

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).

Centaurea diffusa Lam.

Diffuse knapweed

Family: Asteraceae

Range: All western states.

Habitat: Plains, rangelands, and forested benchlands, particularly on rugged terrain not well suited for cultivation; often on well drained soils. Needs less moisture than spotted knapweed; can thrive in semi-arid and arid conditions. Seldom persists in shaded places. Not common on cultivated lands or irrigated pasture because it cannot tolerate cultivation or excessive moisture.

Origin: Native to southeastern Eurasia.

Western states listed as Noxious Weed: Arizona, California, Colorado, Idaho, Montana, New Mexico, Nevada, North Dakota, Oregon, South Dakota, Utah, Washington, Wyoming

California Invasive Plant Council (Cal-IPC) Inventory: Moderate Invasiveness



Diffuse knapweed is a bushy herbaceous taprooted biennial or short-lived perennial that grows to about 3 ft tall. The leaves are alternate and variously covered with short to medium interwoven grayish hairs. The upper leaves are entire and linear; the lower stem leaves are 4 to 8 inches long and deeply pinnate-lobed one to two times. Plants are basal rosettes in fall and winter and bolt to produce erect, highly branched flowering stems in late spring and summer.

The flowerheads consist of spiny or comb-like phyllaries and white or pink to pale purple disk flowers. Unlike squarrose knapweed, the spiny phyllaries (3 mm long) do not reflex downward. The achenes either lack a pappus or have a very short bristly pappus (< 1 mm long). Plants reproduce only by seed. Diffuse knapweed inflorescences detach from the parent plant when stems break off near the ground and tumble along the ground in the wind, dispersing seed to a greater distance than most *Centaurea* species. Data shows that about 20 to 50% of plant inflorescences tumble off site. Diffuse knapweed has been shown to occasionally hybridize with spotted knapweed. It is not known how long seeds remain viable in the soil, but it is assumed that survival would be similar to other *Centaurea* species, 2 to 5 years, with a few seeds surviving longer.

NON-CHEMICAL CONTROL

Mechanical

(pulling, cutting, disking)

Physical and mechanical approaches to diffuse knapweed control include hand pulling, digging, tilling, disking, and cutting or mowing. Physical removal or damage can provide some control depending on the timing and frequency of treatment, the presence of competitive, desirable vegetation, and the level of soil disturbance caused by the treatment.

Hand pulling is practical for scattered diffuse knapweed plants, or for areas where other control methods are not feasible and sufficient labor is available. Repeated hand pulling is necessary during the season and over many years. Successful control has been reported when plants were hand removed 3 times a year (spring, summer, and late summer) over a period of 5 years. Every effort should be made to remove the entire taproot with little soil disturbance. If not possible, then cut the root 2 to 4 inches below the soil surface to remove much of the reproductive crown. Gloves should be worn when hand pulling. The best timing for hand removal is before plants produce viable seed. Hand pulling has not been effective in all areas. On dry soils, it may be difficult to remove the root crown and this can lead to rapid reestablishment.

Mowing typically doesn't kill knapweeds; cut plants generally survive and recover to set seed. Plants mowed at the rosette stage will quickly recover, and mowing too late (after seed set) can disperse seed. However, mowing at the late bud to early bloom stage will reduce seed production. Mowing can also remove dead growth to improve herbicide coverage. A program of cutting only bolted plants, particularly at

	<p>the early bloom stage, for several consecutive years can greatly suppress diffuse knapweed. Cultivation is effective when repeated, but diffuse knapweed typically grows in areas not conducive to tillage.</p>
Cultural	<p>Grazing is not an effective eradication method. Diffuse knapweed is not typically considered palatable to livestock. Furthermore, intensive grazing can create ideal seedbeds for further invasion. However, researchers have shown that cattle, sheep and goats will readily graze diffuse knapweed in early spring. Cattle grazing twice in spring decreased seed production by 50%. Sheep typically graze diffuse knapweed from the rosette through bud stage or when it is the only plant available. The timing of grazing may be critical to its success. Although there is no direct evidence, it is likely that the optimal timing would be similar to that of spotted knapweed. For spotted knapweed, early and late-season grazing appear to be the most effective timing with sheep: early season (spring) to reduce flower production, and late season (fall) to reduce density of young plants. In one study, two consecutive years of early and late sheep grazing reduced spotted knapweed but had little effect on the native grass community.</p> <p>Burning has been shown to give effective control of diffuse knapweed while stimulating grass regrowth. Within 2 years of burning, most diffuse knapweed rosettes were eliminated. A low-severity fire will not kill the below-ground reproductive structures of diffuse knapweed, but a severe fire can kill some of the plant crowns. Burning removes current growth but may enhance seed germination. Dry soil conditions at the time of burning can reduce germination. Burning also can remove dead growth to improve the effect of herbicide applications.</p>
Biological	<p>Currently, there is no single biological control agent that effectively controls diffuse knapweed populations. However, numerous biocontrol insects from diffuse knapweed's native range are established in the United States, including flies and weevils which attack seedheads. These include the banded gall fly (<i>Urophora affinis</i>), knapweed seedhead fly (<i>U. quadrifasciata</i>), knapweed peacock fly (<i>Chaetorellia acrolophi</i>), lesser knapweed flower weevil (<i>Larinus minutus</i>), and broad-nosed seedhead weevil (<i>Bangasternus fausti</i>). <i>Larinus minutus</i> in particular is an aggressive and effective biocontrol insect for diffuse and spotted knapweed.</p> <p>Root-feeding insects may have a more detrimental effect on knapweed populations than seed-feeding ones. Larvae of the diffuse knapweed root beetle (<i>Sphenoptera jugoslavica</i>) feed in the roots of diffuse knapweed. Larvae of the moths <i>Agapeta zoegana</i> and <i>Pterolonche inspersa</i> and the weevil <i>Cyphocleonus achates</i> feed in the roots of both diffuse knapweed and spotted knapweed.</p> <p>The collective stress on the plant caused by these insects sharply reduces seed production and may lead to reduced competitiveness. However, they have not been shown to significantly reduce diffuse knapweed plant densities.</p>

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	
<p>2,4-D</p> <p>Several names</p>	<p>Rate: 1 to 2 qt product/acre (0.95 to 1.9 lb a.e./acre)</p> <p>Timing: Postemergence from rosette to beginning of bolting, or fall rosette. Optimal at early flowering stage.</p> <p>Remarks: Control with 2,4-D is only temporary and does not prevent seedling establishment the following year. Generally requires repeat applications. It is not considered as effective as other growth regulator herbicides for season-long control. 2,4-D is broadleaf-selective and has no soil activity. Do not apply ester formulation when outside temperatures exceed 80°F. Amine forms are as effective as ester forms for small rosettes, and amine forms reduce the chance of off-target movement.</p>
<p>Aminocyclopyrachlor + chlorsulfuron</p> <p><i>Perspective</i></p>	<p>Rate: 4.75 to 8 oz product (<i>Perspective</i>)/acre</p> <p>Timing: Postemergence and preemergence. Postemergence applications are most effective for plants from the seedling to the mid-rosette stage.</p> <p>Remarks: <i>Perspective</i> 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</p>

	<p>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).</p>
Aminopyralid <i>Milestone</i>	<p>Rate: 5 to 7 oz product/acre (1.25 to 1.75 oz a.e./acre)</p> <p>Timing: Postemergence and preemergence. Postemergence applications are most effective for plants from the rosette to the bolting stage. Effective control can also be obtained with a fall application to new regrowth.</p> <p>Remarks: Aminopyralid is one of the most effective herbicides for the control of diffuse knapweed. It is safe on grasses, although preemergence application at high rates can greatly suppress invasive annual grasses, such as medusahead. Aminopyralid has a longer residual and higher activity than clopyralid. Other members of the Asteraceae and Fabaceae are very sensitive to aminopyralid. For postemergence applications, adding a non-ionic surfactant (0.25 to 0.5% v/v spray solution) enhances control under adverse environmental conditions; however, this is not normally necessary. Other premix formulations of aminopyralid can also be used for diffuse knapweed control. These include <i>Opensight</i> (aminopyralid + metsulfuron; 1.5 to 3.3 oz product/acre) and <i>Forefront HL</i> (aminopyralid + 2,4-D; 1.2 to 2.1 pt product/acre), both applied at the rosette to bolting stages.</p>
Clopyralid <i>Transline</i>	<p>Rate: 0.67 to 1.33 pt product/acre (4 to 8 oz a.e./acre). Use higher rate for older plants or dense stands.</p> <p>Timing: Preemergence (for seedling control) or postemergence (for seedlings and perennial plant control). Generally optimal to apply in spring, at beginning of bolting up to the bud stage. Can also apply to fall regrowth. Results are best if applied to rapidly growing weeds.</p> <p>Remarks: While clopyralid is very safe on grasses, it will injure many members of the Asteraceae, particularly thistles, and can also injure legumes, including clovers. Most other broadleaf species and all grasses are not injured.</p>
Clopyralid + 2,4-D <i>Curtail</i>	<p>Rate: 2 to 4 qt <i>Curtail</i>/acre</p> <p>Timing: Same as for clopyralid.</p> <p>Remarks: Add a non-ionic surfactant.</p>
Dicamba <i>Banvel, Clarity</i>	<p>Rate: 1 to 2 pt product/acre (0.5 to 1 lb a.e./acre). Use higher rate for older plants or dense stands.</p> <p>Timing: Postemergence from rosette to beginning of bolting, or fall rosette. Optimal at early flowering stage.</p> <p>Remarks: Dicamba is a broadleaf-selective herbicide often combined with other active ingredients. It is not typically used alone to control diffuse knapweed. Dicamba can also be mixed with 2,4-D (1 pt dicamba + 2 pt 2,4-D/acre) or picloram (1 to 2 pt dicamba + 0.5 to 1 pt picloram/acre) for spot treatments.</p> <p>Dicamba is available mixed with diflufenzopyr in a formulation called <i>Overdrive</i>. This has been reported to be effective on diffuse knapweed. Diflufenzopyr is an auxin transport inhibitor which causes dicamba to accumulate in shoot and root meristems, increasing its activity. <i>Overdrive</i> is applied postemergence to rapidly growing plants at 4 to 8 oz product/acre. 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.</p>
Picloram <i>Tordon 22K</i>	<p>Rate: 1 to 2 pt product/acre (4 to 8 oz a.e./acre). Use higher rates for older plants or dense stands.</p> <p>Timing: Preemergence and postemergence. Postemergence applications are best at rosette to mid-bolting stage (before flowering to prevent current year seed production), or fall rosette stage. Apply when plants are growing rapidly. Under favorable growing conditions, summer application can be effective if higher rates are used.</p> <p>Remarks: Picloram is a broadleaf herbicide. It gives a broader spectrum of control than aminopyralid, aminocyclopyrachlor, and clopyralid, and has much longer soil residual activity. Lower rates may require annual spot treatments. Treatment made in bud stage may not prevent seed production in the year of application. Picloram has been shown to provide selective control of diffuse knapweed for 3 to 4 years. Although well-developed grasses are not usually injured by labeled use rates, some applicators have noted that young grass seedlings with fewer than four leaves may be killed. Do not apply near trees. Picloram is a restricted use herbicide. It is not</p>

	<p>registered for use in California.</p> <p>Control with lower rates may be improved by tank mixing with dicamba or 2,4-D; picloram and dicamba (0.25 to 0.5 pt/acre + 0.125 to 0.25 pt/acre) and picloram plus 2,4-D (0.5 to 1 pt picloram + 1 to 2 pt 2,4-D/acre). A backpack sprayer or a wiper is highly recommended in small areas to minimize damage to non-target plants.</p>
AROMATIC AMINO ACID INHIBITORS	
<p>Glyphosate <i>Roundup, Accord XRT II,</i> and others</p>	<p>Rate: Broadcast foliar treatment: 3 qt product (<i>Roundup ProMax</i>)/acre (3.375 lb a.e./acre). Spot treatment: 1.5% v/v solution</p> <p>Timing: Postemergence to rapidly growing knapweed when most plants are at bud stage.</p> <p>Remarks: Glyphosate will only provide control during the year of application; it has no soil activity and will not kill seeds or inhibit germination the following season. Glyphosate is nonselective. To achieve selectivity, it can be applied using a wiper or spot treatment to control current year's plants.</p>
BRANCHED-CHAIN AMINO ACID INHIBITORS	
<p>Imazapyr <i>Arsenal, Habitat, Stalker,</i> <i>Chopper, Polaris</i></p>	<p>3 to 4 pt product/acre has been shown to give some level of control.</p>

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.