

## Control Methods

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<b>Biological</b>	<b>Chemical</b>
None currently available	2,4-D, Chlorsulfuron, Dicamba, Glyphosate, Imazapyr, Isoxaben, Metsulfuron methyl, and Triclopyr

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<b>Cultural</b>	<b>Mechanical</b>
Maintain healthy stands of native vegetation, revegetation/ competitive planting, implement introduction prevention measures	Repeated hand pulling or grubbing of small infestations to cut and dig out roots and eliminate seed production

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***Scotch Thistle Flowerhead***

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***Scotch Thistle Plants***

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***Scotch Thistle Basal Rosette***

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***Scotch Thistle Leaves  
and Winged Stems***

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Agriculture, Botany Laboratory, 2001  
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# Scotch Thistle

[*Onopordum acanthium* L.] Sunflower (Asteraceae) Family

## General Description

Vigorous biennial or short-lived perennials with coarse, spiny leaves and conspicuous spiny-winged stems. Plants typically germinate in fall after the first rains and exist as rosettes throughout the first year until flowering stems develop during the second spring/summer season. Severe infestations can form tall, dense, impenetrable stands, especially in fertile soils. To date, biological control agents have been unsuccessful in the United States. Introduced from Europe and the Mediterranean region.

## Seedlings

Cotyledons oval to oblong, gradually tapered at the base, fleshy, ~1.5 to 2 cm long. Leaves elliptic to oblanceolate and irregularly spiny toothed. Scotch thistle leaves covered with white woolly hairs, with the lower surface more densely covered than the upper.

## Mature Plants

Stem wings, spiny, continuous, and conspicuous to 0.5 to 1.5(3) m tall. Stem wings broad, typically ~2 to 3 cm wide, but can be up to 5 cm wide. Foliage covered with woolly light gray hairs. Leaves alternate, spiny, 10 to 50 cm long, +/- broadly elliptic. Margins spiny toothed to shallow, spiny lobed.

## Roots and Underground Structures

Taproots stout.

## Flowers

June-September. Heads spheric to hemispheric, mostly solitary but sometimes in clusters (cymes) of two to seven. Heads consist of numerous spiny-tipped phyllaries in many overlapping rows and numerous disk flowers. Phyllaries linear to narrowly lanceolate, covered with short hairs and a few cobwebby hairs. Phyllary spines less than 5 mm long. Receptacles fleshy, deeply pitted, with pits bordered by membranous extensions of tissue, and lacking bristles (chaff). Corollas white or purple, glabrous, 20 to 25 mm long.

## **Fruit and Seeds**

Achenes narrowly obovate, more or less 4- or 5-angled, glabrous, and mottled brown to blackish, 4 to 5 mm long. Surface roughened with wavy transverse ridges. Pappus bristles equal, numerous, minutely barbed, fused into a ring at the base which separates as a unit, pink to reddish and 7 to 9 mm long.

## **Postsenescence Characteristics**

Stems can persist into the next season with spiny phyllaries and receptacles attached.

## **Habitat**

Natural areas, disturbed sites, roadsides, fields, and especially sites with fertile soils.

## **Propagation/Phenology**

Reproduces only by seeds. Most seeds germinate in fall after the first rains, but some seeds can germinate year-round under favorable moisture and temperature conditions. Buried seed of Scotch thistle can remain viable in the soil seed bank for at least 7 years and possibly to 20 years or more. Yearly seed production and seed dormancy are highly variable depending on environmental conditions. Newly matured achenes are sensitive to light and contain a water-soluble germination inhibitor that can be removed by leaching with water or negated with gibberellic acid. Germination of newly matured achenes is also stimulated by the presence of nitrogen, cold stratification, and fluctuating temperatures. Chilling sensitizes recently matured achenes to photoperiod, with 8 hours of light being optimal for germination. Achene burial induces dormancy. Achenes recovered from soil are sensitive to light quality, but not photoperiod, and are less responsive to the germination stimulators listed above. Germination of dormant seed in the upper soil layer is stimulated by low intensity burning, but imbibed seeds appear less tolerant of heating by fire. One plant can produce an average of 20,000 to 40,000 seeds. A single plant produces seeds with differing degrees of dormancy, with about 8 to 14 percent of achenes non-dormant. Seedlings emerge from soil depths to 4.5 cm, with 0.5 cm being optimal.

## Control Methods

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### Biological

Rosette weevil

### Chemical

2,4-D, Chlorsulfuron, Clopyralid, Dicamba, Fluroxypyr, and Metsulfuron methyl

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### Cultural

Maintain healthy stands of native vegetation, revegetation/competitive planting, possibly goat grazing, implement introduction prevention measures

### Mechanical

Repeated hand pulling or grubbing of small infestations to cut and dig out roots and eliminate seed production

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***Tansy Ragwort Plant***

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***Tansy Ragwort Basal Rosettes***

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***Tansy Ragwort Plant***

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***Tansy Ragwort Flowerheads***

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forestryimages.org](http://www.<br/>forestryimages.org)

# Tansy Ragwort

[*Senecio jacobaea* L.] Sunflower (Asteraceae) Family

## General Description

Yellow-flowered biennial, perennial, or winter annual herbaceous plants with alternate, pinnately lobed leaves. Stems +/- erect, single or branched from the crown, to 0.6 m tall. Introduced from Eurasia.

## Seedlings

Remain as rosettes until maturity. First leaves alternate. Subsequent leaves variable, margins toothed to deeply pinnate lobed. Cotyledons oval, ~3 mm long, with tips truncate or slightly indented. Bases rounded, wedge shaped. First leaves oval with wavy margins, 6 to 8 mm long, sometimes with a few glandular hairs.

## Mature Plants

Foliage glabrous to lightly covered with long wavy to cottony hairs, especially along midveins and on lower leaf surfaces and new growth. Leaves highly variable, +/- evenly spaced on stems. Lower leaves taper into indistinct petioles. Upper leaves reduced, sessile, +/- clasp stem. Stems erect, single or branched from the crown, branched near the top, to 1.2 m tall. Leaves deeply 1- or 2-pinnately dissected, mostly 5 to 20 cm long. Lower leaves deciduous.

## Roots and Underground Structures

Crown or short taproot produces many spreading fleshy roots ~15 cm long, with numerous, deeper secondary fibrous roots. Roots and crowns, especially of rosettes, readily develop new shoot and root buds when injured or disturbed.

## Flowers

July-September. Flower heads showy yellow, numerous (20 to 60), in dense +/- flat-topped clusters. Heads consist of numerous disc and 12 to 15 ray flowers. Ray corollas 8 to 12 mm long, ~2 mm wide, well spaced. Involucre (phyllaries as a unit) hemispheric to cylindric. Main phyllaries ~13, 3 to 5 mm long. Phyllaries (flower head bracts) often black tipped, in one equal row, typically with a few highly reduced phyllaries at the base. Insect pollinated.

## **Fruit and Seeds**

Achenes cylindrical with shallow ribs, 1.5 to 3 mm long, light brown, often pubescent. Pappus bristles numerous, soft, white, about twice the achene length. Pappus +/- deciduous. Ray achenes glabrous. Disc achenes pubescent on ribs have a more persistent pappus.

## **Postsenescence Characteristics**

Dead brown stems can persist for several months.

## **Habitat**

Disturbed sites, waste places, roadsides. Also pastures, rangelands, near riparian areas, and in forested areas. Grows best on light, well-drained soils in cool, moist climates. Seldom tolerates high water tables or acidic soils. Grows in grassland, woodland, and dune communities in native range.

## **Propagation/Phenology**

Reproduces by seed and vegetatively from roots. Seeds dispersed by wind usually travel only a few meters. Seeds can survive ingestion by birds. Seeds do not require an after-ripening period and are often highly viable. Germination occurs soon after seeds are shed summer through fall, but germination can also occur yearround. Ray seeds have thicker coats (pericarp), disperse later, and germinate slower than disc seeds. Frost, drought, and burial often induce seed dormancy. Seeds can remain viable for at least 6 years under field conditions. Highest seedling emergence is from soil depths of 1 to 2 cm. Open sites with little competing vegetation favor seedling survival. Plants are typically biennial, but some regenerate after flowering and become perennial. Crowns and roots can develop new root and shoot buds, especially in response to disturbance or injury. Root fragments can produce new shoots.

## Management Favoring/Discouraging Survival

Mowing or mechanical control often enhances survival by stimulating vegetative reproduction. Managing areas to maintain continuous vegetative cover decreases survival of seedlings.

### Control Methods

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<b>Biological</b>	<b>Chemical</b>
Ragwort flea beetle, Ragwort seed fly, and Cinnabar moth	2,4-D, Clopyralid, Dicamba, Metsulfuron methyl, and Triclopyr

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<b>Cultural</b>	<b>Mechanical</b>
Maintain healthy stands of native vegetation, revegetation/competitive planting, possibly sheep grazing, implement introduction prevention measures	None recommended

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***Carolina Horsenettle Plant***

*Photo Courtesy of Staff CDFA, California Dept. of Food and Agriculture, Integrated Pest Control Branch, 2001 @ calphotos.berkeley.edu*



***Carolina Horsenettle Flowers, Leaves and Stems***

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***Carolina Horsenettle Flowers, Leaves and Stems (above)***

*©Photo Courtesy of Ted Bodner, Southern Weed Science Society @ www.forestryimages.org*

***Carolina Horsenettle Fruits and Prickly Stem (left)***

*©Photo Courtesy of Ted Bodner, Southern Weed Science Society @ www.forestryimages.org*

# Carolina Horsenettle

[*Solanum carolinense* L.] Nightshade (Solanaceae) Family

## General Description

Noxious perennial herbs to shrubs, usually with creeping roots and prickles on the stems. Foliage is covered with star-shaped hairs. Introduced from the central and eastern U.S. and northern Mexico.

## Seedlings

New shoots from roots resemble seedlings, but lack cotyledons. Cotyledons narrowly lanceolate to elliptic, ~10 mm long, ~1.5 mm wide, +/- glabrous. Upper surfaces glossy green. Lower surfaces light green. Stalk below cotyledons (hypocotyl) often purple tinged, covered with short, stiff, downward pointing hairs. Subsequent leaves alternate, ovate, with margins entire to slightly wavy. First two leaves sparsely covered with short, stiff hairs. Third and later leaves also covered with star-shaped hairs.

## Mature Plants

Stems usually prickly openly branched. Leaves alternate, simple, +/- dull green, ovate to lanceolate, to ~15 cm long, usually with wavy to coarse-lobed margins. Foliage is covered with minute star-shaped hairs (requires magnification), typically yellowish to straw colored except where noted. New foliage is more densely covered with hairs. Prickles straight, thin, flattened, yellowish, to ~5 mm long, often on leaf veins.

## Roots and Underground Structures

Plants develop colonies from extensive systems of creeping horizontal and deep vertical roots, both of which produce new shoots. Horizontal roots are true roots, but are erroneously described as rhizomes in many publications. Horizontal roots can extend outward to 1 m or more before developing new shoots. Vertical roots can penetrate soil to depths of 2 m or more. Roots store large quantities of carbohydrates and have a high regenerative capacity. In horsenettle, root carbohydrate levels are lowest ~1 month after shoots emerge in spring. Regeneration depths for small root fragments are much less in dry, saturated, or heavy soils. Root fragments tolerate some desiccation, but not freezing.

## **Flowers**

May-September. Flower clusters are modified cymes (oldest flower at tip of main axis). Cymes racemelike, with 5 to 20 flowers. Often lower flowers are bisexual while upper flowers have reduced female parts and are functionally male. Corolla star shaped, 5-lobed. Sepals lack prickles (except white-margined nightshade). Anthers erect, longer than filaments, spreading or loose around style. Anthers 7 to 9 mm long. Insect pollinated.

## **Fruit and Seeds**

Berries round, not enclosed halfway to completely in a spiny calyx. Immature berries green. Seeds numerous, +/- ovate, flattened. Seeds yellowish to orange brown, 1.5 to 3 mm long, 1.3 to 2.2 mm wide, smooth, glossy.

## **Postsenescence Characteristics**

Foliage of horsenettle dies back after the first fall frost, and dead stems may persist for several months. Dead stems of silver leaf nightshade typically lose prickles and have a few wrinkled yellowish fruit.

## **Habitat**

Plants usually grow in places disturbed by people or livestock, especially those with summer moisture or irrigation. Grows best on sandy, well-drained soils. Plants tolerate considerable drought because of deep root systems.

## **Propagation/Phenology**

Reproduces by seed and vegetatively from creeping roots. Fruit and seeds disperse with agricultural activities, water, mud and soil movement, and animals. Root fragments disperse primarily with cultivation or other human activities. In winter, roots of horsenettle go dormant and foliage dies back. Roots generate new shoots in spring. Seeds germinate spring through summer. Flowering often commences about 1 month after new shoots emerge, and berries begin to mature 4 to 8 weeks later. Each berry contains 40 to 170 seeds (average ~85). One plant can produce up to 5,000 seeds. Most

seed is dormant at maturity and requires a cool, moist period to break dormancy. Fluctuating temperatures appear to stimulate germination. Fresh horsenettle leaves inhibit germination of its seeds. Seedlings emerge from soil depths to 10 cm in light-textured soils (optimal 1 to 5 cm).

## Control Methods

<b>Biological</b>	<b>Chemical</b>
None currently available	2,4-D, Clopyralid, Dicamba, Glyphosate, Isoxaben, and Triclopyr
<b>Cultural</b>	<b>Mechanical</b>
Maintain healthy stands of native vegetation, revegetation/competitive planting, implement introduction prevention measures	Repeated hand pulling or grubbing of small infestations to eliminate seed production, mowing



***Jointed Goatgrass Inflorescences***

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***Jointed Goatgrass Plants***

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***Jointed Goatgrass  
Leaf Collar Region***

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***Jointed Goatgrass Spikelets***

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# Jointed Goatgrass

[*Aegilops cylindrica* Host.] Grass (Poaceae) Family

## General Description

Winter annuals closely related to and resembling winter wheat (*Triticum aestivum* L.). Goatgrass species hybridize with wheat and are sometimes crossed with wheat to impart adaptive characteristics such as cold tolerance and disease resistance. Introduced from Mediterranean Europe and western Asia.

## Seedlings

Typically the joint (section of inflorescence axis and spikelet that contains the seeds) is still attached to the mesocotyl (part of embryonic stalk near the cotyledon) of dug-up seedlings. Similar to winter wheat, but blades, auricles, ligules, and leaf sheaths with evenly spaced, fine hairs along the margins (ciliate). Coleoptile and first leaf typically reddish to brownish green. Ligule membranous, 0.5 mm long or less.

## Mature Plants

Stems branching at the base and erect, spreading, or abruptly bent near the base. Mostly erect. To 50 cm tall. Culms (stems) hollow. Blade upper surfaces often glabrous. Blades flat, spreading, ciliate, about 2 to 3 mm wide; lower surface and sometimes upper surface sparsely covered with fine hairs. Sheaths open. Ligule membranous, 0.5 mm long or less, with upper margins finely fringed.

## Roots and Underground Structures

Roots fibrous.

## Spikelets/Florets

Spikelets 1 per node, alternate, laying flat against and fitting into a groove in a zig-zag rachis. Glume and lemma awns stiff, sharp, and minutely barbed. Glumes and rachis enclose each floret and harden at maturity. Each spikelet and its associated node and rachis is called a joint. Typically there are two 1-seeded fruits (caryopses) per joint. Unlike winter wheat, goatgrass caryopses adhere to the lemma and palea and are difficult to separate from the joint. Caryopses resemble long grains of winter wheat: oblong, reddish to light

brown, grooved, 6 to 9 mm long, with short hairs at the apex. May-June. Spikes cylindrical, disperse as units at maturity, but ultimately break apart into joints. Joints cylindrical with blunt ends. Spikelets +/- cylindrical with two to five florets, the lower two usually fertile. Lemmas of terminal spikelets 1-awned, awns 4 to 5 cm long, erect. Lemmas of lower spikelets pointed or 1-awned, awns 1 to 5 mm long. Out crossing or self-pollinating.

### **Postsenescence Characteristics**

Persistent inflorescences and spikelets of dried grasses and joints on the ground facilitate species identification.

### **Habitat**

All goatgrass species inhabit dry, disturbed sites, fields, and roadsides. Primarily infests rangelands and pastures, including grasslands and oak woodlands, but usually not chaparral. Tolerates serpentine and hard, shallow, dry, gravelly soils.

### **Propagation/Phenology**

Reproduces by seed. Dispersed by livestock, especially sheep, human activities, water (joints float), and wind. Seeds germinate in the joints in the field, but joints appear to reduce germination. Under experimental conditions, seed germination in the joints was about 41 percent. Removing seed from joints increased germination to about 91 percent. Germination occurs under a wide range of temperatures (less than 41 °F and greater than 77 °F). Some seeds can remain dormant for 2 or more years. Seedling growth is fastest at about 41 to 50 °F. Some seed can survive ingestion by cattle.

## Control Methods

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### **Biological**

None currently available

### **Chemical**

Glyphosate and Isoxaben

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### **Cultural**

Maintain healthy stands of native vegetation, revegetation/ competitive planting and possibly early spring burning, implement introduction and prevention measures

### **Mechanical**

Hand grubbing and spring tillage prior to seed-set

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**Camelthorn Stem, Thorns and Leaves**

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**Camelthorn Flowers and Leaves**

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**Camelthorn Stem, Leaves and Fruits  
(above)**

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**Camelthorn Plant (left)**

©Photo Courtesy of Steve Dewey, Utah  
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# Camelthorn

[*Alhagi pseudoalhagi* (Bieb.) Desv. ex B. Keller and Schaparenko] Pea (Fabaceae) Family

## General Description

Perennial green shrub to 1(2) m tall, with simple leaves, many thorny branches, and an extensive root system. Plants spread rapidly by clonal vegetative reproduction from vigorous rhizomes. A desert plant introduced from the Mediterranean region and western Asia. Intense eradication programs have eliminated most populations in the state.

## Seedlings

Lack thorns. Cotyledons ovate, thick, leathery, ~5 to 10 mm long. Often found growing in cattle manure from seed passed through digestive tract. Seedling shoots grow slowly compared to its roots and to shoots of alfalfa and some clovers.

## Mature Plants

Stems +/- glabrous, greenish, longitudinally ridged, and highly branched, with the leaf axil of nearly every node supporting an ascending leafless branchlet, 2 to 5 cm long, tipped with a thorn about 5 mm long. Leaves alternate, sparse, simple, thick, leathery, elliptic or obovate, and 7 to 20 mm long, with petioles 1 to 2 mm long and stipules about 1 mm long. Upper leaf surfaces glabrous (sometimes sparsely hairy) and covered with minute red dots. Lower leaf surfaces are sparsely (to moderately) covered with hairs. Deciduous in cool climates. Morphology is variable depending on environmental conditions. Thorns are smaller and fewer, and leaves larger and more numerous in moister habitats.

## Roots and Underground Structures

Extensive rhizomes present. Woody root system can grow more than 2 m deep and to a distance of 8(12) m or more in all directions. Rhizomes at depths to 1.5 m produce new shoots and deep vertical roots at about 1 to 1.5 m intervals. In turn, each new clone sends out rhizomes in all directions. Infestations can spread at a rate of about 10 m per year.

## **Flowers**

June-July. Two to six short-stalked flowers are produced alternately along each thorn branchlet axis. Flowers pealike, with magenta to pink petals 8 to 9 mm long. Sepals persistent, fused and cuplike, with small unequal teeth. Stamens 10, with bases of 9 filaments fused into a tube around the style and 1 separate. Self-fertile. Flower production is high under hot, dry conditions (700 to 4,000 per plant) and low (sometimes to 0) under moist, shady conditions. Only a low percentage (~20%) of flowers set seed.

## **Fruit and Seeds**

July-August. Pods (loment) reddish brown at maturity, slender, often curved, 1 to 3 cm long, constricted between seeds, and often tipped with a small spine. Pods do not split open to release seeds but can break apart between seeds. Seeds 5 to 8, oval, yellowish or greenish brown with dark mottling or solid dark brown, smooth textured, about 3 mm long and 2.5 mm wide. Soft- and hard-coated seeds are produced. Fruit are eaten by herbivores, especially cattle and horses.

## **Postsenescence Characteristics**

Woody tissues persistent after plant death.

## **Habitat**

Arid agricultural areas and riverbanks where roots can access water tables or other water sources during the growing season. Often grows in heavy soils. Tolerates some salinity. Aboveground parts can be killed by hard frosts.

## **Propagation/Phenology**

Reproduction mostly by vegetative clones from rhizomes, occasionally from seed. Seed dispersed primarily by livestock browsing on fruit, but also by water and high winds blowing clumps of branches with fruit. Passing through a herbivore digestive tract or acid scarification appears to stimulate germination. Optimal

temperature and soil depth for germination is near 81 °F and 1 cm respectively. Light appears to inhibit germination. Seeds can survive submersion in water for at least 8 months and can remain viable for several years in semiarid soils. Viability decreases rapidly after 1 year in cool, moist soil conditions.

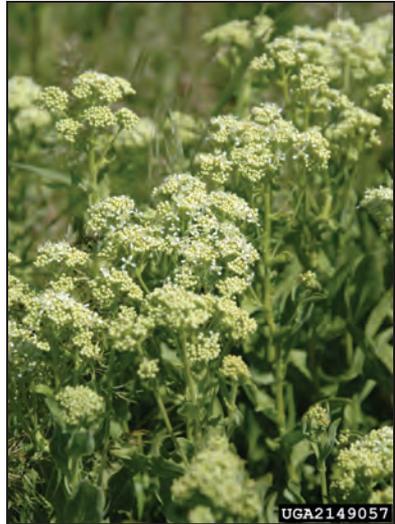
### Control Methods

<b>Biological</b>	<b>Chemical</b>
None currently available	2,4-D, Dicamba, and Imazapyr
<b>Cultural</b>	<b>Mechanical</b>
Maintain healthy stands of native vegetation, revegetation/competitive planting, implement introduction and prevention measures	None recommended



**Whitetop Plants**

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**Whitetop Plants**

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**Whitetop Fruit**

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**Whitetop Flowers**

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# Whitetop

[*Cardaria draba* (L.) Desv.] Mustard (Bassicaceae) Family

## General Description

Noxious perennials to 0.4(0.5) m tall, with creeping horizontal roots that vigorously produce new plants. Whitetop was introduced from Eurasia.

## Seedlings

Develop taproots to a depth of 25 cm and lateral roots with shoot buds within 1 month. Cotyledons oval to elliptic, 7 to 9 mm long, ~2.5 mm wide, unequal, pale gray green, with peppery taste. First leaves ovate to oblong, dull, scaly, somewhat larger than the cotyledons, often with slightly wavy margins. Subsequent leaves resemble first leaves, but sometimes have short, fine hairs along the margins. First and subsequent leaves have bases tapered to petioles equal to or longer than the length of the blades.

## Mature Plants

Stems +/- erect, sparse to densely covered with simple short hairs. Leaves alternate, gray green, variable, obovate, (ob)lanceolate, oblong to elliptic. Surfaces, especially lower, sparsely to densely covered with simple, short white hairs. Margins irregularly toothed to entire. Basal leaves short stalked. Upper leaves sessile, with rounded-acute to acute-lobed bases that clasp the stem. Whitetop leaves to 9 cm long and 4 cm wide, sometimes smaller. Leaf base lobes often rounded acute. Hairs sparse to dense.

## Roots and Underground Structures

Plants develop extensive systems of persistent, deep, vertical and horizontal roots that vigorously produce new shoots at irregular intervals. Root fragments can generate new plants. Vertical roots can penetrate the soil to depths of 2 m or more. Roots can account for 75 percent of the total plant biomass and, as a result, store considerable amounts of carbohydrates. Carbohydrate reserves typically accumulate to maximum levels by mid-summer and are minimal in early to mid-spring. Roots survive cold winter climates and periods of drought. Mycorrhizal associations do not develop.

## **Flowers**

Inflorescences often +/- flat topped (compound corymbs). Flowers fragrant, numerous, 4-petaled, white. Insect pollinated. March-July. Sepals glabrous. Petals mostly 3 to 4 mm long.

## **Fruit and Seeds**

Pods (silicles) 2-chambered, variable, inflated, with a persistent style 1 to 2 mm long at the apex, do not open (or open slowly) to release seeds. Seeds (0)1 to 2 per chamber, ovoid, slightly flattened, reddish brown, 1.5 to 2 mm long, 1 to 1.5 mm wide, with minutely granular surfaces. Whitetop pods upside-down heart shaped to broadly ovate in outline, often constricted at septum and +/- 2-lobed, 2.5 to 3.5 mm long, 3 to 5 mm wide, glabrous.

## **Postsenescence Characteristics**

Foliage dies back during extended periods of freezing temperatures or drought.

## **Habitat**

Disturbed open sites, fields, grain and vegetable crops, especially irrigated crops such as alfalfa and sugar beets, orchards, vineyards, roadsides, and ditches. Often grows on moderately moist, alkaline to saline soils, but tolerates a wide range of soil types and moisture conditions.

## **Propagation/Phenology**

Reproduces vegetatively from creeping roots and less importantly by seed. Root fragments generate new plants, but regeneration is poor in dry soils. Under favorable conditions, plants often increase vegetatively by more than a 61-cm radius per year. Light stimulates seed germination but is not required. Seed germinates in the fall after the first rains. Plants typically do not flower the first year. In 1 year, a single plant on open ground without competition can spread vegetatively to cover an area to 3.7 m in diameter and can produce up to 455 shoots. One plant can produce up to 4,800 seeds, with ~85 percent viability. Seed germinates at

temperatures ranging from 0.5 to 40 °C (optimum 20 to 35 °C). Dry-stored seed remains viable for up to 5 years, but under field conditions, seed is probably viable for a much shorter period.

## Control Methods

<b>Biological</b>	<b>Chemical</b>
Thistle head feeding weevil and Rosette weevil	2,4-D, Chlorsulfuron, Dicamba, Fluroxypyr, Glyphosate, Imazapyr, Isoxaben, Metsulfuron methyl, and Sulfometuron methyl
<b>Cultural</b>	<b>Mechanical</b>
Maintain healthy stands of native vegetation, revegetation/competitive planting, and grazing, implement introduction and prevention measures	Repeated mowing or tilling prior to seed-set



### ***Halogeton Plants***

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### ***Halogeton Plant***

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### ***Halogeton Flowers and Foliage***

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### ***Halogeton Flowers, Stem and Foliage***

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# Halogeton

[*Halogeton glomeratus* (M. Bieb.) C. Meyer] Goosefoot  
(Chenopodiaceae) Family

## General Description

Erect winter to summer annual with small fleshy leaves, to 0.5 m tall. Halogeton typically invades disturbed arid and semiarid sites with alkaline to saline soils. Plant tissues accumulate salts from lower soil horizons. The salts leach from dead plant material, increasing topsoil salinity and favoring halogeton seed germination and establishment. Some salt in the foliage consists of soluble oxalates toxic to livestock, especially sheep. Soluble oxalates cause an acute reduction in bloodstream calcium (hypocalcemia). Symptoms of poisoning include staggering and muscular spasms. Toxicity of plant material depends on environmental conditions, plant maturity, and the condition of livestock. As little as 340 g of foliage can be fatal to poorly nourished animals. Livestock supplemented with calcium fortified feeds are less susceptible to the toxic effects. Animals usually avoid consuming the bitter tasting foliage if more suitable forage is available. Introduced from the cold desert regions of Eurasia.

## Seedlings

Cotyledons cylindrical, gradually narrowed to the +/- blunt apex, ~3 to 6 mm long, ~1 mm wide, glabrous. First leaves appear opposite, cylindrical, usually broadest near the tip, with tufts of long white interwoven hairs in the axils. Tips rounded with a short bristle at the apex.

## Mature Plants

Stems branched, often curved at the base, ascending to erect, +/- fleshy, usually tinged reddish or purple. Leaves alternate, sessile, dull green to bluish green, fleshy, cylindrical, 4 to 22 mm long, ~1 to 2 mm wide, broadest at the apex. Apex bluntly rounded, tipped with a stiff bristle 1 to 2 mm long. Foliage glabrous, except for tufts of long white interwoven hairs in the leaf axils. Leaves deciduous or shriveled in fruit.

## **Roots and Underground Structures**

Taproots grow slowly and can penetrate soil to depths of up to 50 cm. Lateral roots may spread up to 46 cm in all directions.

## **Flowers**

June-September. Flower clusters numerous and dense in most leaf axils, small, headlike, with 0 to 3 bractlets 1.5 to 2 mm long below each cluster. Flowers bisexual and female (pistillate). Petals lacking. Sepals five. Most flowers have petallike sepals with narrow oblong bases 1 to 2 mm long and membranous fan-shaped tips 2 to 3.5 mm long. Fan-shaped tips greenish yellow to red tinged, conspicuously veined. Some flowers have bractlike sepals 2 to 3 mm long. Stamens 0 (pistillate flowers) or two to five (bisexual flowers).

## **Fruit and Seeds**

August-October. Utricles (thin-walled, 1-seeded fruit) 1 to 2 mm long, enclosed by sepals. Fruit with sepals typically hide stems. Utricles loosely enclosed by fan-shaped sepals contain blackish-brown seeds and are commonly referred to as black seeds in the literature. Utricles tightly enclosed by adherent brown bractlike sepals contain brown seeds, and entire structures are referred to as brown seeds. Seeds +/- teardrop shaped, often with two points, flattened, ~1 to 2 mm long, with a coiled embryo.

## **Postsenescence Characteristics**

Plants turn straw colored when cool season frosts begin. Plants with some fruit, particularly those enclosed by bractlike sepals, may remain intact through winter.

## **Habitat**

Disturbed open sites, dry lakebeds, shrublands, roadsides, typically where native vegetation is sparse. Inhabits arid and semiarid regions, especially where winters are cold. Grows on many soil types, but is adapted to alkaline and saline soils with at least 5,800 ppm of sodium chloride.

## Propagation/Phenology

Reproduces by seed. Plants typically produce enormous quantities of seed (average is ~75 seeds per 2.5 cm of stem). Seeds disperse with wind, water, human activities, seed-gathering ants, animals, and when dry plants break off at ground level and tumble with the wind. Many seeds survive ingestion by animals, including sheep and rabbits. Plants produce two types of seed depending on photoperiod. Black seeds typically develop after mid-August, lack or have a short after-ripening period, and remain viable for ~1 year. Brown seeds usually develop before mid-August, are dormant at maturity, and can survive for ~10 years or more under field conditions. Experimental evidence suggests that the bractlike sepals enforce dormancy of brown seeds. Cool, moist vernalization appears to enhance germination of brown seeds by decomposing the adherent sepals. Plants typically produce more black seeds than brown, but the ratio varies according to environmental conditions. Most black seeds are shed by early November. Brown seeds may remain on plants until February. Most seeds germinate late fall to early spring in cold winter areas, but some germination can occur year-round when conditions become favorable. Black seeds can imbibe water and germinate in less than 1 hour.

## Control Methods

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<b>Biological</b>	<b>Chemical</b>
None currently available	2,4-D, Chlorsulfuron and Metsulfuron methyl

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<b>Cultural</b>	<b>Mechanical</b>
Maintain healthy stands of native vegetation, revegetation/competitive planting, implement introduction prevention measures	Repeated hand pulling or grubbing of small infestations to eliminate seed production, tillage

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***Texas Blueweed Flowerhead***

©Photo Courtesy of Ruth E. Timme,  
Research Assistant, University of  
Maryland @ [www.ruthtimme.com](http://www.ruthtimme.com)



***Texas Blueweed  
Flowerhead Involucre***

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***Texas Blueweed Plants***

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***Texas Blueweed Plants***

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# Texas Blueweed

[*Helianthus ciliaris* DC] Sunflower (Asteraceae) Family

## General Description

Erect herbaceous perennial, to 0.7 m tall, with bluish-green foliage and creeping roots. New shoots from root buds often create dense patches of plants. Introduced from south-central U.S. and northern Mexico.

## Mature Plants

Strong pungent odor, especially when crushed. Texas blueweed stems often sparsely covered with short stiff hairs. Leaves typically glabrous or hairy on the margins (ciliate), sessile, bluish green, covered with a whitish film (glaucous), mostly opposite, oblong to lanceolate, 3 to 8 cm long. Margins wavy, entire to shallowly lobed.

## Roots and Underground Structures

Texas blueweed develops an extensive system of woody horizontal creeping roots with buds approximately every 5 cm. Root fragments can produce new shoots from buds. Plants are shallow rooted in uncultivated soils, but develop deeper root systems on cultivated land.

## Flowers

Showy composite flower heads solitary on long peduncles. Ray flowers yellow. June-November. Flower head receptacles 1.2 to 2.5 cm across. Unit of disk flowers rounded on top, yellowish. Ray flower corollas about 1 cm long. Disk flower corollas 4 to 5 mm long with red lobes. Receptacle scales (chaffy bracts) hairy at the tips, entire or 3-lobed. Achenes about 3 mm long. Pappus scales about 2 mm long.

## Habitat

Roadsides, irrigated fields, stream and ditchbanks, low drainage areas. Grows best on cultivated soils and often infests alkaline or saline soils.

## Propagation/Phenology

Reproduces by vegetative clones from roots and by seed.  
Seed viability is often low.

## Control Methods

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<b>Biological</b>	<b>Chemical</b>
None currently available	2,4-D, Clopyralid, Dicamba, Glyphosate, Imazapic, Imazapyr and Isoxaben

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<b>Cultural</b>	<b>Mechanical</b>
Maintain healthy stands of native vegetation, revegetation/competitive planting, implement introduction prevention measures	Repeated hand pulling or grubbing of small infestations, to cut and dig out roots and eliminate seed production, tillage, cultivation

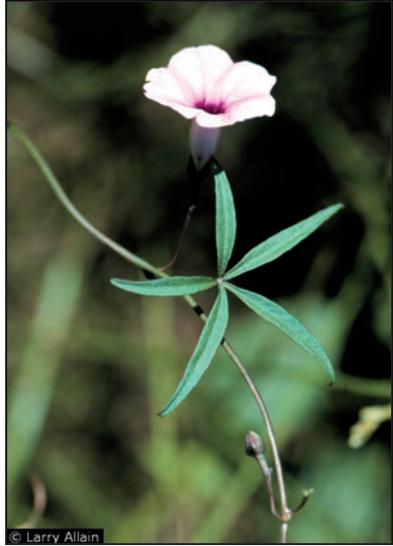
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***Morning-glory Flowers and Leaves***

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***Morning-glory Flower and Leaves***

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***Morning-glory Flowers and Leaves***

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***Morning-glory Flowers and Leaves***

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# Morning-glory

[*Ipomoea* spp. L.] Morning-glory (Convolvulaceae) Family

## General Description

All species of morning-glory are declared prohibited noxious weeds in Arizona. Scarlet morning-glory is a hairless annual with ridged, often reddish stems, twining or trailing on the ground, which reproduces only by seeds. May be from 1.2 to 4.7 m in length. The alternate leaves, on stalks 2.5 to 10.2 cm long, are of two principal shapes. On some plants they are unlobed, with the base deeply heart shaped and the tip conspicuously long pointed, 3.8 to 6.4 cm long. On other plants (var. *hederifolia*), some or all of the leaves are deeply cut into three to five fingerlike lobes. Tall morning-glory is an annual climbing and twining vine. From a fibrous root system. The twining or trailing stems are hairy, 1.5 to 4 m long. Similar to woolly morning-glory, but the leaves are all heart shaped and unlobed. More or less hairy, and pointed at the tip, the blades are 6.4 to 10.2 cm long, on stalks 5.1 to 10.2 cm long.

## Flowers

The scarlet red flowers easily separate scarlet morning-glory from all other Arizona species. (Others are pink, purple, blue, or white.) The flowers are narrowly trumpet shaped, 2.5 to 3.2 cm long, and 1.3 to 1.7 cm across. Two to several flowers are borne on a stalk 3 to 5 inches long, arising from the leaf axils. The globe-shaped seedpods contain four to six blackish seeds. These are plump, somewhat egg shaped but angular, 3 mm or slightly longer. Tall morning-glory flowers are white to blue, or purple to bright pink, with considerable variation and different markings, 3.8 to 6.6 cm long, and 3.8 to 5.1 cm across. The 5-lobed calyx is conspicuously hairy, 1.3 to 1.9(2.5) cm long. The globe-shaped seedpods contain four to six seeds. The seeds are similar, but flattened and larger, about 5 mm long, minutely hairy except around the scar, 3- to 4-angled, and brownish black.

## Habitat

Scarlet morning-glory is native in Arizona, New Mexico, and in tropical America. It is a pest in cotton fields and other commercial croplands in southeastern Arizona, from Apache to Coconino County and southward. Often found along roadsides, ditches, sandy washes, hillsides, and canyons; 610 to 2,134 m elevation; flowering May to October. Prefers full sunlight. Tall morning-glory is native in tropical America. It occurs with woolly and scarlet morning-glories on the farms, fields, roadsides and ditches in central and southern Arizona, flowering from about June to October.

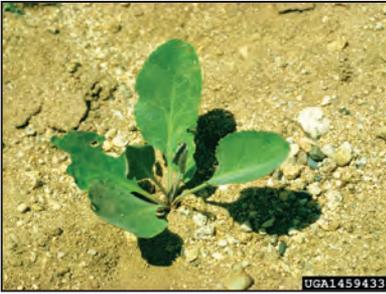
## Propagation/phenology

Reproduces by seed.

## Control Methods

<b>Biological</b>	<b>Chemical</b>
None currently available	Fluroxypyr, Glyphosate, Hexazinone, Imazapic, Imazapyr and Isoxaben
<b>Cultural</b>	<b>Mechanical</b>
Maintain healthy stands of native vegetation, revegetation/competitive planting, implement introduction prevention measures	Repeated hand pulling or grubbing of small infestations, to cut and dig out roots and eliminate seed production





***Perennial Pepperweed Seedling***

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***Perennial Pepperweed Plant***

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***Perennial Pepperweed Foliage***

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***Perennial Pepperweed Flowers***

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# Perennial Pepperweed

[*Lepidium latifolium* L.] Mustard (Brassicaceae) Family

## General Description

Erect noxious perennial to 2 m tall, with white flowers and extensively creeping roots. Plants are highly competitive and typically form dense colonies that displace native vegetation and wildlife. Toxicity to grazing livestock is undocumented. Perennial pepperweed has spread rapidly throughout the western U.S. since its introduction from Eurasia.

## Seedlings

Cotyledons obovate to oblong, ~3-8 mm long, glabrous, tip rounded, base tapered into a short stalk ~2 to 3 mm long. First leaves developmentally alternate, but appear opposite, ovate to oblong, ~4 to 12 mm long, glabrous, tip +/- rounded, base +/- wedge shaped, on a stalk ~5 mm long. Margins entire to slightly wavy. Subsequent leaves resemble first leaves and are increasingly larger.

## Mature Plants

Crown and lower stems +/- weakly woody. Foliage glabrous, green to gray green. Leaves alternate, lanceolate to elliptic or oblong. Basal leaves to 30 cm long and 8 cm wide, with serrate margins and on long stalks (~3 to 15 cm long). Stem leaves reduced, +/- sessile, tapered at the base, margins entire to weakly serrate.

## Roots and Underground Structures

Roots long, thick, minimally branched, vigorously creeping. Most roots occur in the top 60 cm of soil, but some can penetrate to depths of 3 m or more. Carbohydrate reserves are lowest when flowering stems are elongating (bolting stage).

## Flowers

May-September. Inflorescences +/- pyramidal to rounded on top. Petals four, white, spoon shaped, ~1.5 mm long. Sepals oval, less than 1 mm long, +/- covered with long simple hairs. Stamens six, four long, two short. Insect pollinated.

## **Fruit and Seeds**

Pods (silicles) 2-chambered, round to slightly ovate, slightly flattened, lacking a notch at the apex, ~2 mm long, +/- covered with long simple hairs. Stigma sessile, persistent. Stalks much longer than pods, glabrous or sparsely pubescent. Seeds ellipsoid, slightly flattened, +/- 1 mm long, 0.5 mm wide, reddish brown, with a shallow groove on each side and minutely granular surface. Seeds fall from pods irregularly through winter and some may remain in pods until the following season.

## **Postsenescence Characteristics**

Aboveground parts typically die in late fall and winter. The pale tan dead stems persist for more than 1 year.

## **Habitat**

Wetlands, riparian areas, meadows, salt marshes, flood plains, beaches, roadsides, irrigation ditches, agronomic crops, especially alfalfa, orchards, vineyards, irrigated pastures, and ornamental plantings. Typically grows on moist or seasonally wet sites. Tolerates saline and alkaline conditions.

## **Propagation/Phenology**

Reproduces vegetatively from creeping roots and root fragments and by seed. Roots do not hold soil together very well, allowing erosion of river, stream, or ditchbanks. Root fragments and seeds float and disperse with flooding, soil movement, and agricultural and other human activities. Seeds can also cling to tires and shoes, and the feet, fur, and feathers of animals and contaminate hay or crop and pasture seed. Large fragments can survive extreme desiccation on the soil surface for extended periods. Fragments as small as 1 to 2 cm long and 2 to 8 mm in diameter can develop into new plants. New shoots begin to grow from roots in late winter. Fluctuating temperatures appear to stimulate seed germination. Plants usually produce abundant, often highly viable seed, but seedlings are seldom detected in the field. In wet years,

seed production is sometimes limited by white rust (*Albugo* spp.) infection. Seedlings emerge mid-winter through mid-spring. Heavy infestations are difficult to control. Cleaning heavy equipment after use in infested areas and curtailing movement or use of soil, hay, and crop or pasture seed contaminated with perennial pepperweed root fragments and/or seed can help prevent new infestations. Single techniques, such as repeated mowing, hand digging, cultivation, grazing, and burning, typically do not adequately control perennial pepperweed. In addition, cultivation may increase infestations by dispersing root fragments. Field observations suggest that plants may not tolerate an extended period of flooding during the growing season.

## Control Methods

<b>Biological</b>	<b>Chemical</b>
None currently available	2,4-D, Chlorsulfuron, Fluroxypyr, Glyphosate, Imazapic, Imazapyr, Isoxaben and Sulfometuron methyl
<b>Cultural</b>	<b>Mechanical</b>
Maintain healthy stands of native vegetation, revegetation/competitive planting, flooding, implement introduction prevention measures	Repeated hand pulling or grubbing of small infestations to cut and dig out roots and eliminate seed production



***African Rue Leaves***

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***African Rue Plants***

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***African Rue Flower***

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***African Rue Leaves and Fruit***

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# African Rue

[*Peganum harmala* L.] Caltrop (Zygophyllaceae) Family

## General Description

Bushy, herbaceous perennial with short creeping roots, to 0.8 m tall. African rue contains numerous alkaloids and all plant parts are toxic. Seed coats contain the alkaloid harmine and are especially toxic when ingested. However, livestock seldom consume plants because of the bitter taste. Toxicity symptoms in guinea pigs include weakness and paralysis of the hindquarters. Dehulled seeds yield edible oil similar to cottonseed oil. Plants have been used medicinally and produce red dye in the Middle East. Introduced from the Mediterranean region and Middle East.

## Mature Plants

Stems stiff, erect, highly branched, angled above, glabrous. Leaves alternate, fleshy, bright green, 2 to 5 cm long, irregularly divided three times or more into linear segments. Stipules bristlelike.

## Roots and Underground Structures

Taproot branched, with stout, short-creeping lateral roots usually greater than 15 cm deep. New shoots can develop from lateral roots.

## Flowers

Late spring-early fall. Flowers white, ~2.5 cm in diameter and solitary on stalks 2 to 5 cm long or more in the leaf axils. Sepals five, linear, ~1.5 cm long. Petals five, oblong, ~1.5 cm long.

## Fruit and Seeds

Capsules spherical, leathery, 7 to 15 mm in diameter, orange brown at maturity, 3-chambered, and opening by three valves at the apex to release numerous dark brown to black angular seeds, 3 to 4 mm long.

## Postsenescence Characteristics

Aboveground parts dieback in winter.

## Habitat

Dry places, such as roadsides and abandoned fields, in desert and semidesert regions. Grows best on sites that receive some runoff water.

## Propagation/Phenology

Reproduces primarily by seed, but roots can produce new shoots, especially when severed. Most seed falls near the parent plant, but some seed dispersed by water, human activities and machinery, or by adhering to the feet, fur, or feathers of animals. Seeds can germinate under fairly saline conditions. Germination starts in early spring and is sporadic throughout the growing season when adequate moisture is available. Seedlings emerge from soil depths to 3 cm, but most emergence occurs from the upper 0.5 cm.

## Control Methods

<b>Biological</b>	<b>Chemical</b>
None currently available	2,4-D, Dicamba, Glyphosate, Isoxaben and Triclopyr
<b>Cultural</b>	<b>Mechanical</b>
Maintain healthy stands of native vegetation, revegetation/competitive planting, implement introduction prevention measures	None recommended





***Salt Cedar Flowers***

©Photo Courtesy of Mr. and Mrs. Robert G. Young @ USDA-NRCS PLANTS Database/USDA NRCS. 1992. *Western wetland flora: Field office guide to plant species. West Region, Sacramento, CA.* @ [plants.usda.gov](http://plants.usda.gov)



***Salt Cedar Flowers and Foliage***

©Photo Courtesy of Steven Perkins @ USDA-NRCS PLANTS Database @ [plants.usda.gov](http://plants.usda.gov)



***Salt Cedar Flowers and Foliage***

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***Salt Cedar In Bloom***

©Photo Courtesy of Steve Dewey, Utah State University @ [www.forestryimages.org](http://www.forestryimages.org)

# Salt Cedar

[*Tamarix* spp. L.] Tamarisk (Tamaricaceae) Family

## General Description

Deciduous or evergreen shrubs or small trees reaching 1.6 to 6.4 m tall and forming dense thickets. Salt cedars are characterized by slender branches and gray-green foliage. The bark of young branches is smooth and reddish brown. As the plants age, the bark becomes brownish purple, ridged and furrowed. Leaves are scalelike, about 2 mm long and overlap each other along the stem. They are often encrusted with salt secretions. Salt cedars were introduced from Eurasia.

## Roots and Underground Structures

Large plants of salt cedar can transpire at least 757 liters per plant each day and will often dry up ponds and streams.

## Leaves

Small leaves on green stems are alternate, overlap each other and appear scalelike (similar to a cedar tree). Foliage is salty to taste.

## Stems

Highly branched with a smooth, dark brown to reddish-brown bark.

## Flowers

March to September. Borne in fingerlike clusters on terminal and lateral branches, are small, pink to white and have five petals.

## Reproductive Structures

By seed.

## Habitat

Sold as ornamentals, but have escaped and become naturalized along streams, canals, and reservoirs in much of the Southwest. Salt cedar can grow on highly saline soils containing up to 15,000 ppm soluble salt and can tolerate alkali conditions.

## Propagation/Phenology

Salt cedar spreads vegetatively, by adventitious roots or submerged stems, and sexually. Each flower can produce thousands of tiny (2 mm diameter) seeds that are contained in a small capsule usually adorned with a tuft of hair that aids in wind dispersal. Seeds can also be dispersed by water. Seedlings require extended periods of soil saturation for establishment.

## Control Methods

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<b>Biological</b>	<b>Chemical</b>
Salt cedar leaf beetle	Glyphosate, Imazapic, Isoxaben and Triclopyr

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<b>Cultural</b>	<b>Mechanical</b>
Maintain healthy stand of native vegetation, revegetation/competitive planting, possibly goat grazing, implement introduction prevention measures	Repeated hand pulling or grubbing of small infestations of small plants, root-cutting and bulldozing

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**Red Brome Ligule**

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**Red Brome Inflorescences  
and Spikelets**

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**Red Brome Inflorescences  
and Spikelets**

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**Red Brome Plant**

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