United States
Department of
Agriculture

Forest
Service

Southwestern
Region

MR-R3-01-2

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.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or part of an individual’s income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA’s TARGET Center at (202) 720-2600 (voice and TTY). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, SW, Washington, DC 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TTY). USDA is an equal opportunity provider and employer.

Field Guide to Noxious and Invasive Weeds

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

Compiled and Edited by
Mitchel R. White, Ph.D.
Ecologist
Apache-Sitgreaves National Forests

2008

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

Class B, Treatment Priority 2

Class C, Treatment Priority 3

[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.*

Acknowledgements

Initial funding for this publication was provided through a RAC grant by the Eastern Arizona Counties Resource Advisory Committee under Title II of the Secure Rural Schools and Community Self-Determination Act of 2000.

I would like to thank all of the individuals and/or organizations who so graciously granted permission and allowed use of their photographs. Credits can be found under each.

Russian Knapweed Plant

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

Russian Knapweed Flowerheads and Leaves

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

Russian Knapweed Plant

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

Russian Knapweed Flowerheads and Leaves

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

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

©Photo Courtesy of The Nature Conservancy, 2000 @ tncweeds.ucdavis.edu

Lens-podded Hoarycress Fruit

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

Lens-podded Hoarycress Leaves and Stem

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

Lens-podded Hoarycress Plant

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

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

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

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

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

Musk Thistle Flowerhead

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

Musk Thistle Plants

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

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

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

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

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

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

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

Iberian Starthistle Pre-bloom Flowerhead

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

Iberian Starthistle Basal Rosettes

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

Iberian Starthistle Flowerhead

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

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

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

Yellow Starthistle Flowerhead

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

Yellow Starthistle Plant

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

Yellow Starthistle Basal Rosette

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