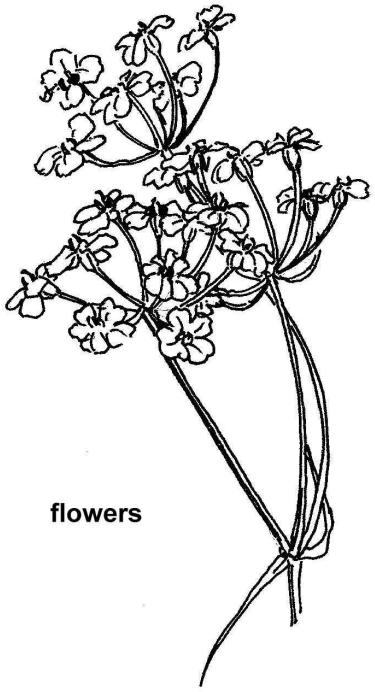
Wild caraway

Carum carvi L.

Family: *Apiaceae* (Parsley)
Other Names: none widely accepted
USDA Code: CACA19
Legal Status: Colorado Noxious List A (general weeds)

Keys to Identification:
- First year rosettes can be identified by their carrot-like leaves and slender tuber.
- Mature plants have hollow stems, and produce small, white or pink flowers in umbrella-like clusters.

Identification
Growth form: Biennial, or sometimes perennial forb.
Flower: Flowers are small, white or pinkish, and occur in terminal or lateral loose clusters.
Seeds/Fruit: Seeds are narrow, oblong, brown, and have five distinct tan, linear, ribs.
Leaves: Shoot leaves are alternate and normally oblong or oval in shape. Stem leaves resemble those of carrots in shape but tend to droop more.
Stems: Mature plants are 1-3 feet tall and have one or more shoots emerging from a single taproot. Shoots are slender, erect, branching, and normally hollow.
Roots: Taproot.
Seedling: No information available.
Other: Fruits have distinctive caraway odor.


flowers

Similar Species
Exotics: Somewhat similar to poison hemlock *(Conium maculatum)*, but lacks spotted stems.
Natives: Other members of the Parsley family are similar in overall appearance. Be sure to note root and fruit characteristics, flower color and foliage odor for successful keying.

Impacts
Agricultural: Can be a pest in hay meadows.
Ecological: Wild caraway can invade disturbed areas and push out native vegetation. It is a prolific seed producer and can spread rapidly.
Human: No information available.


fruits

Habitat and Distribution
General requirements: Wild caraway is commonly found in mountain meadows, hayfields, and along irrigation ditches and roadsides. It prefers full sun and well drained soils.
Distribution: Widely naturalized in the northern United States and Canada. It is found from 5000-9500 feet in the western half of Colorado, except in the extreme western part of the state (Rutledge and McLendon 1998).
Historical: Wild caraway was introduced into the U.S. as a cultivated species (Whitson et al. 1996), but escaped and is now widespread throughout the country. The seeds are used as medicine and the leaves are sometimes used in salads and soups (GardenGuides 1999).

Biology/Ecology

Life cycle: Wild caraway spends the first year as a leafy rosette. The second year the plant bolts and flowers. The stems of the delicate flowers produce seed cases, each containing two seeds (GardenGuides 1999).
Mode of reproduction: Reproduces by seeds.
Seed production: Under ideal conditions, each plant may produce several thousand seeds.
Seed bank: No information available.
Dispersal: Spread in hay, and in waterways.
Hybridization: No information available.

Control

Biocontrol: None known.
Mechanical: Wild caraway plants can be cut or pulled prior to seed set.
Fire: No information available.
Herbicides: Herbicides should be applied in spring to seedlings and first year rosettes. Metsulfuron at 0.5 to 1 oz per acre or 2,4-D at 1 qt. (1.0lb ai/ac) is effective.
Cultural/Preventive: Wild caraway plants are sensitive to root disturbance and could be eliminated by tilling, although such practices are not likely to be suitable for natural areas. Best preventive practices include the elimination of seed production, and maintaining healthy native communities.

Keys to Control:
- Eliminate seed production.
- Re-seed controlled areas with desirable species.

Integrated Management Summary

Eliminate seed production by cutting or pulling wild caraway plants before seed set. Herbicides should also be applied before seed set. Later in the season, cut seed heads to prevent seed from maturing. Try to minimize disturbance caused by these control measures; restore and maintain native vegetation in such areas.

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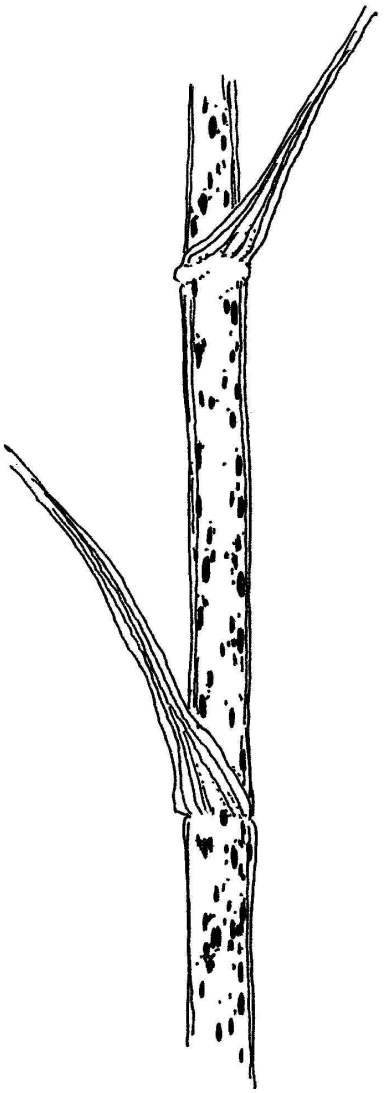
Poison hemlock

Conium maculatum L.

Family: *Apiaceae* (Parsley)
Other Names: hemlock
USDA Code: COMA2
Legal Status: Colorado Noxious List A (general weeds)

Keys to Identification:
- The leaves of poison hemlock are glossy, green and fern-like in appearance.
- The stems are covered with purple spots.

Identification
Growth form: Biennial forb.
Flower: The white flowers are borne in umbrella-like clusters that are supported by a stalk.
Seeds/Fruit: Seeds are light brown, ribbed, and concave.
Leaves: Leaves are generally alternate, but may be opposite above (Stubbendieck et al. 1995). Leaves are shiny, green, finely divided and leaflets are segmented leaves on short stalks. Leaves have a strong musty odor.
Stems: Mature plants grow 4-10 feet tall. Stems are erect, extensively branched, and covered with purple spots.
Roots: Taproot.
Seedling: Seedling leaves are fernlike in appearance.



Similar Species
Exotics: Superficially similar to other exotic members of the Parsley family, such as wild caraway *(Carum carvi)* or wild carrot *(Daucus carota).* Spotted stems are diagnostic.
Natives: Native members of the Parsley family, including water hemlock *(Cicuta douglasii),* and osha *(Ligusticum porteri)* are somewhat similar in overall appearance, but lack the distinctive spotted stems.

Impacts
Agricultural: Poison hemlock crowds out desirable forage species and can poison livestock and humans. Sheep are less sensitive than cattle and horses (DiTomaso 1999).
Ecological: Although it is not an aggressive invader, poison hemlock may gradually increase in frequency in native riparian and lowland communities.
Human: Poison hemlock is a highly poisonous plant that should be handled with care. All parts of the plant are poisonous.

Habitat and Distribution
General requirements: Poison hemlock is generally found on dry to moist soils and can tolerate poorly drained soils. Poison hemlock plants tend to be scattered in riparian areas. It is usually found along streams, roadside ditch banks and irrigation ditches, the borders of pastures and cropland, and will gradually invade perennial crops.
Distribution: Naturalized throughout the United States.
Historical: Poison hemlock is a native of Europe, and is generally believed to be the plant that was used to kill Socrates.

Biology/Ecology

Life cycle: Poison hemlock is a biennial that can grow to impressive heights (up to ten feet). The first year plants form a small seedling that resembles wild carrot. Plants typically bolt the second year and produce numerous clusters of white flowers. Plants flower from April through July (USDA 1997). Seeds are dispersed for an extended period beginning in July and continuing into winter. Most seeds mature before dispersal and can germinate immediately if environmental conditions are favorable; however, some seeds are dormant (Baskin and Baskin 1990).
Mode of reproduction: Poison hemlock reproduces by seeds.
Seed production: No information available.
Seed bank: Seeds may remain viable in the soil for about three years (Calweed 1999).
Dispersal: Seeds can be spread in mud which sticks to machinery and clothing, or in transported soil. Also dispersed to a limited extent by water or wind.
Hybridization: No information available.

Control

Keys to Control:
- Eliminate seed production and exhaust the soil seed bank.
- Re-seed controlled areas with desirable species.

Biocontrol: The European palearctic moth (*Agonopterix alstroemeriana*), was somehow introduced into the United States. It apparently feeds exclusively on poison hemlock. It is found in Colorado, and is a biological control agent in Idaho, Oregon and Washington where it is effective (William et al. 1996).
Mechanical: Poison hemlock can be controlled by digging, repeated mowing, pulling, or by spring/winter burns. Care should be taken to avoid contact with bare skin (wear gloves). Wash hands thoroughly after handling any part of this plant, especially when plant sap is present.
Fire: No information available.
Herbicides: Tebithuron can provide excellent pre-emergent control of poison hemlock. Chlorsulfuron and chlorsulfuron + metsulfuron provide both pre-emergent and foliar control (DiTomaso 1999). Picloram, dicamba, 2,4-D at 1 lb. ai/acre, or glyphosate at 1.5 lb. ai/acre, can also be used to provide chemical control of poison hemlock. Apply foliar herbicides during the rosette stage with a wick to minimize damage to adjacent desirable vegetation. Cut any stems that arise after treatment. Herbicide treatment may need to be repeated for several years until the seed bank is depleted (Panter and Keeler 1988).
Cultural/Preventive: Prevent the establishment of new infestations by eliminating seed production and maintaining healthy native communities.

Integrated Management Summary

The tendency of this species to grow in wet areas may restrict the use of certain herbicides. Eliminate seed production and exhaust the soil seed bank by removing seed heads before seeds mature. Use gloves for hand pulling, and avoid touching the plant with bare skin. Integrated management of poison hemlock could also utilize an introduction of the palearctic moth and treatment with herbicides, combined with reseeding and altered livestock grazing management to promote healthy plant communities.

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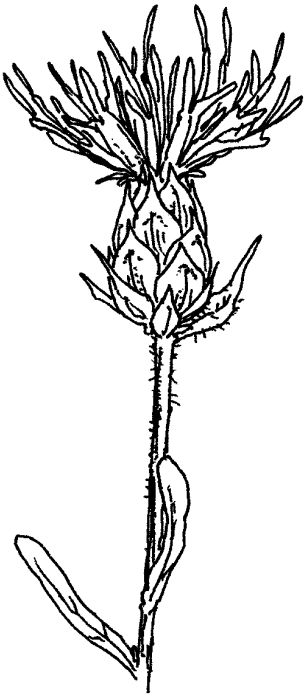
=List B

Russian knapweed

Acroptilon repens (L.) De Candolle; ***Centaurea repens*** L.

Family: *Asteraceae* (Sunflower)
Other Names: Turkestan thistle, mountain bluet, creeping knapweed
USDA Code: ACRE3, CERE6
Legal Status: Colorado Noxious List B (top ten worst)

Keys to Identification:
- Russian knapweed can be distinguished from other knapweeds by the pointed papery tips of the floral bracts.



Identification

Growth form: Perennial forb.
Flower: The flower heads of Russian knapweed are urn-shaped, solitary, and composed of disk flowers only (Zimmerman 1996). Floral bracts are broad, ovoid, entire, and greenish at the base with papery, finely hairy edges. Flowers are numerous, all tubular. The petals are pink or purple, turning straw colored at maturity.
Seeds/Fruit: Seeds are oval and compressed. Seeds are grayish or ivory, with long white bristles (pappus) at the tip when young, but these fall from the seed as it matures.
Leaves: Leaves are alternate. Lower stem leaves are narrowly oblong to lance-shaped, and deeply lobed. The upper leaves are oblong, toothed, and become progressively smaller. Rosette leaves are lance-shaped, tapering at both ends with the broadest part at the tip.
Stems: Mature plants are between 18-36 inches tall. The stems are erect, thin, stiff, branched, and when young are covered with soft, short, gray hair (Zimmerman 1996).
Roots: Russian knapweed has a well-developed root system, which functions as the major means of propagation and spreading. The roots are easily recognizable by their black or dark brown color and presence of small alternately arranged, scale leaves, which support buds in their axils (Zimmerman 1996).
Seedling: The cotyledons (seed leaves) are oval. The first true leaves are alternate, and lanceolate with shallow toothed or smooth edges. The surface of the leaves looks grayish-green, but is not hairy.

Similar Species

Exotics: Russian knapweed can be distinguished from other knapweeds by the pointed papery tips of the floral bracts.
Natives: Many native members of the Asteraceae resemble knapweed in the rosette stage.

Impacts

Agricultural: No information available.
Ecological: Russian knapweed forms dense colonies that displace native species and reduce forage production (Whitson 1999). Russian knapweed does not establish readily in healthy, natural habitats. It typically invades disturbed areas, forming dense single-species stands. Once established, Russian knapweed uses a combination of adventitious shoots and allelopathic chemicals to spread outward into previously undisturbed areas. The plant extends radially in all directions and can cover an area of 39 feet^2 within two years (Watson 1980). Russian knapweed contains an allelopathic polyacetylene compound, which inhibits the growth of competing plants (Stevens 1986). Tests conducted with alfalfa (*Medicago sativa*), barnyard grass (*Echinochloa crus-galli*), and red millet

(*Panicum miliaceum*) indicated Russian knapweed effectively inhibits root length elongation of grasses as well as broad-leaved plants by 30% when the polyacetylene compound is at a soil concentration of 4 parts per million (Stevens 1986). This allelopathic effect, combined with dense vegetative reproduction, allows for Russian knapweed to quickly colonize and dominate new sites.
Human: No information available.

Habitat and Distribution
General requirements: Russian knapweed is commonly found along roadsides, riverbanks, irrigation ditches, pastures, waste places, clearcuts and croplands. It is not restricted to any particular soil but does especially well in clay soil. Selleck (1964) observed that Russian knapweed infestations increased in dry locations but decreased in moist locations due to competition with perennial grasses.
Distribution: Russian knapweed is found throughout the western United States. In Colorado, Russian knapweed is widespread in the southwest portion of the state, with scattered infestations elsewhere on both the east and west slope.
Historical: Russian knapweed is native to Eurasia, and was probably introduced to North America as a contaminant in crop seed.

Biology/Ecology
Life cycle: Russian knapweed spreads by creeping horizontal roots and seed. Shoots emerge early in spring shortly after soil temperatures remain above freezing. All shoot development originates from root-borne stem buds (Watson 1980). These buds arise adventitiously at irregular intervals along the horizontal roots. Plants form rosettes and bolt in late May to mid-June. Russian knapweed flowers from June to October (Zimmerman 1996). It does not appear to reproduce extensively from seed.
Mode of reproduction: Russian knapweed reproduces primarily vegetatively. The root system consists of the original root (taproot), one to many horizontal roots, and their vertical extensions. Buds on the horizontal roots can form adventitious shoots that may grow to be independent plants.
Seed production: A single plant may produce 1,200 seeds per year.
Seed bank: Seeds may remain viable for 2-8 years (Carpenter and Murray 1998).
Dispersal: Knapweed seeds are often spread in hay and on vehicle undercarriages.
Hybridization: No information available.

Control

Keys to Control:
- Use an aggressive monitoring program to detect new infestations.
- A combination of mechanical, chemical, and biological control and re-seeding is needed to remove an infestation of Russian knapweed.

Biocontrol: The Division of Plant Industry's Biological Pest Control Section is working to establish *Subanguina picridis* (a gall forming nematode) at three sites in Colorado. However, this species is currently unavailable for general redistribution.
Mechanical: Cutting or removal of the above ground portion of the plant reduces the current year growth, and may eliminate seed production, but it will not kill Russian knapweed. Cutting several times before the plants bolt stresses Russian knapweed plants and forces them to use nutrient reserves stored in the root system. The plants that re-emerge are usually smaller in size and lower in vigor. Once plants have bolted there are no more buds on the roots capable of reproduction, until buds begin to form again in mid-August to September. A combination of cutting and herbicides can be used to control Russian knapweed. In the fall, apply picloram to any plants that have re-emerged. This process may have to be repeated annually for several years to exhaust the soil seed bank.
Fire: No information available.
Herbicides: Spraying Curtail® herbicide, which is a mixture of 2,4-D and clopyralid, on dormant plants in the fall has been very effective at controlling Russian knapweed in Utah, but only if it is followed by reseeding during the year following treatment (Chad Reid, pers. comm.). Picloram at 1 lb. ai/acre is widely used on Russian knapweed and is considered to be the most effective herbicide regardless of time of application (Duncan 1994). Clopyralid is also effective against knapweeds and thistles and will kill other composites, legumes and smartweeds, but has little or no impact on many other forbs. In Wyoming, picloram applied either at bloom or seed stage at 0.38 lb. ai/ac, clopyralid at 0.25 lb. ai/ac and the combination of clopyralid (0.18 lb./ac) + 2,4-D (1.0 lb./ac) + picloram (0.25 lb./ac) provided 95% control two years after application (Whitson 1999). Glyphosate at 1.5 lb. ai/acre or dicamba at 1 lb. ai/acre can be applied during the bud-growth stage can be used to control the topgrowth of Russian knapweed.

However, abundant regrowth from the root systems will occur the following year and additional applications may be necessary. Timing of applications to the late bud and fall growth stage is critical with most herbicides to achieve good control of knapweed. A backpack sprayer or a wick is highly recommended to minimize damage to non-target plants if they are abundant.

The best way to control Russian knapweed is to combine herbicide treatment with seeding competitive grasses. Benz et al. (1999) found that clopyralid + 2,4-D treatment of Russian knapweed in the late bloom stage followed by fall seeding of a bunchgrass and a sod-forming grass was the most effective method they tested. Substituting metsulfuron herbicide for the clopyralid + 2,4-D resulted in lower control but it was still effective.
Cultural/Preventive: Preventive measures include maintaining healthy native communities, and minimizing disturbance and seed distribution.

Integrated Management Summary

Russian knapweed is characterized by its extensive root system, low seed production, and persistence. It is a strong competitor and can form dense colonies in disturbed areas. The most effective method of control for Russian knapweed is to prevent its establishment through proper land management. The healthier the natural community, the less susceptible it will be to Russian knapweed invasion. Areas should be monitored three times a year (spring, summer, and fall) and all Russian knapweed plants should be destroyed immediately. Since Russian knapweed is so persistent, it is important to combine killing Russian knapweed with seeding competitive grasses.

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=List C

Corn chamomile

Anthemis arvensis L.

Family: *Asteraceae* (Sunflower)
Other Names: scentless chamomile
USDA Code: ANAR6
Legal Status: Colorado Noxious List C (new in Colorado – call your county weed supervisor!)

Keys to Identification:
- Leaves are narrow, highly divided.
- Flowers resemble daisies with a yellow disc floret that is surrounded with white ray flowers.
- Mayweed chamomile (*Anthemis cotula* L.) is almost identical to corn chamomile but can be identified by its foul odor.

Identification
Growth form: Annual forb.
Flower: Flowers are 0.75 inches in diameter and are borne at the ends of branched stems. Flowers resemble daisies with white ray flowers and yellow disc flowers.
Seeds/Fruit: Seeds (achenes) are dark brown and grooved.
Leaves: Leaves are alternate and finely dissected.
Stems: Mature plants are 10-30 inches tall. Stems are erect, smooth, and highly branched above.
Roots: Dense fibrous root system.
Seedling: No information available.

Similar Species
Exotics: *Matricaria perforata* (scentless false mayweed) is locally common on the Western Slope, and is sometimes confused with *Anthemis arvensis* (corn chamomile) or *Anthemis cotula* (mayweed chamomile). In fact, most populations in the Gunnison Basin and Blue River area which have been reported as *Anthemis* are probably *Matricaria*. Corn chamomile (*Anthemis arvensis*) is almost identical to mayweed chamomile but can be identified by its lack of odor, and it is not yet common in Colorado. Oxeye daisy *(Chrysanthemum leucanthemum)* appears similar from a distance, but does not have finely dissected leaves.
Natives: The native *Hymenopappus newberryi* has few stem leaves, and is perennial.

Impacts
Agricultural: Corn chamomile can reduce crop production. It is considered unpalatable to livestock and its feed value is poor (Woo et al. 1991).
Ecological: No information available.
Human: No information available.

Habitat and Distribution
General requirements: Corn chamomile is commonly associated with ruderal habitats. It is found along roadsides, ditches, in urban areas, waste places, cultivated fields, and pastures. It can grow in a wide range of soils but seems to prefer moist, poorly drained soils. Corn chamomile prefers moist areas and increases in abundance during years of above average precipitation.
Distribution: Not yet widespread in Colorado.

Historical: Corn chamomile is a native of Europe that was introduced into North America as an ornamental or seed contaminant.

Biology/Ecology

Life cycle: Corn chamomile germinates readily in the spring and fall. It has a dense, fibrous root system, which spreads rapidly during wet periods. Late summer and fall-germinated seedlings may overwinter as rosettes. In the spring, bolting commences with the elongation of the central stem. Overwintering plants flower in mid-May and spring-germinated seedlings flower in June. Flowering stops after a killing frost, usually in October.
Mode of reproduction: Reproduces primarily by seeds. Occasionally, basal shoots that are lying along the ground surface will develop adventitious roots along the contact surface (Woo et al. 1991).
Seeds production: Corn chamomile is a prolific seed producer and can produce up to 960,000 seeds per plant.
Seed bank: Seed may remain viable in the soil for 4-6 years.
Dispersal: No information available.
Hybridization: No information available.

Control

Biocontrol: No information available.
Mechanical: Infestations can be mowed or tilled several times a year to prevent seed production. Smaller infestations can be pulled by hand. Mowing or pulling must be carried out early enough to prevent seed production; more than one mowing may be needed in most years.
Fire: No information available.
Herbicides: Metsulfuron is very effective, and is the preferred herbicide. Picloram or dicamba at 0.5 lb. ai/acre can be applied to seedlings for effective control. Picloram or glyphosate at 1.5 lb. ai/acre will control established plants when applied up to the bud or early flower stage.
Cultural/Preventive: In grain fields, infested areas should be swathed and harvested separately to avoid spreading seed. Maintain healthy and undisturbed native plant communities.

Keys to Control:
- Prevent seed production.
- Reduce the soil seed bank.
- Re-seed controlled areas with desirable species.
- Minimize additional disturbance

Integrated Management Summary

This species is not yet established in Colorado, and should be a priority for immediate eradication if found. Prevent the establishment of new infestations by minimizing disturbance and seed dispersal. Eliminate seed production to decrease the spread of this annual forb, and continue to deplete the seed bank for four to six years. Reseeding areas with perennial grasses for several years will reduce an infestation.

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Mayweed chamomile

Anthemis cotula L.

Family: *Asteraceae* (Sunflower)
Other Names: mayweed, dog fennel, stinking mayweed, stinkweed
USDA Code: ANCO2
Legal Status: Colorado Noxious List A (general weeds)

Keys to Identification:
- Leaves are narrow, highly divided, and have a foul odor.
- Corn chamomile (*Anthemis arvensis*) is almost identical to mayweed chamomile but can be identified by its lack of odor.

Identification

Growth form: Annual forb.
Flower: Flowers are borne at the ends of branches and in leaf axils. Flowers are 0.75 inches in diameter, with 12 white ray flowers and a yellow disk center.
Seeds/Fruit: Single-seeded fruit (achene) with about 10 ribs, approximately 1mm long (Stubbendieck et al. 1995).
Leaves: Leaves are alternate, highly divided into narrow segments, 2-6 cm long.
Stems: Mature plants are from 0.5 to 2 feet tall, highly branched, and have a foul odor.
Roots: Taproot with secondary fibrous root system.
Seedling: No information available.
Other: Foliage has an unpleasant odor.

Similar Species

Exotics: *Matricaria perforata* (scentless false mayweed) is locally common on the Western Slope, and is sometimes confused with *Anthemis cotula* (mayweed chamomile). In fact, most populations in the Gunnison Basin and Blue River area which have been reported as *A. cotula* are probably *M. perforata*. Although *A. cotula* is listed as a state noxious weed and *M. perforata* is not, both are alien invasive annual species with similar growth habits and appearance. *A. cotula* is distinguished by the presence of soft chaff (dry membranous bracts or scales) on the receptacle, and has odorous foliage. *M. perforata* lacks recepticular chaff. Corn chamomile (*Anthemis arvensis*) is almost identical to mayweed chamomile but can be identified by its lack of odor. Oxeye daisy *(Chrysanthemum leucanthemum)* appears similar from a distance, but does not have finely dissected leaves.
Natives: The native *Hymenopappus newberryi* has few stem leaves, and is perennial.

Impacts

Agricultural: Contact with mayweed chamomile can cause skin rashes, blistering of livestock muzzles, and irritation to mucous membranes of grazing livestock (Whitson et al.1996). It may also impart a strong flavor to the milk of dairy animals (Whitson et al. 1996).
Ecological: Mayweed chamomile invades disturbed and overgrazed areas.
Human: No information available.

Habitat and Distribution

General requirements: Mayweed chamomile easily adapts to many different environments and growing conditions. It is commonly found in waste areas, fields, and overgrazed pastures.
Distribution: Found throughout the United States.
Historical: Native to Europe.

Biology/Ecology

Life cycle: Mayweed chamomile germinates readily in the spring and fall. It has a dense, fibrous root system, which spreads rapidly during wet periods. Late summer and fall-germinated seedlings may overwinter as a rosette. In the spring, bolting commences with the elongation of the central stem. Overwintering plants flower in mid-May and spring-germinated seedlings flower in June. Flowering stops after a killing frost, usually in October.
Mode of reproduction: Mayweed chamomile reproduces by seed.
Seed production: Mayweed chamomile is a prolific seed producer and can produce up to 960,000 seeds per plant.
Seed bank: Seed may remain viable in the soil for 4-6 years.
Dispersal: No information available.
Hybridization: No information available.

Control

Biocontrol: None known.
Mechanical: Infestations can be mowed or tilled several times a year to prevent seed production. Smaller infestations can be pulled by hand. In grain fields, infested areas should be swathed and harvested separately to avoid spreading seed. Mowing must be carried out early enough to prevent seed production, and may have to be repeated during the growing season.
Fire: No information available.
Herbicides: Metsulfuron is very effective, and is the preferred herbicide. Picloram or dicamba at 0.5 lb. ai/acre can be applied to seedlings for effective control. Glyphosate at 1.5 lb. ai/acre or picloram at 0.5 lb. ai/acre will control established plants when applied up to the bud or early flower stage.
Cultural/Preventive: In grain fields, infested areas should be swathed and harvested separately to avoid spreading seed. Maintain healthy undisturbed native communities.

Keys to Control:
- Prevent seed production.
- Reduce the soil seed bank.
- Re-seed controlled areas with desirable species.
- Minimize additional disturbance.

Integrated Management Summary

Prevent the establishment of new infestations by minimizing disturbance and seed dispersal. Eliminate seed production to decrease the spread of this annual forb, and continue to deplete the seed bank for four to six years. Reseeding areas with perennial grasses for several years will reduce an infestation.

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Common burdock

Arctium minus (Hill) Bernh.

Family: *Asteraceae* (Sunflower)
Other Names: lesser burdock, wild burdock, bardane, wild rhubarb, beggar's button.
USDA Code: ARMI2
Legal Status: Colorado Noxious List A (general weeds)

Keys to Identification:
- Common burdock can be easily identified by its bur-like flowerheads.
- Plants are highly branched and may grow up to, and occasionally over, seven feet in height.

Identification

Growth form: Biennial forb.
Flower: Flowers are purple and are borne in clusters at the ends of branches.
Seeds/Fruit: Mature flower heads form a prickly bur that readily sticks to clothing or animals.
Leaves: Stem leaves are alternate, broadest at the leaf base and somewhat diminished upward. Leaf margins are toothed or wavy, and the entire leaf is wooly beneath and dark green above. Rosette leaves are large, hairy, and heart-shaped.
Stems: Mature plants are 3-7 feet tall. The stem is erect, coarse, and much branched.
Roots: Large fleshy taproot.
Seedling: Leaves of the rosette stage are large, simple and usually heart-shaped (Stubbendieck et al. 1995).

Similar Species

Exotics: *Arctium lappa* has larger heads on longer peduncles, and is less common. Cocklebur (Xanthium strumarium) has smaller, spiny-margined leaves.
Natives: None known.

Impacts

Agricultural: Common burdock is not considered a problem in crops since it is intolerant to cultivation. Livestock are fond of common burdock and the foliage imparts a bitter taste to the milk if it is eaten in large quantities. Common burdock burs can become entangled in the hair of sheep damaging the quality and reducing the value.
Ecological: Due to its biennial nature, common burdock is confined to areas that are not severely disturbed on an annual basis.
Human: Because of its diuretic effects, common burdock has been listed as a poisonous plant (Gross et al. 1980).

Habitat and Distribution

General requirements: Common burdock can commonly be found growing along roadsides, ditchbanks, in pastures and waste areas. It generally prefers riparian areas that have moist, fertile soils with high nitrogen contents.
Distribution: Established throughout much of the United States. Very common in central and north central Colorado.
Historical: Common burdock is a native of Eurasia. The hooked spines of the flower heads gave rise to the idea of Velcro (Whitson et al. 1996).

Biology/Ecology

Life cycle: The bulk of germination occurs in early spring (Gross et al. 1980). During the first year the plant forms a rosette. The following year the plant produces a stout, grooved, rough stem with numerous branches. Flowering and seed production occur from July to September. Seeds are mature by September and are shed continuously throughout the autumn, winter, and following spring.
Mode of reproduction: Common burdock reproduces solely by seed.
Seed production: Common burdock typically produces between 6,000-16,000 seeds per plant.
Seed bank: No information available.
Dispersal: Bur-like seed heads are readily dispersed by sticking to animal fur or clothing.
Hybridization: Likely to hybridize with other *Arctium* species.

Control

Biocontrol: None known.
Mechanical: Tillage can be used to kill the plants in the first year rosette stage. Mowing or cutting can be used to eliminate seed production. Mow after the plant has bolted but before it has flowered.
Fire: No information available.
Herbicides: Common burdock can be controlled with 2,4-D, picloram, or dicamba at 1 lb. ai/acre, or glyphosate at 1.5 lb. ai/acre. Herbicides are most effective when applied to first-year rosettes.

Keys to Control:
- Eliminate first year rosettes through tillage or herbicide applications.
- Eliminate seed production in second year plants through mowing or cutting.

Cultural/Preventive: Prevent the establishment of new infestations by minimizing disturbance and seed dispersal, eliminating seed production and maintaining healthy native communities.

Integrated Management Summary

As with other plants which reproduce solely by seed, integrated management efforts must include the elimination of seed production and the depletion of the seed bank. Combine herbicide or tillage treatment of rosettes with removal of seed heads from any plants that have bolted. Preventing dispersal of burs is particularly important.

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Plumeless thistle

Carduus acanthoides L.

Family: *Asteraceae* (Sunflower)
Other Names: bristly thistle, spiny plumeless thistle
USDA Code: CAAC
Legal Status: Colorado Noxious List A (general weeds)

Keys to Identification:
- Plumeless thistle can be distinguished from musk thistle by the leaf-like spines on the stem, and hairs on the underside of the leaf.
- Plumeless thistle flower heads are 1-2 inches in diameter, about one-third the size of musk thistle flower heads.

Identification
Growth form: Winter annual or biennial forb.
Flower: Flower heads are solitary at the ends of branches or in clusters of 2-5. Flower bracts are narrowly lance-shaped and appear as sharp spines. Flowers are purplish-pink and clustered in heads that are 1-2 inches in diameter.
Seeds/Fruit: One-seeded fruit (achene), capped by a ring of bristles.
Leaves: Basal rosette leaves are usually 4-8 inches long with spiny lobes. Stem leaves alternate, stalkless, hairy underneath, and blending into the stem.
Stems: Mature plants are between 1-4 feet tall and have a stout, fleshy taproot. Stems are freely branched above and covered with leaf-like spines that extend up to the flowering heads (Whitson et al. 1996).
Roots: Thick, fleshy taproot.
Seedling: No information available.
Other: Closely related to musk thistle (*Carduus nutans*).

Similar Species
Exotics: Plumeless thistle is similar to musk thistle. Rosettes of plumeless thistle are distinguished from those of musk thistle by having leaves that are deeply serrate (saw-toothed) almost to the midrib.
Natives: There are many native thistle species (in the genus *Cirsium*). The natives generally do not have leaves clasping the stem all the way from node to node (strongly decurrent leaves), and many have hairy upper and lower leaf surfaces and are blue-green or gray in color.

Impacts
Agricultural: Plumeless thistle is unpalatable to livestock; large or dense infestations may reduce available forage.
Ecological: Plumeless thistle does not typically pose a threat to high quality natural areas, although it has been known to invade native and restored grasslands despite the presence of dense, native prairie vegetation (Wisconsin DNR 1998). However, this species is highly aggressive in disturbed areas, and can pose a major problem in buffer and restoration areas (Wisconsin DNR 1998). Plumeless thistle is one of the most aggressive thistles due to its large seed production (Feldman 1997).
Human: No information available.

Habitat and Distribution
General requirements: In Colorado, plumeless thistle is locally abundant in pastures, stream valleys, fields, and along roadsides.

Distribution in Colorado: Plumeless thistle is frequently found in Colorado and has the potential of becoming a widespread noxious weed. Plumeless thistle is especially problematic on the Great Plains and in mesic pastures of the Intermountain West.
Historical: Plumeless thistle is native to Eurasia.

Biology/Ecology

Life cycle: Seedlings emerge from early spring to late fall and the length of time to flowering can vary from 4 to 22 months (Wisconsin DNR 1998). A single taproot is formed and stem elongation takes place in early May. Flowering begins in early June and lower branches continue to flower until mid-August (Wisconsin DNR 1998).
Mode of reproduction: Reproduction is solely by seed.
Seed production: A single plant is capable of producing up to 9,000 seeds
Seed bank: 90-95% of seeds produced may germinate under favorable conditions (Wisconsin DNR 1998, Feldman 1997). Seeds can remain viable in the soil for up to 10 years (Wisconsin DNR 1998).
Dispersal: Seeds are mainly dispersed by wind.
Hybridization: May hybridize with musk thistle *(Carduus nutans).*

Control

Keys to Control:
- Eliminate plumeless thistle seed production by removing flower heads or treating plants with herbicides prior to bolting.
- Re-seed controlled areas with desirable species.

Biocontrol: Two biological control agents; *Rhinocyllus conicus*, a flower head weevil; and *Trichosirocalus horridus*, a rosette weevil appear to limit populations of plumeless and musk thistle (Wisconsin DNR 1998), but may also impact native thistles, including rare species (Louda et al. 1997).
Mechanical: As with musk thistle, plumeless thistle flower heads can be cut and removed to eliminate seed production. Rosettes can also be removed mechanically. This can be an effective control method for relatively small infestations. However, it must be repeated annually to exhaust the soil seed bank.
Fire: No information available.
Herbicides: Picloram at 0.25 lb., dicamba, or 2,4-D at 1 lb. ai/acre, or glyphosate at 1.5 lb. ai/acre, are the most commonly used herbicides. Chlorsulfuron and metsulfuron will also control plumeless thistle. Herbicides should be applied in the spring 10-14 days before plumeless thistle bolts, or in the fall to new rosettes. Chlorsulfuron or metsulfuron should be applied to bolting plumeless thistle.
Cultural/Preventive: It is essential to re-seed controlled areas with desirable species.

Integrated Management Summary

Control of plumeless thistle is similar to that of the closely related musk thistle (see page 135). Elimination of seed production is key. Rosettes can be pulled or dug out by hand prior to bolting, or treated with herbicide. Once plants have bolted, seed heads must be removed to prevent the production of viable seed. For an example of one group's experiences controlling plumeless thistle, see page 62.

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=List B

Musk thistle

Carduus nutans L. subsp. ***macrolepsis*** (Peterman) Kazmi

Family: *Asteraceae* (Sunflower)
Other Names: nodding thistle, nodding plumeless thistle
USDA Code: CANUM2
Legal Status: Colorado Noxious List B (top ten worst)

Keys to Identification:
- Musk thistle can be identified by the broad, spine-tipped bracts located under the flower.
- Flowering heads are terminal, solitary and usually nodding.

Identification

Growth form: Biennial, or sometimes winter annual forb.
Flower: Flower heads are terminal, solitary, 1.5 to 3 inches in diameter, and usually nodding. Flowers are deep rose, violet or purple, occasionally white. Flowers are subtended by broad, spine-tipped bracts.
Seeds/Fruit: One-seeded oblong fruit (achene) about 0.2 inches long, shiny, yellowish-brown with a plume (pappus) of white hair-like bristles.
Leaves: Leaves are alternate, dark green, deeply lobed, and spiny margined. The leaf margins are often white. The leaves extend onto the stem giving a winged appearance (Whitson et al. 1996). Basal rosettes are well developed, leaves elliptical to lanceolate, 6-14 inches, smooth to densely hairy.
Stems: Mature plants can grow as tall as 6 feet. It can appear solitarily or with several stems from one base, and is highly branched above.
Roots: Fleshy taproot.
Seedling: No information available.

Similar Species

Exotics: Musk thistle is similar to plumeless thistle *(Carduus acanthoides)*. Rosettes of plumeless thistle are distinguished from those of musk thistle by having leaves that are deeply serrate (saw-toothed) almost to the midrib.
Natives: There are many native thistle species (in the genus *Cirsium*). The natives generally do not have leaves clasping the stem all the way from node to node (strongly decurrent leaves), and many have hairy upper and lower leaf surfaces and are blue-green or gray in color.

Impacts

Agricultural: Likely to infest pastures, and is unpalatable to livestock.
Ecological: Musk thistle is a highly competitive weed which invades disturbed areas, pasture, rangeland, forest land, cropland, and waste areas throughout most of the United States. Musk thistle spreads rapidly and forms extensive stands, which force out desirable vegetation (Rutledge and McLendon, 1998). Musk thistle may produce allelopathic chemicals that inhibit desirable plants beyond the spread of the rosettes (Wardle et al. 1993).
Human: No information available.

Habitat and Distribution

General requirements: Musk thistle does not appear to have any specific climatic requirements other than a cool period of vernalization for flowering (Butterfield et al. 1996). It occurs in areas with as little as 10 inches of annual

precipitation (FEIS 1996). Musk thistle establishes best on bare soil, and small shallow cracks are ideal for seedling establishment (FEIS 1996). Musk thistle grows in all soil textures, but the soils must be well-drained (Butterfield et al. 1996) It occurs on soils with a pH range of 6.0 to 8.9 (Butterfield et al. 1996).
Distribution: In Colorado, musk thistle is found up to approximately 10,000 feet in elevation (Beck 1999). It is found throughout North America.
Historical: Native to Eurasia.

Biology/Ecology
Life cycle: Seeds germinate in the fall, forming a rosette of leaves. Typically, musk thistle over-winters as a rosette and bolts the following spring between April-June. Flowering begins in late May or early June and continues through mid-July (Butterfield et al. 1996). Seeds mature and are dispersed 1 to 3 weeks after flowering. Seedlings establish only on bare soils and grow less when shaded by neighboring plants (Beck 1999).
Mode of reproduction: Musk thistle reproduces solely by seed.
Seed production: Musk thistle is a prolific seed producer Average productivity is approximately 10,000 seeds/plant, however, a single plant can produce up to 100,000 seeds (Beck 1999).
Seed bank: Musk thistle seeds appear to remain viable for at least 10 years.
Dispersal: Seed dispersal is by wind water, wildlife and livestock (Beck 1999).
Hybridization: May hybridize with plumeless thistle *(Carduus acanthoides).*

Control
Biocontrol: A number of insects have been used to help control musk thistle. The Division of Plant Industry's Biological Pest Control Section has two species, *Rhinocyllus conicus*, and *Trichosirocalus horridus*, that may be available for redistribution. The most widely released insect is the weevil *Rhinocyllus conicus* (Butterfield et al. 1996). In the spring, adults will feed on the leaves, mate, and deposit eggs on the bracts (Butterfield et al. 1996). When the eggs hatch the larvae begin to bore into the flowerhead, reducing the ability of the plants to produce viable seed. In some cases the weevil has reduced musk thistle populations to less than 10% pre-release levels (Rutledge and McLendon, 1998). However, this weevil will attack native thistles, including rare species (Louda et al. 1997).

Keys to Control:
- Managing rangeland to minimize the amount of bare soil is essential to long-term control.
- Hand chopping at ground level just before flowering, or cutting and bagging seed heads before dispersal can be used to eliminate seed production.
- Repeated treatments over the course of several years can eliminate a musk thistle infestation.

Mechanical: Repeated mowing, hand pulling, or cutting can be used to stop the spread of musk thistle. Mowing or hand-chopping after flowering, but before seed set, prevents seed development and dispersal (Heidel 1987). When pulling musk thistle, it is important to completely remove the crown so that the plant does not simply re-bolt and produce seeds. Repeated visits at weekly intervals over the 4-7 week flowering period is necessary because not all plants flower at the same time (Heidel 1987). Cut plants should be deeply buried or burned because seeds can mature and become viable after cutting (Rutledge and McLendon, 1998).
Fire: No information available.
Herbicides: Musk thistle is most often controlled with herbicides. The most effective chemical control occurs when musk thistle is still in the rosette stage, and quickly decreases once the plant has bolted (Butterfield et al. 1996). 2,4-D, clopyralid at 0.25 lb., or dicamba at 1 lb. ai/acre are effective when applied 10-14 days prior to bolting. A combination of 2,4-D plus dicamba provided 97% control in an experiment in Minnesota (Butterfield et al. 1996). Fall application of picloram at 0.25 lb. ai/acre to rosettes when other plants are dormant is often effective and has less impact on non-target species (Butterfield et al. 1996). Metsulfuron and chlorsulfuron are effective on bolted plants (Beck 1999).
Cultural/Preventive: Prevent the establishment of new infestations by minimizing disturbance and seed dispersal, eliminating seed production and maintaining healthy native communities.

Integrated Management Summary
The key to managing musk thistle is to prevent seed production. Most control methods will have a detrimental effect on other plants and may cause a disturbance that will favor re-invasion by other exotic species (Rutledge and McLendon, 1998). Dense musk thistle stands along roadsides and in degraded areas can be treated by spot use of herbicides, and in high-quality areas by a persistent program of pulling or cutting (Rutledge and McLendon, 1998).

Due to the long seed viability of musk thistle, up to 10 years, control methods may have to be repeated for many years to completely eliminate a stand.
One integrated approach to musk thistle management involves 1) managing livestock grazing to increase grass vigor and reduce bare ground; 2) spray rosettes with clopyralid or 2,4-D; 3) re-seed treated ground with competitive desirable plants in the fall after spraying; 4) follow-up with spot cutting of entire plants when first flowers appear annually for several years to deplete the seed bank in the soil.

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=List B

Diffuse knapweed

Centaurea diffusa Lam.; ***Acosta diffusa*** (Lam.) Sojak

Family: *Asteraceae* (Sunflower)
Other Names: spreading knapweed, tumble knapweed
USDA Code: CEDI3
Legal Status: Colorado Noxious List B (top ten worst)

Keys to Identification:
- The floral bracts have yellow spines with teeth appearing as a comb along the spine margins.
- Flowers are usually white, but may be rose-purple to lavender in appearance.
- Seedlings have finely divided leaves that are covered with short hairs.

Identification
Growth form: Biennial or short-lived perennial forb.
Flower: Flower heads are broadly urn-shaped, 0.6-0.8 inches tall, solitary or in clusters of 2-3 at the ends of the branches. Floral bracts are yellowish with a brownish margin, sometimes spotted, fringed on the sides, and terminating in a slender bristle or spine. The heads contain two types of flowers, ray flowers around the edges surrounding tubular disk flowers. The ray flowers are white, rose-purple, or lavender.
Seeds/Fruit: Seeds are light brown to black.
Leaves: Basal leaves are stalked and divided into narrow, hairy segments. Stem leaves are smaller, alternate, less divided, stalkless, and become bract-like near the flower clusters.
Stems: Stems are upright, 4-24 inches tall, highly branched, angled, with short, stiff hairs on the angles.
Roots: Taproot.
Seedling: Seedlings have finely divided leaves that are covered with short hairs.

Similar Species
Exotics: Diffuse knapweed may be distinguished from other knapweeds by the terminal spine on the floral bract.
Natives: None.

Impacts
Agricultural: Diffuse knapweed reduces the productivity of rangeland by displacing desirable forage species.
Ecological: Diffuse knapweed is a pioneer species that can quickly invade disturbed and undisturbed grassland, shrubland, and riparian communities. Once established, diffuse knapweed outcompetes and reduces the quantity of desirable native species such as perennial grasses. Diffuse knapweed has been reported to contain allelopathic chemicals, which can suppress competitive plant growth and create single species stands (Watson and Renney 1974). The densities of these stands can range from 1-500 plants/m^2. The replacement of native grassland with diffuse knapweed can reduce biological diversity and increase soil erosion (Sheley et al. 1997).
Human: No information available.

Habitat and Distribution
General requirements: Diffuse knapweed is found on plains, rangelands, and forested benchlands. It is generally found on light, dry, porous soils. Diffuse knapweed has been observed at elevations up to 8,500 feet (K.G. Beck, pers. comm.). It grows in open habitats as well as shaded areas (Watson and Renney 1974). Diffuse knapweed is not common on cultivated lands or irrigated pasture because it cannot tolerate cultivation or excessive moisture (Watson and Renney 1974).
Distribution: Diffuse knapweed is now common in the Front Range counties, and has been reported in scattered infestations from both the east and west slope of Colorado.

Historical: Native to Eurasia.

Biology/Ecology

Life cycle: Diffuse knapweed plants first form low rosettes and may remain in this form for one to several years depending on environmental conditions. Diffuse knapweed is a semelparous perennial; it grows as a rosette unitl it reaches a critical size, then bolts, flowers and usually dies (Thompson and Stout 1991). Flower buds are formed in early June and flowering occurs in July and August (Watson and Renney 1974). Mature seeds are formed by mid-August (Watson and Renney 1974).

Mode of reproduction: Reproduces by seeds.

Seed production: A single diffuse knapweed plant can produce up to 18,000 seeds (Harris and Cranston 1979) and a stand of diffuse knapweed can produce up to 40,000 seeds per square meter (Watson and Renney 1974). Along the Colorado Front Range, seed production of 500-1500 seeds pre plant is more typical (Beck et al. 1998).

Seed bank: Seeds may remain dormant for several years.

Dispersal: Seed dispersal for diffuse knapweed is mainly by wind (Watson and Renney 1974). When the seed capsule sways in the breeze or is disturbed, the seeds fall from the small opening in top of the flower head and are distributed around the parent plant (Watson and Renney 1974). However, most of the involucres remain closed until the plant dries up, breaks off at ground level and effectively becomes a tumbleweed, allowing seeds to be dispersed over long distances (Zimmerman 1997). Diffuse knapweed stalks readily lodge under vehicles, expanding their long distance dispersal.

Hybridization: No information available.

Control

Keys to Control:
- Eliminate seed production.
- Stress the plants nutrient reserves as well as the soil seed bank through persistent management.
- Re-seed infested area with desirable species and manage them to produce a vigorous stand of plants.

Biocontrol: Currently, biological control agents are available but the extent to which they effectively control diffuse knapweed populations is unclear. The Division of Plant Industry's Biological Pest Control Section has five species that may be available for redistribution. These five species are *Urophora affinis*, *Urophora quadrifasciata*, *Agapeta zoegana*, *Sphenoptera jugoslavica*, *Cyphocleonus achates*. The seedhead weevil *Larinus minutus* may also become available for distribution.

Mechanical: Cutting or mowing the above-ground portion of the plant, before seed set may be an effective way to reduce seed production, but it will not eliminate the infestation. Mowing usually increases diffuse knapweed density, due to increased germination from the soil seed bank. Mowings should therefore be followed by a fall herbicide treatment (Sebastian and Beck 1999). When a diffuse knapweed plant has been cut, the rosette may live and re-bolt. Additionally, diffuse knapweed seeds can remain dormant for several years, requiring any cutting program to be repeated several times annually (spring, summer, and fall) to be effective. Mowing or fire can be used as a way to remove standing dead material such that subsequently applied herbicide will be more effective (Roché and Roché 1999.)

Pulling can be effective for knapweed control, but it must be repeated frequently. Youtie and Soll (1994) suggested hand-pulling knapweeds three times annually until the plant disappears. The first pulling is in spring when the soil is moist, allowing enough of the plant to be pulled to kill it. The second pulling in June focuses on bolted plants, with the third pulling just before seed dispersal to kill any remaining plants.

Fire: In areas without abundant native perennials, burning has been shown to be an effective control of diffuse knapweed with strong grass regrowth occurring on burned sites (Zimmerman 1997). A low-severity fire may only top-kill (not kill the root) diffuse knapweed, but a severe fire will probably kill the entire plant. Dry soil conditions associated with burns may discourage diffuse knapweed re-infestation as moisture is the limiting factor for diffuse knapweed seed germination. Re-seeding desirable species after burning helps to prevent a re-infestation of diffuse knapweed or other exotic species.

Herbicides: Several herbicides are relatively effective at controlling diffuse knapweed. Picloram is the most widely recommended (Harris and Cranston 1979). Other effective herbicides include clopyralid, dicamba, 2,4-D, and glyphosate (Beck 1997, Youtie 1997, Watson and Renney 1974). To save money and reduce grass injury resulting from higher use rates of a single herbicide, several of these herbicides can be combined (Beck 1997). Tank-mixes of picloram and dicamba (0.25 to 0.5 lb./acre + 0.125 to 0.25 lb./acre), picloram plus 2,4-D (0.188 lb./acre + 1.0 lb./acre), clopyralid (0.25 lb./acre), clopyralid+2,4-D (0.2+1.0 lb./acre) and dicamba plus 2,4-D (0.5 lb./acre + 1.0 lb./acre) all control diffuse knapweed (Beck 1997). A backpack sprayer or a wick is recommended in

small areas to minimize damage to non-target plants. Herbicides should either be applied before the mature plants set seed, or to rosettes in the fall, to maximize effectiveness.
Cultural/Preventive: Prevent establishment of new infestations, and manage grazing or other land use to maintain vigorous native communities.

Integrated Management Summary
Integrated treatment of diffuse knapweed depends on each situation. Single treatments provide temporary but not long-lasting control. In grasslands where the forb component is minimal or expandable, suggested strategies include altering grazing management to promote vigorous grasses, spraying with picloram, re-seeding with competitive grass species, followed by spot treatment with picloram or hand-pulling. According to Roché and Roché (1997), the best case scenario is establishing competitive forage species that can, with the help of biological control agents and proper livestock management, maintain knapweed at low levels. The most effective method of control for diffuse knapweed is to prevent its establishment. Areas that are adjacent to known patches of diffuse knapweed should be monitored two to three times a year (spring, summer, and fall) and any new rosettes should be destroyed. Established plants or stands of diffuse knapweed can be pulled or spot treated with picloram. Burning may be an effective means of controlling diffuse knapweed in areas where seasonal or occasional fires are part of the natural ecosystem (Zimmerman 1997). Seeding desirable perennial grasses is essential to prevent weed reinvasion (Beck 1997).

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=List B

Spotted knapweed

Centaurea maculosa L.; ***Acosta maculosa*** (L.) Holub

Family: *Asteraceae* (Sunflower)
Other Names: none widely accepted
USDA Code: CEMA4
Legal Status: Colorado Noxious List B (top ten worst)

Keys to Identification:
- Spotted knapweed can be distinguished from other similar-looking knapweeds by the dark tips and fringed margins of the floral bracts.

Identification
Growth form: Short-lived, rarely biennial perennial forb.
Flower: Flowering heads are solitary at the ends of branches. The floral bracts are stiff and tipped with a dark comb-like fringe. The flowers are pinkish-purple or rarely cream colored.
Seeds/Fruit: Seeds have a tuft of persistent bristles.
Leaves: Rosette leaves are up to 6 inches long, and deeply lobed. The principal stem leaves are pinnately divided, have smooth margins, and become smaller toward the top of the shoot. Leaves are alternate.
Stems: Mature plants are 1-3 feet tall with one or more stems.
Roots: Spotted knapweed has a stout taproot.
Seedling: Rosettes of spotted and diffuse knapweed are nearly indistinguishable. Leaves are narrow and 1-2 times pinnately divided (Stubbendieck et al. 1995).
Other: Closely related to diffuse knapweed (*Centaurea diffusa*).

Similar Species
Exotics: Other knapweeds include diffuse knapweed (*Centaurea diffusa*) which has a distinct terminal spine on the floral bracts, Russian knapweed *(Centaurea repens)* whose flowers are smaller than those of spotted knapweed and do not have black mottling on the flower bracts, squarrose *(Centaurea virgata)* and black *(Centaurea nigra)* knapweeds.
Natives: American star-thistle *(Centaurea americana).* Other native members of the sunflower family can resemble knapweed in the seedling/rosette stage.

Impacts
Agricultural: Spotted knapweed reduces or displaces desirable plant species, thereby reducing livestock and wildlife forage (Sheley et al. 1999).
Ecological: Spotted knapweed is a highly competitive weed that invades disturbed areas and degrades desirable plant communities. It forms near monocultures in some areas of western North America (FEIS 1996). There is evidence that spotted knapweed produces allelopathic chemicals that inhibit the growth of other plants (Rutledge and McLendon, 1998). Like diffuse knapweed, spotted knapweed has been reported to contain cnicin, an allelopathic chemical (Fetcher and Renney 1963). Cnicin inhibits root growth of other plants, and destroys their ability to compete for limited soil moisture and nutrients. This allows spotted knapweed to form dense monocultures. However, Kelsey and Bedunah (1989) reported that resource capture was more important than allelopathy in determining spotted knapweed success. Although spotted knapweed is usually found in disturbed

areas, once a plant colony is established, it may invade adjacent areas that are relatively undisturbed or in good condition (Rutledge and McLendon, 1998). Spotted knapweed infestations in Montana had higher surface water runoff and higher sediment yields than bluebunch wheatgrass-dominated sites (Lacey et al. 1989).
Human: The sap of spotted knapweed can cause skin irritation in some people. As a precaution, anyone working with spotted knapweed should wear protective gloves and avoid getting knapweed sap into open cuts or abrasions. Workers should wash their hands and exposed skin with soap and water following contact with this plant.

Habitat and Distribution
General requirements: Spotted knapweed is adapted to well-drained, light to coarse-textured soils that receive summer rainfall (FEIS 1996, Rutledge and McLendon, 1998). Spotted knapweed is not tolerant of shade. It tends to inhabit somewhat moister sites than diffuse knapweed, preferring areas that receive 12 to 30 inches mean annual precipitation.
Distribution: Spotted knapweed infestations are not as severe in Colorado as diffuse knapweed (Beck 1997). However, this weed spreads rapidly and is quickly becoming more common. In Colorado, it is commonly found between 4,000 to 6,000 feet, but has been found as high as 10,000 feet (A. Green, pers. comm.).
Historical: Native to central Europe.

Biology/Ecology
Life cycle: Spotted knapweed germinates in spring or fall (Beck 1997). Spotted knapweed seedlings develop into and remain as rosettes for at least one growing season while root growth occurs (FEIS 1996). It usually bolts for the first time in May of its second growing season and flowers August through September (Rutledge and McLendon, 1998). Individual flowers bloom for 2-6 days (FEIS 1996). Plants are self fertile and are also cross-pollinated by insects.
Mode of reproduction: Spotted knapweed reproduces entirely by seed and is a prolific seed producer.
Seed production: Plants may produce up to 140,000 seeds/m² (Rutledge and McLendon, 1998). Most seeds are shed immediately after reaching maturity.
Seed bank: Spotted knapweed seeds exhibit three germination behaviors: dormant light-sensitive, dormant light insensitive, and non-dormant (FEIS 1996). Dormant seeds form a seed bank and may remain viable in the soil for over 8 years (Rutledge and McLendon, 1998).
Dispersal: Knapweed seeds are often spread in hay and on vehicle undercarriages.
Hybridization: No information available.

Control
Biocontrol: Currently, there is no single biological control agent that effectively controls knapweed populations. Some researchers believe that it will take a combination of up to twelve different insects to reduce knapweed infestations (Beck 1997). The Division of Plant Industry's Biological Pest Control Section has five species that may be available for redistribution. These five species are *Urophora affinis*, *U. quadrifasciata*, *Agapeta zoegana*, *Sphenoptera jugoslavica*, *Cyphocleonus achates*. The seedhead flies *U. affinis* and *U. quadrifasciata* have been released in many Front Range communities (Beck 1997). These insects cause plants to produce fewer viable seeds and abort terminal or lateral flowers (Beck 1997). Biological control insects may help reduce knapweed plants in stands of desirable plant species. For this reason, insects may be beneficial in combination with other control methods.

Cattle and sheep will both graze spotted knapweed, although sheep appear to be the more effective control animal. Olson et al. (1997) found that limited duration sheep grazing of spotted knapweed when associated grasses were dormant reduced knapweed seedlings and rosettes and reduced knapweed reproduction. Goats would also probably be effective in controlling spotted knapweed.

Keys to Control:
- The most effective method of control for spotted knapweed is to prevent its establishment. Areas should be monitored two to three times a year (spring, summer, and fall) and any new rosettes should be destroyed.
- Established plants or stands of spotted knapweed can be pulled or spot treated with picloram, or a combination of picloram and dicamba.
- Burning may be an effective means of controlling knapweed in areas where seasonal or occasional fires are part of the natural ecosystem.

Mechanical: Cutting, mowing, or removing the above ground portion of the plant after flowering, but before seed set, may be an effective way to eliminate seed production. However, spotted knapweed seeds can remain dormant in

the soil for nearly a decade, requiring any cutting program to be repeated annually to be effective. A long-term program with repeated cuts of bolted plants only for several years will strongly reduce numbers and cover of spotted knapweed. Pulling can control spotted knapweed in small areas. Pulling works best when the soil is wet so the entire plant crown can be removed, thereby killing the plant.

Fire: Burning has either promoted or controlled spotted knapweed; this variability in effect probably reflects differences in environmental conditions before and after the burns occurred and differences in the competitiveness of the native plant communities that were burned. Burning has been shown to be an effective control of knapweed with strong grass re-growth occurring on burned sites (Watson and Renney 1974). However, herbicide efficacy may increase when applied on post-burn rangeland, possibly due to the removal of standing dead material that would otherwise intercept herbicide (Lacey et al. 1995). A low-severity fire may only top-kill knapweed, but a severe fire will probably kill the plant. Dry soil conditions associated with burns may discourage knapweed re-infestation as moisture is the limiting factor for knapweed seed germination. Re-seeding desirable species should be part of any burning program to deter a re-infestation of knapweed or other exotic species.

Herbicides: Several herbicides are relatively effective at controlling knapweed. Picloram at 1.0 lb. ai/acre is the most effective, but has a long soil life and can damage non-target species (Harris and Cranston 1979, Watson and Renney 1974). Davis (1990) found that picloram applied at 0.25 lb. ai/ac provided 100% spotted knapweed control for 3-5 years. Other effective herbicides include dicamba or 2,4-D at 1 lb. ai/acre, or glyphosate at 1.5 lb. ai/acre. To save money and reduce grass injury resulting from higher use rates of a single herbicide, several of these herbicides can be combined (Beck 1997). Tank-mixes of picloram and dicamba (0.25 to 0.5 lb./acre + 0.125 to 0.25 lb./acre), picloram plus 2,4-D (0.188 lb./acre + 1.0 lb./acre), and dicamba plus 2,4-D (0.5 lb./acre + 1.0 lb./acre) all control knapweed (Beck 1997). Clopyralid applied at 0.24 lb. ai/ac and at 0.2 lb. ai/ac + 2,4-D at 1.0 lb. ai/ac provide control comparable to picloram when applied at the bolt or bud growth stages (Sheley et al. 1999). A backpack sprayer or a wick is highly recommended in small areas to minimize damage to non-target plants. Herbicides should be applied before the mature plants set seed to maximize effectiveness.

Cultural/Preventive: Prevent the establishment of new infestations by minimizing disturbance and seed dispersal.

Integrated Management Summary

Spotted knapweed can spread readily by stems that are carried on vehicles or in infested hay or seed. Early detection and prompt control of small spotted knapweed infestations are by far the most economical ways to manage this weed.

Spotted and diffuse knapweed can be managed similarly (Beck 1997). They are readily controlled with herbicides but will re-invade unless cultural techniques are used (Beck 1997). Sheley and Jacobs (1997) found that a ninety percent reduction in diffuse knapweed was necessary to shift the competitive relationship in favor of bluebunch wheatgrass.

Spotted knapweed infestations are not as severe in Colorado as diffuse knapweed (Beck 1997). However, this weed spreads rapidly and is quickly becoming more common. The sap of spotted knapweed can cause skin irritation in some people. As a precaution, anyone working with spotted knapweed should wear protective gloves and avoid getting knapweed sap into open cuts or abrasions. Workers should wash their hands and exposed skin with soap and water following contact with this plant.

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=List C

Black knapweed

Centaurea nigra

Family: *Asteraceae* (Sunflower)
Other Names: Lesser knapweed
USDA Code: CENI2
Legal Status: Colorado Noxious List C (new in Colorado – call your county weed supervisor!)

Keys to Identification:
- Black knapweed florets are purple, and all tubular.
- Floral bracts have long, black fringes from a black or dark brown triangular center.

floral bract

Identification
Growth form: Perennial forb.
Flower: Flower heads are solitary at the ends of the branches. The flowers are purple and all tubular. Floral bracts have long, black fringes from a black or dark brown triangular center.
Seeds/Fruit: No information available.
Leaves: Upper leaves are generally narrow with entire margins. Lower leaves are larger and generally lobed.
Stems: Stems are erect, unwinged, and are freely branched near the top.
Roots: Black knapweed has both a vertical taproot and spreading lateral roots.
Seedling: Fall emerging seedlings overwinter as a rosette of leaves.
Other: The whole plant is dull green and covered with small, rough hairs.

Similar Species
Exotics: Black knapweed is distinguished from other knapweeds by the floral bracts which have long, black fringes from a black or dark brown triangular center. The heads tend to be larger than those of diffuse or spotted knapweed.
Natives: Native members of the sunflower family can resemble knapweed in the seedling/rosette stage.

Impacts
Agricultural: Black knapweed can infest disturbed rangeland and reduce forage production.
Ecological: Black knapweed does not establish readily in healthy, natural habitats. It typically invades disturbed areas and can form dense stands. Once established, black knapweed outcompetes and reduces the quantity of desirable native species (e.g. perennial grasses).
Human: No information available.

Habitat and Distribution
General requirements: Black knapweed can commonly be found along roadsides, riverbanks, irrigation ditches, pastures, waste places, clearcuts, and croplands. It can tolerate a wide range of environmental conditions but prefers moist soils that receive summer rainfall.

Distribution: Currently rare in Colorado; has been confirmed in Routt County.
Historical: No information available.

Biology/Ecology

Life cycle: Black knapweed generally flowers from July through August. The seeds of black knapweed can germinate from spring through early fall. Seedlings that emerge in the fall often overwinter as a rosette of leaves, and resume growth again in the spring.
Mode of reproduction: Black knapweed reproduces by seed and to some extent by short lateral roots (Roché and Roché 1991).
Seed production: Black knapweed can produce over 1,000 seeds per plant.
Seed bank: Seeds can remain viable in the soil for over five years.
Dispersal: People are the major agents of knapweed spread. Knapweed is often spread in hay and on vehicle undercarriages.
Hybridization: Black knapweed readily crosses with brown knapweed (*Centaurea jacea*) to form a fully fertile hybrid, meadow knapweed (*Centaurea pratensis*).

Control

Biocontrol: None known.
Mechanical: Small infestations can be pulled and larger infestations can be mowed, burned or mulched and then treated with herbicides as soon as new seedlings emerge.
Fire: No information available.
Herbicides: Picloram at 0.5 lb, 2,4-D, or dicamba at 1 lb. ai/acre, or a combination of clopyralid plus 2,4-D (Curtail™), are commonly used and effective herbicides.
Cultural/Preventive: Minimize disturbance and establish healthy stands of tall grasses or forbs to outcompete black knapweed.

Keys to Control:
- Small infestations can be controlled by hand pulling, or spot herbicide treatment.
- Larger infestations require a combination of mechanical, or burning, and chemical control.

Integrated Management Summary:

Land mangers must learn to identify knapweed. New infestations of this species should be high priority for control. Timely control of a few plants is very cost-effective compared to treating larger acreage later. Since black knapweed establishes disturbed sites, persistent monitoring of commonly disturbed areas (e.g. roadsides, along trails, streambanks, and where hay is fed) is a good way to search for new infestations. Control knapweed infestations with a combination of mechanical and chemical treatments. In addition, improving the health of a natural area and guarding against disturbance or overuse are good preventive measures.

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=List C

Yellow starthistle

Centaurea solstitialis L.

Family: ***Asteraceae*** (Sunflower)
Other Names: St. Barnaby's thistle
USDA Code: CESO3
Legal Status: Colorado Noxious List C (new in Colorado – call your county weed supervisor!)

Keys to Identification:
- Yellow starthistle has rigid, branching, winged stems that are covered with cottony hairs.
- Flower heads are distinguished by sharp, straw-colored thorns, which are up to 0.75 inches long.

Identification

Growth form: Winter annual forb.
Flower: Flower heads are yellow, located singly at the ends of branches. Flower heads are distinguished by sharp, straw-colored thorns, which are up to 0.75 inches long.
Seeds/Fruit: Yellow starthistle has two types of seeds, plumed and plumeless.
Leaves: Basal leaves are deeply lobed while the upper leaves are entire and sharply pointed.
Stems: Mature plants are 2-3 feet tall and have rigid, branching, winged stems that are covered with cottony hairs (Whitson et al. 1996).
Roots: Taproot.
Seedling: Seedlings have oblong, tongue-shaped cotyledons (Herzog and Randall 1998).

Similar Species

Exotics: Purple starthistle *(Centaurea calcitrapa)* and Iberian starthistle *(Centaurea iberica)* are related exotics, but are not yet found in Colorado. Purple starthistle has been reported in Wyoming.
Natives: None known.

Impacts

Agricultural: Yellow starthistle causes a neurological disorder called chewing disease (equine nigropallidal encephalomalacia) in horses that eat it (Maddox et al. 1985).
Ecological: Yellow starthistle is a pioneering plant that becomes established on disturbed land. It forms dense infestations, reduces the available edible forage, and exhibits a suspected allelopathic effect on some associated species (Maddox et al. 1985).
Human: No information available.

Habitat and Distribution

General requirements: Yellow starthistle invades rangelands, pastures, roadsides, cropland, and wastelands. It is intolerant of shade and requires light on the soil surface for winter rosette and taproot development (FEIS 1996). Yellow starthistle is capable of establishing on deep, well-drained soils as well as on shallow, rocky soils that receive from 10-40 inches of annual precipitation. In the Pacific Northwest, yellow starthistle favors sites that were formerly dominated by big sage-brush, bluebunch wheatgrass, Idaho fescue and Sandberg bluegrass (Sheley et al. 1999).

Distribution: Well established in the Pacific coast states, and spreading west. Found in eight known locations on the Front Range and West Slope. Elevations range from 5,000-6,500' and it appears to favor dryland conditions.
Historical: Introduced from Europe, where it is native to the Mediterranean region.

Biology/Ecology

Life cycle: Seedlings usually emerge in the fall, form rosettes, and begin growing a taproot. Root growth continues throughout the winter. Yellow starthistle bolts in late spring and flowers June through August.
Mode of reproduction: It reproduces entirely by seed (FEIS 1996).
Seed production: Plants usually produce 700 - 1,000 seeds/plant, but vigorous plants may produce up to 170,000 seeds/plant (Herzog and Randall 1998, FEIS 1996).
Seed bank: Seeds may remain viable for several years (Herzog and Randall 1998).
Dispersal: Plumed and plumeless seeds are dispersed at different times. Plumed seeds are dispersed by wind shortly after maturity. Plumeless seeds remain in the seedhead until it disintegrates in the fall or winter.
Hybridization: No information available.

Control

Biocontrol: There are several biological control agents that can dramatically reduce seed production. The most commonly used biological control agent is *Bangasternus orientalis*, a seed head weevil. Larvae feed on the seeds and can destroy up to 60% of the seeds in a head (Rees et al. 1996). Reseeding with competitive grass species is a key part of integrated yellow starthistle control, with appropriate species varying by locality (Sheley et al. 1999). Cattle and sheep will graze yellow starthistle before it has spines. Multiple grazing periods are necessary to control yellow starthistle.

Keys to Control:
- Management and control will only be successful when several techniques such as prescribed burning and spot herbicide treatment or large-scale herbicide spraying are combined to remove yellow starthistle and replace it with competitive native perennials.

Mechanical: Hand pulling can be used to remove small infestations of yellow starthistle. Mowing can be used to control larger infestations. Mowing alone is ineffective as a control method, but it can be helpful in stressing yellow starthistle plants that grow above desirable seeded species during revegetation (Sheley et al. 1999).
Fire: Recent studies suggest that yellow starthistle was controlled with prescribed burning in California grasslands (Hastings and DiTomasso 1996). Burning should be conducted during the early flowering stage (before seed production).
Herbicides: Herbicides are most effective when applied from the seedling to bolt stages. Picloram at 0.25 lb., dicamba, or 2,4-D at 1 lb. ai/acre are the most commonly used herbicides. Chemical control is most appropriate for large infestations, particularly when desirable plants are abundant in the understory, on highly productive sites, and around the periphery of infestations to control their spread (Sheley et al. 1999).
Cultural/Preventive: Grazing management is imperative for yellow starthistle control, mainly to promote stands of healthy desirable plants.

Integrated Management Summary

This species is not yet well established in Colorado, and should be a priority for immediate eradication if found. Yellow starthistle favors disturbed sites such as roadsides, ditches, orchards, and overgrazed rangeland and pasture (FEIS 1996). Yellow starthistle will even invade undisturbed grassland communities where site conditions are ideal. The large seed bank in the soil combined with a long seed life make this plant extremely difficult to control. Management and control will only be successful when several techniques such as prescribed burning and spot herbicide treatment or large-scale herbicide spraying are combined to remove yellow starthistle and replace it with competitive native perennials. Anecdotal evidence indicates that yellow starthistle does not compete with planted, improved grass varieties on California foothills range (Bill Burrows, pers. comm.). Land management practices should focus on promoting healthy native plant communities.

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=List C

Squarrose knapweed

Centaurea virgata Lam. var. ***squarrosa*** (Willd.) Boiss.

Family: *Asteraceae* (Sunflower)
Other Names: none widely accepted
USDA Code: CEVIS
Legal Status: Colorado Noxious List C (new in Colorado – call your county weed supervisor!)

Keys to Identification:
- Squarrose knapweed is often confused with diffuse knapweed (*Centaurea diffusa*). However, the two species may be distinguished by their floral bracts.
- Squarrose knapweed floral bract tips are recurved or spreading with the terminal spine longer than the lateral spines on each bract.

Identification

Growth form: Perennial forb.
Flower: Flower heads are small, numerous, and have 4-8 rose or pink colored flowers. The flower bract tips are recurved or spreading, with the terminal spine longer than the lateral spines on each bract.
Seeds/Fruit: No information available.
Leaves: Lower leaves are deeply dissected, upper leaves are bract-like.
Stems: Mature plants are typically between 12-18 inches tall with highly branched stems.
Roots: Taproot.
Seedling: Seedlings have deeply indented, gray-green leaves.

Similar Species

Exotics: Often confused with diffuse knapweed *(Centaurea diffusa),* but differs principally in the fact that it is a true perennial, and bracts are recurved. Unlike diffuse knapweed, seed heads of squarrose knapweed are highly deciduous, falling off the stems soon after seeds mature.
Natives: None known.

Impacts

Agricultural: Can affect rangeland productivity by displacing desirable native species.
Ecological: Squarrose knapweed is a highly competitive weed that can displace native rangeland plants. It grows aggressively in dry disturbed areas, particularly in sand or cinders such as roadsides or cinderpits. Like other knapweed species, squarrose knapweed releases allelopathic chemicals that inhibit the growth of other plants.
Human: No information available.

Habitat and Distribution

General requirements: Squarrose knapweed is found on plains, rangelands, and forested benchlands. In Utah, squarrose knapweed grows mostly in big sagebrush-bunchgrass rangeland, but it is also found at higher and lower elevations in juniper and salt desert range, respectively (Roché 1999). It is generally found on light, dry, porous soils. It prefers open habitats to shaded areas. Squarrose knapweed is not common on cultivated lands or irrigated pasture because it cannot tolerate cultivation or excessive moisture.
Distribution: Not yet known to be present in Colorado but expected to first invade the West Slope. Currently established in California, Utah, Oregon and Washington.
Historical: Native to Asia.

Biology/Ecology

Life cycle: Squarrose knapweed may spend several years as a rosette before it bolts and produces seeds (Roché and Roché 1991). Once it has matured, squarrose knapweed may continue to flower and produce seeds for several years. Squarrose knapweed flowers from June through August. Seed heads are highly deciduous and fall off the stems soon after seeds mature.
Mode of reproduction: Reproduces by seeds.
Seed production: Each seed head produces 3-4 seeds.
Seed bank: Seeds may remain viable in the soil for several years.
Dispersal: The seed heads readily stick to animal fur and vehicle tires, thereby promoting long-distance dispersal.
Hybridization: No information available.

Control

Keys to Control:
- Eliminate seed production.
- Stress the plants nutrient reserves as well as the soil seed bank through persistent management.
- Re-seed infested area with desirable species.

Biocontrol: Some of the insects that attack spotted knapweed attack squarrose knapweed, including gall-forming flies *Urophora affinis* and *U. quadrifasciata*. There appears to be sparse evidence whether these and other insects exert much damage on squarrose knapweed.
Mechanical: Cutting, mowing, or removing the above ground portion of the plant, before seed set may be an effective way to reduce seed production, but it will not eliminate the infestation. When a squarrose knapweed plant has been cut, the rosette may live and re-bolt. Additionally, squarrose knapweed seeds can remain dormant for several years, requiring any cutting program to be repeated annually (spring, summer, and fall) to be effective. A long-term program with repeated cuts only of bolted plants for several years will strongly reduce numbers and cover of squarrose knapweed. Pulling is similar to cutting in that pulling will not kill squarrose knapweed plants but may reduce seed production.
Fire: Burning is not recommended for control of squarrose knapweed. Burning favors expansion of squarrose knapweed, particularly in drier situations such as juniper-dominated rangeland (Roché 1999).
Herbicides: Several herbicides are relatively effective at controlling knapweeds. Effective herbicides include picloram, dicamba, and glyphosate (Beck 1997, Youtie 1997, Watson and Renney 1974). Picloram (0.25-0.5 lb. ai/ac), clopyralid (0.5 lb. ai/ac), and dicamba (2 lb. ai/ac) have been effective. Fall application to newly resprouted basal leaves when precipitation is available to carry the herbicide into the soil can be very effective (Roché 1999). To save money and reduce grass injury resulting from higher use rates of a single herbicide, several of these herbicides can be combined (Beck 1997). A backpack sprayer or a wick is highly recommended in small areas to minimize damage to non-target plants. Herbicides should be applied before the mature plants set seed to maximize effectiveness.
Cultural/Preventive: Prevent establishment of new infestations, and manage grazing or other land use to maintain vigorous native communities.

Integrated Management Summary

This species is not yet established in Colorado, and should be a priority for immediate eradication if found. Squarrose knapweed is a competitive rangeland weed native to the eastern Mediterranean area (Whitson et al. 1996). It is a perennial relative of diffuse knapweed (Roché and Roché 1991), and control methods are similar (see page 139). Squarrose knapweed is increasing in density throughout the West, particularly along livestock trails, recreational vehicle trails and roads where animals and vehicles disperse the spring seedheads. Sheep may be particularly effective dispersal agents because sheep roam widely and the spiny seed heads lodge in wool. As with all knapweeds, preventing seed dispersal is an important component of an integrated management strategy.

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=List C

Rush skeletonweed

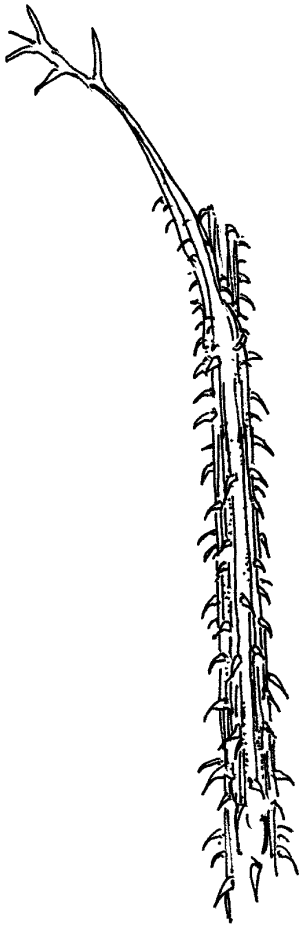
Chondrilla juncea L.

Family: *Asteraceae* (Sunflower)
Other Names: gum succory, devil's-grass, naked weed, hog-bite
USDA Code: CHJU
Legal Status: Colorado Noxious List C (new in Colorado – call your county weed supervisor!).

Keys to Identification:
- Plants are very "stemmy" with inconspicuous leaves (except sometimes at the base).
- The base of the stems are usually covered with red, downwardly bent, coarse hairs.
- Broken stems and leaves exude a milky sap.
- Yellow flowers.

Identification

Growth form: Perennial forb.
Flower: Flower heads are produced along or at the ends of stems, either individually or in a group of two to three (Rees et al. 1996). Each flower head contains 10 to 12, strap-shaped, bright yellow flowers that are flat across the end with distinct lobes or teeth (Rees et al. 1996).
Seeds/Fruit: Seeds are pale brown to nearly black and have a white pappus.
Leaves: Leaves form in a basal rosette, are sharply toothed, and wither as the flower stem develops. Rosette leaves are lance-shaped, deeply lobed, and 2-5 inches long. Stem leaves are inconspicuous, narrow and entire (Whitson et al. 1996).
Stems: Mature plants are 1-4 feet tall. Lower stems have short, downwardly bent, coarse hairs. Upper stems are smooth.
Roots: Deep extensive root system.
Seedling: No information available.



Similar Species

Exotics: There are three forms of rush skeletonweed in the United States, with the forms differing in inflorescence morphology and susceptibility to control measures (Sheley et al. 1999).
Natives: Often confused with a native skeletonweed *Lygodesmia juncea*, which has pink (occasionally white) flowers.

Impacts

Agricultural: Infestations of rush skeletonweed can reduce livestock and wildlife forage (Sheley et al. 1999). The extensive deep root system makes rush skeletonweed difficult to control (Whitson et al. 1996). The tall, wiry, latex-producing stems also hinder the operation of crop harvest machinery (Rees et al. 1996). However, rush skeletonweed can provide forage during a drought. Rosette leaves and pre-flowering stems are palatable and nutritious.
Ecological: Rush skeleton weed can form dense monocultures that displace native plants, but rarely invades healthy native communities (Sheley et al. 1999)..
Human: No information available.

Habitat and Distribution

General requirements: Rush skeletonweed generally inhabits well-

drained, light-textured soils. It is capable of growing in a wide range of conditions, but prefers areas that have cool winters, warm summers, with a predominance of winter and spring rainfall (Rees et al. 1996). This species grows in waste places and in overgrazed rangeland, especially in the Pacific Northwest and in California.
Distribution: Not yet found in Colorado, but established in states to the west. Expected to invade in the next few years, particularly in the northwest area of the state. However, this species may be discovered virtually anywhere in Colorado.
Historical: Native to southern Europe.

Biology/Ecology
Life cycle: Buds on the root crown or along lateral roots may give rise to new rosettes. Each rosette produces one or more stems, 20-60 inches long, with multiple spreading or ascending light–green branches (Rees et al. 1996). Flowering and seed production occurs from mid-July through frost. Flowers are self-fertile. There are three forms of rush skeletonweed in the United States, with the forms differing in inflorescence morphology and susceptibility to control measures (Sheley et al. 1999).
Mode of reproduction: Rush skeletonweed can reproduce by both seed and through vegetative propagation.
Seed production: A single multi-stemmed plant may produce as many as 15,000-20,000 seeds.
Seed bank: No information available.
Dispersal: Seeds are readily dispersed by wind, water, animals or humans.
Hybridization: No information available.

Control
Biocontrol: Several biological control agents are available and occasionally will provide effective control (Rees et al. 1996). In field tests in California, *P. chondrilla* a rust fungus, appears to be the most important biological control agent for rush skeleton weed (Supkoff et al. 1988). Sheep can control rush skeletonweed if the weeds are grazed at a moderate level while desirable plants are grazed lightly. This can be achieved through planned rotational grazing (Sheley et al. 1999).

Keys to Control:
- Hand pulling or mowing can be used to control small infestations.
- Apply herbicides after the plant has bolted, but before seed production.
- Herbicides should be applied two or more times annually, for several years to control rush skeletonweed.

Mechanical: Hand-pulling can be used on small infestations. However, due to the extensive root system of rush skeletonweed, these methods have to be repeated at least twice annually for several years before the weed is controlled. Mowing and cultivation are ineffective at controlling rush skeletonweed (Sheley et al. 1999).
Fire: No information available.
Herbicides: Picloram applied at 2 lb. ai/acre to rosettes has been widely used (Sheley et al. 1999). Also, a mixture of 1% glyphosate / 1% dicamba applied 2 or more times annually provided control in Calaveras County, California (Calweed 1997). Annual applications of clopyralid (0.2 lb. ai/ac) + dicamba (1 lb. ai/ac) provided 95% control of rush skeletonweed in Australia over three years (Heap 1993). Best results are obtained by making consistent applications over a three to five year period. Herbicides should be applied after the plant has bolted, but before seed production. Herbicides are most effective on plants that are infected with biological control agents (Sheley et al. 1999).
Cultural/Preventive:

Integrated Management Summary
Rush skeletonweed infests several million acres in the Intermountain west and California and has become a serious problem in many areas. It is commonly found in grain crops, pastures, rangelands, disturbed areas, and along roadsides. It is not yet established in Colorado, so the most important control is to be on the lookout for it and prevent new infestations. If infestations are discovered, they should be controlled immediately, and all seed production prevented. Report occurrences of this plant immediately to the county weed supervisor.

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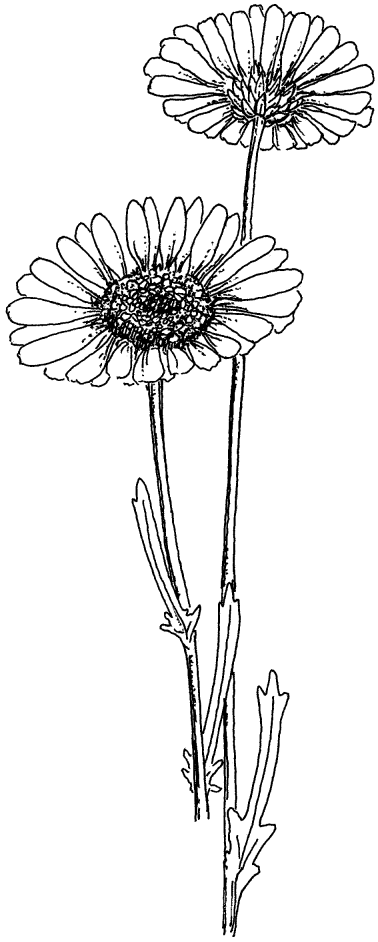
Oxeye daisy

Chrysanthemum leucanthemum L.; ***Leucanthemum vulgare*** Lam.

Family: *Asteraceae* (Sunflower)
Other Names: white daisy
USDA Code: CHLE80, LEVU
Legal Status: Colorado Noxious List A (general weeds)

Keys to Identification:

- Oxeye daisy can be identified by its daisy-like flowers. Flowering heads are solitary at the ends of branches, have white ray flowers and yellow disk flowers and are about 2 inches in diameter.



Identification
Growth form: Short-lived perennial forb.
Flower: Flowering heads are solitary at the ends of branches. Flower heads have white ray flowers and yellow disk flowers.
Seeds/Fruit: Fruits have about 10 ribs.
Leaves: Alternately arranged leaves become progressively smaller upward along the stem. Basal and lower stem leaves are 2-5 in long, lance-shaped to narrowly egg-shaped. The upper leaves become stalkless and toothed.
Stems: Mature plants are 10-24 inches tall with erect, smooth to sparsely hairy stems.
Roots: The plants have shallow, branched rhizomes.
Seedling: No information available.

Similar Species
Exotics: Oxeye daisy is easily confused with the ornamental Shasta daisy *(Chrysanthemum maximum)*, which is a more robust plant with larger flowers.
Natives: None known.

Impacts
Agricultural: The plant is unpalatable to cattle; dense infestations can reduce cattle forage.
Ecological: If given the chance, this plant can become noxious and is capable of taking over and modifying natural areas, pasture and rangeland (Rutledge and McLendon, 1998), and may increase soil erosion compared to native plant communities (Olson and Wallander 1999
Human: No information available.

Habitat and Distribution
General requirements: In Colorado, oxeye daisy is usually found at higher elevations in meadows, along roadsides, and in waste places. In many places this plant escaped from gardens and established in meadows, around mines and ghost towns in the mountains (Rutledge and McLendon, 1998).
Distribution: Widely distributed throughout the United States.
Historical: Escaped from cultivation as an ornamental.

Biology/Ecology
Life cycle: Basal rosettes must experience a period of cold temperatures

to initiate flowering (Rutledge and McLendon, 1998). Flowering occurs from June through August. The plant grows vigorously in poorer soils, possibly because it is a poor competitor with established plants on better soils (Olson and Wallander 1999). Oxeye daisy may require reduced competition from neighboring plants or disturbance to establish (Olson and Wallander 1999).
Mode of reproduction: Oxeye daisy reproduces by seeds and short rootstocks.
Seed production: A typical plant produces over 500 seeds.
Seed bank: Seeds can remain viable in the soil for at least 2-3 years and sometimes far longer (Rutledge and McLendon, 1998).
Dispersal: No information available.
Hybridization: No information available.

Control
Biocontrol: None known.
Mechanical: Hand pulling or digging before seed head production can used to effectively control small infestations. However, for this method to be successful it is important to remove as much of the underground part as possible.
Fire: No information available.
Herbicides: Larger infestations of oxeye daisy are commonly controlled with herbicides. Picloram 0.25 lb., dicamba, or 2,4-D at 1 lb. ai/acre, or glyphosate at 1.5 lb. ai/acre will control oxeye daisy. Other herbicides that have proven effective include imazapyr, and sulfometuron methyl (Rutledge and McLendon, 1998). No biological control agents exist for oxeye daisy.
Cultural/Preventive: Prevent the establishment of new infestations by minimizing disturbance and seed dispersal, eliminating seed production and maintaining healthy native communities.

Keys to Control:
- Small infestations can be controlled by hand pulling or digging the plants before seed heads are produced.
- Minimize the amount of bare soil exposed by land management practices.
- Maintain a significant grass canopy to shade out oxeye daisy.

Integrated Management Summary
Oxeye daisy has the potential to invade disturbed areas, form small colonies, and modify existing communities. Integrated treatments potentially include nitrogen fertilization and sheep or goat grazing; and nitrogen fertilization and picloram application. Nitrogen fertilizer stimulates other vegetation, especially grasses, that likely out-compete daisy plants for nitrogen, grow taller and shade out the daisy. Sheep or goat grazing is designed to selectively impacts the daisy without adversely affecting the desirable species. Picloram can effectively control daisy plants but it can damage desirable forbs, as well.

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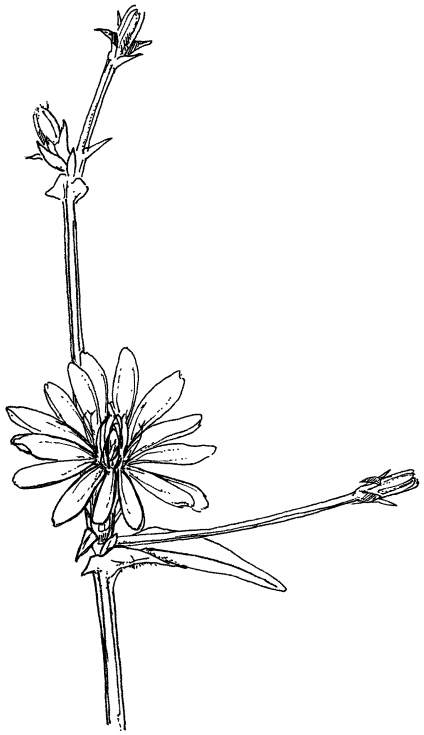
Chicory

Cichorium intybus L.

Family: *Asteraceae* (Sunflower)
Other Names: coffeeweed, blue sailors, succory
USDA Code: CIIN
Legal Status: Colorado Noxious List A (general weeds)

Keys to Identification:
- Flower heads are 1.5 inches in diameter and are normally blue, but may appear white or purple.
- Flowers are square on the end and lobed.
- Stalkless flowers.

Identification
Growth form: Perennial forb.
Flower: Flowers are born in the axils of the upper leaves. Flowers are 1.5 inches in diameter, usually blue, but are occasionally purple or white.
Seeds/Fruit: Fruits are ribbed and tipped by a crown of minute scales.
Leaves: Basal leaves are rough, 2-10 inches long, lance-shaped, toothed or pinnately parted. Upper leaves are smaller, alternate, stalkless, clasping the stem, with undivided margins.
Stems: Mature plants range in size from 1-6 feet tall. Stems are erect and branched above.
Roots: Plants grow from a deep taproot.
Seedling: No information available.
Other: The entire plant exudes a milky juice when broken.



Similar Species
Exotics: None known.
Natives: Chicory can be distinguished from blue lettuce *(Lactuca pulchella)* by its more branched growth pattern, and flowers which are essentially stalkless.

Impacts
Agricultural: Although it is grown as a hay crop in Europe, dairy products from cows which eat it may have a bitter taste (Stubbendieck et al. 1995).
Ecological: Chicory is a ruderal species that invades disturbed areas.
Human: Milky latex may cause dermatitis.

Habitat and Distribution
General requirements: Chicory is widespread along roadsides and in disturbed areas. It can adapt to a wide range of soils and environmental conditions.
Distribution: Common throughout North America.
Historical: Chicory is a native of the Mediterranean region. It is often planted for use as salad greens and the root used as a substitute for or additive to coffee (Whitson et al. 1996).

Biology/Ecology
Life cycle: Flowering occurs from July to September.
Mode of reproduction: Reproduces by seeds.
Seed production: No information available.

Seed bank: No information available.
Dispersal: No information available.
Hybridization: No information available.

Control

Biocontrol: None known.
Mechanical: Chicory may be controlled by mowing, cutting, or pulling plants before seed production. This process may have to be repeated annually to exhaust nutrient reserves in the roots of plants as well as to control plants that emerge from the soil seed bank.
Fire: No information available.
Herbicides: Chicory can be controlled with a mixture of picloram + 2,4-D (Grazon P+D™) if it is applied when plants are actively growing (Dow AgroSciences 1998). In general, use 2-4 pints of the mixture in enough water to give a total spray volume of 10-20 gallons per acre (Dow AgroSciences 1998). Dicamba, 2,4-D, and picloram at 1.0 lb. ai/acre, or glyphosate at 1.5 lb. ai/acre, will also control chicory. To provide more complete control, add an agricultural surfactant and/or a drift control additive for improved deposition (Dow AgroSciences 1998).
Cultural/Preventive: Prevent the establishment of new infestations by minimizing disturbance and seed dispersal, eliminating seed production and maintaining healthy native communities.

Keys to Control:
- Maintain a healthy cover of perennial plants.
- Re-seed controlled areas with desirable species.
- Minimize additional disturbance.

Integrated Management Summary

This perennial weed is difficult to eliminate. Because it prefers disturbed areas, the maintenance of healthy plant communities and revegetation of disturbed areas can help prevent the spread of chicory. Combine preventive measures with mechanical and chemical control.

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=List B

Canada thistle

Cirsium arvense (L.) Scop.; ***Breea arvensis*** (L.) Lessing

Family: ***Asteraceae*** (Sunflower)
Other Names: field thistle, Californian thistle
USDA Code: CIAR4
Legal Status: Colorado Noxious List B (top ten worst).

Keys to Identification:
- Purple flowers form in clusters of 1-5 per branch.
- The floral bracts of Canada thistle are spineless.
- Small heads, vanilla scent

Identification
Growth form: Perennial forb.
Flower: Flower heads are white to purple and borne in clusters of 1-5 per branch, with a strong vanilla scent. Heads are only about 1cm in diameter.
Seeds/Fruit: One-seeded fruits (achenes) are straw or light brown in color, straight or slightly curved (Moore 1975).
Leaves: Leaves are spiny, alternate, oblong or lance-shaped, with the base leaves stalkless and clasping, or extended down along the stem.
Stems: Mature plants range from 2-4 feet in height.
Roots: Canada thistle has two types of roots, horizontal and vertical. The horizontal roots produce numerous shoots, while vertical roots store water and nutrients in their many small branches.
Seedling: Early spring growth appears as rosettes with spiny-tipped, wavy leaves.
Other: The floral bracts of Canada thistle are spineless.

Similar Species
Exotics: Bull thistle (*Cirsium vulgare*); flower bracts are somewhat tapered and covered with spines. Scotch thistle (*Onopordum acanthium*); stems appear the have wings, floral bracts are covered with spines. Plumeless thistle (*Carduus acanthoides*); floral bracts are covered with sharp spines. Musk thistle (*Carduus nutans*); floral bracts are broad with spiny tips. Russian knapweed and Canada thistle are often confused.
Natives: Wavyleaf thistle (*Cirsium undulatum*): flower bracts often have a prominent white glandular dorsal ridge (often sticky to touch) and minutely hairy margins (Whitson et al. 1996). Leafy thistle (*Cirsium foliosum*): the leaves surrounding the terminal flowers are pink to white. Yellowspine thistle (*Cirsium ochrocentrum*): flower bracts are covered with cobweb-like hairs and have a spreading yellow spine at the tip. The tall biotype of Colorado thistle *(Cirsium coloradense)* and *Cirsium traceyi* are also similar. Most native thistles are more hairy and lighter green/blue in color. Canada thistle is comparatively darker green.

Impacts
Agricultural: Canada thistle is an aggressive, creeping, perennial weed. It infests crops, pastures, rangelands, roadsides, and riparian areas (Beck 1996).
Ecological: Canada thistle spreads rapidly through horizontal roots, which give rise to shoots (Moore 1975). Its root system can be extensive, growing horizontally as much as 18 feet in one season (Nuzzo 1998). Most Canada thistle patches spread at a rate of 3-6 feet/year, crowding out more desirable species and creating thistle monocultures.
Human: Spiny thickets of Canada thistle can restrict recreational access to infested areas.

Habitat and Distribution

General requirements: Canada thistle thrives in the Northern Temperature Zone due to its day length response and a high temperature limitation on growth (Haderlie et al. 1991). Although Canada thistle mainly invades disturbed areas, it does invade native plant communities, open meadows (including wetlands), and ponderosa pine savanna (Rutledge and McLendon 1998). Canada thistle is adapted to a wide range of soil types and environmental conditions (FEIS 1996). It is best adapted to rich, heavy loam, clay loam, and sandy loam, with an optimum soil depth of 20 inches (FEIS 1996, Rutledge and McLendon 1998). Canada thistle can tolerate saline soils (up to 2% salt) and wet or dry soil (Rutledge and McLendon 1998). However, it does not tolerate waterlogged or poorly aerated soils. Canada thistle usually occurs in 17-35 inch annual precipitation zones or where supplemental soil moisture is available (Beck 1996). Canada thistle is also somewhat shade intolerant. It can grow along the edge of forested areas, but is rarely found within forests.

Distribution: Canada thistle is common found along roadsides, fields, pastures, meadows, and other disturbed areas statewide in Colorado (FEIS 1996, Rutledge and McLendon 1998). In Colorado, Canada thistle is typically found from 4,000-9,500 feet. Canada thistle is found throughout the northern half of the United States and lower portions of Canada.

Historical: Canada thistle is a native of southeastern Eurasia. It was introduced to Canada as a contaminant of crop seed as early as the late 18th century. Since its introduction, it has spread throughout North America (Whitson et al. 1996).

Biology/Ecology

Life cycle: Over-wintering roots develop new underground roots and shoots in January and begin to elongate in February (Nuzzo 1998). Shoots emerge between March and May, when mean weekly temperatures reach 5° C, and form rosettes (Nuzzo 1998). Early in the spring, plants remain near the soil surface until long days (over 14 hours of light) trigger flowering and stem elongation (Haderlie et al. 1991, FEIS 1996). Canada thistle is dioecious (male and female flowers are produced on separate plants). Female flowers can be readily distinguished from male flowers by the absence of pollen (abundant in male flowers) and presence of a distinct vanilla-like fragrance. Flowering occurs from June to October in Colorado (Rutledge and McLendon 1998). Seeds mature July to October.

Mode of reproduction: Canada thistle reproduces primarily vegetatively through creeping horizontal roots, and can quickly form dense stands. Every piece of the root system is capable of forming a new plant (Rutledge and McLendon 1998). This allows dense monocultures of Canada thistle to form even without seed production. Canada thistle growth is limited or stopped when temperatures exceed 30° C for extended periods of time.

Seed production: A female Canada thistle plant can produce up to 5,200 seeds in a season, but the average is about 1,500 seeds/plant (Rutledge and McLendon 1998).

Seed bank: Mature seeds germinate most readily in mid-spring. Seeds that do not germinate may remain dormant for several years but most studies indicate that the majority of seeds do not remain viable after three years of burial (Rutledge and McLendon 1998).

Dispersal: Seeds are distributed by wind.

Hybridization: No information available.

Control

Keys to Control:
- Eliminate seed production.
- Reduce the plant's nutrient reserves through persistent management.

Biocontrol: Currently, there is no single biological control agent that effectively controls Canada thistle. However, there are several agents that have been reported to provide very limited control. One species, *Urophora cardui* (a gall fly), may be available for redistribution from the Division of Plant Industry's Biological Pest Control Section.

Mechanical: Mowing pastures and hay meadows can be an effective control if it is repeated at about one-month intervals throughout the growing season. Combining mowing with herbicides will further enhance control of Canada thistle. However, a recent study (Beck and Sebastian 2000) found that mowing or mowing+herbicide was only effective where the root system of Canada thistle is restricted by a high water table, such as near rivers or sub-irrigated meadows.

Fire: Prescribed burning in the spring has been proposed as a means of slowing the spread of Canada thistle. Such fires could reduce the number of mature plants, decrease seed production, and stimulate the growth of native grasses (FEIS 1996).

Herbicides: Chemical control of Canada thistle should be conducted in the spring or fall depending on local environmental conditions. In general, fall treatments are more effective as herbicide absorption is enhanced in the

late summer and fall when shoot to root translocation is the greatest. However, translocation of the herbicide is dependent on moist soil conditions. If fall is a dry period in your area, a spring application around the flower bud stage (early June), when root carbohydrate reserves are at their lowest, is recommended.

Clopyralid + 2,4-D (commonly sold as Curtail®) applied at a rate of 2-3 quarts/acre will effectively control Canada thistle. Curtail should either be applied in the late spring (when Canada thistle plants are entering the bud growth stage) or in the fall (October) when Canada thistle roots are actively growing. The performance of Curtail can be improved when proceeded by two or three mowings under conditions when the root systems are restricted (Beck 1996, Beck and Sebastian 2000). Begin mowing when Canada thistle is 12-15 inches tall and repeat at about one month intervals (Beck 1996). Apply Curtail in October or about one month after the last mowing. Clopyralid alone can be applied at a rate of 2/3 to 1 pint/acre in the spring or fall. Spring applications should be timed to the rosette to bud growth stages. 2,4-D or picloram are effective when applied at a rate of 1 lb. ai/acre in the spring when Canada thistle is in the pre-bud to early bud growth stages (about 10-15 inches tall). For increased control, retreat with dicamba (1 lb. ai/acre) in the fall to prevent regrowth of plants.

Cultural/Preventive: Reduce the spread of Canada thistle seeds by always purchasing "weed free" seeds. Quickly eliminate new seedlings before they have a chance to form a well-developed root system.

Integrated Management Summary

The tendency of this species to grow in wet areas may restrict the use of certain herbicides. Control efforts should target Canada thistle plants in high-quality areas first (typically areas that contain mostly native species and few undesirable species), and then work on controlling lower quality areas (areas that are already infested with undesirable species and have fewer desirable species present). Management strategies should be adjusted to reflect weather conditions (Nuzzo 1998). For example, drought stress reduces the effectiveness of most herbicides, but increases the effectiveness of mechanical controls (e.g., mowing or burning). It takes at least two years of control to determine whether a particular method is effective. Several studies have recorded a temporary decline in Canada thistle in the first year of control followed by a return to the pre-treatment conditions the second growing season (Nuzzo 1998). For one example of Canada thistle control, see page 60.

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Bull thistle

Cirsium vulgare (Savi) Tenore

Family: Asteraceae (Composite)
Other Names: common thistle, spear thistle, fuller's thistle
USDA Code: CIVU
Legal Status: Colorado Noxious List A (general weeds)

Keys to Identification:
- Bull thistle can be distinguished from other thistles by rubbing the upper surface of its leaves. Bull thistle leaves are prickly hairy above and cottony below.
- Bull thistle has stiff pointy spines on its leaf tips and spine-tipped, purple flower heads.

Identification
Growth form: Biennial forb.
Flower: Flowers are 1.5-2 inches wide and clustered at the ends of branches. The flower bracts are somewhat tapered and covered with spines (Whitson et al. 1996). Flowers are pinkish to dark purple.
Seed/Fruit: Seeds are capped with a circle of plume-like white hairs.
Leaves: Leaves are alternate. Bull are the only thistles in Colorado that are prickly hairy on the top surface of the leaves. They are cottony-hairy on the undersides.
Stems: In mature plants the leaves extend down, clasping the stem and are divided into segments (i.e. strongly decurrent).
Roots: Has a short, fleshy taproot with several primary roots extending from the root crown. Each bears a number of smaller lateral roots.
Seedlings: Seed leaves (cotyledons) are round to spatulate, and smooth. First true leaves are oval to spatulate with spines and a rough, bumpy surface (Carey et al. 1993). First year plants form a rosette with leaves easily distinguished from other thistles by the above leaf characteristics.
Other: Mature plants range between 2-5 feet tall with many spreading branches and (Whitson et al. 1996).

Similar Species
Exotics: Bull thistle is similar to other thistles (*Breea, Carduus, Cirsium* and *Onopordum* genera) but can be distinguished by flower size, bract appearance and leaf surfaces. In rosette form it can be readily distinguished by the prickly upper surface of its leaves.
Natives: There are many native *Cirsium* species, some common (like *Cirsium undulatum*) some rare (like *Cirsium perplexans*). The natives generally do not have leaves clasping the stem all the way from node to node (strongly decurrent leaves), and many have hairy upper and lower leaf surfaces and are blue-green or gray in color.

Impacts
Agricultural: Heavy infestations can exclude livestock from areas. Additionally, the presence of bull thistle in hay decreases the forage value and lowers the market price (Zimmerman 1997). It is an aggressive weed, but it will not survive where cultivation has cut back its stem and destroyed its root system (FEIS 1996).
Ecological: Bull thistle is often a transient species, appearing in recent clear cuts or disturbed areas and becoming a dominant species for several years (Rees et al. 1996).
Human: Bull thistle has been reported to cause hay fever in some individuals (FEIS 1996).

Habitat and Distribution

General requirements: Bull thistle grows in dry to moist habitats. It thrives on nitrogen-rich soils, and it grows on gravelly to clay-textured soils. Bull thistle cannot withstand deep shade, and is nearly absent if light is reduced to less than 40% of full sunlight (FEIS 1996). Potential habitats include pastures, overgrazed rangeland, roadsides, and logged areas.

Distribution: Distribution within Colorado is not well known, but it is certainly found along the Front Range, as well as throughout the Western Slope (A. Green, pers. comm.) In Colorado, bull thistle is most often found between 5,000-10,800 feet in elevation. It is widespread throughout the United States and parts of Canada.

Historical: Bull thistle was introduced to North America as a seed contaminant and is now widespread.

Biology/Ecology

Life cycle: During the first year following germination a basal rosette is formed. The rosette grows until winter, partly dies back, and begins to grow again in early spring (FEIS 1996). Age at bolting is dependent upon plant size and almost all plants require a period of cold temperature to bolt. Flowering occurs from July through September. After flowering and seed production, the plant dies.

Mode of reproduction: Bull thistle reproduces solely by seeds.

Seed production: Mature plants can produce up to 4,000 seeds per plant (Zimmerman 1997).

Seed bank: Seeds have little dormancy, and germinate rapidly whenever conditions are favorable, usually in the spring and fall (FEIS 1996). Although most of the seeds on or near the surface do not remain viable for more than a year, seeds that are buried at a depth of 5 inches may remain viable for up to three years (Zimmerman 1997).

Dispersal: Seeds are capped with a circle of plume-like white hairs and can be windblown for long distances. However, it has been found that 65% of the seeds land within two meters of the parent plant (Zimmerman 1997). Seeds are also likely to be spread by birds, especially goldfinches.

Hybridization: There is no information available on hybridization with other thistles.

Control

Biocontrol: The bull thistle seedhead gall fly (*Urophora stylata*) can reduce seed production up to 80% in some areas (Zimmerman 1997). This agent has been established in Colorado, and prefers open meadows (Rees et al. 1996). However, this species is currently unavailable for redistribution by the Division of Plant Industry's Biological Pest Control Section. Due to its spiny stems and leaves, bull thistle is unpalatable to most livestock (FEIS 1996). However, sheep will graze on bull thistle seedlings or small rosettes.

Keys to Control:

- Kill bull thistle plants after they have bolted, but before plants have flowered.
- Repeat control for several years to deplete the bank of thistle seeds in the soil.

Mechanical: Cutting, mowing, and/or severing the taproot just below the root crown before seed set will eliminate current year seed production, and if continued annually, eliminate an infestation. The best time to cut is late in the season when most of the plants have bolted, but before a significant number have flowered (FEIS 1996). Plants will re-bolt if they are mowed too early. Cutting again a month after the first sweep will eliminate any late bolting plants, and improve the effectiveness of the procedure.

Fire: No information available.

Herbicides: Spot applications of picloram at 0.5 lb., dicamba or 2,4-D at 1 lb. ai/acre will provide effective control. Glyphosate at 1.5 lb. ai/acre is another herbicide that can be used to provide some control of bull thistle. Herbicides should be applied in rosette stage or after mowing as the plant becomes more tolerant of herbicides once the flower stalk is produced (FEIS 1996).

Cultural/Preventive: Minimize disturbance and establish healthy stands of tall grasses or forbs to outcompete bull thistle.

Integrated Management Summary

Bull thistle does not tolerate shade and therefore does not compete well in areas that are populated by tall grasses and forbs. Improving the health of a natural area, and guarding against disturbance or overuse, can be a good preventive measure against bull thistle. Apply herbicides to rosettes in early spring (May, June), and then mow or sever taproots after the plants have bolted but before flowering (probably late June to July). A second mowing or cutting is suggested a month later to pick up late bolting plants. Do not cut or spray if using seedhead biocontrols.

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=List C

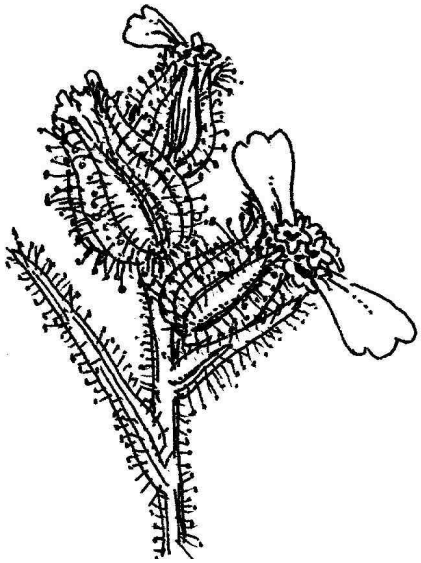
Coast tarweed

Madia sativa Molina

Family: *Asteraceae* (Sunflower)
Other Names: Chilean tarweed
USDA Code: MASA
Legal Status: Colorado Noxious List C (new in Colorado – call your county weed supervisor!)

Keys to Identification:
- Coast tarweed can be identified by the sticky resin with a strong disagreeable scent (like gasoline or turpentine) present on the entire plant.
- Ray flowers are short and yellow.

Identification
Growth form: Annual forb.
Flower: Flowering heads are partially enclosed by leaves and clustered at the apex of the stem, at the ends of branches, and in the leaf axils.
Seeds/Fruit: Seeds are slender, light-gray, gray, or black.
Leaves: Leaves are alternate, narrow and lance-shaped.
Stems: Mature plants are up to 5 feet tall. Stems are erect, leafy, simple or branching.
Roots: No information available.
Seedling: No information available.
Other: The entire plant is sticky, hairy and has a disagreeable odor. It is called tarweed due to its sticky, glandular texture.



Similar Species
Exotics: *Madia glomerata*, a roadside alien weed.
Natives: None known.

Impacts
Agricultural: No information available.
Ecological: The weedy nature of coast tarweed and fact that it is self-compatible facilitate the establishment and spread of the plant (Zardini 1992).
Human: No information available.

Habitat and Distribution
General requirements: Coast tarweed occurs along roadsides, in disturbed areas, dry hillsides, and overgrazed rangeland (Whitson et al. 1996).
Distribution: Coast tarweed was introduced from South America or western North America and can now be found from Washington to California (Whitson et al. 1996, Zardini 1992). Current distribution in Colorado is unknown.
Historical: Coast tarweed seeds have historically been used as a source of oil and its potential as a commercial oil crop is being studied (Scmeda-Hirshmann 1995).

Biology/Ecology
Life cycle: Coast tarweed is a self-compatible, annual plant that is capable of rapid establishment in disturbed areas. It blooms from July to September.
Mode of reproduction: Reproduces by seeds.
Seed production: It is a prolific seed producer.
Seed bank: No information available.
Dispersal: No information available.

Hybridization: No information available.

Control

Biocontrol: None known.
Mechanical: Coast tarweed plants can be cut or pulled prior to seed set. Destroy seedling plants that emerge from the soil seed bank.
Fire: No information available.
Herbicides: Herbicides should be applied to seedlings. The hairy, glandular coating of mature tarweed plants often provides protection from herbicide absorption.
Cultural/Preventive: Prevent the establishment of new infestations by minimizing disturbance and seed dispersal, eliminating seed production and maintaining healthy native communities.

Keys to Control:
- Maintain a healthy cover of perennial plants.
- Re-seed controlled areas with desirable species.

Integrated Management Summary

As an annual plant which reproduces by seeds, coast tarweed can be controlled by eliminating seed production until the soil seed bank is depleted. Cut/pull or treat plants with herbicide prior to seed set. It is not yet widely established in Colorado, so the most important control is to be on the lookout for it and prevent new infestations. If infestations are discovered, they should be controlled immediately, and all seed production prevented.

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=List C

Orange hawkweed

Hieracium aurantiacum L.

Family: *Asteraceae* (Sunflower)
Other Names: devil's paintbrush
USDA Code: HIAU
Legal Status: Colorado Noxious List C (new in Colorado – call your county weed supervisor!)

Keys to Identification:
- Leaves are basal, spatulata shaped, and covered with stiff hairs.
- Flowering heads are clustered at the top of the leafless stems and have orange to red petal-like ray flowers with notched tips.

Identification
Growth form: Perennial forb.
Flower: Flowering heads are clustered at the top of the leafless stems and have orange to red petal-like ray flowers with notched tips.
Seeds/Fruit: Achenes (one-seeded fruits) are small (about 1/16 inch long), dark brown or black, have ridges and bristly plumes.
Leaves: Leaves are mostly basal, spatulata shaped, and covered with stiff hairs.
Stems: Stems are 6-18 inches tall, with stiff hairs.
Roots: Fibrous root system. Stolons root at nodes.
Seedling: Seedling leaves have bristly hairs.
Other: Plants contain milky juice.

Similar Species
Exotics: The yellow flowered hawkweeds *Hieracium pratense* and *H. pilosella* are similar, but do not yet occur in Colorado.
Natives: Native hawkweeds in the genus *Chlorocrepis*, as well as the false dandelions, *Agoseris* spp. could be mistaken for orange hawkweed.

Impacts
Agricultural: Hawkweed is not normally competitive with crop species (Callihan et al. 1997).
Ecological: Although new populations of orange hawkweed likely originate from seeds, established populations expand largely through vegetative growth by stolons. A patch will quickly expand to cover an area with a solid mat of rosettes which crowd out other species (Callihan et al. 1997)
Human: No information available.

Habitat and Distribution
General requirements: Generally found in mountain meadows and clearings, or other open areas such as pastures and hayfields. Orange hawkweed prefers well drained coarse-textured soils (Wilson et al. 1997).
Distribution: Present in five known locations in Colorado including Douglas, Jefferson, Pitkin, and Eagle Counties as well as Rocky Mountain National Park. Elevations range from 5,000-10,500 feet and it appears to favor open and forested areas.
Historical: Native to Europe.

Biology/Ecology

Life cycle: Perennial plants that form rosettes in spring and early summer, and spread primarily by stolons. Plants flower in June-July and quickly produce seed. Plants overwinter as rhizomes, and regrow the next spring (Wilson et al. 1997).
Mode of reproduction: Reproduces by seeds, stolons, and rhizomes.
Seed production: Each flowering stem may produce several hundred seeds.
Seed bank: No information available.
Dispersal: Believed to be spread primarily by recreationists, pack animals, and hay. Although seeds are plumed, they are not widely dispersed by wind (Wilson et al. 1997).
Hybridization: No information available.

Control

Biocontrol: None known.
Mechanical: Small infestations can be carefully dug out by hand, taking care not to scatter root and stolon parts from which the plant can regrow. Mowing will prevent seed production, but encourages increased vegetative reproduction
Fire: No information available.
Herbicides: Dicamba at 0.25 to 0.75 lb. ai/A. is listed for control of orange hawkweed in established lawns and turf. Spring treatments are recommended (Callihan et al. 1997)
Cultural/Preventive: Prevent the establishment of new infestations by minimizing disturbance and seed dispersal, eliminating seed production and maintaining healthy native communities.

Keys to Control:
- Maintain a healthy cover of perennial plants.
- Re-seed controlled areas with desirable species.

Integrated Management Summary

This type of perennial, which spreads primarily by vegetative reproduction, can be difficult to control once it is established. Integrated management strategies should focus on detecting and eradicating infestations as early as possible, and on implementing land use practices which promote a healthy cover of perennial vegetation.

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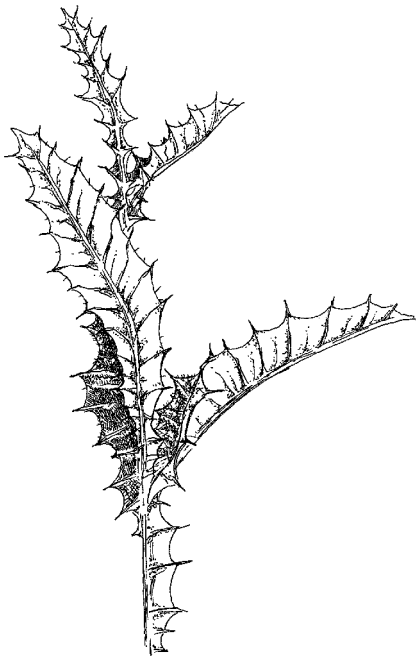
Scotch thistle

Onopordum acanthium L. and ***O. tauricum*** L.

Family: *Asteraceae* (Sunflower)
Other Names: cotton thistle, winged thistle
USDA Code: ONAC, ONTA
Legal Status: Colorado Noxious List A (general weeds)

Keys to Identification:
- Scotch thistle can be distinguished from other thistles by its large size, and by the spiny wings attached to the stems and the dense, fine hair that give it a characteristic grayish-blue or blue-green color.
- Rosettes often have huge, broad leaves.

Identification
Growth form: Perennial forb.
Flower: Flower heads are numerous, 1-2 inches in diameter, with spine-tipped bracts. Flowers are violet to reddish.
Seeds/Fruit: One-seeded fruit (achene) is wrinkled, brown to grayish-black, tipped with a plume (pappus) of slender bristles (Stubbendieck et al. 1995).
Leaves: Leaves are alternate, very large, irregularly lobed, and have sharp yellow spikes. Rosette leaves may be up to 2 feet long and 1 foot wide (Whitson et al. 1996). Upper and lower leaf surfaces of *O. acanthium* are covered with a thick mat of cotton-like or woolly hairs, giving the foliage a gray-green color (Dewey 1991).
Stems: Mature plants can grow up to 12 feet tall, and have a large, fleshy taproot. Stems are numerous, branched, and have broad spiny wings.
Roots: Thick fleshy taproot.
Seedling: No information available.



Leaves

Similar Species
Exotics: *Onopordum acanthium* is the predominant Scotch thistle species in the western United States and is characterized by its hairy leaves (Beck 1991). A hairless species, *Onopordum tauricum*, also occurs but much less frequently, mostly in the Arkansas River drainage in Colorado (Beck 1991).
Natives: There are many native thistle species (in the genus *Cirsium*). The natives generally do not have leaves clasping the stem all the way from node to node (strongly decurrent leaves), and many have hairy upper and lower leaf surfaces and are blue-green or gray in color.

Impacts
Agricultural: Scotch thistle is an aggressive plant that is competitive with desirable native forage species. It can form dense stands that are impenetrable to livestock.
Ecological: No information available.
Human: No information available.

Habitat and Distribution
General requirements: Scotch thistle is often found along roadsides, irrigation ditches, waste areas and on rangelands. The seeds contain a water-soluable germination inhibitor, so Scotch thistle is particularly successful in moist areas that are adjacent to riparian or sub-irrigated deeper soils along stream courses, lower alluvial slopes and bottomlands.
Distribution: Occurs sparsely over much of the United States. It is increasing throughout Colorado.

Historical: Native to Eurasia.

Biology/Ecology

Life cycle: Scotch thistle is a biennial that produces a large, ground level rosette the first year, and a tall, spiny plant the second. Flowering occurs from mid-June to September.
Mode of reproduction: Scotch thistle reproduces by seed.
Seed production: One plant produces70-100 flowering heads containing 100-140 seeds per head (Young and Evans 1969).
Seed bank: Seeds may remain viable in the soil for over 30 years.
Dispersal: Plumed seeds can be dispersed by attaching to clothing and animal fur. Seeds may be transported in hay and machinery, and seed heads may be carried by wind and water.
Hybridization: No information available.

Control

Biocontrol: None known.
Mechanical: As with other perennial forbs, mechanical controls such as mowing or hand cutting are most effective in combination with other methods. Plants can regrow from severed roots, and cut stems may still produce viable seed.
Fire: No information available.

Keys to Control:
- Scotch thistle is best controlled in the rosette stage.
- Sever the taproot of Scotch thistle 1-2 inches below the ground.

Herbicides: Picloram at 0.25 lb., dicamba at 0.5 lb., or 2,4-D at 1 lb., clopyralid at 0.2 lb. ai/acre, or a combination of dicamba+2,4-D, or clopyralid+2,4-D are commonly used to control Scotch thistle. Herbicides should be applied in spring before Scotch thistle bolts or in the fall to rosettes (Beck 1991). Metsulfuron or chlorsulfuron are effective on Scotch thistle after bolting begins (Beck 1999). Herbicide rates will vary depending upon stand density and environmental conditions (Beck 1991).
Cultural/Preventive: No information available.

Integrated Management Summary

Scotch thistle is best controlled in the rosette stage. Scotch thistle can be controlled by severing its taproot 1-2 inches below the ground. Control can be enhanced by a follow-up application of herbicides to the surviving rosettes. One integrated approach to Scotch thistle management involves 1) managing livestock grazing to increase grass vigor and reduce bare ground; 2) spray rosettes with clopyralid or 2,4-D; 3) re-seed treated ground with competitive desirable plants in the fall after spraying; 4) follow-up with spot cutting of entire plants when first flowers appear annually for several years to deplete the seed bank in the soil.

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Common groundsel

Senecio vulgaris L.

Family: *Asteraceae* (Sunflower)
Other Names: old-man-in-the-spring
USDA Code: SEVU
Legal Status: Colorado Noxious List A (general weeds)

Keys to Identification:
- Common groundsel has numerous yellow disk flowers with black-tipped floral bracts.

Identification
Growth form: Annual, winter annual or sometimes biennial forb.
Flower: Flower heads are numerous and have yellow disk flowers but no ray flowers. The floral bracts (phyllaries) are black-tipped.
Seeds/Fruit: Seeds have white hairs attached (like a dandelion) to promote wind dispersal.
Leaves: Leaves are alternate, coarsely and irregularly toothed or pinnately parted.
Stems: Mature plants have numerous stems up to 18 inches tall.
Roots: Small taproot with secondary fibrous root system.
Seedling: Seed leaves (cotyledons) and young leaves are purple on the underside.

Similar Species
Exotics: Woodland groundsel (*Senecio sylvaticus*) is similar in appearance to common groundsel but does not occur in Colorado.
Natives: Many native species in the genus *Senecio* or *Packera* can be confused with this species.

Impacts
Agricultural: Common groundsel is poisonous to cattle and horses.
Ecological: No information available.
Human: Contains pyrrolizidine alkaloids, which can cause irreversible liver damage and possibly death in humans.

Habitat and Distribution
General requirements: Common groundsel grows mainly in cultivated soil but may be found in pastures or along roadsides. It prefers cool, wet environments, and nutrient rich soils.
Distribution: Widely distributed throughout the United States.
Historical: Common groundsel is a native of Europe.

Biology/Ecology
Life cycle: Seeds germinate in late fall or early spring. Seedlings appear as tiny rosettes with sharply notched leaves that are purple on the underside. Common groundsel flowers from April through October. Seeds may mature in opened flowers even after the plants have been killed.
Mode of reproduction: Common groundsel reproduces solely by seed.
Seed production: No information available.
Seed bank: No information available.
Dispersal: Seeds are easily dispersed by wind.
Hybridization: No information available.

Control

Biocontrol: None known.

Mechanical: In croplands, tillage in fall and early spring will kill common groundsel seedlings. Common groundsel has a relatively small root system and is easy to pull. Small infestations can be pulled, and larger infestations can be cut or mowed.

Fire: No information available.

Herbicides: Common groundsel is somewhat tolerant of triazine and dinitroaniline herbicides. However, dicamba at 1 lb. ai/acre or glyphosate at 1.5 lb. ai/acre should provide adequate control.

Keys to Control:

- Eliminate seed production and destroy new seedlings as soon as they emerge.
- Re-seed controlled areas with desirable species.

Cultural/Preventive: Prevent the establishment of new infestations by minimizing disturbance and seed dispersal, eliminating seed production and maintaining healthy native communities.

Integrated Management Summary

Common groundsel invades disturbed areas and is easily outcompeted by native plants in healthy areas. Hence, good management practices in fields, pastures and natural areas, can be an effective way to prevent common groundsel infestation. Since it is a prolific seed producer, it is important to control common groundsel before flowering and seed set. A combination of mechanical and chemical controls can be used to eliminate seed production until the seed bank is depleted.

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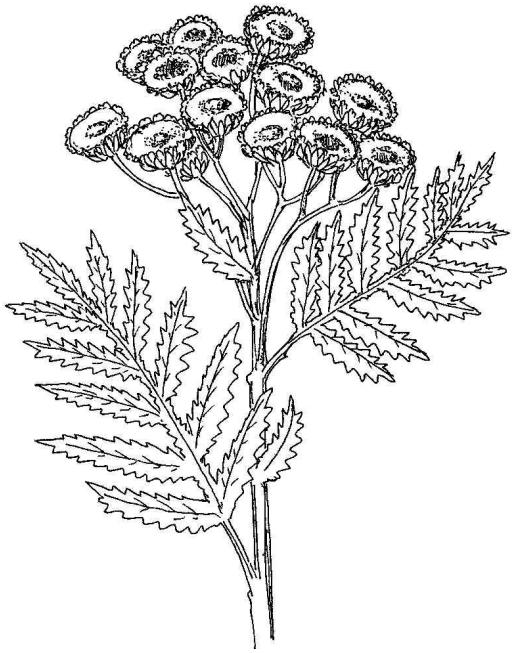
Common tansy

Tanacetum vulgare L.

Family: *Asteraceae* (Sunflower)
Other Names: garden tansy
USDA Code: TAVU
Legal Status: Colorado Noxious List A (general weeds)

Keys to Identification:
- Flower heads contain buttonlike flowers without ray flower "petals".
- Stems are often purplish-red in color.



Identification
Growth form: Perennial forb.
Flower: Yellow flowers are numerous in flat-topped dense clusters at the tops of the plants. Buttonlike flower heads lack ray flowers.
Seeds/Fruit: Seeds are yellowish brown achenes with short, five-toothed crowns.
Leaves: Leaves are alternate, deeply divided into numerous narrow, individual leaflets.
Stems: Mature plants are 1.5 to 6 feet tall. Stems are often purplish-red in color.
Roots: Rhizomatous.
Seedling: No information available.
Other: Rank smelling foliage.

Similar Species
Exotics: None known.
Natives: None known.

Impacts
Agricultural: Common tansy is considered undesirable forage for livestock. Although the plant may be toxic, animals rarely ingest it.
Ecological: May displace native, more desirable species.
Human: Can be toxic if large quantities are consumed.

Habitat and Distribution
General requirements: Common tansy is commonly found along roadsides, stream banks, in waste places, and in pastures. It grows best in full sun and on fertile, well-drained soil.
Distribution: Found throughout the United States.
Historical: Common tansy is a native of Europe that was introduced into North America as an ornamental and medicinal herb (Whitson et al. 1996). It has been used over the centuries for treating various ailments and as an insect repellent.

Biology/Ecology
Life cycle: Flowering typically occurs from July to September.
Mode of reproduction: Reproduces by both seed and creeping rootstocks.
Seed production: No information available.
Seed bank: No information available.
Dispersal: No information available.
Hybridization: No information available.

Control

Biocontrol: None known.

Mechanical: Common tansy can be mowed before flowering and seed set to eliminate seed production. This method may have to be repeated to eliminate regrowth from the rootstocks.

Fire: No information available.

Herbicides: Picloram or dicamba at 1 lb. ai/acre, or glyphosate at 1.5 lb. ai/acre can be used to control common tansy. The best time for treatment is between the early flower (bud) to bloom stage (Dow AgroSciences 1998).

Keys to Control:
- Eliminate seed production and vegetative reproduction from creeping rootstocks.
- Re-seed controlled areas with desirable species.

Cultural/Preventive: Prevent the establishment of new infestations by minimizing disturbance and seed dispersal, eliminating seed production and maintaining healthy native communities.

Integrated Management Summary

As with other rhizomatous perennials, mechanical controls such as mowing or hand cutting are most effective in combination with other methods. Plants can regrow from severed roots, and cut stems may still produce viable seed. Control the spread of common tansy by preventing seed production and dispersal, minimizing the spread of cut rootstocks, and establishing healthy stands of desirable species on controlled areas.

References

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