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Field Guide to Noxious and Invasive Weeds

Known to Occur or Are Potentially Occurring on the Apache-Sitgreaves National Forests

Cover Image: Bull Thistle (*Cirsium vulgare* (Savi) Ten.) USDA-NRCS Plants Database/Britton, N. L. and A. Brown. 1913. “Illustrated flora of the northern states and Canada.” Vol. 3:549.

Field Guide to Noxious and Invasive Weeds

Known to Occur or Are Potentially Occurring on the Apache-Sitgreaves National Forests

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To solve a problem, we must first understand the problem. This guide is designed to help identify the noxious and invasive weeds that threaten our forests and form a plan of action to control their spread.

Introduction

The terms "noxious weed" or "invasive weed" are often used interchangeably. Generally, a weed is an unwanted plant that grows or spreads aggressively. An invasive noxious weed is one that grows and spreads rapidly, replacing desired plants. Forest Service policy defines noxious weeds as: "Those plant species designated as noxious weeds by the Secretary of Agriculture or by the responsible state official. Noxious weeds generally possess one or more of the following characteristics: aggressive and difficult to manage, poisonous, toxic, parasitic, a carrier or host for serious insects or disease, and being native or new to or not common to the United States or parts thereof." The term "noxious" also has legal ramifications for states that have noxious weed laws or regulations.

Noxious and invasive weed control is everyone's concern because they can occur across all land ownerships. Noxious and invasive weeds compete with crops; poison or injure livestock, wildlife and people; reduce forage for wildlife and livestock; create fire hazards; and reduce recreation enjoyment because of thorns, allergies or unsightliness. Noxious and invasive weeds destroy the beauty and natural habitat of Arizona wherever and whenever they occur.

Noxious weeds continue to spread into uninfested areas in the western United States. On Federal lands it is estimated that noxious weeds and invasive plants occur on more than 17 million acres. On National Forest System lands, an estimated 6 to 7 million acres are currently infested, with a projected potential for increasing at a rate of 8 to 12 percent per year. Noxious weeds and invasive plants infest native plant communities in increasing numbers throughout Arizona and are beginning to appear on the Apache-Sitgreaves National Forests (ASNFs) in greater numbers every passing year. Noxious weeds have a significant environmental advantage over native plant species because they are free of natural enemies. Noxious weeds pose an increasing threat to native ecosystems. This is why prevention and direct control methods must

be used to stress or remove noxious and invasive weeds from native plant communities.

The noxious and invasive weeds listed in this document have been introduced to Arizona from other places without the accompaniment of their natural predators to keep them in check. As a result, these plants can overwhelm native plant species and spread dramatically year by year.

To control noxious and invasive weed infestations requires development and implementation of a noxious weed management program which focuses on: (1) preventing introduction of new noxious and invasive weeds; (2) early detection of noxious weed infestations; (3) conducting early treatment of new infestations; and (4) containing and controlling established infestations at times and places that make them most effective and efficient. The most effective and efficient combination depends on factors such as the biology of the particular weed(s) and the circumstances under which it is growing.

To address this need, the Little Colorado River Resources, Conservation and Development Area, Inc., and area stakeholders developed the Little Colorado River Weed Management Area (WMA). Development of the WMA began in 2004 and has made steady progress toward creating a self-sustaining organization. In 2006, a grant was secured through the Eastern Arizona Counties Resource Advisory Committee (RAC). With this grant, the WMA began to implement its goals:

1. To create a weed management group that serves as northeastern Arizona's leading community action team in addressing the threat of noxious and invasive weeds to our environment.

2. To write and implement a weed management strategy that addresses noxious and invasive weed identification, suppression, control, education and training.

3. To assist the Apache-Sitgreaves National Forests in documenting and inventoring noxious and invasive weeds in a minimum of 15 specific areas.

Members of the local weed group in action.

It is the mission of the WMA to reach these goals by bringing education to forest and area residents and visitors about the impact of noxious and invasive weeds and to motivate volunteers to help in this effort. "Weed Warrior" volunteers will be equipped with literature, technology, and the passion to protect this beautiful part of Arizona. If you are interested in helping to protect your forests, please mail the form near the back of this document to the WMA and someone will contact you about volunteering.

Within Arizona, the Arizona Department of Agriculture has been given the overall responsibility for regulating noxious and invasive weeds within the state. Arizona law requires the department to maintain a noxious weed list that categorizes invasive plants based on their presence or absence in Arizona and on the ability of land managers to regulate a particular plant once it occurs in the state. Unfortunately, more new noxious and invasive weed species are found each year, and requests to add new species to the noxious weed list are increasing. A copy of Arizona's noxious weed list can be obtained by contacting the Arizona Department of Agriculture at (602) 542-4373 or by visiting their Web site at http://www.azda.gov/.

Contents

Noxious and invasive weeds[1] arranged alphabetically by genera within each treatment/priority class

Class A, Treatment Priority 1

Common Name	Scientific Name	Page
Russian Knapweed	*Acroptilon repens* (L.) DC	1
Lens-podded hoarycress	*Cardaria chalepensis* (L.) Hand.-Maz.	5
Hairy whitetop	*Cardaria pubescens* (C.A. Mey.) Jarmolenko	9
Plumeless thistle	*Carduus acanthoides* L.	13
Musk thistle	*Carduus nutans* L.	17
Purple starthistle	*Centaurea calcitrapa* L.	21
Diffuse knapweed	*Centaurea diffusa* Lam.	25
Iberian starthistle	*Centaurea iberica* Trev. ex Spreng.	29
Yellow starthistle	*Centaurea solstitialis* L.	37
Spotted knapweed	*Centaurea stoebe* L. ssp. *micranthos* (Gugler) Hayek	33
Sicilian starthistle	*Centaurea sulphurea* Willd.	45
Squarrose knapweed	*Centaurea virgata* Lam. ssp. *squarrosa* (Willd.) Gugler	41
Rush skeletonweed	*Chondrilla juncea* L.	49
Canada thistle	*Cirsium arvense* (L.) Scop.	53
Teasel	*Dipsacus fullonum* L.	57
Russian olive	*Elaeagnus angustifolia* L.	61
Leafy spurge	*Euphorbia esula* L.	65
Black henbane	*Hyoscyamus niger* L.	69
Dyers woad	*Isatis tinctoria* L.	73

Dalmatian toadflax	*Linaria genistifolia* (L.) P. Mill. ssp. *dalmatica* (L.) Maire & Petitm.	77
Yellow toadflax	*Linaria vulgaris* P. Mill.	81
Purple loosestrife	*Lythrum salicaria* L.	85
Scotch thistle	*Onopordum acanthium* L.	89
Tansy ragwort	*Senecio jacobaea* L.	93
Carolina horsenettle	*Solanum carolinense* L.	97

Class B, Treatment Priority 2

Common Name	Scientific Name	Page
Jointed Goatgrass	*Aegilops cylindrica* Host	101
Camelthorn	*Alhagi pseudoalhagi* (Bieb.) Desv. ex B. Keller & Schaparenko	105
Whitetop	*Cardaria draba* (L.) Desv.	109
Halogeton	*Halogeton glomeratus* (Bieb.) C.A. Mey.	113
Texas blueweed	*Helianthus ciliaris* DC	117
Morning-glory	*Ipomoea* spp. L.	121
Perennial pepperweed	*Lepidium latifolium* L.	125
African rue	*Peganum harmala* L.	129
Salt cedar	*Tamarix* spp. L.	133

Class C, Treatment Priority 3

Common Name	Scientific Name	Page
Red Brome	*Bromus rubens* L.	137
Cheatgrass	*Bromus tectorum* L.	141
Southern sandbur	*Cenchrus echinatus* L.	145
Field sandbur	*Cenchrus incertus* M. Curtis	149
Bull thistle	*Cirsium vulgare* (Savi) Ten.	153
Field bindweed	*Convolvulus arvensis* L.	159
Hounds tongue	*Cynoglossum officinale* L.	163
Weeping lovegrass	*Eragrostis curvula* (Schrad.) Nees	167
Lehmann lovegrass	*Eragrostis lehmanniana* Nees	171
Redstem filaree	*Erodium cicutarium* (L.) L'Hér. ex Ait.	175
Oxeye daisy	*Leucanthemum vulgare* Lam.	179
Burclover	*Medicago polymorpha* L.	183
White sweetclover	*Melilotus albus* (L.) Lam.	187
Yellow sweetclover	*Melilotus officinalis* Medik.	191
Purslane	*Portulaca oleracea* L.	195
Himalayan blackberry	*Rubus armeniacus* Focke	199
Russian thistle	*Salsola* spp. *L.*	203
Perennial sowthistle	*Sonchus arvensis* L.	207
Johnsongrass	*Sorghum halepense* (L.) Pers.	211
Puncture-vine	*Tribulus terrestris* L.	215
Siberian elm	*Ulmus pumila* L.	219
Mullein	*Verbascum thapsus* L.	223
Cocklebur	*Xanthium strumarium* L.	227

[1.] *Region 3 Noxious Weed Classification System – Plant Status Codes - Treatment Priority 1, Class A noxious and invasive weeds are nonnative (exotic) to the state and are of limited distribution or are unrecorded in the state and pose a serious threat to agricultural crops, rangelands, plants listed as endangered, threatened or sensitive, and other natural resources in the state. Class A noxious and invasive weeds receive the highest priority (1). Management emphasis is complete eradication. Treatment Priority 2, Class B noxious and invasive weeds are nonnative (exotic) species that are of limited distribution or are unrecorded in a region of the state but are common in other regions of the state. Class B noxious and invasive weeds receive second highest priority (2). Management emphasis is to contain the spread, decrease population size, and eventually eliminate the infestation when cost-effective technology is available. Treatment Priority 3, Class C consists of any other noxious and invasive weeds (nonnative or native). Class C noxious and invasive weeds receive the lowest priority (3). Management emphasis is to contain spread to present population size or decrease population when possible.*

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Russian Knapweed Plant

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Russian Knapweed Flowerheads and Leaves

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Russian Knapweed Plant

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Russian Knapweed Flowerheads and Leaves

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Russian Knapweed

[*Acroptilon repens* (L.) DC] Sunflower (Asteraceae) Family

Class A Noxious Weed, Treatment Priority 1

General Description

Noxious perennial to 3.4 ft tall, with dark, creeping rhizomes. Plants exhibit allelopathic effects and are aggressively competitive, facilitating rapid colonization and development of dense stands. Infestations can be extremely long lived due to extensive root and rhizome systems. Stems dieback after flowering in summer, and new shoots are generated in spring. Introduced from central Asia.

Seedlings

Uncommon in the field. Cotyledons ovate to spatulate and scurfy on the lower surface. First several rosette leaves elliptic to oblanceolate and covered with a white, powdery bloom. Margins entire. Subsequent rosette leaves irregularly 1-pinnately lobed with pronounced wavy margins.

Mature Plants

Stems erect, openly branched, leafy, and mostly covered with cobwebby gray hairs. Stem leaves alternate and not extending down the stem (winged). Basal and lower stem leaves mostly oblong, 1.5 to 4 inches long, and 1-pinnately lobed with pronounced wavy margins or 2-pinnately lobed. Upper stem leaves narrowly lanceolate to linear, entire or toothed, and 0.25 to 1.25 inches long. Leaves lack hairs or are covered with short to medium interwoven hairs.

Roots and Underground Structures

Slender creeping rhizomes branch frequently at various depths forming an extensive vertical and horizontal root system. Rhizomes covered with alternate, small, narrow, appressed, clasping scale leaves. Each scale leaf has a bud in its axil capable of producing a new shoot. Mature rhizomes dark brown to black. Young rhizomes paler, with longer, less appressed scale leaves. Roots and rhizomes can penetrate the soil to several meters deep. New shoots and roots are produced at various intervals along the rhizomes from depths to 4 ft or more. Severed root pieces as small as 1 inch can generate new shoots from depths to 6 inches.

Flowers

May-September. Hemispheric flower heads arranged in panicle-like or flat-topped clusters and consist of about 30 white, pink, or lavender blue disk flowers interspersed with bristles on the receptacle. Corollas about 15 mm long. Phyllaries (flower head bracts) arranged in several overlapping rows. Each phyllary is ovate, with a green base and a broad, papery margin at the tip. Plants primarily outcross.

Fruit and Seeds

Achenes white or pale gray, obovoid, lacking a lateral notch at the base, and 0.1 to 0.2 inch long. Pappus consists of many unequal, early deciduous, white bristles, about 0.25 to 0.4 inch long. Each bristle is minutely barbed on the lower part and plumose on the upper part.

Postsenescence Characteristics

Old flower stems can persist for an extended period after senescence. Phyllaries and achenes remaining on old stems can aid with species identification.

Habitat

Fields, cultivated sites, orchards, vineyards, roadsides, ditchbanks, and waste places. Inhabits many soil types.

Propagation/Phenology

Reproduces primarily by vegetative shoots from rhizomes. Plants usually produce small quantities of viable seed. Seed heads mostly remain closed. Seeds disperse passively near the parent plant or with the seed head. Seeds germinate over a broad temperature range (33 to 95 ºF; optimal 68 to 95 ºF), and light is not required. Scarification, fluctuating temperatures, and alternating light and dark periods increase germination. Seed can remain viable about 2 to 3 years.

Control Methods

Biological	Chemical
Russian knapweed gall nematode and Russian knapweed mite	2,4-D, Chlorsulfuron, Clopyralid, Fluroxypyr, Glyphosate, Imazapic, Isoxaben, and Metsulfuron methyl
Cultural	**Mechanical**
Maintain healthy stands of native vegetation, revegetation/ competitive planting, implement introduction and prevention measures	Hand pulling or grubbing, mowing, disking to sever roots prior to seed-set

Lens-podded Hoarycress Flowers

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Lens-podded Hoarycress Fruit

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Lens-podded Hoarycress Leaves and Stem

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Lens-podded Hoarycress Plant

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Lens-Podded Hoarycress

[*Cardaria Chalepensis* (L.) Hand.-mazz.] Mustard (Bassicaeceae) Family

General Description

Noxious perennials to 16 (20) inches tall, with creeping horizontal roots that vigorously produce new plants. Lens-podded hoarycress was introduced from central Asia.

Seedlings

Develop taproots to a depth of 10 inches and lateral roots with shoot buds within 1 month. No description is available for lens-podded hoarycress. However, seedlings of this species likely resemble those of whitetop.

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. Lens-podded hoarycress leaves to 3 inches long and 1 inch wide, often smaller. Leaf base lobes often rounded-acute. Hairs sparse. Difficult to distinguish from whitetop in the vegetative state.

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 6.5 ft 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. April-August. Sepals glabrous. Petals mostly 0.1 to 0.15 inch long.

Fruit and Seed

Pods (silicles) 2-chambered, variable, inflated, with a persistent style 1/16 to 1/8 inch 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, 1/16 to 1/8 inch long, 1/16 to 1/8 inch wide, with minutely granular surfaces. Lens-podded hoarycress pods +/- disc shaped, round to broadly (ob)ovate or barely kidney shaped (indented at the apex) in outline, not 2-lobed or constricted at septum, 0.1 to 0.2(0.3) inch long, 0.15 to 0.2(0.28) inch wide, glabrous.

Postsenescence Characteristic

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

Reproduce 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 2-ft 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. One flowering stem of lens-podded hoarycress can produce up to 850 mature pods. Lens-podded hoarycress competes poorly with shrubs in natural communities. Seedlings recover from injury more readily than those of whitetop.

Control Methods

Biological	Chemical
Thistlehead feeding weevil and Rosette weevil	2,4-D, Dicamba, Fluroxypyr, Glyphosate, Isoxaben, and Metsulfuron methyl
Cultural	**Mechanical**
Maintain healthy stands of native vegetation, revegetation/ competitive planting, implement introduction and prevention measures	Repeated mowing or tilling prior to seed-set

Hairy Whitetop Flowers

Photo Courtesy of Luigi Rignanese, 2005 @ calphotos.berkeley.edu

Hairy Whitetop Fruit

©Photo Courtesy of Mary Ellen (Mel) Harte @ www.forestryimages.org

Hairy Whitetop Plants

©Photo Courtesy of Steve Matson, 2005 @ calphotos.berkeley.edu

Hairy Whitetop Leaves and Stem

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Hairy Whitetop

[*Cardaria pubescens* (C. Meyer) Jarmol.] Mustard (Bassicaeceae) Family

General Description

Noxious perennials to 0.4 (0.5) m tall, with creeping horizontal roots that vigorously produce new plants. Hairy whitetop was introduced from central Asia.

Seedlings

Develop taproots to a depth of 25 cm and lateral roots with shoot buds within 1 month. No description is available for hairy whitetop. However, seedlings of this species likely resemble those of whitetop.

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. Hairy Whitetop leaves to 8 cm long and 2 cm wide, usually much smaller. Leaf base lobes mostly acute. Hairs 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. April-September/October. Sepals covered with simple, short hairs. Petals mostly 2 to 3.5 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. Hairy Whitetop pods strongly inflated, spherical to ovoid, sometimes (ob)ovate in outline, not vertically narrowed at the septum, 3 to 4.5 mm long, 2.5 to 4.5 mm wide, covered with short hairs.

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

Reproduce 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. One flowering stem of lens-podded whitetop or white can produce up to 850 mature pods. Lens-podded and hairy whitetop (and probably white) compete poorly with shrubs in natural communities. Plants produce ~30 to 560 (average 300) pods per plant.

Control Methods

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

Plumeless Thistle Flowerheads

©Photo Courtesy of Gary L. Piper, Washington State University @ www.forestryimages.org

Plumeless Thistle Leaf

©Photo Courtesy of Steve Dewey, Utah State University @ www.forestryimages.org

Plumeless Thistle Flower, Winged Stem and Leaves

©Photo Courtesy of Steve Dewey, Utah State University @ www.forestryimages.org

Plumeless Thistle Basal Rosette

©Photo Courtesy of Loke T. Kok, Virginia Polytechnic Institute and State University @ www.forestryimages.org

Plumeless Thistle

[*Carduus acanthoides* L.] Sunflower (Asteraceae) Family

General Description

Erect thistles with prickly winged stems and leaves. Plants exist as basal rosettes until flowering shoots develop at maturity. Plumeless thistle is a biennial (or winter annual) to 1.5 m tall. Plumeless thistle and musk thistle readily hybridize with one another, and plants with intermediate characteristics may be found where their ranges overlap. Introduced from Europe.

Seedlings

Plumeless thistle seedling rosette has wavy leaves with yellow spines along the leaf margins.

Mature Plants

Stems branched near the top. Basal leaves elliptic to lanceolate, pinnately lobed, and with prickly-toothed margins. Stem leaves alternate, reduced, with bases that extend down the stem forming spiny wings (decurrent). Plumeless thistle stems strongly winged, glabrous to lightly woolly. Leaves 1-pinnate lobed, typically sparsely hairy. Lower leaves mostly 10 to 20 cm long.

Roots and Underground Structures

Taproots long, thick, fleshy, occasionally branched, and capable of penetrating the soil to depths of 40 cm or more.

Flowers

May-August. Heads consist of deeply lobed, purple to pink (rarely white), disk flowers. Phyllaries spine tipped, overlapping in several rows. Receptacles flat, densely covered with cream-colored bristles interspersed among the disk flowers. Insect pollinated. Heads (hemi-) spherical, 1 to 3 cm diameter, solitary or clustered, on stalks less than 2 cm long. Disk flowers purple, 14 to 20 mm long, with tubes 7 to 10 mm long. Phyllaries narrowly lanceolate, 2 mm wide or less, glabrous to pubescent, tips erect to spreading.

Fruit and Seeds

Achenes elliptic, curved, slightly compressed, sometimes slightly 4- to 5-sided in cross section, smooth, glossy, golden to brown. Pappus bristles numerous, cream colored, fine, minutely barbed (with magnification), united at the base to form a ring and deciduous as a unit. Plumeless thistle. Achenes 2 to 3 mm long, with faint lengthwise stripes. Pappus bristles 11 to 13 mm long.

Postsenescence Characteristics

Foliage is killed by hard frost, but plants remain intact for an extended period after death. The persistent spiny character of the foliage helps to distinguish plants.

Habitat

Thistles typically colonize disturbed open sites, roadsides, pastures, annual grasslands, and waste areas. Plumeless thistle often occupies similar but drier, better-drained sites. Serious infestations of plumeless thistle are often associated with sandy, fertile soils.

Propagation/Phenology

Reproduces by seed. Seeds fall near the parent plant or disperse by wind, water, birds, small mammals, and human activities. Plumeless thistle seeds appear to lack an after ripening period. The optimal temperature for germination of plumeless thistle seeds is near 68 ºF, and light is not required. Seeds of both species typically germinate late summer through spring, depending on environmental conditions. Most plants are biennials, germinating in the winter/spring months and existing as a rosette until flowering in the spring/summer of the following year.

Control Methods

Biological	Chemical
Thistle head feeding weevil, Rosette weevil and Thistle crown fly	2,4-D, Chlorsulfuron, Fluroxypyr, Metsulfuron methyl, and Triclopyr
Cultural	**Mechanical**
Maintain healthy stands of native vegetation, revegetation/ competitive planting, implement introduction and prevention measures	Repeated hand grubbing, mowing or tilling prior to seed-set

Musk Thistle Flowerhead

©Photo Courtesy of Ricky Layson, Forest Resource Consultants, Inc., United States @ www.forestryimages.org

Musk Thistle Basal Rosette

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Musk Thistle Flowerhead

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Musk Thistle Plants

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Musk Thistle

[*Carduus nutans* L.] Sunflower (Asteraceae) Family

General Description

Erect thistles with prickly winged stems and leaves. Plants exist as basal rosettes until flowering shoots develop at maturity. Musk thistle is a biennial (or winter annual) to 1.5 m tall. Musk thistle and plumeless thistle readily hybridize with one another, and plants with intermediate characteristics may be found where their ranges overlap. Introduced from Europe.

Seedlings

Musk thistle cotyledons nearly sessile, oblong, with tips often squared, 7.5 to 15 mm long, 2.5 to 6 mm wide. Cotyledon veins are white and broad. First two true leaves appear opposite. Subsequent leaves are alternate and form a basal rosette. Leaves are pale green, waxy, oval to elliptic, shallowly lobed, and irregularly prickly toothed. Hairs are sometimes scattered on the upper surface and the main veins of the lower surface.

Mature Plants

Stems branched near the top. Basal leaves elliptic to lanceolate, pinnately lobed, and with prickly-toothed margins. Stem leaves alternate, reduced, with bases that extend down the stem forming spiny wings (decurrent). Musk thistle stems narrowly winged, glabrous to woolly. Leaves 1- to 2-pinnate lobed, glabrous to sparsely hairy. Lower leaves mostly 10 to 40 cm long.

Roots and Underground Structures

Taproots long, thick, fleshy, occasionally branched, and capable of penetrating the soil to depths of 40 cm or more.

Flowers

June-September. Heads consist of deeply lobed, purple to pink (rarely white), disk flowers. Phyllaries spine tipped, overlapping in several rows. Receptacles flat, densely covered with cream-colored bristles interspersed among the disk flowers. Insect pollinated. Heads (hemi-) spherical, 2 to 7 cm diameter, solitary, often nodding on stalks usually more than 2 cm long. Disk flowers purple, 20 to 25 mm long, with

tubes 12 to 14 mm long. Phyllaries lanceolate to ovate, mostly 3 to 8 mm wide, spreading to reflexed at the middle, glabrous to sparsely woolly.

Fruit and Seeds

Achenes elliptic, curved, slightly compressed, sometimes slightly 4- to 5-sided in cross section, smooth, glossy, golden to brown. Pappus bristles numerous, cream colored, fine, minutely barbed (with magnification), united at the base to form a ring and deciduous as a unit. Musk thistle achenes 4 to 5 mm long, with longitudinal dotted stripes. Pappus bristles 13 to 25 mm long.

Postsenescence Characteristics

Foliage is killed by hard frost, but plants remain intact for an extended period after death. The persistent spiny character of the foliage helps to distinguish plants.

Habitat

Thistles typically colonize disturbed open sites, roadsides, pastures, annual grasslands, and waste areas. Musk thistle grows best on moist alluvial soils but tolerates a wide range of conditions, from acidic to saline soils. Plants establish poorly on highly acidic or nutrient deficient soils, or soils with extremes in moisture content.

Propagation/Phenology

Reproduces by seed. Seeds fall near the parent plant or disperse by wind, water, birds, small mammals, and human activities. Musk thistle plants appear to require a period of chilling to induce flowering. First flower heads can produce large numbers of seeds, sometimes 1,500 or more seeds per head. Late flower heads produce fewer seeds, to less than 25 seeds per head. Most seeds (~99%) are dispersed within 50 m of the parent plant. Few seeds (<1%) are deposited further than 100 m from their source. Typically, seeds are dispersed 1 to 3 weeks after flowering. Reports of seed dormancy or an after ripening period in musk thistle seeds are variable. Most musk thistle seeds germinate 2 to 4 weeks after dispersal.

Additional Ecological Aspects

Musk thistle seeds appear to possess allelopathic qualities. They can inhibit germination and radicle growth in other pasture species, but stimulate or have no affect on other seeds of their own species. This suggests that the allelopathic potential of musk thistle seeds may be an evolved mechanism to encourage its own establishment. Emerged musk thistle plants can also weaken other pasture species by an allelopathic interaction at the early bolting stage, when the larger rosette leaves are decomposing and releasing soluble inhibitors, and at the stage when bolting plants are dying and releasing insoluble inhibitors. No specific chemicals have been identified. Although musk thistle is sometimes associated with fertile soils, it is more likely to increase in situations of declining fertility. Furthermore, it has the potential to induce long-term decline of soil nitrogen input. This appears to be related to its allelopathic activity.

Control Methods

Biological	Chemical
Thistlehead feeding weevil, Rosette weevil and Thistlecrown fly	2,4-D, Chlorsulfuron, Clopyralid, Dicamba, Fluroxypyr, Glyphosate, Hexazinone, Isoxaben, Metsulfuron methyl, Sulfometuron methyl and Triclopyr
Cultural	**Mechanical**
Maintain healthy stands of native vegetation, revegetation/ competitive planting for shade, implement introduction and prevention measures	Mowing or hand grubbing before flowering and cutting plant below crown

Purple Starthistle Flowerhead

©Photo Courtesy of Barry Rice, sarracenia.com @ www.forestryimages.org

Purple Starthistle Mature Flowerheads

©Photo Courtesy of Barry Rice, sarracenia.com @ www.forestryimages.org

Purple Starthistle Basal Rosettes

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Purple Starthistle Plants

©Photo Courtesy of Barry Rice, sarracenia.com @ www.forestryimages.org

Purple Starthistle

[*Centaurea calcitrapa* L.] Sunflower (Asteraceae) Family

General Description

Noxious bushy weeds with spiny or comblike phyllaries and white, pink, or purple flowers. Plants exist as basal rosettes until erect, highly branched flowering stems are produced late spring/summer. *Centaurea* species produce allelopathic effects and are highly competitive with other plants, often displacing desired vegetation. Purple starthistle may be an annual, biennial or perennial, to 1 m tall. Introduced from southern Europe.

Seedlings

Cotyledons spatulate to oval. Rosette leaves pinnate divided. Purple starthistle develop straw-colored spines at the centers of rosettes.

Mature Plants

Upper stem leaves not winged. Foliage variously covered with short to medium interwoven gray hairs. Leaves alternate. Lower stem leaves deeply 1- or 2-pinnate lobed, ~10 to 20 cm long. Purple starthistle leaves are resin dotted. Upper leaves mostly pinnate divided. New leaves densely covered with gray hairs (gray-tomentose).

Roots and Underground Structures

Taproot stout.

Flowers

Flower heads consist of few to many fertile disc flowers interspersed with long bristles on the receptacle. Phyllaries overlapping in several rows, with tips variously spiny or comblike. Phyllary characteristics are important for species identification. Purple starthistle flowers July-October. Flowers 25 to 40 per head. Corollas purple, 15 to 24 mm long. Involucre 15 to 20 mm long, body 6 to 8 mm diameter. Main phyllaries greenish or straw colored, spine tipped. Central spine stout, spreading, 10 to 25 mm long.

Fruit and Seeds

Achenes (1-seeded fruit) oblong, 2.5 to 3.5 mm long, apex flattened, tapered to a rounded, laterally notched base.

Pappus (when present) +/- whitish, composed of unequal, stiff, minutely barbed bristles or tiny, flat scales. Purple starthistle achenes white, often brown streaked. Pappus usually lacking.

Postsenescence Characteristics

Old flower stems can persist for an extended period after senescence (less common for diffuse knapweed). Phyllaries and achenes remaining on old stems can aid with species identification when plants are over wintering as rosettes.

Habitat

Fields, roadsides, disturbed open sites, grasslands, overgrazed rangelands, and logged areas. Plants seldom persist in shaded places and colonize most soil types with a disturbed A horizon. Purple starthistle frequently grows on heavy, fertile, often alluvial soils.

Propagation/Phenology

Reproduces by seeds, except where noted. These species have variable dispersal mechanisms described below. However, most seeds or seed heads of all *Centaurea* species fall near the parent plant, and some can disperse to greater distances with human activities, vehicles, heavy machinery, water, soil movement, and by clinging to shoes, clothing, and tires, and the feet, fur, or feathers of animals. Germination can occur over a broad range of environmental conditions. Seedling emergence is typically highest after the first fall rains. Mortality of seedlings that emerge in spring can be high when conditions become dry after emergence. Most seedlings emerge from seeds at or near the soil surface. Plants produce fewer viable seeds in dry years. Infestation density correlates with the age of the population and degree of disturbance. All germination types occur on each plant. New rosettes may develop at ~3 cm intervals along lateral roots, expanding populations peripherally. About 2 to 3 weeks after maturity, drying phyllaries pop seed heads open, ejecting seeds a short distance. Stems typically do not break off and tumble with the

wind. Some seedlings can emerge from soil depths to 5 cm. Plants may produce up to 40,000 seeds per plant. Seedlings can emerge from soil depths to 3 cm. Purple starthistle seeds disperse with the seed head as a unit.

Control Methods

Biological	Chemical
None currently available	2,4-D, Clopyralid, Dicamba, Fluroxypyr, Glyphosate, Imazapyr, Isoxaben, and Sulfometuron methyl
Cultural	**Mechanical**
Maintain healthy stands of native vegetation, revegetation/ competitive planting, implement introduction and prevention measures	Hand pulling or grubbing and severing roots prior to seed-set

Diffuse Knapweed Flowerhead

©Photo Courtesy of Cindy Roche @ www.forestryimages.org

Diffuse Knapweed Flowerheads

©Photo Courtesy of USDA APHIS PPQ Archives, USDA APHIS PPQ @ www.forestryimages.org

Diffuse Knapweed Basal Rosette

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Diffuse Knapweed Plant

©Photo Courtesy of W. J. Ferlatte California Dept. of Food and Agriculture, Integrated Pest Control Branch, 2001 @ calphotos.berkeley.edu

Diffuse Knapweed

[*Centaurea diffusa* Lam.] Sunflower (Asteraceae) Family

General Description

Noxious bushy weeds with spiny or comblike phyllaries and white, pink, or purple flowers. Plants exist as basal rosettes until erect, highly branched flowering stems are produced late spring/summer. *Centaurea* species produce allelopathic effects and are highly competitive with other plants, often displacing desired vegetation. Diffuse knapweed is typically a biennial, occasionally annual or triennial, to 0.8 m tall. Usually forms large, dense infestations. Introduced from southeast Eurasia.

Seedlings

Cotyledons spatulate to oval. Rosette leaves pinnate divided.

Mature Plants

Upper stem leaves not winged. Foliage variously covered with short to medium interwoven gray hairs. Leaves alternate. Lower stem leaves deeply 1- or 2-pinnate lobed, ~10 to 20 cm long. Diffuse knapweed upper leaves are entire, linear or bractlike.

Roots and Underground Structures

Taproot long.

Flowers

Flower heads consist of few to many fertile disc flowers interspersed with long bristles on the receptacle. Phyllaries overlapping in several rows, with tips variously spiny or comblike. Phyllary characteristics are important for species identification. Diffuse knapweed flowers June-September. Flowers average 12 to 13 per head. Corollas white, pink, or pale purple, 12 to 13 mm long. Involucre length 10 to 13 mm. Main phyllaries pale green, spine tipped; spines straw colored. Central spine spreading to 3 mm long.

Class A Noxious Weed, Treatment Priority 1

Fruit and Seeds

Achenes (1-seeded fruit) oblong, 2.5 to 3.5 mm long, apex flattened, tapered to a rounded, laterally notched base. Pappus (when present) +/- whitish, composed of unequal, stiff, minutely barbed bristles or tiny, flat scales. Diffuse knapweed achenes dark brown, ~13 per head. Pappus scales less than 1 mm long or lacking.

Postsenescence Characteristics

Phyllaries and achenes remaining on old stems can aid with species identification when plants are over wintering as rosettes.

Habitat

Fields, roadsides, disturbed open sites, grasslands, overgrazed rangelands, and logged areas. Plants seldom persist in shaded places and colonize most soil types with a disturbed A horizon. Diffuse knapweeds often colonize light, well-drained soils, but require less moisture than spotted knapweed.

Propagation/Phenology

Reproduces by seeds, except where noted. These species have variable dispersal mechanisms described below. However, most seeds or seed heads of all *Centaurea* species fall near the parent plant, and some can disperse to greater distances with human activities, vehicles, heavy machinery, water, soil movement, and by clinging to shoes, clothing, and tires, and the feet, fur, or feathers of animals. Germination can occur over a broad range of environmental conditions. Seedling emergence is typically highest after the first fall rains. Mortality of seedlings that emerge in spring can be high when conditions become dry after emergence. Most seedlings emerge from seeds at or near the soil surface. Plants produce fewer viable seeds in dry years. Infestation density correlates with the age of the population and degree of disturbance. Diffuse knapweed seeds exhibit three germination patterns: non-dormant seeds that germinate with or without light exposure, dormant seeds that germinate in response to red light, and dormant seeds that are not light sensitive. All germination types occur on each plant. For diffuse knapweed,

optimal germination is between 50 to 82 ºF. In addition to seeds, spotted knapweed can reproduce vegetatively from lateral roots just below the soil surface. New rosettes may develop at ~3 cm intervals along lateral roots, expanding populations peripherally. About 2 to 3 weeks after maturity, drying phyllaries pop seed heads open, ejecting seeds a short distance. Stems typically do not break off and tumble with the wind. Some seedlings can emerge from soil depths to 5 cm. Plants may produce up to 40,000 seeds per plant. Diffuse knapweed seeds often disperse when stems break off near the ground and tumble along with the wind. Seedlings can emerge from soil depths to 3 cm. Most seed germinates the first year, but buried seed can remain dormant for about 3 years.

Control Methods

Biological	Chemical
Seedhead gallflies and Peacock fly	2,4-D, Clopyralid, Dicamba, Fluroxypyr, Glyphosate, Imazapyr, Isoxaben, and Triclopyr
Cultural	**Mechanical**
Maintain healthy stands of native vegetation, revegetation/ competitive planting for shading, spring burning, implement introduction and prevention measures	Repeated hand pulling or grubbing of small infestations prior to seed-set

Iberian Starthistle Flowerheads

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Iberian Starthistle Pre-bloom Flowerhead

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Iberian Starthistle Basal Rosettes

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Iberian Starthistle Flowerhead

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Iberian Starthistle

[*Centaurea iberica* Spreng.] Sunflower (Asteraceae) Family

General Description

Noxious bushy weeds with spiny or comblike phyllaries and white, pink, or purple flowers. Plants exist as basal rosettes until erect, highly branched flowering stems are produced late spring/summer. *Centaurea* species produce allelopathic effects and are highly competitive with other plants, often displacing desired vegetation. Iberian starthistle may be an annual, biennial, or short-lived perennial, to 1 m tall. Closely resembles purple starthistle. Introduced from southeast Eurasia.

Seedlings

Cotyledons spatulate to oval. Rosette leaves pinnate divided. Iberian starthistles develop straw-colored spines at the centers of rosettes.

Mature Plants

Upper stem leaves not winged. Foliage variously covered with short to medium interwoven gray hairs. Leaves alternate. Lower stem leaves deeply 1- or 2-pinnate lobed, ~10 to 20 cm long. Iberian starthistle leaves are resin dotted. Upper leaves mostly pinnate divided. New leaves green and covered with minute bristly hairs.

Roots and Underground Structures

Taproot stout.

Flowers

Flower heads consist of few to many fertile disc flowers interspersed with long bristles on the receptacle. Phyllaries overlapping in several rows, with tips variously spiny or comblike. Phyllary characteristics are important for species identification. Iberian starthistle flowers July-October. Many flowers per head. Corollas rose-pink to whitish, 15 to 20 mm long. Involucre 15 to 18 mm long, body 8 to 14 mm diameter. Phyllaries and central spines resemble those of purple starthistle, but often slightly smaller.

Fruit and Seeds

Achenes (1-seeded fruit) oblong, 2.5 to 3.5 mm long, apex flattened, tapered to a rounded, laterally notched base. Pappus (when present) +/- whitish, composed of unequal, stiff, minutely barbed bristles or tiny, flat scales. Iberian starthistle achenes white, often brown streaked. Pappus bristles ~1 mm long.

Postsenescence Characteristics

Old flower stems can persist for an extended period after senescence. Phyllaries and achenes remaining on old stems can aid with species identification when plants are over wintering as rosettes.

Habitat

Fields, roadsides, disturbed open sites, grasslands, overgrazed rangelands, and logged areas. Plants seldom persist in shaded places and colonize most soil types with a disturbed A horizon. Iberian starthistle often colonizes banks of watercourses and other moist sites.

Propagation/Phenology

Reproduces by seeds, except where noted. These species have variable dispersal mechanisms described below. However, most seeds or seed heads of all *Centaurea* species fall near the parent plant, and some can disperse to greater distances with human activities, vehicles, heavy machinery, water, soil movement, and by clinging to shoes, clothing, and tires, and the feet, fur, or feathers of animals. Germination can occur over a broad range of environmental conditions. Seedling emergence is typically highest after the first fall rains. Mortality of seedlings that emerge in spring can be high when conditions become dry after emergence. Most seedlings emerge from seeds at or near the soil surface. Plants produce fewer viable seeds in dry years. Infestation density correlates with the age of the population and degree of disturbance. All germination types occur on each plant. New rosettes may develop at ~3 cm intervals along lateral roots, expanding populations peripherally. About 2 to 3 weeks after maturity, drying phyllaries pop seed heads open, ejecting seeds a short distance. Stems typically do not break off and tumble with

the wind. Some seedlings can emerge from soil depths to 5 cm. Plants may produce up to 40,000 seeds per plant. No information is available for Iberian starthistle, but it is likely similar to purple starthistle.

Control Methods

Biological	Chemical
None currently available	2,4-D, Clopyralid, Dicamba, Fluroxypyr, Glyphosate, Imazapyr, Isoxaben, and Sulfometuron methyl
Cultural	**Mechanical**
Maintain healthy stands of native vegetation, revegetation/ competitive planting, implement introduction and prevention measures	Repeated hand pulling or grubbing and severing roots prior to seed-set

Spotted Knapweed Flowerhead

©Photo Courtesy of Carla Hoopes, Montana Statewide Noxious Weed Awareness and Education Program @ www.forestryimages.org

Spotted Knapweed Dried Phyllaries and Flowerheads

©Photo Courtesy of Steve Dewey, Utah State University @ www.forestryimages.org

Spotted Knapweed Foliage

©Photo Courtesy of Montana Statewide Noxious Weed Awareness and Education Program Archives, Montana State University @ www.forestryimages.org

Spotted Knapweed Basal Rosette

©Photo Courtesy of Steve Dewey, Utah State University @ www.forestryimages.org

Spotted Knapweed

[*Centaurea stoebe* L. ssp. *micranthos* (Gugler) Hayek]
Sunflower (Asteraceae) Family

General Description

Noxious bushy weeds with spiny or comblike phyllaries and white, pink, or purple flowers. Plants exist as basal rosettes until erect, highly branched flowering stems are produced late spring/summer. *Centaurea* species produce allelopathic effects and are highly competitive with other plants, often displacing desired vegetation. Spotted knapweed is a biennial to short-lived perennial, to 1 m tall. Introduced from Europe.

Seedlings

Cotyledons spatulate to oval. Rosette leaves pinnate divided.

Mature Plants

Upper stem leaves not winged. Foliage variously covered with short to medium interwoven gray hairs. Leaves alternate. Lower stem leaves deeply 1- or 2-pinnate lobed, ~10 to 20 cm long. Spotted knapweed leaves are resin dotted. Upper leaves mostly pinnate divided.

Roots and Underground Structures

Taproot stout.

Flowers

Flower heads consist of few to many fertile disc flowers interspersed with long bristles on the receptacle. Phyllaries overlapping in several rows, with tips variously spiny or comblike. Phyllary characteristics are important for species identification. Spotted knapweed flowers June-October. Flowers 30 to 40 per head. Corollas white, pink, or purple, 12 to 25 mm long. Involucre (unit of phyllaries) length 10 to 13 mm. Phyllaries pale green or pink tinged, with parallel veins. Phyllary tips dark, comblike, not spine tipped. Self-fertile.

Fruit and Seeds

Achenes (1-seeded fruit) oblong, 2.5 to 3.5 mm long, apex flattened, tapered to a rounded, laterally notched base. Pappus (when present) +/- whitish, composed of unequal,

Class A Noxious Weed, Treatment Priority 1

stiff, minutely barbed bristles or tiny, flat scales. Spotted knapweed achenes pale brown, finely hairy, ~30 per head. Pappus bristles 1 to 2 mm long.

Postsenescence Characteristics

Old flower stems can persist for an extended period after senescence. Phyllaries and achenes remaining on old stems can aid with species identification when plants are over wintering as rosettes.

Habitat

Fields, roadsides, disturbed open sites, grasslands, overgrazed rangelands, and logged areas. Plants seldom persist in shaded places and colonize most soil types with a disturbed A horizon. Spotted knapweed serious infestations mostly occur on light, well-drained soils in areas that receive some summer rainfall.

Propagation/Phenology

Reproduces by seeds, except where noted. These species have variable dispersal mechanisms described below. However, most seeds or seed heads of all *Centaurea* species fall near the parent plant, and some can disperse to greater distances with human activities, vehicles, heavy machinery, water, soil movement, and by clinging to shoes, clothing, and tires, and the feet, fur, or feathers of animals. Germination can occur over a broad range of environmental conditions. Seedling emergence is typically highest after the first fall rains. Mortality of seedlings that emerge in spring can be high when conditions become dry after emergence. Most seedlings emerge from seeds at or near the soil surface. Plants produce fewer viable seeds in dry years. Infestation density correlates with the age of the population and degree of disturbance. Spotted knapweed seeds exhibit three germination patterns: non-dormant seeds that germinate with or without light exposure, dormant seeds that germinate in response to red light, and dormant seeds that are not light sensitive. All germination types occur on each plant. For spotted knapweed, optimal germination is between 50 and 82 ºF. In addition to seeds, spotted knapweed can reproduce vegetatively from lateral roots just below the soil surface. New rosettes may develop at ~3 cm intervals along lateral roots, expanding populations peripherally. About 2

to 3 weeks after maturity, drying phyllaries pop seed heads open, ejecting seeds a short distance. Stems typically do not break off and tumble with the wind. Some seedlings can emerge from soil depths to 5 cm. Plants may produce up to 40,000 seeds per plant. Most seed germinates the first year, but buried seed can remain dormant for about 3 years.

Control Methods

Biological	Chemical
Seedhead gallflies, seedhead moth and root boring weevil	2,4-D, Clopyralid, Dicamba, Fluroxypyr, Glyphosate, Imazapyr, Isoxaben, and Triclopyr
Cultural	**Mechanical**
Maintain healthy stands of native vegetation, revegetation/ competitive planting for shade, spring burning, implement introduction and prevention measures	Repeated hand pulling or grubbing of small infestations, regular cultivation prior to seed-set

Yellow Starthistle
Immature Flowerhead

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Yellow Starthistle Flowerhead

©Photo Courtesy of Stephen Ausmus, USDA Agricultural Research Service, United States @ www.forestryimages.org

Yellow Starthistle Plant

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Yellow Starthistle Basal Rosette

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Yellow Starthistle

[*Centaurea solstitialis* L.] Sunflower (Asteraceae) Family

General Description

Noxious erect winter annuals (sometimes biennials) with spiny, yellow-flowered heads, mostly to 2 m tall. Yellow starthistle was introduced from southern Europe.

Seedlings

Cotyledons oblong to spatulate, base wedge shaped, tip +/- squared. First few leaves typically oblanceolate. Subsequent rosette leaves oblanceolate, entire to pinnate lobed. Terminal lobes largest. Later rosette leaves to 15 cm long. Hair characteristics are visible with 10 to 14x magnification. Cotyledons 6 to 9 mm long, 3 to 5 mm wide. Later rosette leaves typically deeply lobed +/- to midrib, appear ruffled. Surfaces +/- densely covered with fine cottony hairs that +/- stiff, thick hairs and leaf surfaces. Lobes mostly acute, with toothed to wavy margins. Terminal lobes +/- triangular to lanceolate. Leaves of rosettes under reduced light levels are larger and more erect.

Mature Plants

Stems stiff, openly branched from near or above the base or sometimes not branched in very small plants. Stem leaves alternate, mostly linear or +/- narrowly oblong to oblanceolate. Margins smooth, toothed, or wavy. Leaf bases extend down the stems (decurrent) and give stems a winged appearance. Rosette leaves typically withered by flowering time. Largest stem wings typically to ~3 mm wide. Lower stem leaves sometimes +/- deeply pinnate lobed. Foliage grayish- to bluish-green, densely covered with fine white cottony hairs that +/- hide thick, stiff hairs and glands.

Roots and Underground Structures

Taproots grow vigorously early in the season to soil depths of 1 m or more, giving plants access to deep soil moisture during the dry summer and early fall months.

Flowers

Heads ovoid, spiny, solitary on stem tips, consist of numerous yellow disk flowers. Heads sometimes closely 2

to 3 clustered in Malta starthistle. Vigorous individuals of Malta and yellow starthistle may develop flower heads in branch axils. Phyllaries palmately spined, with one long central spine and two or more pairs of short lateral spines. Insect pollinated. May-December. Corollas mostly 13 to 20 mm long. Involucre (phyllaries as a unit) ~12-18 mm long. Phyllaries +/- dense to sparsely covered with cottony hairs or with patches at the spine bases. Central spine of main phyllaries 10 to 25 mm long, stout, yellowish to straw colored throughout. Lateral spines typically 2 to 3 pairs at the base of the central spine. Mostly self-incompatible.

Fruit and Seeds

Achenes (seeds) +/- barrel shaped, +/- compressed, laterally notched at the base. Pappus bristles slender, stiff, unequal. Produces two types of achenes, both glabrous, ~2 to 3 mm long, with broad bases. Outer ring of achenes dull dark brown, often speckled with tan, lack pappus bristles, often remain in heads. Inner achenes glossy, gray or tan to mottled cream colored and tan, with slender white pappus bristles 2 to 5 mm long.

Postsenescence Characteristics

Stems with old flower heads turn gray-brown and can remain intact for over a year. Plants usually senesce in late summer or fall. Heads shed the central spines, but tightly retain a ball of dense fuzzy gray hairs (chaff) on the receptacle. Often a dense layer of thatch develops on heavily infested sites.

Habitat

Open, disturbed sites, grasslands, rangeland, open woodlands, fields, pastures, roadsides, waste places. Yellow also occurs in cultivated fields.

Propagation/Phenology

Reproduces by seed. Seeds fall near the parent plant or are dispersed to short distances with wind and to greater distances with human activities, animals, water, and soil movement. Most seeds germinate after the first fall rains. Plants exist as basal rosettes

through winter and early spring until flowering stems develop in late spring or early summer. Seed heads typically contain ~30 to 80 seeds. Large plants can produce nearly 75,000 seeds. Some seed is viable 8 days after flower initiation. Seed germination is closely correlated with rainfall events. Light is required for seed germination. Seed can survive for up to 10 years in the field, depending on environmental conditions. Shaded conditions reduce flower production and root growth. In some areas, flowering plants may be found year-round in areas not exposed to severe frost. Photoperiod or a period of cool, moist conditions (vernalization) does not appear to influence time of flowering. Yellow starthistle litter appears to inhibit germination of its seeds, probably by blocking light penetration.

Control Methods

Biological	Chemical
Seedhead weevil	2,4-D, Chlorsulfuron, Clopyralid, Dicamba, Glyphosate, Imazapic, Imazapyr, Isoxaben, and Triclopyr
Cultural	**Mechanical**
Maintain healthy stands of native vegetation, revegetation/ competitive planting, implement introduction and prevention measures	Repeated hand pulling or grubbing, mowing before flowering, grazing

Squarrose Knapweed Flowerhead

©Photo Courtesy of Cindy Roche @ www.forestryimages.org

Squarrose Knapweed Mature and Immature Flowerheads

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Squarrose Knapweed Immature Flowerheads

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Squarrose Knapweed Seedlings

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Squarrose Knapweed

[*Centaurea squarrosa* Willd.] Sunflower (Asteraceae) Family

General Description

Noxious bushy weeds with spiny or comblike phyllaries and white, pink, or purple flowers. Plants exist as basal rosettes until erect, highly branched flowering stems are produced late spring/summer. *Centaurea* species produce allelopathic effects and are highly competitive with other plants, often displacing desired vegetation. Squarrose knapweed is a perennial, with a woody base, to 0.5 m tall. Introduced from Asia.

Seedlings

Cotyledons spatulate to oval. Rosette leaves pinnate divided.

Mature Plants

Upper stem leaves not winged. Foliage variously covered with short to medium interwoven gray hairs. Leaves alternate. Lower stem leaves deeply 1- or 2-pinnate lobed, ~10 to 20 cm long. Squarrose knapweed upper leaves are entire, linear or bractlike, mostly lacking at flowering.

Roots and Underground Structures

Taproot stout.

Flowers

Flower heads consist of few to many fertile disc flowers interspersed with long bristles on the receptacle. Phyllaries overlapping in several rows, with tips variously spiny or comblike. Phyllary characteristics are important for species identification. Squarrose knapweed flowers June-August. Flowers 4 to 8(10) per head, outer sterile. Corollas pink to pale purple, 7 to 9 mm long. Involucre 7 to 8 mm long. Main phyllaries pale green to straw colored, sometimes purple tinged, spine tipped. Central spine usually reflexed downward, to 3 mm long.

Fruit and Seeds

Achenes (1-seeded fruit) oblong, 2.5 to 3.5 mm long, apex flattened, tapered to a rounded, laterally notched base. Pappus (when present) +/- whitish, composed of unequal, stiff, minutely barbed bristles or tiny, flat scales. Squarrose knapweed achenes pale brown, 1 to 4 per head. Pappus bristles 2 to 2.5 mm long, or lacking.

Postsenescence Characteristics

Old flower stems can persist for an extended period after senescence. Phyllaries and achenes remaining on old stems can aid with species identification when plants are over wintering as rosettes.

Habitat

Fields, roadsides, disturbed open sites, grasslands, overgrazed rangelands, and logged areas. Plants seldom persist in shaded places and colonize most soil types with a disturbed A horizon. Squarrose knapweed often grows on degraded rangeland soils and is more adaptable to drought and cold temperatures than spotted and diffuse knapweed.

Propagation/Phenology

Reproduces by seeds, except where noted. These species have variable dispersal mechanisms described below. However, most seeds or seed heads of all *Centaurea* species fall near the parent plant, and some can disperse to greater distances with human activities, vehicles, heavy machinery, water, soil movement, and by clinging to shoes, clothing, and tires, and the feet, fur, or feathers of animals. Germination can occur over a broad range of environmental conditions. Seedling emergence is typically highest after the first fall rains. Mortality of seedlings that emerge in spring can be high when conditions become dry after emergence. Most seedlings emerge from seeds at or near the soil surface. Plants produce fewer viable seeds in dry years. Infestation density correlates with the age of the population and degree of disturbance. New rosettes may develop at ~3 cm intervals along lateral roots, expanding populations peripherally. About 2 to 3 weeks after maturity, drying phyllaries pop

seed heads open, ejecting seeds a short distance. Stems typically do not break off and tumble with the wind. Some seedlings can emerge from soil depths to 5 cm. Plants may produce up to 40,000 seeds per plant. Squarrose knapweed seeds disperse with the seed head as a unit from August through winter. Most seed germinates the first year, but buried seed can remain dormant for about 3 years.

Control Methods

Biological	Chemical
Sulfur knapweed root moth	2,4-D, Clopyralid, Dicamba, Fluroxypyr, Glyphosate, Imazapyr, and Isoxaben
Cultural	**Mechanical**
Maintain healthy stands of native vegetation, revegetation/ competitive planting, implement introduction and prevention measures	Repeated hand pulling or grubbing, mowing, disking prior to seed-set

Sicilian Starthistle Flowerhead

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Sicilian Starthistle Flowerheads, Leaves and Stems

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Sicilian Starthistle Basal Rosette

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Sicilian Starthistle Flowerheads

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Sicilian Starthistle

[*Centaurea sulphurea* Willd.] Sunflower (Asteraceae) Family

General Description

Noxious erect winter annuals (sometimes biennials) with spiny yellow-flowered heads, mostly to 1 m tall. Introduced from southwestern Europe.

Seedlings

Cotyledons oblong to spatulate, base wedge-shaped, tip +/- squared. First few leaves typically oblanceolate. Subsequent rosette leaves oblanceolate, entire to pinnate lobed. Terminal lobes largest. Later rosette leaves to 15 cm long. Hair characteristics are visible with 10 to 14x magnification. Rosette leaves broader and typically more shallowly lobed than those of yellow starthistle. Lateral lobes +/- acute. Terminal lobes +/- ovate, with broadly acute tips and finely toothed margins. Surfaces sparsely covered with stiff thick hairs. Fine cottony hairs and resinous dots lacking.

Mature Plants

Stems stiff, openly branched from near or above the base or sometimes not branched in very small plants. Stem leaves alternate, mostly linear or +/- narrowly oblong to oblanceolate. Margins smooth, toothed, or wavy. Leaf bases extend down the stems (decurrent) and give stems a winged appearance. Rosette leaves typically withered by flowering time. Stem leaves toothed. Largest stem wings usually ~5 to 6 mm wide. Foliage +/- yellowish green, sparsely covered with stiff hairs.

Roots and Underground Structures

Taproots do not penetrate the soil as deeply as those of yellow starthistle.

Flowers

Heads ovoid, spiny, solitary on stem tips, consist of numerous yellow disk flowers. May develop flower heads in branch axils. Phyllaries palmately spined, with one long central spine and two or more pairs of short lateral spines. Insect pollinated. May-July. Corollas usually 25 to 35 mm long,

paler than those of yellow starthistle. Involucre 12 to 30 mm long. Phyllaries glabrous. Central spine of main phyllaries 10 m to 25 mm long, stout, yellowish to straw colored near the tip, blackish to dark brown near the base. Lateral spines typically 3 to 5 pairs at the base of the central spine.

Fruit and Seeds

Achenes (seeds) +/- barrel shaped, +/- compressed, laterally notched at the base. Pappus bristles slender, stiff, unequal. Achenes ~5 to 8 mm long, glossy dark brown, often faintly streaked tan. Bases deeply notched, broad, hooklike. Pappus bristles dark brown to black, 6 to 7 mm long.

Postsenescence Characteristics

Stems with old flower heads turn gray-brown and can remain intact for over a year. Plants often senesce earlier than yellow starthistle. Heads retain the central spines, and a large proportion retain the receptacle and dense, fuzzy gray hairs.

Habitat

Open, disturbed sites, grasslands, rangeland, open woodlands, fields, pastures, roadsides, waste places. Yellow also occurs in cultivated fields.

Propagation/Phenology

Reproduces by seed. Seeds fall near the parent plant or are dispersed to short distances with wind and to greater distances with human activities, animals, water, and soil movement. Most seeds germinate after the first fall rains. Plants exist as basal rosettes through winter and early spring until flowering stems develop in late spring or early summer. The biology of this species is largely undocumented. Where species occur together, seedlings and rosettes of Sicilian starthistle often out-compete those of yellow starthistle.

Control Methods

Biological	Chemical
Seedhead weevils	2,4-D, Clopyralid, Dicamba, Fluroxypyr, Glyphosate, Imazapyr, and Isoxaben
Cultural	**Mechanical**
Maintain healthy stands of native vegetation, revegetation/ competitive planting, implement introduction and prevention measures	Repeated hand pulling or grubbing, mowing before flowering, grazing

Rush Skeletonweed Flowerheads

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Rush Skeletonweed Flowering Stem

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Rush Skeletonweed
Flower, Stems and Leaves

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Rush Skeletonweed Basal Rosette

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Rush Skeletonweed

[*Chondrilla juncea* L.] Sunflower (Asteraceae) Family

General Description

Herbaceous perennial or biennial, with rigid, wiry flowering stems to 1 m tall, milky sap. Plants exist as basal rosettes until flowering stems develop at maturity and rosette leaves wither. Persistent flower stems can hinder harvest machinery. Several forms (biotypes) occur, differing in leaf width, branching pattern, and flowering time. Characteristics can vary between, but rarely within populations since all reproduction is by clones (vegetative and seed apomixis). Plants are highly competitive for water and nutrients. Rush skeletonweed is also a significant problem in several other countries, particularly Australia. Introduced from southern Europe.

Seedlings

Cotyledons spatulate to oval. First leaves elliptic with backward pointing teeth. Require a continuous moisture supply for up to 6 weeks to develop a persistent root system.

Mature Plants

Rosette leaves oblanceolate, 4 to 12 cm long, 1 to 5 cm wide, prostrate, and typically lacking hairs. Margins often purple tinged and irregularly shallow lobed, with lobes often pointing backward toward the leaf base. Lobes opposite one another. Terminal lobe more or less sharp pointed. Rosettes produce one or more flowering stems with numerous branches. Upper stems mostly lack hairs, but typically have dense, bristly, downward pointing hairs at the base. Stem leaves often absent or bractlike, but when present resemble reduced rosette leaves.

Roots and Underground Structures

Taproot slender, deep, persistent, with short lateral branches along the length. Taproots become somewhat woody with age and can penetrate soil to depths of 2 to 3 m or more. Most lateral roots are short lived, non-woody, and less than 8 cm long, but a few lateral roots near the surface can become rhizomelike and grow laterally for 15 to 20 cm before turning downward. Adventitious buds near the top of the taproot and

on major lateral roots can produce new rosettes. Roots are easily fragmented, with pieces as small as 1 to 2 cm producing new rosettes from depths to 1 m.

Flowers

July until flowering stems killed by frost (fall or winter). Flower heads axillary or terminal, sessile or short stalked, and solitary or in interrupted spikelike clusters of 2 to 5. Each flower head consists of 7 to 12 bright yellow ligulate flowers, strap shaped with 5-lobed corollas 12 to 18 mm long, and phyllaries (bracts) cylindric as a unit and in two unequal rows, the outer much smaller than the inner. Receptacle lacks small bracts (chaff) among the flowers. Temperatures of at least 59 ºF are necessary to induce flower production.

Fruit and Seeds

Achene body oblong, tapered at both ends, lacking hairs, pale to dark brown, and 3 to 4 mm long, with many lengthwise ribs, pointed tubercles near the top, and to six small scales at the apex, surrounding the point of beak attachment. Beak slender, 5 to 6 mm long, not including the pappus which consists of many equal, fine, white bristles about 5 mm long.

Postsenescence Characteristics

Persistent rigid stems with clusters of flower head bracts (and sometimes seeds) on old stems distinguish rush skeletonweed from dandelion (*Taraxacum officinale* Wigg.) and weeds such as mustards (*Brassica* spp.) and radish (*Raphanus* spp.).

Habitat

Disturbed soils of roadsides, croplands, especially irrigated grain fields, semiarid pastures, rangelands, and residential properties. Grows best on well-drained, sandy or gravelly soils in climates with cool winters and hot, relatively dry summers without prolonged drought. Tolerates a wide variety of environmental conditions, including rainfall less than 250 mm to more than 1,200 mm, cold winter areas, and continental climates. Severe infestations are less common on heavy clay soils.

Propagation/Phenology

Triploid. Reproduces only by clones produced vegetatively from adventitious buds on roots and asexually by apomictic seed. Seeds primarily disperse with wind, but also by water, animals, and human activity. Seeds can be highly viable, with ~90 percent germination the first year and are short lived under field conditions, to ~2 percent the third year but often less than 6 months. Seeds lack dormancy and can germinate within 24 hours under optimal conditions. Fresh seeds germinate without light and at a temperature range of 45 to 104 ºF (optimum 59 to 86 ºF). Seed germination and new bud growth begin in fall after first rains in mild winter areas or early spring in colder climates. Seedling emergence is reduced in water saturated or heavy clay soils and during drought conditions. First year plants on deep sandy soil can produce viable seed earlier. Can develop from rosette to seed maturity in 1 month. Flowering stems are produced in early summer. One plant can produce 15,000 to 20,000 seeds per season.

Control Methods

Biological	Chemical
Stem/leaf gall midge, Skeletonweed gall mite and Skeletonweed rust	2,4-D, Fluroxypyr, Glyphosate, Imazapic, Imazapyr, Isoxaben, and Triclopyr
Cultural	**Mechanical**
Maintain healthy stands of native vegetation, revegetation/ competitive planting, implement introduction and prevention measures	None recommended

Canada Thistle Mature and Immature Flowerheads

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Canada Thistle Mature and Immature Flowerheads

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Canada Thistle Plants

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Canada Thistle Leaves

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Canada Thistle

[*Cirsium arvense* L.] Sunflower (Asteraceae) Family

General Description

Canada thistle is a dioecious, perennial forb (up to 1.5 m tall). Canada thistle is a highly competitive noxious weed. It was introduced from Eurasia.

Seedlings

Shoots begin to emerge in the early spring when soil temperatures reach about 41 °F. Development of rosette leaves occurs first, followed by vertical elongation early summer.

Mature Plants

Its erect stem is highly branched above, green, and glaberescent to covered with dense cobweblike hairs. Canada thistle usually occurs in small to large patches with numerous individuals arising from horizontal, lateral roots bearing adventitious shoots. Leaves are simple and placed alternately on the stem. Lower cauline leaves are oblong to oblanceolate (5 to 18 cm long and 1.5 to 6 cm wide) and entire or shallowly to pinnately lobed. Each lobe has few to many spines (up to 5 mm long). Both leaf surfaces may be glabrous, or the upper surface may be lightly pubescent while the lower surface is densely pubescent. Cauline leaves are reduced in size upward and less lobed. Leaves may have a petiole (up to 1 cm long) or be sessile, clasping, or short decurrent.

Roots and Underground Structures

Extensive rhizomes of Canada thistle make it unique among the thistles. Rhizomes develop at depths far below the zone of rhizome development for most species. Most rhizome development occurs in the first 75 cm of the soil, but they have been reported to occur nearly 7 m deep. Lateral root growth of up to 6 m in one growing season has been recorded. Root buds are produced on lateral roots at 6- to 12-cm intervals. With these closely placed buds, root fragments as small as 8 mm in length and 3 to 6 mm thick have produced new shoots, and root fragments 13 cm in length nearly always produce new shoots. Root fragments can produce viable shoots in as few as 5 days. Root/shoot elongation increases with temperature and photoperiod. Elongation is greatest at 59 °F day/night

temperatures, soil temperatures of 86 °F, and a photoperiod of 15 hours. Root reserves are lowest just prior to flowering, and are the greatest in early fall when aboveground growth stops.

Flowers

Flowering is generally from June to September when day length reaches 14 to 18 hours. Heads are numerous, and occur in terminal corymblike clusters. Each head is discoid and unisexual or incompletely dioecious. Pistillate flowers are 1 to 2 cm high and 0.5 to 1 cm wide, and staminate flowers are somewhat shorter. Bracts are imbricate, in five to six rows, ovate to lanceolate (2 to 6 mm long and up to 1.2 mm wide), spine tipped with a spine up to 1 mm long, and glabrous to covered with a dense cobweblike hair. The corolla is tubular and pink or purple in color (occasionally white). Staminate corolla tubes are 12 to 14 mm long, and anthers are 3.5 to 4 mm long and occasionally have vestigial pistillate parts. Pistillate corollas are longer (19 to 24 mm long) and may have vestigial anthers. Achenes are light brown to straw colored (2 to 4 mm long and up to 1.5 mm wide). Each achene has a pappus of numerous white to grayish plumose bristles reaching up to 2.5 cm in length.

Habitat

It grows in a wide variety of soils, including sand dunes, but it is most abundant in clayey soils. It can tolerate saline soils and wet or dry soils, but it grows best in dry soils. Also, Canada thistle does not readily tolerate water logged, poorly aerated soils. However, it may be found growing under these conditions in a lowered condition. It has a temperature tolerance of -31 to 104 °F. Optimal annual precipitation is 400 to 750 mm.

Propagation/phenology

Canada thistle is incompletely dioecious, with the staminate and pistillate flowers usually borne on separate plants. Each plant produces from 30 to 100 heads in a season. One plant has the potential to produce up to 5,200 seeds in a season, but the average

seed production is about 1,500 seeds per plant. Seeds are dispersed primarily by wind. Seed size is variable averaging 650,000 to nearly 1,500,000 per kg. Germination rates of between 50 and 95 percent have been observed. An average of 90 percent of the yearly seed production germinates within 1 year. Studies have shown that some seed can remain viable in the soil for up to 21 years and up to 4 months in water. Germination is restricted with osmotic pressures above 0.5 megapascals. Optimal germination is between pH 5.8 and 7.0. Each crop of seed produces a succession of seedlings. Some will germinate that fall and produce a rosette. These will then flower the next summer. Other seeds will not germinate until the next spring (or later) and may or may not flower that year.

Control Methods

Biological	Chemical
Stem-boring beetle and Gallfly	2,4-D, Chlorsulfuron, Clopyralid, Dicamba, Fluroxypyr, Glyphosate, Imazapyr, Isoxaben, Metsulfuron methyl, Sethoxydim, Sulfometuron methyl, and Triclopyr
Cultural	**Mechanical**
Maintain healthy stands of native vegetation, revegetation/ competitive planting for shade, implement introduction and prevention measures	Removing flowers to prevent seed production

Teasel Flowerhead

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Teasel Mature Flowerhead

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Teasel Basal Rosettes

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Immature Teasel Plant

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Teasel

[*Dipsacus fullonum* L.] Teasel (Dipsacaceae) Family

General Description

Teasels are monocarpic perennials. The plant grows as a basal rosette for a minimum of 1 year, then sends up a tall, flowering stalk and dies after flowering. The rosette stage varies according to the amount of time needed to acquire enough resources for flowering to occur. Introduced from Europe.

Seedlings

During the rosette stage, leaves change from being somewhat ovoid in the younger stage to large, oblong, and quite hairy in the older stage. During the rosette phase, teasel develops a large taproot.

Mature Plants

Flowering stems may reach 1.9 to 2.3 m in height. Flowering plants have large, oblong, opposite, sessile leaves that form cups (the cups may hold water) and are prickly, especially on the lower midrib. The leaves of cut-leaved teasel are broader and have feathering lobes. Stems are also prickly. Teasel's unique inflorescence makes the plant readily identifiable when flowers or seed heads are present.

Roots and Underground Structures

The taproot may be over .5 m in length and 2.5 cm in diameter at the crown.

Flowers

June through October. Flowers are small and packed in dense, oval-shaped heads. The flowers are subtended by stiff, spiny bracts that are located terminally on the flowering stems. Teasel usually has white flowers, while common teasel generally has purple flowers.

Habitat

Teasel grows in open, sunny habitats that range from wet to dry levels. Optimal conditions seem to be mesic habitats. Roadsides and heavily disturbed areas are the most

common habitats of teasel. Teasel sometimes occurs in high quality prairies, savannas, seeps, and sedge meadows.

Propagation/Phenology

A single teasel plant can produce over 2,000 seeds; up to 30 to 80 percent of the seeds may germinate. Seeds may remain viable for at least 2 years. Seeds typically don't disperse far; most seedlings will be located near the parent plant. Seeds may be water dispersed, which allows dispersal over longer distances. Immature seed heads of cut-leaved teasel are capable of producing viable seed.

Control Methods

Biological	Chemical
None currently available	2,4-D, Chlorsulfuron, Glyphosate, Isoxaben, and Triclopyr
Cultural	**Mechanical**
Maintain healthy stands of native vegetation, revegetation/ competitive planting, late spring burns, implement introduction and prevention measures	Repeated hand pulling or grubbing prior to seed-set

Russian Olive Flowers and Foliage

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Russian Olive Fruit

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Russian Olive Flowers and Foliage

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Russian Olive Winter Bark

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Russian Olive

[*Elaeagnus angustifolia* L.] Oleaster (Elaeagnaceae) Family

Class A Noxious Weed, Treatment Priority 1

General Description

Russian olive is a small, usually thorny shrub or small tree that can grow to 9.6 m in height. Its stems, buds, and leaves have a dense covering of silvery to rusty scales. Leaves are egg or lance shaped, smooth margined, and alternate along the stem. At 3 years of age, plants begin to flower and fruit. Highly aromatic, creamy yellow flowers appear in June and July and are later replaced by clusters of abundant silvery fruit. Russian olive is native to Eurasia.

Ecological Threat

Russian olive can out-compete native vegetation, interfere with natural plant succession and nutrient cycling, and tax water reserves. Because Russian olive is capable of fixing nitrogen in its roots, it can grow on bare, mineral substrates and dominate riparian vegetation where overstory cottonwoods have died. Although Russian olive provides a plentiful source of edible fruit for birds, ecologists have found that bird species richness is actually higher in riparian areas dominated by native vegetation.

Habitat

Russian olive is found along streams, fields and open areas. Seedlings are tolerant of shade and it thrives in a variety of soil and moisture conditions, including bare mineral substrates.

Propagation/Phenology

Establishment and reproduction of Russian olive is primarily by seed, although some vegetative propagation also occurs. The fruit of Russian olive is a small cherry-like drupe that is readily eaten and disseminated by many species of birds.

Control Methods

Biological	Chemical
None currently available	Dicamba, Fluroxypyr, Glyphosate, Imazapic, Imazapyr, Isoxaben, Tebuthiuron, and Triclopyr
Cultural	**Mechanical**
Maintain healthy stands of native vegetation, revegetation/ competitive planting, implement introduction and prevention measures	Repeated hand pulling or deep root grubbing prior to seed-set

Leafy Spurge Flowers

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Leafy Spurge Flowers

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Leafy Spurge Plant

©Photo Courtesy of Steve Dewey, Utah State University @ www.forestryimages.org

Leafy Spurge Rhizomes with Characteristic Pink Nodes

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Leafy Spurge

[*Euphorbia esula* L.] Spurge (Euphorbiaceae) Family

General Description

Noxious perennials with milky white latex to 0.8 m tall. Introduced from southwestern Europe. Plants develop extensive creeping root systems and are highly variable. There are many regional biotypes, creating much taxonomic confusion.

Seedlings

Hypocotyl dull reddish brown at the soil line, pale green above. Outer root tissues becoming brown and corky at an early stage. Cotyledons linear to elliptic, 2 to 4 mm wide, 4 to 19 mm long, becoming leaflike with age. Upper surface covered with white powdery granules. Lower surface pale and conspicuously veined. Seedling leaves similar in shape to mature leaves except smaller. First leaves opposite. Subsequent leaves alternate but close together so as to appear sub-opposite. Leaf pairs folded or rolled longitudinally in bud, with one leaf enclosing the other. Seedlings develop adventitious buds near the soil line at an early stage. Seedling descriptions for oblong and toothed spurges are unavailable.

Mature Plants

Stems +/- woody at the base. Leaves sessile, glabrous, mostly alternate (some may be opposite or whorled just below the inflorescence branches). Inflorescence bracts opposite, cordate to kidney shaped, sessile, glabrous, shorter and broader than leaves. Stipules absent. Stems erect, glabrous or hairy. Leaves linear to narrowly oblanceolate, 2 to 6 cm long, typically about 0.5 cm wide, and tips acute or rounded. Margins smooth. Bracts yellow green.

Roots and Underground Structures

Develops an extensive system of vigorous, spreading, rhizomelike long horizontal roots, short horizontal feeder roots, and short and long vertical roots. Long horizontal roots and crowns produce many pink scaly buds from which new shoots can develop. Most root buds develop within 30 cm of the soil surface, but a few can develop as deep as 300 cm. Vertical roots can reach depths to 9 m. Under favorable

conditions, root fragments as deep as 2.8 m can produce new shoots for up to 5 years. Long roots become corky and brown with age and can tolerate considerable periods of drought. The root system stores abundant food reserves, enabling roots to produce new shoots for many years under adverse conditions such as continual grazing or mowing.

Flowers

Monoecious. Inflorescence umbellike at the stem tips, with the central inflorescences maturing first (cymelike). Each infloresence appears to consist of one flower, but is actually a cluster of reduced unisexual flowers (cyathium). A cyathium consists of several staminate (male) flowers, each reduced to one stamen, inserted on a glabrous bell-shaped hypanthium (receptacle extension) and one pistillate (female) flower situated above the staminate flowers on a stalk from the center of the hypanthium. Each pistillate flower has three styles fused together at the bases and branched at the tips and a 3-chambered ovary. The rim of the hypanthium has four flattened glands that lack petallike appendages. Insect pollinated. Leafy spurge flowers June-September. Cyathium 1.5 to 2.5 mm long. Glands two horned (crescent shaped), 1.5 to 2 mm long. Style branches half the style length. Staminate flowers 11 to 21.

Fruit and Seeds

Capsules round, 3-chambered, 3 to 5 mm long, smooth to granular with one yellow brown to gray or mottled, smooth seed per chamber. Seeds ovoid to oblong, round in cross-section, 2 to 3 mm long, and with a yellowish caruncle (small elaisome) near the end of attachment.

Postsenescence Characteristics

Leafy spurge shoots dieback with the onset of the cold season. Leaves often turn reddish just before dropping. About 42 days of chilling are required to release plants from post-senescent dormancy.

Habitat

Waste areas, disturbed sites, roadsides, fields, pastures, rangeland, alfalfa fields, and riparian areas. Plants tolerate subtropic to subarctic climates, xeric to mesic conditions and flooding for at least 4

to 5 months if shoots can grow above the water surface. Grows best on coarse-textured soils, although most soil types are tolerated.

Propagation/Phenology

Mature capsules of many spurges rupture and forcefully eject seeds some distance from the parent plant. Reproduces by seed and vegetatively from extensively creeping roots. Infestations are usually initiated by seed, but population expansion is mostly vegetative. Seeds mature about 30 days after the female flower appears. Mature capsules eject seeds to 5 m from the parent plant. Seeds can germinate soon after maturing and can float on water for several days, germinating on the surface. Most seeds germinate in early spring, but germination may occur throughout the growing season under favorable moisture conditions. A cold, moist stratification period followed by warmer temperatures increases germination of some biotypes. Seedling emergence is optimal at depths of 1.5 to 5 cm, but can occur from depths to ~15 cm. Under field conditions, some seeds can remain viable for at least 8 years. Most seedlings do not flower the first season. Individual shoots typically produce ~10 to 50 capsules. Flower production and shoot survival decrease with increasing shade.

Control Methods

Biological	Chemical
Flea beetles	2,4-D, Dicamba, Fluroxypyr, Glyphosate, Imazapic, and Isoxaben
Cultural	**Mechanical**
Maintain healthy stands of native vegetation, revegetation/ competitive planting, grazing of goats and sheep, possibly fall burning, implement introduction prevention measures	Mowing or cutting before flowering, repeated hand pulling or grubbing of small infestations, to cut and dig out roots and eliminate seed production

Black Henbane Flowers

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Black Henbane Plant

©Photo Courtesy of Mary Ellen (Mel) Harte @ www.forestryimages.org

Black Henbane Flowers and Seed Capsules

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Black Henbane Foliage

©Photo Courtesy of Mary Ellen (Mel) Harte @ www.forestryimages.org

Black Henbane

[*Hyoscyamus niger* L.] Nightshade (Solonaceae) Family

General Description

Coarse, erect biennial or summer annual to 1 m tall. Foliage is covered with sticky glandular hairs and has a foul odor. All plant parts contain tropane alkaloids (hyoscyamine, hyoscine or scopolamine, atropine) and are toxic to humans and animals when ingested. Livestock rarely consume plants because of the unpleasant odor and bitter taste. Introduced into eastern North America from Eurasia as a medicinal herb.

Seedlings

Cotyledons lanceolate to oblong, 3 to 5 mm long, 1 to 2 mm wide, with a few hairs on the basal margins. Lower midvein terminates with a gland. Stalk below the cotyledons (hypocotyl) short, visible above ground only at the earliest stage. Subsequent rosette leaves alternate, +/- oblong, often with petioles nearly as long as the blades. Margins entire to slightly wavy. Veins conspicuous, depressed on the upper surface, prominent below. Petioles and veins covered with long glandular hairs.

Mature Plants

Stems erect, leafy, branched (biennial form) or few branched (annual form), densely covered with long glandular hairs. Leaves alternate, gray green, covered with short glandular hairs, short stalked (lower) to sessile (upper), oblong to lanceolate, 5 to 20 cm long, coarsely toothed to acutely pinnate lobed, with conspicuous pale veins covered with long glandular hairs. Lower leaves short stalked, upper sessile.

Roots and Underground Structures

Taproot thick, fleshy.

Flowers

June-September. Racemes terminal, leafy, 1-sided, +/- coiled at the tips, with flowers solitary in leaf axils below. Petals fused, funnel shaped, unequally 5-lobed, oblique at the opening (limb), 2 to 3(4) cm long, pale (greenish) yellow with conspicuous purple veins and a purple throat. Sepals fused,

urn shaped, 5-lobed, densely covered with long glandular hairs at the base, 1 to 1.5 cm long, enlarging to 2.5 to 3 cm long in fruit. Lobes acute, spreading, stiff. Stamens five (two short). Filaments hairy. Anthers purple. Annual plants often have paler flowers and bloom later than biennials.

Fruit and Seeds

Capsules ovoid, 0.8 to 1.5 cm long, 2-chambered, open by a thick lid at the top (circumcissle), loosely enclosed and concealed by a stiff, prominently veined calyx (sepals collectively). Seeds numerous, brown to gray, deeply pitted, flattened, ~1.5 mm long, variably shaped, oval to +/- square, contain a higher concentration of alkaloids than leaves or roots.

Habitat

Disturbed open sites, roadsides, fields, waste places, and abandoned gardens. Grows best in sandy or well-drained loam soils with moderate fertility. Does not tolerate waterlogged soils.

Propagation/Phenology

Reproduces by seed. Seeds that mature early in a season typically produce biennial plants. Seeds maturing late in a season often produce annual plants. Newly matured seeds germinate without light. Seeds that become dormant germinate best when exposed to light. Under field conditions, seed can remain viable for ~4 years. Biennial seedlings require a cold, moist period to induce stem elongation and flowering. In colder, more northern regions the proportion of annual plants is higher than in more southern climes.

Control Methods

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

Dyers Woad Flowers

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Dyers Woad Plant

©Photo Courtesy of Steve Dewey, Utah State University @ www.forestryimages.org

Dyers Woad Seeds

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Dyers Woad Basal Rosette

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Dyers Woad

[*Isatis tinctoria* L.] Mustard (Brassicaceae) Family

General Description

Erect biennial, sometimes winter annual or short-lived perennial, to 1.2 m tall. Immature plants exist as basal rosettes until flowering stems develop at maturity. Plants are highly competitive and often grow in dense colonies. Dyers woad is primarily a noxious weed of rangeland, agronomic crops, and undisturbed natural areas in the intermountain west region of the northwestern U.S. Dyers woad was introduced from Europe.

Seedlings

Cotyledons ovate, glabrous, ~15 to 20 mm long. Tips +/- squared, often slightly indented. Bases +/- wedge shaped, tapering into a stalk ~5 to 12 mm long. First leaves alternate, elliptic to obovate with smooth margins, ~15 to 20 mm long, +/- rounded at the tip, sparsely covered with long hairs. Bases taper to a hairy stalk ~4 to 10 mm long. Subsequent few leaves resemble first leaves.

Mature Plants

Flowering stems typically several per rosette, gray to purplish, glabrous, typically branched near the top. Leaves +/- bluish green, often covered with a powdery white bloom (glaucous). Midveins conspicuously pale. Rosette leaves oblanceolate to elliptic, ~3 to 18 cm long, 1 to 4 cm wide, tips +/- rounded, bases gradually tapered to stalk ~1/2 to 3/4 the length of the blade, sparsely covered with simple long hairs, especially on veins. Margins weakly toothed to +/- wavy. Stem leaves alternate, sessile, broad to narrowly arrowhead shaped (sagittate) with smooth margins, sometimes broadest near the tip, clasping and lobed at the base, +/- glabrous.

Roots and Underground Structures

Taproots of rosette and mature plants penetrate the soil to an average depth of about 1 m. Most lateral root growth occurs in the top 30 cm of soil during the second year.

Flowers

April-June. Panicles of racemes +/- flat topped (corymblike) or umbrella shaped. Petals four, bright yellow, spoon shaped, ~3 to 4 mm long. Sepals four, separate to base, shorter than petals. Stamens six, four long, two short. Insect or self-pollinated.

Fruit and Seeds

Fruit (silicles) pendant, black to blue or purplish black, flattened, oblong to oblanceolate, 8 to 18 mm long, 5 to 7 mm wide, longitudinally ridged at the center of each side, gradually tapered to a slender stalk. Stigma sessile. Fruit do not open, mostly contain one seed. Seeds oblong, +/- round in cross section, grooved into two unequal halves, dull yellowish to orangish brown, ~3 to 4 mm long.

Postsenescence Characteristics

Dried plants with a few fruit may persist well into winter.

Habitat

Disturbed and undisturbed sites, roadsides, railroad rights-of-way, fields, pastures, grain and alfalfa fields, forest and rangeland. Often grows on dry, rocky or sandy soils.

Propagation/Phenology

Reproduces by seed. Most fruit fall near the parent plants, but some fruit disperse short distances with wind and to greater distances with water, soil movement, human activities, as a seed and hay contaminant, and possibly by clinging to the fur or feathers of animals. Seeds mature about 8 weeks after flower stem initiation. Fruit coats contain water-soluble inhibitors that prevent many seeds from germinating until leaching occurs and reduce seedling growth of Dyers woad and other species. Some seeds germinate in the presence of the inhibitor. Rupture of fruit coats increases germination. Seeds germinate in fall and early spring. At maturity, fall germinating plants typically produce more seeds than spring germinating plants. Seed longevity under field conditions has not been studied.

Control Methods

Biological	Chemical
Rust	2,4-D, Chlorsulfuron, and Metsulfuron methyl
Cultural	**Mechanical**
Maintain healthy stands of native vegetation, revegetation/ competitive planting, implement introduction and prevention measures	Repeated hand pulling or grubbing of small infestations to cut and dig out roots and eliminate seed production

Dalmatian Toadflax Flowers

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Dalmatian Toadflax Leaves

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Dalmatian Toadflax Plants

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Dalmatian Toadflax Plants

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Dalmatian Toadflax

[*Linaria genistifolia* (L.) Miller ssp. *dalmatica* (L.) Maire and Petitm.] Figwort (Scrophulariaceae) Family

General Description

Herbaceous perennials, with creeping roots and showy yellow flowers, to 1.2 m tall. Plants are highly competitive for soil moisture with winter annuals and shallow-rooted perennials. Infestations often form large colonies, displacing desirable vegetation. On infested rangeland, livestock typically avoid grazing plants. Introduced from the Mediterranean region.

Seedlings

Compete poorly with established vegetation for soil moisture. Seedlings that have lost their cotyledons resemble new shoots from roots. Seedlings initially develop a taproot. No description of dalmatian toadflax is available. However, it is often unable to survive rapid or extreme temperature changes.

Mature Plants

Stems typically branched near the top. Leaves primarily alternate, but crowded and often appearing opposite or whorled, especially near the bases of stems. Leaf margins entire. Aboveground parts dieback to the ground in fall. Dalmatian toadflax stems erect, glabrous. Leaves sessile, ovate to lanceolate, 3 to 6 cm long, with pointed or long-tapered tips, +/- clasping at the base, stiff, typically ascending, glabrous, usually bluish green and covered with a whitish film (glaucous). Generally more robust than yellow toadflax.

Roots and Underground Structures

Plants develop an extensive system of vertical and creeping lateral roots that produce new shoots. Root fragments can produce new plants. Roots can associate with vesicular-arbuscular mycorrhizae. Dalmatian toadflax roots can penetrate soil to depths of 2 m or more. Lateral roots are typically 5 to 20 cm below the soil surface and can extend outwards to 3.5 m in all directions. Acclimated roots of yellow toadflax can survive temperatures as low as 5 ºF.

Flowers

May-September. Flowers showy, yellow, snapdragonlike. Corolla 2-lipped, 5-lobed, with a long, +/- straight, downward pointing spur near the base of the lower corolla tube. Stamens four, in two pairs. Self-incompatible. Insect pollinated. Dalmatian toadflax racemes elongate, dense or open, erect or drooping at the tips. Corollas bright yellow, (2)3.5 to 5 cm long including spur. Throat and lower lip white or orange hairy. Flowers in bud often purplish at apex.

Fruit and Seeds

Capsules +/- round, 2-chambered, opening by irregular slits at the apex to release numerous black to brown seeds. Dalmatian toadflax capsules 3 to 7 mm long. Seeds pyramidlike, ridged, ~1.2 mm long. Seed occasionally resembles that of yellow toadflax, possibly due to hybridization.

Postsenescence Characteristics

Stiff stems with attached seed capsules containing seed can remain erect for an extended period during the winter.

Habitat

Disturbed open sites, fields, pastures, degraded rangelands, roadsides, agronomic and perennial crops. Dalmatian toadflax tolerates a broad range of climatic conditions and soil types. Dalmatian toadflax grows best in cool, semiarid climates and dry, coarse soils at neutral to slightly alkaline pH.

Propagation/Phenology

Reproduces by seed and vegetatively from creeping lateral roots. Most seed falls near the parent plant. Some seed disperses short distances with wind and to greater distances with water, soil movement, and by clinging to the feet, fur or feathers of animals. Seed production and viability is highly variable, depending on out-crossing and presence of pollinators. Seeds germinate in spring and fall when conditions become favorable. Germination occurs on

the soil surface and to a depth of 3 cm. Plants can rapidly colonize a site by vegetative reproduction from creeping roots. Dalmatian and yellow toadflax can hybridize. Dalmatian toadflax plants with 10 to 15 stems can produce up to 500,000 seeds, with an average of ~140 to 250 seeds per capsule. Seeds appear to require an after-ripening period of ~1 to 2 months. Seeds produced early in a season have a longer dormant period than seeds produced later. Under field conditions, seed may remain viable for up to 10 years. Most seedlings emerge from within 5 mm of the soil surface. Germination is highest on open sites with compacted soils and little vegetation.

Control Methods

Biological	Chemical
Toadflax moth	2,4-D, Chlorsulfuron, Dicamba, Fluroxypyr, Glyphosate, and Isoxaben
Cultural	**Mechanical**
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

Yellow Toadflax Plants

©Photo Courtesy of Linda Wilson, University of Idaho @ www.forestryimages.org

Yellow Toadflax
Rhizomes and Sprouts

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Yellow Toadflax Flowers

©Photo Courtesy of Michael Shephard, USDA Forest Service @ www.forestryimages.org

Yellow Toadflax Plants

©Photo Courtesy of Mary Ellen (Mel) Harte @ www.forestryimages.org

Yellow Toadflax

[*Linaria vulgaris* Miller] Figwort (Scrophulariaceae) Family

General Description

Herbaceous perennials, with creeping roots and showy yellow flowers, to 1.2 m tall. Plants are highly competitive for soil moisture with winter annuals and shallow-rooted perennials. Infestations often form large colonies, displacing desirable vegetation. On infested rangeland, livestock typically avoid grazing plants. Yellow toadflax was reportedly first introduced to North America from Europe, by a man named Ranstead, who accompanied William Penn to present day Pennsylvania in the late 1600s. Yellow toadflax has since widely escaped cultivation. Yellow toadflax has been used medicinally and as a dye and can harbor cucumber mosaic and broad bean wilt viruses. Native to the Mediterranean region.

Seedlings

Compete poorly with established vegetation for soil moisture. Seedlings that have lost their cotyledons resemble new shoots from roots. Seedlings initially develop a taproot. Yellow toadflax cotyledons lanceolate, 4 to 10 mm long, pale green, with a slightly powdery film.

Mature Plants

Stems typically branched near the top. Leaves primarily alternate, but crowded and often appearing opposite or whorled, especially near the bases of stems. Leaf margins entire. Aboveground parts dieback to the ground in fall. Yellow toadflax stems erect to ascending, usually less than 1 m tall, glabrous or glandular hairy near the top. Leaves +/- sessile, linear, 2.5 to 5 cm long, soft, mostly spreading to drooping, glabrous or sparsely covered with long, soft hairs.

Roots and Underground Structures

Plants develop an extensive system of vertical and creeping lateral roots that produce new shoots. Root fragments can produce new plants. Roots can associate with vesicular-arbuscular mycorrhizae. Lateral roots are typically

5 to 20 cm below the soil surface and can extend outward to 3.5 m in all directions. Acclimated roots of yellow toadflax can survive temperatures as low as 5 ºF.

Flowers

May-September. Flowers showy, yellow, snapdragonlike. Corolla 2-lipped, 5-lobed, with a long, +/- straight, downward pointing spur near the base of the lower corolla tube. Stamens four, in two pairs. Self-incompatible. Insect pollinated. Yellow toadflax racemes dense, erect, +/- glandular. Corolla bright yellow, sometimes whitish, 1.5 to 3.5 cm long including spur. Throat and lower lip orange-hairy.

Fruit and Seeds

Capsules +/- round, 2-chambered, opening by irregular slits at the apex to release numerous black to brown seeds. Yellow toadflax capsules 9 to 12 mm long. Seeds flat, circular, with a papery wing, ~1.5 to 2 mm diameter. Without cross-pollination, only a few seeds develop.

Postsenescence Characteristics

Stiff stems with attached seed capsules containing seed can remain erect for an extended period during the winter.

Habitat

Disturbed open sites, fields, pastures, degraded rangelands, roadsides, agronomic and perennial crops. Both species tolerate a broad range of climatic conditions and soil types. Yellow toadflax often infests moist, coarse soils and can tolerate subarctic conditions.

Propagation/Phenology

Reproduces by seed and vegetatively from creeping lateral roots. Most seed falls near the parent plant. Some seed disperses short distances with wind and to greater distances with water, soil movement, and by clinging to the feet, fur or feathers of animals. Seed production and viability is highly variable, depending on out-crossing and presence of pollinators. Seeds germinate in spring

and fall when conditions become favorable. Germination occurs on the soil surface and to a depth of 3 cm. Plants can rapidly colonize a site by vegetative reproduction from creeping roots. Dalmatian and yellow toadflax can hybridize. Yellow toadflax average seed production is highly variable, from 10 to 110 seeds per capsule and 1,500 to 30,000 seeds per plant. Intense competition with other plants appears to lower or prevent seed production. Seeds can float on water for extended periods and may remain viable for 8 years or more under field conditions. Most seeds are dormant at maturity. A cool, moist period breaks dormancy, and germination of these seeds does not require light. However, evidence suggests that light stimulates germination of seeds that have not had a cool, moist period. Under experimental conditions, root fragments from 3-week old seedlings developed new shoots. First year plants can produce ~90 to 100 secondary shoots from roots and ~200 to 250 shoots by the second season.

Control Methods

Biological	Chemical
Toadflax flower feeding beetle and Toadflax capsule weevil	2,4-D, Dicamba, Fluroxypyr, Glyphosate, Isoxaben, and Metsulfuron methyl
Cultural	**Mechanical**
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

Purple Loosestrife Flowers

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Purple Loosestrife Flowering Inflorescence

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Purple Loosestrife Plants (above)

©Photo Courtesy of Linda Haugen, USDA Forest Service @ www.forestryimages.org

Purple Loosestrife Foliage (left)

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Purple Loosestrife

[*Lythrum salicaria* L.] Loosestrife (Lythraceae) Family

General Description

Erect perennial with showy pinkish-purple flower spikes, to 2(3) m tall. A mature plant can develop into a large clump up to 1.5 m in diameter. Aboveground foliage usually dies during the cool season, and new shoots sprout from a broad woody crown in spring. Plants often form dense colonies that displace native vegetation and wildlife. Introduced from Eurasia.

Seedlings

Cotyledons ovate, 3 to 5 mm long, tips rounded, bases wedge shaped, glabrous, on petioles 1 to 2 mm long. Stalk below cotyledons (hypocotyl) often purplish dotted. First and subsequent few leaves opposite, 5 to 8 mm long, resemble cotyledons.

Mature Plants

Stems simple or branched, sometimes +/- square or 5-angled. Leaves sessile, margins smooth. Stipules lacking. Stems typically covered with short hairs. Leaves lanceolate, 5 to 14 cm long, base slightly lobed (cordate), covered with short hairs or glabrous, mostly opposite or whorled. Upper leaves sometimes alternate.

Roots and Underground Structures

Taprooted and/or with locally spreading roots. Spreading roots typically form an expanded crown to ~0.5 m in diameter. New shoots grow from the expanded crown in spring. Roots can associate with mycorrhizae.

Flowers

June-September. Spikes showy, terminal, +/- dense, with 1 to 2 flowers per bract (reduced leaf) axil. Calyx tube (hypanthium) cylindrical, 4 to 6 mm long, longitudinally 8 to 12 ribbed, with 4 to 6 triangular sepal lobes 0.5 to 1 mm long at the top and longer appendages in between. Petals 4 to 6(7). Ovary superior but appears inferior, surrounded by and not

fused to calyx tube. Calyx tube appendages linear, 2 to 3 mm long. Bracts ovate, slightly pinched in at the tip (acuminate). Petals bright pinkish purple, 8 to 14 mm long, with +/- ruffled margins. Stamens +/- twelve. Flower types consist of three combinations of style and stamen length (heterostyly). Insect pollinated.

Fruit and Seeds

Capsules ~3 to 4 mm long. Seeds +/- narrowly ovoid to triangular, reddish-brown, surrounded by persistent calyx tube, open into halves at tip. Seeds numerous, flattened, sometimes 3-angled in cross-section, often concave on one side, 0.5 to 1 mm long.

Postsenescence Characteristics

Aboveground parts of purple loosestrife typically die in late fall. Senescing foliage often turns red. Dead brown stems often persist through winter, are oppositely branched, and may retain a few capsules.

Habitat

Perennial and seasonal wetlands, including marsh and pond edges, streambanks, canals, and ditches. Especially invasive on disturbed sites. Tolerates some shade and most soil types, including infertile soils. Grows best in slightly acid to neutral soils. Does not tolerate being submerged during the growing season.

Propagation/Phenology

Reproduces primarily by seed. Stem fragments can develop roots under favorable conditions. Seeds disperse with water, mud, human activities, and by clinging to feathers, fur, and feet of animals. A large plant can produce more than 2 million viable seeds in one season. Most seeds sink in water. Seeds typically germinate mid-spring through early summer. Upon germination, seedlings float to the surface. Optimal temperature range for germination is between 15 to 20 ºF. Light appears to increase germination. Seeds under cold, dry storage remain highly viable for at least 3 years, but longevity under field conditions is unknown. Seedlings can mature and flower within 8 to 10 weeks.

Control Methods

Biological	Chemical
None currently available	2,4-D, Chlorsulfuron, Dicamba, Glyphosate, Imazapyr, Isoxaben, Metsulfuron methyl, and Triclopyr
Cultural	**Mechanical**
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

Scotch Thistle Flowerhead

©Photo Courtesy of Eric Coombs, Oregon Department of Agriculture@ www.forestryimages.org

Scotch Thistle Plants

©Photo Courtesy of Steve Dewey, Utah State University @ www. forestryimages.org

Scotch Thistle Basal Rosette

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Scotch Thistle Leaves and Winged Stems

©Photo Courtesy of Douglas Barbe, California Dept. of Food and Agriculture, Botany Laboratory, 2001 @ calphotos.berkeley.edu

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

Biological	Chemical
Rosette weevil	2,4-D, Chlorsulfuron, Clopyralid, Dicamba, Fluroxypyr, and Metsulfuron methyl
Cultural	**Mechanical**
Maintain healthy stands of native vegetation, revegetation/ competitive planting, possibly goat grazing, implement introduction prevention measures	Repeated hand pulling or grubbing of small infestations to cut and dig out roots and eliminate seed production

Tansy Ragwort Plant

©Photo Courtesy of Faith Duncan, USDA Forest Service @ www.forestryimages.org

Tansy Ragwort Basal Rosettes

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Tansy Ragwort Plant

©Photo Courtesy of Michael Shephard, USDA Forest Service @ www.forestryimages.org

Tansy Ragwort Flowerheads

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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 cylindric 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

Biological	Chemical
Ragwort flea beetle, Ragwort seed fly, and Cinnabar moth	2,4-D, Clopyralid, Dicamba, Metsulfuron methyl, and Triclopyr
Cultural	**Mechanical**
Maintain healthy stands of native vegetation, revegetation/ competitive planting, possibly sheep grazing, implement introduction prevention measures	None recommended

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

©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 (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 (Solonaceae) 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

Biological	Chemical
None currently available	2,4-D, Clopyralid, Dicamba, Glyphosate, Isoxaben, and Triclopyr
Cultural	**Mechanical**
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 cylindric, disperse as units at maturity, but ultimately break apart into joints. Joints cylindric with blunt ends. Spikelets +/- cylindric 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 ºF and greater than 77 ºF). Some seeds can remain dormant for 2 or more years. Seedling growth is fastest at about 41 to 50 ºF. Some seed can survive ingestion by cattle.

Control Methods

Biological	Chemical
None currently available	Glyphosate and Isoxaben
Cultural	**Mechanical**
Maintain healthy stands of native vegetation, revegetation/ competitive planting and possibly early spring burning, implement introduction and prevention measures	Hand grubbing and spring tillage prior to seed-set

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)

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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 (loments) 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 ºF 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

Biological	Chemical
None currently available	2,4-D, Dicamba, and Imazapyr
Cultural	**Mechanical**
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 (Bassicaeceae) 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 ºC (optimum 20 to 35 ºC). 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

Biological	Chemical
Thistle head feeding weevil and Rosette weevil	2,4-D, Chlorsulfuron, Dicamba, Fluroxypyr, Glyphosate, Imazapyr, Isoxaben, Metsulfuron methyl, and Sulfometuron methyl
Cultural	**Mechanical**
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

Biological	Chemical
None currently available	2,4-D, Chlorsulfuron and Metsulfuron methyl
Cultural	**Mechanical**
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

Texas Blueweed Flowerhead

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Texas Blueweed Flowerhead Involucres

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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

Biological	Chemical
None currently available	2,4-D, Clopyralid, Dicamba, Glyphosate, Imazapic, Imazapyr and Isoxaben
Cultural	**Mechanical**
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

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

Biological	Chemical
None currently available	Fluroxypyr, Glyphosate, Hexazinone, Imazapic, Imazapyr and Isoxaben
Cultural	**Mechanical**
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

©Photo Courtesy of Steve Dewey, Utah State University @ www.forestryimages.org

Perennial Pepperweed Foliage

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Perennial Pepperweed Flowers

©Photo Courtesy of Jennifer Forman, 2002 @ calphotos.berkeley.edu

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

Biological	Chemical
None currently available	2,4-D, Chlorsulfuron, Fluroxypyr, Glyphosate, Imazapic, Imazapyr, Isoxaben and Sulfometuron methyl
Cultural	**Mechanical**
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

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

Salt Cedar Flowers

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Salt Cedar Flowers and Foliage

©Photo Courtesy of Steven Perkins @ USDA-NRCS PLANTS Database @ plants.usda.gov

Salt Cedar Flowers and Foliage

©Photo Courtesy of Steven Perkins @ USDA-NRCS PLANTS Database @ plants.usda.gov

Salt Cedar In Bloom

©Photo Courtesy of Steve Dewey, Utah State University @ 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

Biological	Chemical
Salt cedar leaf beetle	Glyphosate, Imazapic, Isoxaben and Triclopyr
Cultural	**Mechanical**
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

Red Brome Ligule

©Photo Courtesy of Steve Matson, 2005 @ calphotos.berkeley.edu

Red Brome Inflorescences and Spikelets

©Photo Courtesy of Patrick J. Alexander @ USDA-NRCS PLANTS Database @ plants.usda.gov

Red Brome Inflorescences and Spikelets

©Photo Courtesy of Brother Alfred Brousseau, Saint Mary's College of California, 1995 @ calphotos.berkeley.edu

Red Brome Plant

©Photo Courtesy of John M. Randall @ tncweeds.ucdavis.edu

Red Brome

[*Bromus rubens* L.] Grass (Poaceae) Family

General Description

Red brome is a tufted, cool-season annual bunchgrass. The annual growth pattern, hyaline lemma, dense panicle with a purplish tinge and pubescent culms distinguish this species from other bromes. Red brome is an introduced annual grass with little value. It was introduced from southern Europe.

Mature Plants

Reaches height of 20 cm to 50 cm.

Habitat

Red brome occurs at low to medium elevations (generally below 5,000 ft), in deserts and chaparral hillsides, and various places where competition from established herbaceous plants is minimal: along roadsides, waste places, rangelands and cultivated fields. It is a dominant species on some rangeland that, previous to the destruction of the vegetation, were abundant in perennial native grasses. Red brome is commonly found growing on shallow, dry soil or poor textured, clayey soils.

Propagation/Phenology

Red brome is a cool season annual that germinates in the fall and grows slowly until early spring at which time the growth rate rapidly increases, culminating with development of the reproductive structures. Due to the fall germination and winter growth period, red brome grows in locales with hot, dry summers and mild, moist winters. This species is killed by winter freeze and requires between 10 cm and 25 cm of precipitation throughout its growing season. Like all annual grasses, development of Red brome is comprised of six stages: germination, vegetative growth, floral bud development, maturation of flowers, fruiting, and senescence. The prevailing environmental conditions influence the various stages of development in different ways. Germination of red brome seeds is particularly dependent on the moisture level of the soil. The ability to germinate throughout the fall, winter

and spring, provides the seeds an opportunity to maximize the utilization of available moisture in order for a vigorous growth phase early in development of the plant. Flowering starts in late winter and continues throughout the spring. Red brome is a prolific seed producer: an average of 76 seeds per plant in natural populations, 142 seeds per plant in experimental mixed stand plots, or 83,600 seeds per square meter of densely spaced plants. Reproductive capacity is reduced by a low seedling survival rate and by a low maturation probability.

Control Methods

Biological	Chemical
None currently available	Chlorsulfuron, Isoxaben, Pendimethalin and Sulfometuron methyl
Cultural	**Mechanical**
Maintain healthy stands of native vegetation, revegetation/competitive planting, implement introduction and prevention measures, burning and reseeding, mulching	Hand pulling, grubbing, mowing prior to seed set, manage to reduce seed production

Cheatgrass Leaf Blades and Ligule

©Photo Courtesy of Steve Dewey, Utah State University @ www.forestryimages.org

Cheatgrass Plant

©Photo Courtesy of Forest and Kim Starr, United States Geological Survey @ www.forestryimages.org

Cheatgrass Inflorescences and Spikelets

©Photo Courtesy of Tom Heutte, USDA Forest Service @ www.forestryimages.org

Cheatgrass Inflorescence and Spikelets

©Photo Courtesy of Steve Dewey, Utah State University @ www.forestryimages.org

Cheatgrass

[*Bromus tectorum* L.] Grass (Poaceae) Family

General Description

Cheatgrass is an erect winter or spring annual grass. It was introduced from Europe.

Mature Plants

At maturity the foliage and seed heads often become purplish before drying completely and becoming brown or tan. Panicles are 5 to 20 cm long and rather dense. Cheatgrass panicles change color from green to purple to brown as the plant matures and eventually dries out. Branches are slender, pubescent, flexuous, with up to eight spikelets.

Seedlings

The seedlings are bright green with conspicuously hairy leaves, hence the alternate common name, downy brome.

Spikelets

Spikelets including awns are 2 to 4 cm long, nodding, with two to eight pubescent or villous florets. The glumes are villous, the lower ones 5 to 8 mm long, and the upper ones 7 to 11 mm long. Lemmas are toothed, 9 to 12 mm long, lanceolate, and covered with long, soft hairs. Awns are 12 to 14 mm long, slender and straight. The palea is shorter than the lemma. Each floret has three stamens and the anthers are 0.5 to 1 mm long.

Roots

Cheatgrass has a finely divided root system, which penetrates to depths of around 30 cm (11.8 inches), allowing it to extract most or all of the available moisture from this shallow layer of the soil profile. The roots of *Bromus tectorum* continue to grow during the winter, allowing it to gain control of a site before the seedlings of other species are established.

Habitat

Cheatgrass occurs in a wide variety of habitats across the continental U.S. Cheatgrass is common in recently burned rangeland and wild lands, winter crops, waste areas, abandoned fields, eroded areas, and overgrazed grasslands.

Although cheatgrass readily invades perennial forage crops and rangeland under poor management, it also invades communities in the absence of disturbance. Cheatgrass can persist in changeable environments because seed germination is staggered from August until May.

Propagation/Phenology

Cheatgrass reproduces only from seeds, germinates in the fall or winter, expands its roots over winter, and rapidly exploits the available water and nutrients in early spring. Vast numbers of cheatgrass seedlings usually germinate after the first fall rain in infested areas. The root system continues to develop throughout most of the winter and the plant has an extensive root system by spring. This allows it to extract higher levels of soil moisture and nutrients. Cheatgrass has a compressed phenology and usually dries out and casts seeds by mid-June. These dry plants can fuel wildfires. If fires occur frequently, perennials will likely give way to a community dominated by cheatgrass and other annuals.

Control Methods

Biological	Chemical
None currently available	Chlorsulfuron, Glyphosate, Isoxaben, Pendimethalin, Sethoxydim and Sulfometuron methyl
Cultural	**Mechanical**
Maintain healthy stands of native vegetation, revegetation/competitive planting, implement introduction and prevention measures, burning and reseeding, mulching	Hand pulling, grubbing, mowing prior to seed set, manage to reduce seed production

Southern Sandbur Plants

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Southern Sandbur Inflorescence

©Photo Courtesy of Forest and Kim Starr, United States Geological Survey @ www.hear.org/starr/hiplants/images

Southern Sandbur Spikelets

©Photo Courtesy of John D. Byrd, Mississippi State University @ www.forestryimages.org

Southern Sandbur Spikelets

©Photo Courtesy of CDFA Seed Laboratory @ www.cdfa.ca.gov

Southern Sandbur

[*Cenchrus echinatus* L.] Grass (Poaceae) Family

General Description

Introduced summer annuals, to 0.6 m tall, with loose spikes (racemes) of spiny burs at maturity. Southern sandbur was introduced from the southern U.S., Mexico, Central and South America.

Seedlings

Leaves folded in bud. Sheaths, ligules, and blades resemble those of mature plants.

Mature Plants

Loosely tufted. Culms branched and often abruptly bent near the base (geniculate). Ligules consist of a fringe of hairs, 0.5 to 1.5 mm long. Often there is a tuft of hairs ~2 to 3 mm long at the position of the auricles. Sheaths open, flattened, +/- glabrous, margins narrowly membranous, sometimes lined with a few long hairs. Collar narrow, lighter in color. Blades flat, sometimes folded, appear +/- glabrous, but are rough with very short hairs (visible with magnification). Southern sandbur is typically erect. Blades 3.5 to 11 mm wide, 6 to 20 cm long. Upper surfaces of blade bases often sparsely covered with long, soft hairs (pilose). Lower stems often maroon at maturity.

Roots and Underground Structures

Roots fibrous, shallow. Sometimes roots at the nodes.

Spikelets/Florets

Spikelets (1 to 8) enclosed by fused, spiny bracts that form a bur. Racemes of burs loosely spikelike, terminal. Main flowering axis (rachis) wavy. Burs disperse as units. Upper leaves sometimes partially enclose the lower burs. Spikelets consist of two florets. Only the upper floret is fertile. October. Bracts (spines) 40 to 60. Lower bracts with slender, flexible spines and clearly in a single whorl. Upper bract spines stiff. Racemes 3 to 8 cm long, spines stiff. Longest bract usually less than 5 mm long. Fertile florets generally 4 to 6 mm long.

Postsenescence Characteristics

Late in the season, lower foliage becomes straw colored and stems turn reddish or maroon. After a frost, entire plants become straw colored. Stems with burs can persist through winter. Dispersed burs can remain on or near the soil surface through the following summer.

Habitat

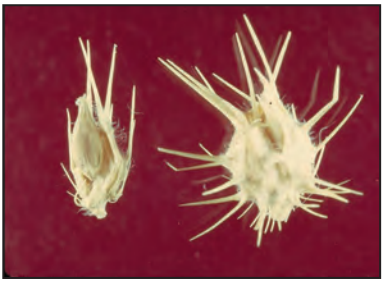
Aggressively colonizes open, disturbed sites in fields, orchards, vineyards, alfalfa, cultivated crops, and ditchbanks. Often infests sandy, well-drained soils.

Propagation/Phenology

Reproduces by seed. Burs disperse by clinging to skin and fur of animals, shoes and clothing of humans, tires, farm machinery, and by floating on water. Seedlings emerge in spring or early summer, and growth is rapid under moist conditions. Mechanical scarification and the presence of low levels of nitrate appear to stimulate germination. Seedlings can emerge from soil depths to 10 cm.

Control Methods

Biological	Chemical
None currently available	Glyphosate, Imazapic, Imazapyr, Isoxaben, Pendimethalin and Sethoxydim
Cultural	**Mechanical**
Maintain healthy stands of native vegetation, revegetation/competitive planting, implement introduction and prevention measures	Tillage effective when plants are small and prior to seed-set



Field Sandbur Spikelets

©Photo Courtesy of Staff CDFA, California Dept. of Food and Agriculture, Botany Laboratory @ calphotos.berkeley.edu

Field Sandbur Inflorescence

©Photo Courtesy of Luigi Rignanese, 2005 @ calphotos.berkeley.edu

Field Sandbur Plant

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Field Sandbur Inflorescence

©Photo Courtesy of Patrick J. Alexander @ USDA-NRCS PLANTS Database @ plants.usda.gov

Field Sandbur

[*Cenchrus incertus* M. Curtis] Grass (Poaceae) Family

General Description

Summer annuals, to 0.6 m tall, with loose spikes (racemes) of spiny burs at maturity. Field sandbur was introduced from the southern U.S., Mexico, Central and South America.

Seedlings

Leaves folded in bud. Sheaths, ligules, and blades resemble those of mature plants.

Mature Plants

Loosely tufted. Culms branched and often abruptly bent near the base (geniculate). Ligules consist of a fringe of hairs 0.5 to 1.5 mm long. Often there is a tuft of hairs ~2 to 3 mm long at the position of the auricles. Sheaths open, flattened, +/- glabrous, margins narrowly membranous, sometimes lined with a few long hairs. Collar narrow, lighter in color. Blades flat, sometimes folded, appear +/- glabrous, but are rough with very short hairs (visible with magnification). Field sandbur is erect to spreading. Blades 2.5 to 5 mm wide, 4 to 12 cm long.

Roots and Underground Structures

Roots fibrous, shallow. Sometimes roots at the nodes.

Spikelets/Florets

Spikelets (one to eight) enclosed by fused, spiny bracts that form a bur. Racemes of burs loosely spikelike, terminal. Main flowering axis (rachis) wavy. Burs disperse as units. Upper leaves sometimes partially enclose the lower burs. Spikelets consist of two florets. Only the upper floret is fertile. July-September. Bracts (spines) 8 to 40. Lower bracts not clearly whorled. All spines stiff. Longest bract usually less than 5 mm long. Fertile florets generally 4 to 6 mm long.

Postsenescence Characteristics

Late in the season, lower foliage becomes straw colored and stems turn reddish or maroon. After a frost, entire plants become straw colored. Stems with burs can persist through winter. Dispersed burs can remain on or near the soil surface through the following summer.

Habitat

Aggressively colonizes open, disturbed sites in fields, orchards, vineyards, alfalfa, cultivated crops, and ditchbanks. Often infests sandy, well-drained soils.

Propagation/Phenology

Reproduces by seed. Burs disperse by clinging to skin and fur of animals, shoes and clothing of humans, tires, farm machinery, and by floating on water. Seedlings emerge in spring or early summer, and growth is rapid under moist conditions. The biology of this species is poorly documented.

Management Favoring/Discouraging Survival

Sandburs compete poorly with dense vegetation and rarely become established in well managed pastures. Disturbances that bury burs and remove existing vegetation stimulate germination and enhance seedling establishment. However, repeated cultivation before burs develop reduces the seed bank and can eventually eliminate an infestation. Under mowing regimes, plants grow low to the ground and can still produce burs.

Control Methods

Biological	Chemical
None currently available	Glyphosate, Imazapic, Imazapyr, Isoxaben, Pendimethalin and Sethoxydim
Cultural	**Mechanical**
Maintain healthy stands of native vegetation, revegetation/competitive planting, implement introduction and prevention measures	Tillage effective when plants are small and prior to seed-set

Bull Thistle Mature and Immature Flowerheads

©Photo Courtesy of Forest and Kim Starr, United States Geological Survey @ www.forestryimages.org

Bull Thistle Plant

©Photo Courtesy of Steve Dewey, Utah State University @ www.forestryimages.org

Bull Thistle Foliage

Bull Thistle Leaf

©Photo Courtesy of Steve Dewey, Utah State University @ www.forestryimages.org

©Photo Courtesy of Dan Tenaglia, Missouriplants.com @ www.forestryimages.org

Bull Thistle

[*Cirsium vulgare* (Savi) Ten.] Sunflower (Asteraceae) Family

General Description

Erect prickly plants with purple, pink, or white flower heads that consist only of disk flowers. Coarse biennial, annual, or short-lived perennial to ~2 m tall, with stiff, hairy foliage and conspicuous prickly-winged stems. Upper leaf surfaces have stiff bristly hairs. Bull thistles have taproots. Bull thistle is common throughout temperate and mediterranean climate regions of the world. Regional biotypes vary primarily in life cycle patterns and seed dormancy and survival. Introduced from Eurasia.

Seedlings

Cotyledons oval to oblong, ~7 to 20 mm long, 3 to 7 mm wide, fused at the base, thick, dull, glabrous or slightly granular, paler below. First leaves alternate, elliptic to oblanceolate, tapered at the base into a winged stalk, ~2 to 4 times longer than cotyledons. Margin unevenly toothed teeth terminate with a weak prickle. Leaf surfaces, especially upper, covered with long, stiff, papillae-based hairs. Lower surfaces +/- granular, initially cobwebby. Rosettes often reach a diameter ~60 cm the first spring. Subsequent few to several leaves typically resemble first leaves, except increasingly larger.

Mature Plants

Leaves variable, +/- sessile, toothed to lobed, sometimes with lobes toothed. Rosette leaves elliptic to oblanceolate, ~10 to 40 cm long. Margins +/- deeply coarse lobed and toothed, with main prickles ~5 to 15 mm long. Stem leaves smaller, more deeply lobed and spinier than rosette leaves. Upper surfaces of all leaves green, evenly covered with stiff, sharp-pointed, papillae-based hairs ~1 mm long, sometimes sparsely cobwebby. Lower surfaces +/- covered with cobwebby hairs. Leaf bases extend nearly all the way down stem internodes as conspicuous prickly wings. Stems coarse, usually single, branched, loosely covered with white cobwebby hairs, +/- glandular.

Roots and Underground Structures

Taproots thick, fleshy, to ~70 cm deep, often branched into several arms.

Flowers

June-October. Heads one to a few, hemispheric to bell shaped, +/- loosely covered with cobwebby hairs, and with at least one bractlike leaf just below. Flower heads consist of several overlapping rows of spine-tipped phyllaries and numerous disk flowers interspersed with bristles on the receptacle. Involucres (phyllaries as units) 2.5 to 4 cm long, 2 to 4 cm diameter. Phyllaries lanceolate to linear, spreading to reflexed. Spines 1 to 5 mm long, +/- yellowish. Corollas purple, ~25 to 35 mm long, lobes mostly 5 to 8 mm long. Insect and self-pollinated.

Fruit and Seeds

Achenes ovate to elliptic, slightly compressed, smooth, glossy, with a basal attachment scar and a short beak (+/- 0.5 mm long) surrounded by a collar at the apex. Achenes 3 to 5 mm long, ~1 mm wide, gray or tan, sometimes with darker longitudinal striations. Pappus bristles ~15 to 30 mm long, +/- white. Pappus bristles plumose and deciduous, forming a ring at the base and falling as a unit. Surface of achenes mucilagenous when wet.

Postsenescence Characteristics

Flower stems typically senesce in fall, often with the onset of frosty nights. Old flower stems with flower head remnants usually persist for an extended period. Dead bull thistle stems may remain standing for 1 to 2 years.

Habitat

Open disturbed sites, roadsides, fields, pastures, hillsides, rangeland, and forest openings. Thistles typically do not tolerate deep shade or constantly wet soils. Also agronomic crops, orchards, recently logged and newly planted forestry sites. Grows best on heavy, fertile soils.

Propagation/Phenology

Bull thistle reproduces by seed. Plants exist as rosettes until flowering stems develop at maturity. Seeds germinate in fall after the first rains or in spring. Fluctuating temperatures and moisture stimulate germination. Germination occurs under a wide temperature range (41 to 104 ºF) and with or without light. Compared to other thistles, bull thistle seeds can germinate under low moisture conditions. First year rosettes usually persist through summer, but may dieback during a dry summer and regrow in fall. Rosettes (typically second year) require a cold period (vernalization) and the presence of sufficient soil nitrogen to initiate growth of flower stems. Thus, plants on very poor soil may take more than 2 seasons to mature. Seed and flower head production is highly variable, depending on environmental conditions. Seeds per flower head range from less than 100 to more than 400, with an average of ~200. Most seeds fall near the parent plants or disperse short distances with wind. Some seeds disperse to greater distances with human activities, water, soil movement, and as seed or hay contaminants. Birds and small mammals can consume and disperse some seeds. Seed dormancy at maturity is variable, depending on environmental conditions and biotype. Soil disturbance facilitates seed germination and seedling establishment. Seedlings typically emerge from soil depths to ~5 cm. Rosette foliage may be killed by a hard freeze and regrow from roots in spring. Plants in grazed pastures often produce more seed than plants in adjacent ungrazed areas. Most seeds either germinate within the first year or die, but seeds buried ~15 cm or deeper may survive to ~3 years or more.

Control Methods

Biological	Chemical
Gallfly	2,4-D, Chlorsulfuron, Clopyralid, Dicamba, Fluroxypyr, Imazapic, Imazapyr, Metsulfuron methyl and Triclopyr
Cultural	**Mechanical**
Maintain healthy stands of native vegetation, revegetation/competitive planting for shade, implement introduction prevention measures	Repeated hand pulling or grubbing, mowing, disking prior to seed-set

Field Bindweed Flower

©Photo Courtesy of Tom Heutte, USDA Forest Service @ www.forestryimages.org

Field Bindweed Plant

©Photo Courtesy of Mary Ellen (Mel) Harte @ www.forestryimages.org

Field Bindweed Flowers

©Photo Courtesy of Chris Evans, University of Georgia @ www.forestryimages.org

Field Bindweed Flower, Stem and Leaves

©Photo Courtesy of Tom Heutte, USDA Forest Service @ www.forestryimages.org

Field Bindweed

[*Convolvulus arvensis* L.] Morning-glory (Convolvulaceae) Family

General Description

Viney perennial with an extensive system of deep creeping roots and rhizomes. Plants typically develop large patches and are difficult to control. Introduced from Europe.

Seedlings

Cotyledons unequal, +/-square to kidney shaped, indented at the tip, ~8 to 20 mm long, 3 to 10 mm wide, glabrous, dull green with whitish veins, on stalks ~10 to 20 mm long. First leaves +/- arrowhead shaped, blunt at the tip, similar in size to the cotyledons. Subsequent leaves increasingly larger, +/- resemble mature leaves. New leaves loosely creased along the main vein in bud. Taproot grows deep rapidly. By 6 weeks, creeping lateral roots have developed, typically in the top 30 cm of soil.

Mature Plants

Stems twine around and over other plants or trail along the ground. Leaves alternate, short stalked, arrowhead shaped to +/- oblong or round, tips often rounded, typically 2 to 4 cm long, glabrous or sparsely covered with short hairs, dull green, sometimes covered with a whitish powdery bloom. Basal lobes +/- pointed, often flared outward (hastate). Leaf size and shape vary greatly depending on environmental conditions such as light intensity, soil moisture, and frequency of cultivation or defoliation.

Roots and Underground Structures

Roots cordlike, white, fleshy, brittle. Root systems consist of a vigorous, extensive network of primary and secondary taproots, numerous short-lived lateral feeder roots, and long-lived horizontal creeping roots that develop rhizomes from endogenous buds. Rhizomes grow to the soil surface and produce new shoots. Roots can penetrate soil to a depth of 3 m or more depending on the availability of soil moisture. Most horizontal creeping roots develop in the top 60 cm of

soil. Root systems competitively extract soil moisture and can survive extended periods of drought and repeated cultivation.

Flowers

April-October or until the first frost. Flowers axillary, solitary or in cymes of two to four, on stalks (peduncles) ~2 to 6 cm long. Corolla white or pinkish, funnel shaped, 1.5 to 3 cm long, pleated and spiraled in bud. Calyx +/- bell shaped, usually less than 5 mm long. Stigmas two, linear, cylindrical, not flattened. Bracts two, linear to narrowly lanceolate, 1 to 10 mm long, attached ~10 to 25 mm below flower. Flowers open for 1 day. Insect pollinated. Self-incompatible.

Fruit and Seeds

Capsules spherical, +/- inflated, +/- 8 mm in diameter. Seeds few per capsule, variable in shape, but typically obovate, slightly compressed, +/- 3-sided in cross-section, 3 to 4 mm long, dull, dark gray brown, covered with small, rough, irregular tubercles.

Postsenescence Characteristics

Shoots typically dieback during the cool season.

Habitat

Cultivated fields, orchards, vineyards, gardens, pastures, abandoned fields, roadsides, and waste places. Grows best on moist, fertile soils. Tolerates poor, dry, gravelly soils, but seldom grows in wet soils. Inhabits regions with temperate, Mediterranean, and tropical climates.

Propagation/Phenology

Reproduces by seed and vegetatively from deep creeping roots and rhizomes. Seeds are hard coated and can survive ingestion by birds and other animals. Most seeds can imbibe water and germinate 10 to 15 days after pollination. However, seed coats mature 15 to 30 days after pollination, and ~80 percent of seeds become impermeable to water. Seeds germinate throughout the growing season, but peak germination usually occurs mid-spring through early summer. Germination can occur under various temperature regimes, from 41 to 104 ºF, but is highest and most rapid when temperatures fluctuate from 59 to 68 ºF. A large portion of the seed bank remains

dormant from year to year. Under field conditions, seed can survive for 20 years or more. A high percent of seed under dry storage can survive for at least 50 years. Seed production is highly variable. Dry, sunny conditions and calcareous soils favor seed production. Frequent cultivation, rain, or heavy, wet soils can inhibit seed set. One plant can produce up to 500 seeds. Most new shoots appear in early spring. Undisturbed patches can expand their radius up to 10 m per year. Root fragments as small as 5 cm can generate new shoots.

Management Favoring/Discouraging Survival

Field bindweed's extensive root system utilizes deep soil moisture and allows the plant to withstand serious drought. Additionally, the plant is capable of summer dormancy and new shoots emerge from adventitious buds on vertical and lateral roots when rainfall returns. It may form small patches but generally does not constitute a serious threat. In rangelands, field bindweed rarely overlaps with winter and spring grazing systems due to its emergence in late spring. It provides very little green summer forage, as sheep and cattle generally avoid it. It is possible to bring bindweed to a manageable level, but it requires intensive effort and a watchful eye. Additionally, even when infestations are reduced to a minimal level, care must be taken to prevent re-establishment from seed, which are capable of persisting in the soil for 30 to 50 years.

Control Methods

Biological	Chemical
Bindweed gall mite	2,4-D, Chlorsulfuron, Dicamba, Fluroxypyr, Glyphosate, Imazapyr, Isoxaben, Metsulfuron methyl and Triclopyr
Cultural	**Mechanical**
Maintain healthy stands of native vegetation, revegetation/ competitive planting, implement introduction prevention measures	Repeated hand pulling or grubbing prior to seed-set

Hounds Tongue Plants

©Photo Courtesy of Steve Dewey, Utah State University @ www.forestryimages.org

Hounds Tongue Fruit

©Photo Courtesy of Kurt Stüber, Max-Planck Institute for Plant Breeding Research @ www.forestryimages.org

Hounds Tongue Flowers

©Photo Courtesy of Steve Dewey, Utah State University @ www.forestryimages.org

Hounds Tongue Basal Rosette

©Photo Courtesy of Brother Alfred Brousseau, Saint Mary's College of California, 1995 @ calphotos.berkeley.edu

Hounds Tongue

[*Cynoglossum officinale* L.] Borage (Boraginaceae) Family

General Description

Erect (30 to 120 cm) biennial or short-lived perennial forb with a thick, black, woody taproot. It forms a rosette in the first year and usually flowers in the second year. Hounds tongue is native to Eurasia.

Mature Plants

Initial growth is in the form of a basal rosette with a single flowering stem produced the second year. Most plants have one or two stems, although plants with up to eight stems have been reported with a single stem producing up to 300 seeds. The stem is unbranched below the inflorescence and leafy throughout. Basal and lower cauline leaves are petiolate, elliptic to oblanceolate (15 to 20 cm long and 2 to 5 cm wide) and tapering at the base. Upper leaves are alternate, numerous, not reduced or larger, acute to obtuse, and sessile or clasping. All leaves are pubescent on upper and lower surfaces.

Flowers

May through July. Flowers are perfect and in racemosely arranged cymes axillary to the leaves or on terminating short branches, pedicellate, crowded at anthesis, less crowded in fruit. The calyx (4 to 6 mm long in flower, enlarging to 1 cm in fruit) consists of five sepals with triangular lobes fused in the shape of a star. The corolla is a dull reddish purple with five lobes fused at the lower part into a cylindrical tube (5 to 6 mm long) and not exceeding the calyx. The throat of the corolla bears five hairy scales. Five stamens are inserted into the upper part of the tube. The pistil consists of a deeply lobed ovary and simple style.

Fruit

Fruit is indehiscent and consists of one to four nutlets. Nutlets (5 to 7 mm long) are brown or grayish brown, rounded triangular, dorsally flattened, and covered with short, barbed prickles.

Habitat

It grows on rangeland, pastures, abandoned cropland, roadsides, and waste places. It is most abundant in areas with more than 10 percent bare ground. It colonizes easily and quickly forms dense monocultures on disturbed habitats. It can become established on rangelands and retard the re-establishment of valuable range species.

Propagation/Phenology

Reproduces by seed. Seeds mature from July through August. Newly ripened seeds exhibit innate dormancy which is released by a period of vernalization. Most of the seed overwinters in the soil, although some may remain attached to the parent plant. Seed burial depth, ambient temperature and moisture, soil fertility, and light have been found to affect seed germination in Hounds tongue. Maximum germination occurs at 1 cm soil depth; seeds buried 5 cm deep germinate but do not emerge. Seeds on the soil surface desiccate and do not germinate. Seed germination has been found to be stimulated by low (32 to 50 °F, 12 percent soil moisture) and alternating temperatures. Hounds tongue does not produce a large, persistent bank of buried seeds. Research has found that when buried in the soil, no seeds survived 1 year after burial. A persistent seed bank, however, may result from seeds overwintering on the parent plant. Seeds remaining on the parent plant throughout the winter cannot undergo chilling in a moist stratum and, thus, dormancy must be overcome the following year. Estimates of total seed produced per plant range from 50 to more than 2,000. Nutlets remain attached to the parent plant for several months before falling to the ground, generally within a radius of 2 m from the parent plant.

Control Methods

Biological	Chemical
None currently available	2,4-D, Chlorsulfuron, Dicamba, and Imazapic
Cultural	**Mechanical**
Maintain healthy stands of native vegetation, revegetation/competitive planting, implement introduction prevention measures	Repeated hand pulling or grubbing prior to seed-set

Weeping Lovegrass Plant

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Weeping Lovegrass Plant

©Photo Courtesy of USDA-NRCS PLANTS Database @ plants.usda.gov

Weeping Lovegrass Inflorescence

©Photo Courtesy of John M. Randall @ tncweeds.ucdavis.edu

Weeping Lovegrass Infestation

©Photo Courtesy of John M. Randall @ tncweeds.ucdavis.edu

Weeping Lovegrass

[*Eragrostis curvula* (Schrad.) Nees] Grass (Poaceae) Family

General Description

Weeping lovegrass is a warm season perennial bunchgrass native to central and southern Africa. This grass has invaded degraded pastures and disturbed native grasslands. It is naturalized in a large number of locations. The drooping leaf characteristic gives rise to the name "weeping" lovegrass.

Mature Plants

Variable, tufted perennial, deep rooted, bunch type, forming large clumps with abundant drooping basal leaves; culms erect, 60 to 120 cm tall, simple; sheaths keeled and densely to sparsely hispidulous basally; blades narrow, ascending, involute, attenuate to a fine point, arcuate spreading, rough on both surfaces; panicles 15 to 40 cm long, 5 to 10 cm broad, open, with numerous ascending branches, the lower ones pilose in axils, with numerous ascending secondary branchlets that bear the sessile spikelets; spikelets grayish green, appressed, 8 to 10 mm long, 7 to 11 flowered; lemmas about 2.5 mm long, falling individually. Seeds 3 to 5 million/kg. The leaf blades are up to 0.5 m long and 4 mm wide, rolled or flat, appearing setaceous. Culms are unbranched and not easily compressed, with glabrous nodes; basal sheaths densely hairy with long hairs. Inflorescence 100 to 300 mm long, much branched, variable from open and spreading to contracted with branches appressed to the main axis. Lowest branches whorled or not whorled. Plants are extremely variable in morphology.

Spikelets/Florets

Spikelets 4 to 8.2(10) mm long, 1.2 to 2 mm wide, linear lanceolate, plumbeous to yellowish, with 3 to 10 florets; disarticulation irregular to acropetal, proximal rachilla internodes persistent. Glumes lanceolate, hyaline; lower glumes 1.2 to 2.6 mm; upper glumes 2 to 3 mm; lemmas 1.8 to 3 mm, ovate, membranous, lateral veins conspicuous, apices acute; paleas 1.8 to 3 mm, hyaline to membranous, apices obtuse; anthers three, 0.6 to 1.2 mm, reddish brown.

Habitat

Weeping lovegrass prefers a light-textured, well-drained soil, and will thrive on soils of low fertility often in disturbed, overgrazed or trampled grassland. Climatic conditions determine its range of adaptation. It is quite drought tolerant. Low winter temperatures will prevent regrowth and cause the grass to act as an annual or a short-lived perennial. Usually prefers open habitat and is found in a wide variety of vegetation types. Sea level to 3,500 m.

Propagation/Phenology

C4 photosynthetic pathway. It starts growing early in the spring and continues until well into the autumn. Minimum temperature for growth is just above freezing, it is frost tolerant. This grass seeds heavily.

Control Methods

Biological	Chemical
None currently available	Glyphosate
Cultural	**Mechanical**
Maintain healthy stands of native vegetation, revegetation/competitive planting, implement introduction and prevention measures, grazing by goats	Digging out the root system in late winter or early spring, followed by prescribed fire to kill remaining seeds, severe late season defoliation depletes energy reserves

Lehmann Lovegrass Plants

©Photo Courtesy of Michael Schumacher @ allergy.peds.arizona.edu

Lehmann Lovegrass Inflorescence

©Photo Courtesy of John M. Randall @ tncweeds.ucdavis.edu

Lehmann Lovegrass Inflorescence

©Photo Courtesy of S.L. Hatch and J.E. Dawson, S.M. Tracy Herbarium, Texas AandM University @ www.csdl.tamu.edu

Lehmann Lovegrass Infestation

©Photo Courtesy of John M. Randall @ tncweeds.ucdavis.edu

Lehmann Lovegrass

[*Eragrostis lehmanniana* Nees] Grass (Poaceae) Family

General Description

Lehmann lovegrass is a warm season perennial bunchgrass native to central and southern Africa. Widely used for forage and soil erosion control, Lehmann lovegrass has aggressively spread into native communities. A strong competitor, especially after disturbance, this species can exclude native recovery. In addition, it is more flammable and fire tolerant than many native species, altering fire frequency and intensity in invaded systems.

Mature Plants

Plants perennial; cespitose, forming innovations at the basal nodes, without glands. Culms (20)40 to 80 cm, erect, commonly geniculate, sometimes rooting at the lower nodes, glabrous, lower portions sometimes scabridulous. Sheaths sometimes shortly silky pilose basally, hairs less than 2 mm, apices sparsely hairy, hairs to 3 mm; ligules 0.3 to 0.5 mm, ciliate; blades 2 to 12 cm long, 1 to 3 mm wide, flat to involute, glabrous, abaxial surfaces sometimes scabridulous, adaxial surfaces scabridulous. Panicles 7 to 18 cm long, 2 to 8 cm wide, oblong, open; primary branches 1 to 8 cm, appressed or diverging to 40 degrees from the rachises; pulvini glabrous; pedicels 0.5 to 4 mm, diverging or appressed, flexible.

Roots and Underground Structures

Plants without knotty, rhizomatous base.

Spikelets/Florets

Spikelets 5 to 12(14) mm long, 0.8 to 1.2 mm wide, linear lanceolate, plumbeous to stramineous, with 4 to 12(14) florets; disarticulation irregular to basipetal, paleas usually persistent. Glumes oblong to lanceolate, membranous; lower glumes 1 to 1.5 mm; upper glumes 1.3 to 2 mm; lemmas 1.5 to 1.7 mm, ovate, membranous, lateral veins inconspicuous, apices acute to obtuse; paleas 1.4 to 1.7 mm, obtuse; anthers three, 0.6 to 0.9 mm, yellowish. Caryopses 0.6 to 0.8 mm, ellipsoid to obovoid, dorsally compressed, sometimes with a shallow adaxial groove, smooth, translucent, mostly light brown.

Habitat

Lehmann lovegrass has persisted and spread primarily in desert shrub and desert grassland ecosystems of southeastern Arizona at elevations between 3,250 and 4,800 ft. The plant has a narrow range of climatic and edaphic requirements, growing best on sites with sandy to sandy loam-textured soils, and where winter temperatures rarely drop below 32 ºF and summer rainfall ranges between 6 and 9 inches.

Propagation/Phenology

Lehmann lovegrass is a good seed producer. The seeds are small, with 4.2 to 6.5 million per pound. Nearly all fresh seeds are dormant, requiring at least 6 to 9 months of after-ripening. Under natural conditions, seed on the ground may be scarified by fire or by high summertime seed bed temperatures. In southeastern Arizona, high seedling emergence typically occurs following summer rains on sites where the canopy has been removed such as by burning, mowing, or grazing. Vegetative regeneration: Lehmann lovegrass is described as weakly stoloniferous. Stems that come in contact with the ground may root at the nodes.

Control Methods

Biological	Chemical
None currently available	Glyphosate
Cultural	**Mechanical**
Maintain healthy stands of native vegetation, revegetation/competitive planting, implement introduction and prevention measures, grazing by goats	Digging out the root system in late winter or early spring, followed by prescribed fire to kill remaining seeds, severe late season defoliation depletes energy reserves

Redstem Filaree Flowers

©Photo Courtesy of Steve Matson, 2004 @ calphotos.berkeley.edu

Redstem Filaree Plant

©Photo Courtesy of John M. Randall @ tncweeds.ucdavis.edu

Redstem Filaree Plants

©Photo Courtesy of John M. Randall @ tncweeds.ucdavis.edu

Redstem Filaree Fruits and Flowers

©Photo Courtesy of John M. Randall @ tncweeds.ucdavis.edu

Redstem Filaree

[*Erodium cicutarium* (L.) L'Hér. ex Ait.] Geranium (Geraniaceae) Family

General Description

Redstem filaree is a cool season annual herb (winter annual) that was introduced from the Mediterranean region of Europe.

Mature Plants

Plants develop as a basal rosette. A low and spreading 2- to 5-inch tall plant, growing from a central taproot. The stems are leafy and hairy. Flowers February to May, and plants usually dry up and disappear quickly after maturity. Rosette leaves occur on petioles and are hairy. Individual leaves are divided into three to nine individual leaflets that are arranged oppositely from one another. Individual leaflets are lanceolate in outline and range from 1-1/4 to 8 inches long. Leaflets are deeply lobed and do not have petioles (sessile). It is one of the first plants to germinate in late fall or spring.

Roots and Underground Structures

Small taproot and fibrous root system.

Flowers

Clusters of two to eight flowers occur with each individual flower occurring on a relatively long flower stalk (pedicel). Individual flowers are approximately 1/2 inch wide and consist of five bright pink to purple petals.

Fruit and Seeds

Fruit resembles a bird's beak and is approximately 1/2- to 3/4-inch long. Each seed is tipped with an elongated tail, which coils spirally at maturity, assisting the pointed seed in penetrating the soil.

Habitat

Redstem filaree is found in oak woodlands, semidesert grassland, and desert shrublands. It is often found in fields, lawns, and waste places. Redstem filaree is adapted to a broad

range of soil types. It grows in well-drained, clayey, loamy, or sandy soil, and is tolerant of moderately acidic to moderately alkaline soils.

Propagation/Phenology

Reproduces from seed.

Control Methods

Biological	Chemical
None currently available	2,4-D, Clopyralid and Glyphosate
Cultural	**Mechanical**
Maintain healthy stands of native vegetation, revegetation/competitive planting, implement introduction and prevention measures	Seed bed tillage in early spring

Oxeye Daisy Flowerhead

©Photo Courtesy of Steve Dewey, Utah State University @ www.forestryimages.org

Oxeye Daisy Plants

©Photo Courtesy of Mary Ellen (Mel) Harte @ www.forestryimages.org

Oxeye Daisy Stem and Foliage

©Photo Courtesy of Steve Dewey, Utah State University @ www.forestryimages.org

Oxeye Daisy Flowerheads

©Photo Courtesy of Montana Statewide Noxious Weed Awareness and Education Program Archives, Montana State University @ www.forestryimages.org

Oxeye Daisy

[*Leucanthemum vulgare* Lam.] Sunflower (Asteraceae) Family

General Description

A common perennial weed of grassy fields growing to 0.6 m on all the better types of soil, avoiding acid soils and shade. Introduced from Eurasia.

Mature Plants

Erect perennial herb to 1 m high. Leaves slightly hairy to hairless; basal and lower stem leaves ovate to spoon shaped, to 15 (rarely to 18) cm long, to 2 (rarely to 4) cm wide, on a long stalk; stem leaves smaller, upper ones stem-clasping. Seeds dark brown, grey or black with pale ribs. Stem leaves alternate, toothed to pinnately lobed, upper leaves with base stem-clasping; flower heads one to three (at ends of branches), mostly 3 to 6 cm wide; florets arising from a pitted receptacle without scales; outer petallike ray florets 10 to 35, white, 1 to 1.5 cm long, entire to toothed at the tip; inner florets yellow, tubular; seeds about 2.5 mm long.

Roots and Underground Structures

Creeping roots.

Flowers

Many small flowers (florets) in heads surrounded by bracts in several rows, bracts with dark membranous margins, longest bracts 5 to 8 mm long. Flowers most of the year, mainly spring and summer (June to August). The flowers are hermaphrodite (has both male and female organs) and are pollinated by bees, flies, beetles, Lepidoptera (moths and butterflies).

Habitat

Meadows. Oxeye daisy prefers all types of well drained, but moist soils. The plant prefers neutral and basic soils. It cannot grow in the shade. The plant can tolerate strong winds.

Propagation/Phenology

Spreads by seed and creeping roots.

Control Methods

Biological	Chemical
None currently available	Dicamba, Imazapyr and Sulfometuron methyl
Cultural	**Mechanical**
Maintain healthy stands of native vegetation, revegetation/competitive planting, implement introduction and prevention measures, grazing by goats	Digging out the root system in late winter or early spring, followed by prescribed fire to kill remaining seeds, severe late season defoliation depletes energy reserves

Bur Clover Flowers and Foliage

©Photo Courtesy of Steve Matson, 2006 @ calphotos.berkeley.edu

Bur Clover Flower, Stem, Foliage and Fruit

©Photo Courtesy of Ann Dennis, 2002 @ calphotos.berkeley.edu

Bur Clover Fruit

©Photo Courtesy of Steve Matson, 2006 @ calphotos.berkeley.edu

Bur Clover Flowers

©Photo Courtesy of Steve Matson, 2006 @ calphotos.berkeley.edu

Bur Clover

[*Medicago polymorpha* L.] Pea (Fabaceae) Family

General Description

A bright green nearly hairless annual or biennial herb. Introduced from Eurasia.

Seedlings

Cotyledons elliptic to ovate, rounded tip, more or less stalked. First leaf rounded, obtuse at the base; the later three foliolate.

Mature Plants

Weak stems branch from the base, and spread or lie on the ground with the tips ascending, 8 to 64 cm long. Stem prostrate or ascending, angular, hairless or more rarely with some short hairs, up to 40 cm long and 15 to 50 cm high, branched, subglabrous, with a few long hairs on petiolules, lower surface of leaflets, and calyx. Leaves trefoil which arise from a common point at the end of the leaf stalk, simple, terete. Leaflets toothed about in the upper part, with sometimes a brown or blackish blotch at the base. Stipules acute laciniate. Leaflets obovate-cuneate, 7 to 25 mm long, 5 to 23 mm wide, glabrate, margins dentate in upper half, apex rounded to truncate or emarginate, stipules narrowly elliptic to narrowly ovate, laciniate.

Roots and Underground Structures

Fibrous root system with small taproot. This species has a symbiotic relationship with certain soil bacteria; these bacteria form nodules on the roots and fix atmospheric nitrogen.

Flowers

Flowering mostly March to May, but in moist situations it may flower at almost all seasons.

Flowers from May to August and the seeds ripen from July to September. Flowers yellow solitary or usually two to

eight on flowering branches awnless at the top, about equaling the leaf. Standard longer than the keel; (1)3 to 5(8) in racemes; corolla yellow, 3 to 4.5 mm long. The small yellow pealike flowers are borne three to five in a cluster near the end of short stalks.

Fruit and Seeds

Pods 4 to 8(10) mm in diameter, spirally twisted in (1.5)3 to 4(6) turns, glabrous or subglabrous, transverse veins prominent, anastomosing, groove between submarginal and marginal vein wide, with nearly straight prickles 2 to 3 mm long, arising from the submarginal and marginal veins. Seeds several. Pod disk shaped, in a helix of 1.5 to 3.5 turns, 4 to 6 mm in diameter. Sides nearly flat, reticulate, with an outer border thin and with a furrow broken with spines on each side.

Habitat

Naturalized in open, dry to occasionally mesic, disturbed areas such as pastures, and roadsides. The plant prefers light (sandy) and medium (loamy) soils and requires well-drained soil. The plant prefers acid, neutral and basic (alkaline) soils. It cannot grow in the shade. It requires dry or moist soil.

Propagation/Phenology

Reproduces by seed.

Control Methods

Biological	Chemical
None currently available	2,4-D, Chlorsulfuron, Clopyralid, Dicamba, Fluroxypyr, Glyphosate, Imazapic, Imazapyr, Isoxaben, Metsulfuron methyl, Sulfometuron methyl, and Triclopyr
Cultural	**Mechanical**
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

White Sweetclover Plant

©Photo Courtesy of University of Alaska - Anchorage Archives, University of Alaska - Anchorage @ www.forestryimages.org

White Sweetclover Foliage

©Photo Courtesy of Chris Evans, University of Georgia @ www.forestryimages.org

White Sweetclover Flowers

©Photo Courtesy of Elizabeth Bella, USDA Forest Service @ www.forestryimages.org

White Sweetclover Flowering Inflorescences

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White Sweetclover

[*Melilotus albus* (L.) Lam.] Pea (Fabaceae) Family

General Description

White sweetclover is an annual or biennial herb of the pea family, sweet scented, with alternate, pinnately 3-foliate leaves. White sweetclover is native to Europe and western Asia. Its widespread use as bee pasture, in agriculture, and for soil stabilization hastened its spread across North America.

Mature Plants

White sweetclover has an erect, branched, glabrous or glabrate stem, 1 to 3 m high, with serrated, narrowly obovate to oblong leaflets that are truncate or emarginate. It is the only white-flowered sweetclover in Arizona.

Seedlings

Sweetclover seedlings closely resemble those of alfalfa (*Medicago* spp.). However, *Melilotus* may be distinguished from alfalfa by the absence of pubescence on the underside of the leaves and by its bitter taste.

Flowers

The flowers are perfect and much like those of *Trifolium* and *Medicago*, but in small, slender spikelike racemes with a deciduous corolla, free from the filaments. The corolla is 4 to 5 mm long; the fruit is 3 to 4 mm long and somewhat reticulate. The legume is ovoid, leathery and wrinkled, longer than the calyx, and scarcely dehiscent, with one or two seeds.

Habitat

Sweetclovers have long taproots and are drought tolerant and winter hardy, but cannot withstand prolonged flooding. *M. alba* is somewhat more tolerant to standing water than *M. officinalis* and is occasionally found on gravelly, open riverbanks subject to periodic flooding. Sweetclovers are found most commonly on calcareous soils and grow best on rich loams and clay loams with pH levels of 6.5 or higher. *M. officinalis* is apparently more salt tolerant than *M. alba*, although both species will grow on highly alkaline soils.

Propagation/Phenology

In the first season of growth plants produce a vegetative shoot which typically grows to 10 to 30 cm by October. Most root development occurs in late summer, after crown growth has slowed. While the roots develop, crown buds begin to form in the axils of the cotyledons and around the crown just below or at the soil surface. The shoot dies back in autumn, and the taproot and crown bud overwinter. The following spring and early summer, one or more flowering shoots emerge from the buds and rapidly elongate, often attaining a height of 100 cm by August. Rainwater runoff and streamflow are probably the most important means of seed dispersal, although wind can blow seeds up to several meters.

Control Methods

Biological	Chemical
None currently available	2,4-D and Dicamba
Cultural	**Mechanical**
Maintain healthy stands of native vegetation, revegetation/competitive planting, implement introduction and prevention measures. Dormant season burn to stimulate germination in the subsequent growing season, followed by late spring burn next season to eliminate second year plants before seed set	Hand-pulling in summer can be effective if done when the ground is moist. Repeated mowing.

Yellow Sweetclover Leaf

©Photo Courtesy of Louis-M. Landry, 2005 @ calphotos.berkeley.edu

Yellow Sweetclover Flowers

©Photo Courtesy of Steve Dewey, Utah State University @ www.forestryimages.org

Yellow Sweetclover Plants

©Photo Courtesy of Dave Powell, USDA Forest Service @ www.forestryimages.org

Yellow Sweetclover Inflorescences

©Photo Courtesy of Tom Heutte, USDA Forest Service @ www.forestryimages.org

Yellow Sweetclover

[*Melilotus officinalis* Medik.] Pea (Fabaceae) Family

General Description

Yellow sweetclover is an annual or biennial herb of the pea family, sweet scented, with alternate, pinnately 3-foliate leaves. Yellow sweetclover is native to Europe and western Asia. Its widespread use as bee pasture, in agriculture, and for soil stabilization hastened its spread across North America.

Mature Plants

Yellow sweetclover has an erect, branched, glabrous or glabrate stem, 1 to 3 m high, with serrated, narrowly obovate to oblong leaflets that are truncate or emarginate. It is the only white-flowered sweetclover in Arizona.

Seedlings

Sweetclover seedlings closely resemble those of alfalfa (*Medicago* spp.). However, *Melilotus* may be distinguished from alfalfa by the absence of pubescence on the underside of the leaves and by its bitter taste.

Flowers

The flowers are perfect and much like those of *Trifolium* and *Medicago*, but in small, slender spikelike racemes with a deciduous corolla, free from the filaments. The corolla is 5 to 6 mm long; the fruit is 3 to 4 mm long and somewhat reticulate. The legume is ovoid, leathery and wrinkled, longer than the calyx, and scarcely dehiscent, with one or two seeds.

Habitat

Sweetclovers have long taproots and are drought tolerant and winter hardy, but cannot withstand prolonged flooding. *M. alba* is somewhat more tolerant to standing water than *M. officinalis* and is occasionally found on gravelly, open riverbanks subject to periodic flooding. Sweetclovers are found most commonly on calcareous soils and grow best on rich loams and clay loams with pH levels of 6.5 or higher. *M. officinalis* is apparently more salt tolerant than *M. alba*, although both species will grow on highly alkaline soils.

Propagation/Phenology

In the first season of growth plants produce a vegetative shoot which typically grows to 10 to 30 cm by October. Most root development occurs in late summer after crown growth has slowed. While the roots develop, crown buds begin to form in the axils of the cotyledons and around the crown just below or at the soil surface. The shoot dies back in autumn, and the taproot and crown bud overwinter. The following spring and early summer, one or more flowering shoots emerge from the buds and rapidly elongate, often attaining a height of 100 cm by August. Rainwater runoff and streamflow are probably the most important means of seed dispersal, although wind can blow seeds up to several meters.

Control Methods

Biological	Chemical
None currently available	2,4-D
Cultural	**Mechanical**
Maintain healthy stands of native vegetation, revegetation/competitive planting, implement introduction and prevention measures. Dormant season burn to stimulate germination in the subsequent growing season, followed by late spring burn next season to eliminate second year plants before seed set	Hand-pulling in summer can be effective if done when the ground is moist. Repeated mowing.

Purslane Seedlings

©Photo Courtesy of Utah State University Archives, Utah State University @ forestryimages.com

Purslane Flowers and Foliage

©Photo Courtesy of Utah State University Archives, Utah State University @ forestryimages.com

Purslane Foliage

©Photo Courtesy of Lynn Sosnoskie, University of Georgia @ forestryimages.com

Purslane Plant

©Photo Courtesy of Steve Dewey, Utah State University @ www.forestryimages.org

Purslane

[*Portulaca oleracea* L.] Purslane (Portulacaceae) Family

General Description

Purslane is a prostrate, succulent annual that often forms a dense mat. The reddish stems originate from a central rooting point, radiating out like spokes of a wheel. Introduced from Europe.

Mature Plants

Entire plant showing fleshy stems, prostrate growth habit; 2, flower; 3, pods; 4, seed. Stems juicy, smooth, often reddish, either completely prostrate or turned up at the ends, sometimes forming mats 1 foot (30 cm) or more in diameter. Leaves alternate or clustered, simple, juicy, and smooth. The fleshy stems and leaves make this plant drought resistant, difficult to kill.

Roots and Underground Structures

Root system fibrous with a taproot.

Flowers

Purslane germinates from February to March in the southern desert areas to late spring in cooler areas when soil temperatures reach about 60 °F. The yellow flowers occur singly or in small terminal clusters. When fully open, each flower is about 6 mm across, consisting of five yellow petals, two green sepals, numerous yellow stamens, and several pistils that are bunched together in the center of the flower. These flowers have floppy petals that open up for a few hours during bright, sunny mornings. The blooming period occurs from mid-summer through the early fall and lasts about 1 to 2 months. Each flower is replaced by a seed capsule that splits open around the middle to release the numerous small seeds. Each seed is dark brown or black, somewhat flattened, and nearly round or kidney shaped. The surface is granular, appearing somewhat coiled. This plant can spread by reseeding itself, or vegetatively as the broken-off stems can form rootlets to establish new plantlets.

Fruit and Seeds

Seeds are small, flattened, broadly oval, glossy black. Seeds require warm soil to germinate. It germinates very near to or at the soil surface in large numbers after an irrigation or rain.

Postsenescence Characteristics

The stems vary in length, commonly up to 32 cm. Leaves are stalkless (sessile), oval, smooth, succulent, and shiny, and vary from 16 to 64 mm in length. The leaves, although generally arranged opposite, may also occur alternately along the stem, particularly near the base. Small (6 mm), 5-petaled, yellow flowers are borne singly in leaf axils and open only in sunshine. Seeds are borne in a small pod with a top that comes off like the lid on a cookie jar and are reddish brown to black, oval, and tiny (about 1 to 2 mm in diameter). Purslane is a prolific seeder. In late summer, flat mats of mature purslane can be turned over to reveal thousands of seeds on the soil surface.

Habitat

The preference is full sun and mesic to dry conditions. Purslane will grow readily in practically any kind of soil containing loam, sand, or gravelly material. The seeds germinate after the weather becomes warm, and can remain viable in the soil for several decades. Tolerance to heat and drought is excellent. Habitats of purslane include rocky bluffs, cropland, gardens, nursery plots, barnyards, cracks in sidewalks and pavement, and waste areas with sterile soil. This plant prefers disturbed areas and is common in rundown areas of cities.

Propagation/Phenology

Reproduces by seed. The fleshy stems of purslane can remain moist and viable for several days after cultivation and hoeing, and reroot forming “new” plants.

Control Methods

Biological	Chemical
Purslane sawfly	2,4-D, Clopyralid, Dicamba, Fluroxypyr, Glyphosate, Imazapyr, Isoxaben, Metsulfuron methyl, Pendimethalin, and Triclopyr
Cultural	**Mechanical**
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

Himalayan Blackberry Flower

©Photo Courtesy of George Hartwell @ forestryimages.com

Himalayan Blackberry Leaves (underside) and Prickles

©Photo Courtesy of Forest and Kim Starr, United States Geological Survey @ forestryimages.com

Himalayan Blackberry Fruit

©Photo Courtesy of John M. Randall, The Nature Conservancy @ forestryimages.com

Himalayan Blackberry Foliage and Fruit

©Photo Courtesy of John M. Randall, The Nature Conservancy @ www.forestryimages.org

Himalayan Blackberry

[*Rubus armeniacus* Focke] Rose (Rosaceae) Family

General Description

An erect, spreading, or trailing evergreen shrub introduced from Eurasia. This plant forms dense thickets that become impenetrable.

Mature Plants

Himalayan blackberry can reach heights of 10 feet or more. Leaves are alternate, palmately compound (usually five leaflets), persistent (often barely); leaflets oval, 1-1/2 to 3 inches long, dark green above with a heavy white bloom below, margins serrate. Rachis and petiole armed with heavy, recurved prickles. The stems are covered with heavy, broad-based prickles and the larger stems are distinctly 5-angled. The leaves are clustered in fives and their undersides are white. Stems grow to a height of ~18 inches or more before they arch over and trail on the ground. Daughter plants may develop where first year stems touch the ground. Individual stems live only 2 to 3 years, yet reach a density of 525 stems per square meter. In less than 2 years a stem cutting can produce a thicket 5 meters in diameter. A large quantity of hard and dry litter and standing dead stems accumulate in old thickets.

Roots and Underground Structures

Roots have been recorded to a maximum depth of 35 inches, and 10 m in length. Adventitious shoots are occasionally formed on the roots and may emerge from a depth of 18 inches. Root buds produce trailing reddish stems with sharp spines that can grow more than 20 ft per season.

Flowers

Flowers are monoecious; perfect, complete, each about 0.4 to 0.6 inch long, white to pinkish, and borne in clusters of 5 to 20. Blooms June to August.

Fruit and Seeds

Fruit is a black aggregate of drupelets about 1 inch long; adheres to torus (central core) when removed from plant. The fruit is edible.

Habitat

Moist disturbed sites.

Propagation/Phenology

Himalayan blackberry is capable of reproducing both vegetatively and by seed. After reaching a certain height the stem tips will bend down to the ground and root. The plant also sends out adventitious rootstocks (suckers), enabling it to spread slowly from its source. Although seeds germinate mainly in the spring, few germinate the first spring after the seed is formed. The root crown can be up to 8 inches in diameter, from which many lateral roots grow. Thickets can produce 7,000 to 13,000 seeds per square meter, and good seed crops occur nearly every year. When grown in dense shade, however, most species of blackberry do not form seeds.

Control Methods

Biological	Chemical
None currently available	2-4D, Glyphosate and Triclopyr
Cultural	**Mechanical**
Maintain healthy stands of native vegetation, revegetation/competitive planting, implement introduction and prevention measures, dense planting of shade producing vegetation is a long-term solution under some instances	Cutting stems and grubbing the roots, hand cutting stems followed by cut-stump application of approved herbicide in fall

Russian Thistle Stems and Foliage

©Photo Courtesy of Mary Ellen (Mel) Harte @ forestryimages.com

Russian Thistle Flowers

©Photo Courtesy of Forest and Kim Starr, United States Geological Survey @ forestryimages.com

Russian Thistle Flowering Branch

©Photo Courtesy of Forest and Kim Starr, United States Geological Survey @ forestryimages.com

Russian Thistle Plant

©Photo Courtesy of Forest and Kim Starr, United States Geological Survey @ forestryimages.com

Russian Thistle

[*Salsola* spp. L.] Goosefoot (Chenopodiaceae) Family

General Description

Noxious bushy summer annuals, with rigid branches and reduced, stiff, prickly upper stem leaves (bracts) at maturity. Introduced from Eurasia.

Mature Plants

To 1 m tall, usually height +/- equal to width or taller than wide. Stems rigid, typically curved upward. Foliage +/- blue green, glabrous or covered with short, stiff hairs. Leaves fleshy to leathery, 8 to 52 mm long, mostly 0.5 to 1 mm wide, sharp pointed to spine tipped. Bracts +/- awl shaped, reflexed, not overlapping at maturity, with membranous, minutely barbed margins. Leaves alternate, sessile, linear to needlelike, gradate into rigid, spine-tipped bracts in the inflorescences.

Seedlings

Cotyledons and subsequent leaves needlelike. Leaves alternate, but often appear opposite because of short internodes. Cotyledons 10 to 35 mm long. Subsequent leaves fleshy, soft, weakly spine tipped. Stems slender, flexible, typically with reddish-purple longitudinal striations. Immature plants taller than wide, with lateral branches ascending and shorter than the main stem.

Roots and Underground Structures

Taprooted to 1.5 m deep, with laterals spreading to 1.8 m.

Flowers

Bisexual, axillary, mostly solitary. Petals lacking. Sepals four to five, persistent in fruit, typically with winglike appendages that appear petallike. Calyx (sepals as a unit) mostly 2.5 to 3.5 mm long. Stamens five, extended beyond sepals (exserted). Style branches two, exserted. Wind pollinated. Out crossing and self-fertile. July-October. Typically male flowers develop in early July. Bisexual flowers develop from about mid-July to early October. Sepal tips acute, +/- lax, not spinelike. Sepal wings fan shaped, 0.5 to 2.5

mm long, usually minutely toothed to scalloped along the margins, translucent, often pinkish to deep red with conspicuous veins, folded or open.

Fruit and Seeds

Utricles (fruiting structures) +/- spherical, 1-seeded, enclosed by persistent calyces. Seeds +/- round and slightly flattened to slightly conical, ~ 1.5 to 2 mm in diameter, with a thin, gray to brown translucent seed coat (pericarp) and visible dark greenish brown coiled embryo. Fruit 4 to 10 mm diameter, including sepal wings. Sepal wings flat or folded.

Postsenescence Characteristics

Plants become gray to brown. Main stems break off at ground level under windy conditions allowing plants to disperse numerous seeds as they tumble. Skeletons persist for at least 1 year and are typically found along fences and other structures.

Habitat

Typically infests sandy soils on disturbed sites, waste places, roadsides, cultivated and abandoned fields, and disturbed natural and semi-natural plant communities.

Propagation/Phenology

Reproduces by seed. Seed appears to require an after-ripening period. Cotyledons are photosynthetic upon emergence. Most seed germinates the spring following maturation. Seed can germinate when night temperatures are below freezing and daytime temperatures reach 36 ºF. Optimal temperatures for germination are between 7 and 45 and 95 ºF. Germination requires little moisture (0.3 inch of rainfall) and occurs within a few hours. Successful germination requires loose soils. Seedlings that germinate on firm soil seldom survive because radicles are unable to penetrate the soil. Seed in the field typically remains viable for only 1 year, some up to 2 years, rarely to 3. Plants about 0.5 m tall can produce about 1,500

to 2,000 seeds, and large plants can produce up to 100,000. Seed disperses when plants break off at ground level and tumble with the wind. Seedlings attain optimal emergence from litter or soil depths to 1 cm, but can emerge from soil depths to 6 cm.

Control Methods

Biological	Chemical
Leaf mining moth and stem boring moth	2,4-D, Chlorsulfuron, Dicamba, Glyphosate, Isoxaben, Pendimethalin, Sulfometuron methyl, Tebuthiuron and Triclopyr
Cultural	**Mechanical**
Maintain healthy stands of native vegetation, revegetation/ competitive planting, implement introduction prevention measures	Repeated mowing, hand pulling or grubbing of small infestations to eliminate seed production

Perennial Sowthistle Leaf Auricle

©Photo Courtesy of Michael Shephard, USDA Forest Service @ www.forestryimages.org

Perennial Sowthistle Mature and Immature Flowerheads

©Photo Courtesy of Steve Dewey, Utah State University @ www.forestryimages.org

Perennial Sowthistle Mature and Immature Flowerheads

©Photo Courtesy of Tom Heutte, USDA Forest Service @ www.forestryimages.org

Perennial Sowthistle Plants

©Photo Courtesy of Michael Shephard, USDA Forest Service @ www.forestryimages.org

Perennial Sowthistle

[*Sonchus arvensis* L.] Sunflower (Asteraceae) Family

General Description

Vigorous herbaceous perennial, with milky sap and creeping roots that produce new shoots, to 1.8 m tall. Plants are highly competitive, persistent, and can rapidly colonize new sites by vegetative reproduction. Introduced from Europe.

Seedlings

Cotyledons obovate, 4 to 8 mm long, 1 to 4.5 mm wide. Leaves obovate to oblanceolate, bluish green, dull, glabrous, form a basal rosette. Margins wavy to lobed, with backward pointing spiny teeth. Lower surfaces often have a powdery white or purplish film. Newly initiated leaves sometimes pubescent. Seldom flower the first year.

Mature Plants

Foliage bluish green. Stems erect, hollow, ridged, branched only in the upper portion of the plant. Lower stems leafy. Upper stems can be glabrous or glandular hairy. Leaves alternate, highly variable, entire to deeply pinnate lobed, 5 to 30 cm long, 2 to 10 cm wide, clasping the stem at the base with rounded basal lobes (auricles). Lobes +/- triangular, often curved backward, usually 2 to 5(7) per side. Terminal lobe typically longer, broader than lateral lobes. Margins with small spiny teeth. Upper leaves sessile, often unlobed. Lower leaves short petioled, lobed.

Roots and Underground Structures

True roots (often described as rhizomes) produce new shoots and fragment easily. Horizontal roots long, creeping, <1 cm in diameter, typically 5 to 12 cm below soil surface, can grow to 2 m long or more in a season. Vertical roots can penetrate soil to a depth of 2 m and produce new shoot buds to a depth of 0.5 m. Over-wintering roots can survive temperatures to 61 ºF.

Flowers

Summer. Heads 3 to 5 cm wide, consist of numerous bright yellow to orange-yellow, 5-lobed ray (ligulate) flowers

at the stem tips. Pappus bristles fine, soft, white, numerous, ~8 to 12 mm long. Flower head stalks and phyllaries typically covered with stiff glandular hairs. Self-incompatible. Insect pollinated. Heads open ~2 to 3 hours after sunrise and close ~noon.

Fruit and Seeds

Achenes +/- oblong, flattened, 3- to 4-angled with two minutely wrinkled longitudinal ridges between angles, 2.5 to 3.5 mm long excluding pappus, +/- 1 mm wide, light to dark brown.

Postsenescence Characteristics

Aerial stems dieback after first frost.

Habitat

Disturbed sites with damp soils. Thrives on non-compacted, fine, rich, slightly alkaline to neutral soils. Tolerates some salinity. Seedlings are typically found along pond and river margins and in lawns, moist meadows, and uncultivated fields.

Propagation/Phenology

Reproduces by seed and vegetative shoots from roots. Root sections 1 cm long or more can produce new shoots from previously formed buds or develop adventitious buds. Seed disperses with wind, water, and by clinging to the fur or feathers of animals and clothing of people. Flower heads produce viable seed within 5 to 6 days and disperse seed in ~10 days after opening. Some immature seed can continue to mature on cut stems. Isolated plants or clonal patches produce little seed because of self-incompatibility. Newly matured seed lacks a dormancy period. Most seed germinates in spring after soil has warmed to ~20 ºF. Light is not required. Seed can remain viable under field conditions for 3 or more years, but decomposes in water within ~3 months. Seedlings emerge from soil depths to 3 cm (optimal 0.5 cm), but survival is typically low, especially on bare soils. Seedling establishment increases on sites with high moisture and protective plant cover or litter.

Control Methods

Biological	Chemical
None currently available	2,4-D, Clopyralid, Dicamba, Fluroxypyr, Glyphosate, and Isoxaben
Cultural	**Mechanical**
Maintain healthy stands of native vegetation, revegetation/competitive planting, possibly sheep and cattle grazing, implement introduction prevention measures	None recommended

Johnsongrass Inflorescences

©Photo Courtesy of Barry Fitzgerald, USDA Agricultural Research Service @ www.forestryimages.org

Johnsongrass Ligule

©Photo Courtesy of Steve Dewey, Utah State University @ www.forestryimages.org

Johnsongrass Plants

©Photo Courtesy of Charles T. Bryson, USDA Agricultural Research Service @ www.forestryimages.org

Johnsongrass Spikelets

©Photo Courtesy of Steve Dewey, Utah State University @ www.forestryimages.org

Johnsongrass

[*Sorghum halepense* (L.) Pers.] Grass (Poaceae) Family

General Description

Coarse grass with reddish to purplish-black panicles, to 2 m tall. Johnsongrass grows rapidly, is highly competitive with crops, and can be difficult to control. Plants can rapidly develop colonies. Introduced as a forage crop from the Mediterranean region. Johnsongrass is considered one of the 10 most noxious weeds in the world.

Mature Plants

Typically tufted, with tillers from the crown. Stems erect, unbranched, with solid internodes. Blades rolled in bud, flat, glabrous to sparsely hairy, especially near ligules, bright green. Margins rough. Blades 0.5 to 2(3) cm wide, to 60 cm long. Ligules 2 to 5 mm long. Midveins whitish, conspicuous. Ligules membranous, minutely shallow toothed or fringed at the top. Collars broad, whitish or pale green, smooth. Auricles lacking. Sheaths open, ribbed, compressed, glabrous or sparsely hairy near blade junction, shorter than internodes, pale green to reddish. Attached seed elliptic to ovoid, typically 1.5 to 2 mm wide, 4 to 7 mm long, dark reddish brown to black.

Seedlings

Resemble young corn seedlings, but can be distinguished by carefully removing young seedlings from the soil and examining the attached seed.

Roots and Underground Structures

Roots fibrous branched, to depths of ~1.2 m. Prop roots often develop at the base of stalks, similar to those of corn. Johnsongrass has fast-growing rhizomes that produce new plants. Rhizomes ~1 cm in diameter, up to ~2 m long, whitish with large (purplish) brown scales at the nodes, often root at the nodes.

Spikelet/Florets

May-October. Mature panicles open, pyramidal. Panicles 10 to 50 cm long, initially pale green or greenish

violet, often mature to a dark reddish or purplish brown. Some panicles shed spikelets (shatter) at maturity. Spikelets disperse in pairs or trios. Lowest spikelet sessile, bisexual, contains one fertile floret (seed) and one tiny sterile floret. Upper spikelet(s) stalked, staminate, narrower than the fertile spikelet. Fertile spikelets (seeds) 4 to 7 mm long, 1.5 to 2 mm wide. Lemma awns 0 or ~9 to 15 mm long. Fertile spikelet (seed) ellipsoid to ovoid. Mature glumes leathery, thicker than lemma, glossy, reddish brown to black, glabrous to pubescent. Lower glume tightly encloses upper glume and florets. Lemma awns bent, twisted, early deciduous.

Postsenescence Characteristics

Foliage is killed by frost. Dead stems with seed heads may persist through the cold season.

Habitat

Disturbed sites, roadsides, fields, agronomic and vegetable crops. Grow best on fertile, well-drained soils in warm temperate to subtropical regions where some warm season moisture is available. Often grows in moist soils.

Propagation/Phenology

Reproduces by seed and vegetatively from rhizomes. Most seed requires an average after-ripening period of 4 to 5 months. Dormant seed can survive for at least 6 years under field conditions. Water-stressed plants produce fewer dormant seeds. Seed production increases up to 96 ºF and decreases above 102 ºF. New shoots from rhizomes resemble seedlings and typically appear early in the growing season. Seedlings and new shoots begin to develop rhizomes 3 to 6 weeks after emergence. Maximum rhizome growth occurs during the flowering period, which usually begins 6 to 9 weeks after emergence and continues until fall. One plant can produce up to 295 ft of rhizomes in a single season. Rhizomes grow mostly in the top 30 cm of soil, but can grow to 120 cm deep in cultivated soils. Most rhizomes live ~1 year. Rhizome carbohydrate

reserves are lowest ~10 to 30 days after shoot emergence and highest during flowering. Shoots can emerge from rhizomes up to 11 inches deep, but maximum shoot emergence is from rhizomes 2 inches deep or less. Optimal plant growth occurs with light intensities of 30 to 40 percent of full daylight for 16 hrs. Growth is inhibited when light intensity is 20 percent or less of full daylight. Rhizome and seed production is often delayed in dense colonies. Extracts of leaves and rhizomes appear to have allelopathic properties. Panicles retain seed or shed seed near the parent plant (shatter). Seed disperses to greater distances with wind, water, agricultural activities, and animals. Some seed survives ingestion by birds and mammals. Photosynthesis is by the C_4 pathway.

Control Methods

Biological	Chemical
Stem and fruit boring weevils	2,4-D, Dicamba, Fluroxypyr, Glyphosate, Imazapic, Imazapyr, Isoxaben, Metsulfuron methyl, and Pendimethalin
Cultural	**Mechanical**
Maintain healthy stand of native vegetation, revegetation/ competitive planting, implement introduction prevention measures	Repeated hand pulling or grubbing of small infestations to eliminate seed production, tillage

Puncture-vine Plant

©Photo Courtesy of Steve Dewey, Utah State University @ www.forestryimages.org

Puncture-vine Flower and Foliage

©Photo Courtesy of Forest and Kim Starr, United States Geological Survey @ www.forestryimages.org

Puncture-vine Flower, Foliage and Immature Fruit

©Photo Courtesy of Utah State University Archives, Utah State University @ www.forestryimages.org

Puncture-vine Mature Fruit

©Photo Courtesy of Utah State University Archives, Utah State University @ www.forestryimages.org

Puncture-vine

[*Tribulus terrestris* L.] Caltrop (Zygophyllaceae) Family

General Description

Noxious summer annual with prostrate stems up to 2.4 m long. Plants produce many stout-spined burrs that can injure people and animals and puncture bicycle tires. Foliage is toxic to livestock, especially sheep, when consumed in quantity.

Seedlings

Mature rapidly. Cotyledons oblong, 4 to 15 mm long, thick, creased down the center, slightly indented at the tips. First and subsequent leaves resemble those of mature plants.

Mature Plants

Stems highly branched, green to reddish brown, prostrate and spreading radially from the crown on open ground to +/- erect when shaded or competing with other plants. Foliage often sparse to moderately covered with silky and/or bristly silver hairs. Leaves opposite, even pinnate compound, ~3 to 5 cm long, with three to seven leaflet pairs per leaf and a small extension at the tip. Leaflets oblong, 5 to 15 mm long, with +/- oblique bases. Stipules leaflike. Photosynthesis is by the C_4 pathway.

Roots and Underground Structures

Taproot deep (to 2.6 m), slender, branched, often somewhat woody, with a network of numerous fine rootlets. Roots can develop nitrogen-fixing nodules.

Flowers

April-October. Flowers axillary, solitary, bright yellow, 5 to 15 mm in diameter. Petals and sepals 5(4), deciduous. Stamens and ovary chambers twice the number of petals. Insect pollinated.

Fruit and Seeds

Woody burrs gray to yellowish tan, hairy, to ~1 cm in diameter, +/- flattened, lobed, separate into 5(4) wedge-shaped nutlets, each with two stout spines 4 to 7 mm long and several prickles. Seeds usually three to five per nutlet, remain enclosed within burrs.

Postsenescence Characteristics

Burrs often remain on senesced plants or the soil surface.

Habitat

Disturbed places, roadsides, railways, cultivated fields, yards, waste places, and walkways. Grows best on dry, sandy soils, but tolerates most soil types. It is intolerant of freezing temperatures.

Control Methods

Biological	Chemical
Stem and fruit boring weevils	2,4-D, Dicamba, Fluroxypyr, Glyphosate, Imazapic, Imazapyr, Isoxaben, Metsulfuron methyl, and Pendimethalin
Cultural	**Mechanical**
Maintain healthy stand of native vegetation, revegetation/ competitive planting, implement introduction prevention measures	Repeated hand pulling or grubbing of small infestations to eliminate seed production, tillage

Siberian Elm Flowers

©Photo Courtesy of USDA NRCS Archives, USDA NRCS @ www.forestryimages.org

Siberian Elm Leaves

©Photo Courtesy of Patrick Breen, Oregon State University @ www.forestryimages.org

Siberian Elm Tree

©Photo Courtesy of Patrick Breen, Oregon State University @ www.forestryimages.org

Siberian Elm Leaves

©Photo Courtesy of USDA NRCS Archives, USDA NRCS @ www.forestryimages.org

Siberian Elm

[*Ulmus pumila* L.] Elm (Ulmaceae) Family

General Description

This small to medium-sized tree has an open, round crown of slender, spreading branches. Siberian elm generally reaches 16 to 22.4 m. Its bark is gray or brown, with shallow furrows at maturity. Both the buds and twigs are nearly hairless. This elm is distinguished by its small, elliptical, smooth, singly-toothed leaves, which reach lengths of approximately 0.5 to 6 cm. They are tapering or rounded at their asymmetrical base. The alternate leaves are dark green and smooth above, paler and nearly hairless beneath. Foliage is slightly pubescent when young. Flowers are greenish, lack petals, and occur in small drooping clusters of two to five blossoms. The winged fruit has one seed that is circular or ovate with a smooth surface. Fruit are about 16 mm wide and hang in clusters. Siberian elm has relatively small leaves (rarely more than 6 cm) that are symmetrical (or nearly so) and are once-serrate.

Distribution and Habitat

Siberian elm is a fast-growing tree that was introduced to the United States in the 1860s. Native to northern China, eastern Siberia, Manchuria, and Korea, it is the hardiest of all elms and does well even in areas with cold winters and long periods of summer droughts. Because this elm tolerates a variety of conditions such as poor soils and low moisture, it is found in dry regions, along roadsides, and in pastures and grasslands. The tree also grows in moist soils along streams. It invades dry and mesic prairies, including sand prairies.

Propagation/Phenology

This tree flowers in spring before leaves begin to unfold. The fruit develop quickly and are disseminated by wind, allowing the species to form thickets of hundreds of seedlings in bare ground. Seeds germinate readily and seedlings grow rapidly.

Control Methods

Biological	Chemical
None currently available	Dicamba, Fluroxypyr, Glyphosate, Imazapic, Imazapyr, Isoxaben, Tebuthiuron, and Triclopyr
Cultural	**Mechanical**
Maintain healthy stands of native vegetation, revegetation/ competitive planting, implement introduction prevention measures	Girdling in late spring, hand pulling or grubbing of small trees

Mullein Plant

©Photo Courtesy of Forest and Kim Starr, United States Geological Survey @ forestryimages.com

Mullein Flowers

©Photo Courtesy of Forest and Kim Starr, United States Geological Survey @ forestryimages.com

Mullein Basal Rosette (above)

©Photo Courtesy of Steve Dewey, Utah State University @ forestryimages.com

Mullein Foliage (left)

©Photo Courtesy of Forest and Kim Starr, United States Geological Survey @ forestryimages.com

Mullein

[*Verbascum thapsus* L.] Figwort (Scrophulariaceae) Family

Native Range

Mullein is a monocarpic perennial (i.e., takes 2 or more years to flower and die). Introduced from Eurasia.

General Description

Mullein, also known as wooly mullein, is an erect herb in the figwort family, or Scrophulariaceae. First year mullein plants are low-growing rosettes of bluish gray green, feltlike leaves that range from 5 to 32 cm in length and 2.5 to 12 cm in width. Mature flowering plants are produced the second year, and grow to 1.5 to 3.5 m in height, including the conspicuous flowering stalk. The 5-petaled yellow flowers are arranged in a leafy spike and bloom a few at a time from June-August. Leaves alternate along the flowering stalks and are much larger toward the base of the plant. The tiny seeds are pitted and rough with wavy ridges and deep grooves and can germinate after lying dormant in the soil for several decades.

Ecological Threat

Mullein threatens natural meadows and forest openings, where it adapts easily to a wide variety of site conditions. Once established, it grows more vigorously than many native herbs and shrubs, and its growth can overtake a site in fairly short order. Mullein is a prolific seeder and its seeds last a very long time in the soil. An established population of mullein can be extremely difficult to eradicate.

Habitat

Mullein can be found where mean annual precipitation is greater than 7.5 to 15 cm and the growing season lasts for a minimum of 140 days. Intolerant of shade, mullein will grow in almost any open area including natural meadows and forest openings as well as neglected pastures, road cuts, and industrial areas. Mullein prefers, but is not limited to, dry sandy soils.

Propagation/Phenology

During the first summer after germination, mullein produces a taproot and a rosette of leaves. During this vegetative stage, the rosette increases in size during the growing season until low temperatures arrest growth sometime during the autumn and winter. Beginning the next spring, second year plants bolt into maturity, flower, produce seed during the summer, and then die, completing the plant's normal life cycle. Flowers mature from the base to the tip of the stalk. The length of the flowering period is a function of stalk height; longer stalks can continue to flower into early October. It is estimated that a single plant can produce 100,000 to 180,000 seeds which may remain viable for more than 100 years. The seeds are dispersed mechanically near the parent plant during the autumn and winter. Mullein seeds at or near the surface are more likely to germinate.

Control Methods

Biological	Chemical
European curculionid weevil and Mullein moth	Chlorsulfuron, Fluroxypyr, Glyphosate, Imazapic, Imazapyr, Isoxaben, Sulfometuron methyl, and Triclopyr
Cultural	**Mechanical**
Maintain healthy stands of native vegetation, revegetation/ competitive planting, implement introduction prevention measures	Repeated hand pulling, grubbing or chopping of small infestations to eliminate seed production

Cocklebur Plant

©Photo Courtesy of Clarence A. Rechenthin @ USDA-NRCS PLANTS Database @ plants.usda.gov

Cocklebur Stems, Leaves and Fruit

©Photo Courtesy of Luigi Rignanese, 2005 @ calphotos.berkeley.edu

Cocklebur Immature Fruit

©Photo Courtesy of Luigi Rignanese, 2005 @ calphotos.berkeley.edu

Cocklebur Mature Fruit

©Photo Courtesy of Luigi Rignanese, 2005 @ calphotos.berkeley.edu

Cocklebur

[*Xanthium strumarium* L.] Sunflower (Asteraceae) Family

General Description

Cocklebur is a native, broad-leaved, taprooted, annual forb. Stems are erect, ridged, rough and hairy, and frequently branched, resulting in somewhat bushy plants from 20 to 150 cm tall. It has small, green unisexual flowers occurring in separate clusters at the end of the branches and main stem. The fruit is a brown, hard, woody bur from 13 to 26 mm long and covered with stout, hooked prickles. Each fruit contains two seeds. Introduced from Europe.

Regenerative Processes

Cocklebur reproduces by seed only.

Flowering

Flowering is controlled by photoperiod. The plant will not flower at all or only poorly when day length exceeds 14 hours. Thus, in the northern portion of its range, flowering does not occur until late summer. Seeds ripen in the fall. Fruit not removed by animals fall off the plant in the winter or occasionally remain on the plant until the next spring.

Pollination and Fruit Production

Pollen transfer is by wind. The plant is self-compatible and predominantly self-pollinated. Cocklebur may also set seed without fertilization of the ovule. Because of self-compatibility and apomixis, local populations are often genetically very similar. A single, open-grown plant typically produces 400 to 500 fruit.

Fruit Dispersal

The fruit cling to the hide of animals and the clothing of humans and are dispersed in that manner. Fruit not transported by animals fall from the plant during the fall or winter. In riparian habitats, fruit on the soil surface may later be dispersed by water as they float for up to 30 days. The fruit does not dehisce and, thus, seeds germinate within the fruit.

Seed Viability, Dormancy, and Germination

Seed viability is usually high, at least 80 percent. Each bur contains two seeds, one larger than the other. The large seed is nondormant and typically germinates the first spring following production, while the smaller seed germinates later in the season or, more frequently, the following year. Occasionally, the two seeds germinate simultaneously. Depth of burial also influences germination. Seeds lying on the soil surface and those buried more than 15 cm below the soil surface rarely germinate. In Illinois, seed buried in November at various depths in silty loam soil began to emerge after April 1 and continued emerging until May 19. Maximum seedling emergence was from seed buried at 2.5 and 5.1 cm. Another study found that 11 to 16 percent of cocklebur seeds germinated after 30 months of burial at depths ranging from 8 to 38 cm.

Site Characteristics

Cocklebur occurs primarily in disturbed, open habitats. It grows in cultivated fields, vacant lots, sandpits, and dry washes; on beaches and sand dunes; and along the shores of ponds and rivers, especially riverbeds left barren by receding floodwaters. In non-cultivated settings, it primarily occupies beaches and dunes in eastern North America and flood plains in the West. In ruderal habitats, such as agricultural fields, cocklebur often occurs in dense stands, but in natural habitats, such as along shorelines, it often occurs as scattered individuals. Cocklebur is tolerant of a variety of soil conditions ranging from moist clay to dry sand but grows best on compact, sandy soil that is slightly moist below the soil surface and contains a small amount of organic matter. It is tolerant of flooding at all growth stages.

Successional Status

Cocklebur is a weed of ruderal (sandpits, old fields, cultivated fields, etc.) and naturally disturbed habitats (beaches, dunes, and flood plains). As a pioneer, it persists only as long as the ground remains mostly bare and the site remains unshaded. It rarely grows in sod, and plants will not flower or fruit in full shade.

Control Methods

Biological	Chemical
Fungus	2,4-D, Fluroxypyr, Glyphosate, Imazapic, Imazapyr, Isoxaben, Metsulfuron methyl, and Triclopyr
Cultural	**Mechanical**
Maintain healthy stands of native vegetation, revegetation/ competitive planting, implement introduction prevention measures	Repeated hand pulling, grubbing or chopping of small infestations to eliminate seed production, tillage

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Noxious and Invasive Weed Reporting Form

Collection Date: _____

Common Name: _____

Scientific Name: _____

USDA Plant Code: _____

File Type (line, point or polygon): _____

_____

Infested Area (acres): _____

Canopy Cover (percent): _____

LAT DEC (degrees): _____

LONG DEC (degrees): _____

Datum: _____

_____

_____

State: _____ County: _____

Contact: _____

_____

_____

_____