

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](http://wric.ucdavis.edu)) or retail through the Western Society of Weed Science ([wsweedscience.org](http://wsweedscience.org)) or the California Invasive Species Council ([cal-ipc.org](http://cal-ipc.org)).

*Salix* spp.

## Willows

**Family:** Salicaceae

**Range:** There are many native species of willow throughout the United States.

**Habitat:** Willows occur in places with moist soils such as floodplains, ditch and stream banks, the borders of lakes and ponds, meadows, swamps, and fens.

**Origin:** Species from the genus *Salix* are native worldwide, including North America, Europe, and Asia.

**Impact:** While there are occasionally problematic non-native willows, in most cases native willows can become weedy when they occur in irrigation canals and drainage ditches, waterways, and controlled aquatic systems. Due to their shallow root system they can also cause flooding and bank erosion by displacing water from the stream bed. Willows also cause a seasonal influx of organic matter into the stream system when the leaves fall, resulting in reduced water quality.



Willow species are usually winter deciduous shrubs or small trees that grow up to 20 ft in height. The bark is bitter tasting and has antipyretic (fever reducer) properties. The smaller branches are often flexible and can be hairy or glabrous. The leaves are bright green or glaucous, alternate, elliptically shaped, with entire to toothed margins. The woody roots are spreading and can develop new shoots from basal rootstock.

Willow flowers from March to May. The flowers are dioecious (male and female flowers on separate plants). The inflorescences are catkins with many flowers; flowers have a single bract but no sepals or petals. The female flowers have simple pistils while the male flowers consist only of stamens. The flowers are insect- or wind-pollinated. Seed capsules open by two valves and contain numerous elliptic seeds 1 mm long with a tuft of long hair at the apex. Seeds are wind- or water-dispersed. Like other small-seeded, wind-dispersed riparian species, the seeds likely survive only a few months under field conditions.

### NON-CHEMICAL CONTROL

<b>Mechanical</b> (pulling, cutting, disking)	Hand pulling of seedlings less than 1.5 ft tall is a very effective means of controlling young stands. Small root fragments left from pulling small willows should not result in resprouting, but stem fragments will resprout.  Cutting is only effective if paired with herbicide treatment, including cut stump or foliar treatment of new growth.  Heavy equipment including bulldozing is impractical in wet areas due to disturbance to sensitive habitat. Willows will also sprout from small stem pieces left behind or pushed into the ground by the equipment.
<b>Cultural</b>	Neither grazing nor burning is an effective control method for willows.
<b>Biological</b>	Biocontrol agents are being studied for some of the willow species. Some promising agents include scale insects and some walkingstick-like insects in the genus <i>Astroma</i> . An agent that targets a specific species will be difficult to approve due to the mixture of native and non-native willow species in many areas and the frequency of hybridization between willows.

### 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.

**Foliar or Preemergence:** Use only for plants which are less than 6 ft tall and are not immediately next to sensitive native species and waterways. Apply before leaves start to fall.

**Cut Stump:** Useful for treating large individual trees, or where the presence of desirable species and water preclude foliar application. Is an effective method year-round.

**Hack-and-squirt:** Using a hand axe or drill, make cuts 6 to 18 inches above the ground at the same level about 2 to 4 inches apart and 1 inch deep slanting downward to prevent herbicide leakage. Stem injection can be slow and labor-intensive, but it is effective year round and important for protecting sensitive native flora as well as preventing chemical runoff into waterways. Leave the tree undisturbed for 12 months before removal to insure that the treatment was successful.

**GROWTH REGULATORS**

2,4-D <i>Weedar 64</i> and several other names	<p><b>Rate:</b> Foliar broadcast treatment: 2 to 3 qt product/acre in 100 gal water (1.9 to 2.85 lb a.e./acre)</p> <p><b>Timing:</b> Postemergence when the target plants are growing rapidly and the leaves are fully developed.</p> <p><b>Remarks:</b> Thoroughly wet the stem and foliage of target plants. If the target plants are above 6 to 8 ft and in a dense population then a higher rate may be necessary. Use the aquatic formulations of 2,4-D on willows close to a water source.</p>
---------------------------------------------------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Triclopyr <i>Garlon 3A</i> , <i>Garlon 4 Ultra</i>	<p><b>Rate:</b> 4 to 8 qt product (<i>Garlon 3A</i>)/acre or 3 to 6 qt <i>Garlon 4 Ultra</i>/acre (3 to 6 lb a.e./acre)</p> <p><b>Timing:</b> Apply when willows are growing rapidly.</p> <p><b>Remarks:</b> Foliage, stems and root collars must be thoroughly covered with spray. Triclopyr is broadleaf-selective and safe on most grasses. It is most effective on smaller plants and has little or no residual activity. <i>Garlon 3A</i> and other amine formulations are registered for aquatic use. <i>Garlon 4 Ultra</i> 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.</p>
----------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

**AROMATIC AMINO ACID INHIBITORS**

Glyphosate <i>Rodeo</i> , <i>Aquamaster</i>	<p><b>Rate:</b> 3 to 4 qt product (<i>Roundup ProMax</i>)/acre (3.375 to 4.5 lb a.e./acre)</p> <p><b>Timing:</b> Postemergence after full leaf expansion during late summer or early fall before the first frost.</p> <p><b>Remarks:</b> Use a higher rate on larger plants or in dense areas of growth. Glyphosate is a nonselective herbicide. It has no soil activity and its effectiveness is increased by addition of ammonium sulfate. Aquatic registered formulations, e.g., <i>Rodeo</i> and <i>Aquamaster</i>, are available for use close to water.</p>
---------------------------------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

**BRANCHED-CHAIN AMINO ACID INHIBITORS**

Imazapyr <i>Habitat</i>	<p><b>Rate:</b> 4 to 6 pt product/acre (1 to 1.5 lb a.e./acre)</p> <p><b>Timing:</b> Postemergence, to fully leafed-out brush between spring and fall.</p> <p><b>Remarks:</b> Postemergence applications require the addition of a non-ionic surfactant or a crop oil concentrate. Imazapyr is a nonselective herbicide. It has long soil residual activity and leaves more bare ground than other treatments, even a year after application. <i>Habitat</i> is an aquatic registered formulation available for use close to water.</p>
----------------------------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Metsulfuron <i>Escort</i>	<p><b>Rate:</b> 1 to 3 oz product/acre (0.6 to 1.8 oz a.i./acre)</p> <p><b>Timing:</b> Postemergence, to fully leafed-out brush between spring and fall.</p> <p><b>Remarks:</b> Full spray coverage of the foliage and terminal growing points is required. Use a surfactant. Apply only to rangeland and non-crop sites. Not registered in aquatic areas or in California.</p>
------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

**PHOTOSYNTHETIC INHIBITORS**

Hexazinone <i>Velpar L</i>	<p><b>Rate:</b> Broadcast treatment: 2 to 4 gal product/acre (4 to 8 lb a.i./acre). Spot treatment at base of plant (basal-soil): undiluted product at a rate of 2 to 4 ml/inch of stem diameter.</p> <p><b>Timing:</b> From pre-bud break in late winter until new growth hardens off at the end of summer.</p> <p><b>Remarks:</b> Hexazinone is used as a nonselective herbicide in non-cropland areas and as a selective herbicide in reforestation practices. Do not apply to frozen ground. Apply when there is adequate moisture for activation. Not registered for use in aquatic areas. High rates of hexazinone can create bare ground, so only use high rates in spot treatments.</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.