residual activity. It is not registered for use in California.
Metsulfuron + chlorsulfuron *Cimarron X-tra*	**Rate:** 0.5 oz product/acre **Timing:** Postemergence before flowering. **Remarks:** It is not registered for use in California.
Sulfometuron *Oust* and others	**Rate:** 6 to 8 oz product/acre (4.5 to 6 oz a.i./acre) **Timing:** Preemergence or early postemergence, during the rainy season when weeds are germinating or rapidly growing. **Remarks:** Sulfometuron has mixed selectivity, but is fairly safe on native perennial grasses, especially wheatgrass. This rate is very high and may not be the best option. Desirable grasses may be stunted, stressed, or injured. Sulfometuron has fairly long soil residual activity.
PHOTOSYNTHETIC INHIBITORS	
Hexazinone *Velpar L*	**Rate:** 4 to 6 pt product/acre (1 to 1.5 lb a.e./acre) **Timing:** Preemergence before weeds emerge or postemergence to young plants. **Remarks:** Hexazinone has both foliar and soil activity. In soil applications, rates will vary with soil texture and soil organic matter; best results when applied to moist soil. Use rates will also vary depending on the weed species to be controlled. Hardwood trees near application site can absorb this chemical through the roots and may be injured or killed. Do not spray near the root zone of desirable hardwood trees or shrubs. High rates of hexazinone can create bare ground, so only use high rates in spot treatments.

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.