GOOSE HAVEN RESERVOIR COMPLEX EXPANSION #2, #4
WEED MANAGEMENT PLAN

Prepared For:
The City of Lafayette
&
Rock Product of Colorado LLC

Prepared By:
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P.O. Box 18087
Boulder, CO 80308

November 2016

1.0 MANAGEMENT AREAS

The weed management areas in this operation vary depending upon the phase of operation. The following areas are therefore differentiated as Mining Weed Management Areas and Reclamation Weed Management Areas;

1.1 MINING WEED MANAGEMENT AREAS

This weed management area includes of all ground within the Affected Area of the permit. The main areas that weeds tend to propagate at active sand and gravel mining sites are the topsoil and overburden stockpile areas as well as ground that has been disturbed by earthmoving equipment (side of road cuts, areas partially stripped etc.) The active mine sites tend to be less suitable for plant growth and therefore less of a concern.

1.2 RECLAMATION WEED MANAGEMENT AREAS

An important goal of reclamation following final grading is the establishment of vegetative cover to stabilize soils. Those areas identified in Exhibit F – Reclamation Plan Map for topsoil replacement/ revegetation. Weeds will also compete with planted grasses in the revegetation areas, therefore the revegetation areas will also become the primary weed management areas during and following reclamation.

2.0 WEED INVENTORY

2.1 EXISTING WEED INVENTORY

An initial weed inventory shall be conducted utilizing the fact sheets given in Appendix I for identification. The findings shall be recorded on the weed inventory sheet and map found in Appendix II. Weed areas shall be numbered on the map and the corresponding number shall be listed on the sheet.

3.0 WEED MANAGEMENT ACTIONS

3.1 WEED MANAGEMENT DURING MINING

Weed management during mining phases shall be performed at a minimum of once during the 1st quarter of the year twice during the second and third quarters and once in the fourth quarter. Weed management shall be performed by first performing a weed inventory as indicated above. If significant weeds are found, then application of herbicide as specified in the fact sheets for the given weed species shall be performed. If no significant colonies of weeds are found, then no action will be taken.

3.2 WEED MANAGEMENT DURNING RECLAMATION

Following the establishment of vegetation in those areas identified for revegetation shown on Exhibit F, the primary weed control mechanism shall be mowing. Weed inventories and herbicide applications shall occur if needed as described in Section 3.1 above for 1 year following revegetation.

4.0 MONITORING

Monitoring is an essential component of weed management and as such has been included as part of weed management actions above (Section 3.0) in the form of weed inventories which shall be conducted once during the first quarter of each year followed by twice in the second and third quarters and one in the fourth quarter during the mining phases. For reclamation, monitoring of shall occur on the same schedule for 1 year following revegetation.

Key to Appendix I Fact Sheets

Common Name	Scientific Name	Pages - Appendix I
Bull Thistle	*Cirsium vulgare*	1-2
Canada Thistle	*Cirsium arvense*	3-4
Common Teasel	*Dipsacus spp*	5-6
Dalmatian Toadflax	*Linaria dalmatica*	7-8
Diffuse Knapweed	*Entaurea diffusa*	9-10
Field Bindweed	*Onvolvulus arvensis*	11-12
Hoary Cress	*Cardaria draba*	13-14
Hounds tongue	*Cynoglossum officianale*	15-16
Leafy Spurge	*Euphorbia esula*	17-18
Mediterranean Sage	*Salvia aethiopis*	19-20
Musk Thistle	*Carduus nutans*	21-22
Myrtle Spurge	*Euphorbia myrsinites*	23-24
Perennial Pepperweed	*Lepidium latifolium*	25-26
Perennial Sowthistle	*Sonchus arvensis*	27-28
Plumeless Thistle	*Arduus acanthoides*	29-30
Purple Loosestrife	*Lythrum salicaria*	30-31
Russian Knapweed	*Acroptilon repens*	32-33
Russian Olive	*Elaeagnus angustifoilia*	34-35
Sat Cedar	*Tamarix spp.*	36-37
Scotch Thistle	*Onopordum acanthium or O. tauricum*	38-39
Spotted Knapweed	*Centaurea stoebe*	40-41
Yellow Starthistle	*Centaurea solstitialis*	42-43

APPENDIX I

List B Species

Rangeland, pasture, and riparian site recommendations

1

Bull thistle

Colorado Department of Agriculture

305 Interlocken Pkwy
Broomfield, CO 80021

(303) 869-9030
weeds@state.co.us

Key ID Points

1. Leaves are prickly-hairy above and cottony below.
2. Heads cobwebby-pubescent (hairy).
3. Flowers are composite and purple in color.

Updated on: 08/08

Bull thistle Identification and Management

Identification and Impacts

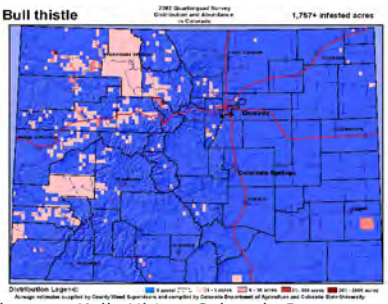
Bull thistle *(Cirsium vulgare (Savi) Tenore)* is a biennial forb that was introduced to North America as a seed contaminant and is now widespread. Gumdrop-shaped flowers are pinkish to dark purple in color and 1 ½ to 2 inches in diameter. The flower bracts are somewhat tapered and covered with spines. Seeds are capped with a circle of plume-like white hairs. Leaves are alternate. In Colorado, Bull thistles are the only species that are prickly hairy on the top and are cottony-hairy on the undersides of the leaves. In mature plants the leaves extend down, clasping the stem and are divided into segments. The plant has a short, fleshy taproot with several primary roots extending from the root crown. Seed leaves are round to spatulate, and smooth. Mature plants can produce up to 4,000 seeds per plant.

Habitats for Bull thistle include dry to moist environments. It thrives on nitrogen-rich soils, and it grows on gravelly to clay-textured soils. Bull thistle cannot withstand deep shade and is commonly seen in areas such as pastures, overgrazed rangeland, roadsides, and logged areas. Within Colorado Bull thistle infestations have been reported to occur in nearly all counties west of the continental divide, this plant has also been observed in the Upper Arkansas Watershed and in pockets on the plains. It is widespread throughout the United States and parts of Canada.

Heavy infestations can reduce livestock forage. Additionally, the presence of bull thistle in hay decreases the forage value and lowers the market price. It is an aggressive weed, but it will not withstand cultivation. Bull thistle is often a transient species, appearing in recent clear cuts or disturbed areas and becoming a dominant species for several years. It has been reported to cause hay fever in some individuals and is often confused with musk thistle.

The key to effective control of Bull thistle is maintaining healthy pastures and rangeland, guarding against disturbance or overuse, and as with most biennial limit seed production. To reduce seed production, plants with buds or flowers should be collected and immediately disposed of or destroyed. Chemical control is most effective when plants are in rosette stage, spring or early fall. Mechanical controls can be used to eliminate small patches or plants in a later growth stages. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

Bull thistle is designated as a "List B" species in the Colorado Noxious Weed Act. It is required to be either eradicated, contained, or suppressed depending on the local infestations. For more information visit www.colorado.gov/ag/weeds or call the State Weed Coordinator at the Colorado Department of Agriculture, Conservation Services Division, 303-239-4100.



Photos © Kelly Uhing, Colorado Department of Agriculture, map above by Crystal Andrews, Colorado Department of Agriculture,

Cirsium vulgare (Savi) Tenore

Management Recommendations

Bull thistle

CULTURAL
Prevent the establishment of new infestations by minimizing disturbance and seed dispersal, eliminating seed production and maintaining healthy native communities. Contact your local Natural Resources Conservation Service for seed mix recommendations. Maintain healthy pastures and prevent bare spots caused by overgrazing.

BIOLOGICAL
Urophora stylata, a fly predator, is used to help control this thistle. The female fly lays eggs in the seed head of the thistle. The maggot then consumes the seed in the flower. This species has overwintered in Colorado but the limited numbers will not allow for general redistribution. For more information, contact the Palisade Insectary of the Colorado Department of Agriculture at 970-464-7916.

MECHANICAL
Because biennial thistles do not reproduce from their roots, any mechanical or physical method that severs the root below the soil surface will kill the weed. It is necessary to revegetate the site with desirable plants. Tillage, hoeing, or even hand-pulling should be successful (not on rangeland), providing it is done before the reproductive growth stages.

Integrated Weed Management:

Prevention is the most effective control with Bull thistle, maintaining healthy pastures and rangeland and continually monitor your property for new infestations.

As with most biennials, limiting seed production is another key to controlling plant populations. Chemical and mechanical options to control Bull thistle are also effective.

HERBICIDES

NOTE: The following are recommendations for herbicides that can be applied to range and pasturelands. Rates are approximate and based on equipment with an output of 30 gal/acre. Please read label for exact rates. Always read, understand, and follow the label directions. The herbicide label is the LAW!

HERBICIDE	RATE	APPLICATION TIMING
Clopyralid (Transline or Stinger)	0.13 to 0.5	Apply to rosettes in spring or fall.
Clopyralid + 2,4-D (Curtail)	0.2 + 1.0 to 0.3 + 1.5	Apply to rosettes in spring or fall.
Dicamba (Banvel, Vanquish, or Clarity)	0.5 + 1.0	Apply to rosettes in spring or fall if good growing conditions exist.
2,4-D or 2,4-D + dicamba (Rangestar)	1.5 to 2.0 1.0 + 0.5	Apply to rosettes in spring.
Picloram (Tordon 22K *restricted use chemical)	0.13 to 0.25	Apply to rosettes in spring or fall.
Chlorsulfuron (Telar)	0.047 (0.75 oz ai)	Spring from bolting to bud stages; add a non-ionic surfactant
Metsulfuron (Escort XP)	0.019 (0.3 oz ai)	Spring from bolting to bud stages; add a non-ionic surfactant.

Canada Thistle Identification and Management

List B

Canada thistle (*Cirsium arvense*) is a non-native, deep-rooted perennial that spreads by seeds and aggressive creeping, horizontal roots called rhizomes. Canada thistle can grow 2 to 4 feet in height. The leaves are oblong, spiny, bright green, and slightly hairy on the undersurface. Unlike other noxious biennial thistles which have a solitary flower at the end of each stem, Canada thistle flowers occur in small clusters of 1 to 5 flowers. They are about 1 cm in diameter, tubular shaped, and vary from white to purple in color.

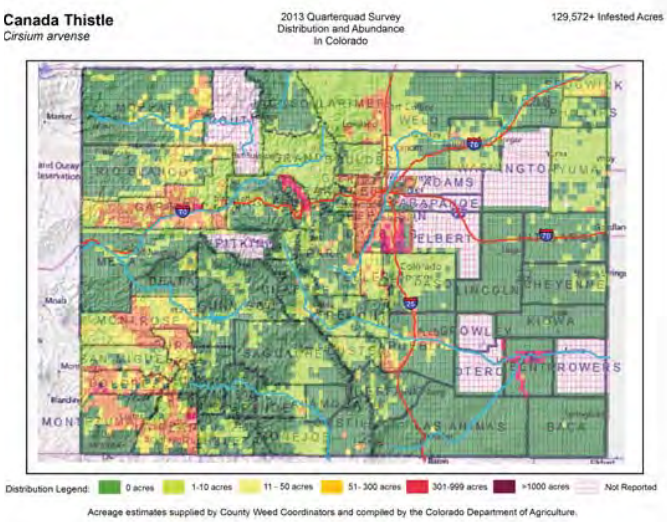
Canada thistle emerges from its root system from late April through May. It flowers in late spring and throughout the summer. It produces about 1,000 to 1,500 seeds per plant that can be wind dispersed. Seeds survive in the soil for up to 20 years. Additionally, Canada thistle reproduces vegetatively through its root system, and quickly form dense stands. Each fragmented piece of root, 0.25 inch or larger, is capable of forming new plants. The key to controlling Canada thistle is to eliminate seed production and to reduce the plant's nutrient reserves in its root system through persistent, long-term management.

Canada thistle is one of the most troublesome noxious weeds in the U.S. It can infest diverse land types, ranging from roadsides, ditch banks, riparian zones, meadows, pastures, irrigated cropland, to the most productive dryland cropland. Large infestations significantly reduce crop and cattle forage production and native plant species. It is a host plant to several agricultural pests and diseases. Canada thistle prefers moist soils, but it can be found in a variety of soil types. It has been found at elevations up to 12,000 feet.

Effective Canada thistle control requires a combination of methods. Prevention is the most important strategy. Maintain healthy pastures and rangelands, and continually monitor your property for new infestations. Established plants need to be continually stressed. Management options become limited once plants begin to produce seeds. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

Canada thistle is designated as a "List B" species as described in the Colorado Noxious Weed Act. It is required to be either eliminated, contained, or suppressed depending on the local infestations. For more information visit www.colorado.gov/ag/weeds and click on the Noxious Weed Program link or call the State Weed Coordinator at the Colorado Department of Agriculture, Conservation Services Division, (303) 869-9030.

2013 Quarter Quad Survey



Key ID Points

1. Cluster of 1-5 white to purple flowers on a stem.
2. Floral bracts are spineless.
3. Small flowers that are 1 cm in diameter.
4. Perennial, rhizomatous plant with spiny, oblong, green leaves.

Canada thistle

Cirsium arvense

List B

Canada thistle

Cirsium arvense

Integrated Weed Management Recommendations

Integrated weed management is imperative for effective Canada thistle control. This weed needs to be continually stressed, forcing it to exhaust root nutrient stores, and eventually die. Mowing or grazing can be followed up with herbicide application. Avoid hand-pulling and tilling which can stimulate the growth of new plants.

CULTURAL
Prevention is the best control strategy. Maintain healthy pastures , riparian areas, and rangelands. Prevent bare ground caused by overgrazing, and continually monitor your property for new infestations. Establishment of select grasses can be an effective control.

BIOLOGICAL
Cattle, goats, and sheep will graze on Canada thistle when plants are young and succulent in the spring. Follow up grazing with a fall herbicide application. Insects are available, and provide limited control. Currently, collection and distribution methods for Canada thistle rust (*Puccinia punctiformis*) are being refined. For more information on Canada thistle biocontrol, contact the Colorado Department of Agriculture - Palisade Insectary at (970) 464-7916.

MECHANICAL
Due to Canada thistle's extensive root system, hand-pulling and tilling create root fragments and stimulate the growth of new plants. Mowing can be effective if done every 10 to 21 days throughout the growing season. Combining mowing with herbicides will further enhance Canada thistle control.

CHEMICAL
The table below includes recommendations for herbicides that can be applied to rangeland and some pastures. Treatments may be necessary for an additional 1 to 3 years because of root nutrient stores. Always read, understand, and follow the label directions.

HERBICIDE	RATE	APPLICATION TIMING
Aminopyralid (Milestone)	5-7 oz/acre or 1 teaspoon/gal water	Apply in spring until flowering and/or to fall regrowth. Add 0.25% v/v non-ionic surfactant (equivalent to 0.32oz/ gal water or 1 qt/100 gal water). Can also add chlorsulfuron (Telar) at 1 oz/acre to the mix.
Aminoclopyrachlor + chlorsulfuron (Perspective)	5.5 oz product/acre + 0.25% v/v non-ionic surfactant	Apply in spring from rosette to flower bud stage and/or fall regrowth. Important: Applications greater than 5.5 oz product/acre exceeds the threshold for selectivity. DO NOT treat in the root zone of desirable trees and shrubs. Not permitted for use in the San Luis Valley.
Clopyralid + triclopyr (Prescott; others)	3 pints product/acre or 1.25 oz/gal water	Apply in spring until flowering and/or fall regrowth. Add 0.25% v/v non-ionic surfactant.

Colorado Department of Agriculture - Conservation Services
305 Interlocken Parkway
Broomfield, CO 80021
(303) 869-9030
www.colorado.gov/ag/weeds

Rev. 10/14

List B Species

Rangeland, pasture, and riparian site recommendations

1

Common

Dipsacus spp.

Colorado Department of Agriculture

305 Interlocken Pkwy
Broomfield, CO 80021

(303) 869-9030
weeds@state.co.us

Common teasel Identification and Management

Identification and Impacts

Common teasel *(Dipsacus spp.)* is a biennial or sometimes monocarpic perennial forb. The fruits are a four-angled achene, each containing a single seed. Common teasel can produce more than 2,000 seeds per plant. The flowers are purple or white with spiny, awned bracts at the base. The flower head is generally egg-shaped, with a square base. The floral bracts at the base of the head are generally longer than the head. Rosette leaves are conspicuously veined, with stiff prickles on the lower midrib and appear to be wrinkled. Stem leaves are simple, opposite, net-veined, stalkless, and clasp the stem. Mature plants can grow up to or over six feet tall. The taprooted stem is rigid with several rows of downward turned prickles. Plants die after production of seed has occurred.

Key ID Points

1. Grows over 6 feet tall.
2. Leaves at the base are dark green and appear rippled.
3. Flowers are purple or white.

Habitats for Common teasel include open, sunny habitats that range from wet to dry levels. It is generally found along irrigation ditches, rivers, abandoned fields, pastures, waste places, and forests. Common teasel is spreading rapidly in America, particularly in the Pacific Northwest. In Colorado, teasel is usually found in relatively moist, disturbed situations but is moving into drier areas. Seeds can stay viable for at least 2 years. Seeds don't generally disperse far form the parent plant. Plants can regenerate fairly easily, due to the bare ground where the basal leaves were. Common teasel is native to Europe where it historically had many uses.

The key to effective control of Common teasel is prevention. Eliminate seed production to decrease the spread of this 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. Mechanical and chemical control methods are effective when dealing with Common teasel. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

Common teasel is designated as a "List B" species in the Colorado Noxious Weed Act. It is required to be either eradicated, contained, or suppressed depending on the local infestations. For more information visit www.colorado.gov/ag/weeds and click on the Noxious Weed Management Program. Or call the State Weed Coordinator at the Colorado Department of Agriculture, Conservation Services

Photos © Kelly Uhing, Colorado Department of Agriculture.

Updated on: 08/08

Management Recommendations

Common teasel

CULTURAL
Prevent the establishment of new infestations by minimizing disturbance and seed dispersal, eliminating seed production and maintaining healthy native communities. Contact your local Natural Resources Conservation Service for seed mix recommendations. Maintain healthy pastures and prevent bare spots caused by overgrazing.

BIOLOGICAL
There is no biological control available for Common teasel. Since biological control agents take years to research, develop and release, no releases are expected in the foreseeable future. For more information, contact the Palisade Insectary of the Colorado Department of Agriculture at 970-464-7916.

MECHANICAL
Treatments such as digging and cutting can be effective in certain situations. Digging at the rosette and bolting stage, making sure that the majority of the root comes up, can be effective. Cutting plants when near the flowering stage is also effective. When using either of these methods, revisiting the site frequently is recommended to ensure regrowth does not occur.

Integrated Weed Management:

The key to controlling Common teasel is to eliminate seed production and exhaust the seed bank in the soil. Common teasel does not reproduce vegetatively and dies after seed production.

Mechanical and chemical control methods can be effective.

HERBICIDES

NOTE: The following are recommendations for herbicides that can be applied to range and pasturelands. Rates are approximate and based on equipment with an output of 30 gal/acre. Please read label for exact rates. **Always read, understand, and follow the label directions. The herbicide label is the LAW!**

HERBICIDE	RATE	APPLICATION TIMING
Metsulfuron (Escort XP)	1 oz. of product/ac. + 0.25% v/v non-ionic surfactant	Apply when in rosette or bolting growth stage. (Spring or Fall rosettes or Early summer bolting)
Aminopyralid (Milestone)	4 to 7 fl. oz./ac. (start with 7 fl. oz.) + 0.25% v/v non-ionice surfactant	Apply when in rosette or bolting growth stage. Best choice of herbicide to use in riparian areas. (Spring or Fall rosettes or Early summer bolting)
Imazapic (Plateau)	8 to 12 fl. oz./ac. + 2 pt/ac. methylated seed oil	Apply when in rosette or bolting growth stage. Good choice of herbicide to use in riparian areas. (Spring or Fall rosettes or Early summer bolting)

Colorado State University

CDA CO

List B Species

Rangeland, pasture, and riparian site recommendations

1

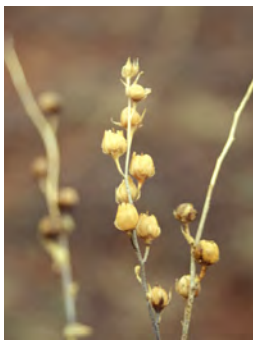
Dalmatian toadflax

Linaria dalmatica

Colorado Department of Agriculture

305 Interlocken Pkwy
Broomfield, CO 80021

(303) 869-9030
weeds@state.co.us



Key ID Points

1. Showy yellow snapdragon-like flowers with an orange throat on elongated racemes.
2. Thick, waxy, bluish heart-shaped leaves that wrap the stem.

Updated on: 08/08

Dalmatian toadflax Identification and Management

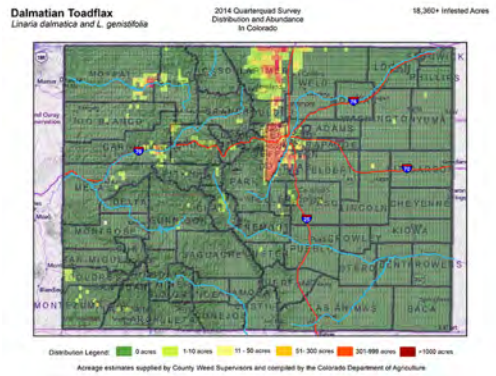
Identification and Impacts

Dalmatian toadflax (*Linaria dalmatica*) is a non-native, perennial forb introduced from the Mediterranean region as a folk remedy, fabric dye and ornamental. It reproduces both by seed and by extensive, creeping rhizomes. A single plant produces 500,000 seeds, most of which fall within 18 inches of the parent plant. Seeds can remain viable for at least 10 years. Dalmatian toadflax grows to 3 feet, and has bright yellow snapdragon-like flowers with an orange throat on elongated racemes. The alternate leaves are broad, with a thick, waxy cuticle and a bluish cast. Each leaf is heart-shaped and wraps the stem.

Habitats for Dalmatian toadflax include disturbed open sites, fields, pastures, rangeland, roadsides, cropland and forest clearings. Infestations can begin in small disturbed sites, then spread even to rangeland and wildlife habitats in excellent condition. Dalmatian toadflax is a highly aggressive plant that can genetically adapt to varied environmental conditions and herbicide controls. Its extreme competitiveness is due to early spring regeneration from vegetative buds on roots that are not dependent on soil moisture or native plant competition. Once established, toadflax quickly overruns native plants and becomes a monoculture that severely reduces forage, productivity, biodiversity and wildlife habitat.

The key to effective control of Dalmatian toadflax is prevention and integrating as many management strategies as possible. Prevention is always desirable when dealing with Dalmatian toadflax. Early detection and eradication can keep populations from exploding, making more management options available. With the plants varying genetically using many different approaches is important such as; chemical, mechanical, cultural and biological methods. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

Dalmatian toadflax is designated as a "List B" species in the Colorado Noxious Weed Act. It is required to be either eradicated, contained, or suppressed depending on the local infestations. For more information visit www.colorado.gov/ag/csd and click on the Noxious Weed Management Program. Or call the State Weed Coordinator at the Colorado Department of Agriculture, Conservation Services Division, 303-239-4100.



Clockwise, from lower left, photos © John M. Randall of The Nature Conservancy; and Linda Wilson and Susan Turner of Invasive.org. Infestation map by Crystal Andrews, Colorado Department of Agriculture.

Management Recommendations

Dalmatian toadflax

CULTURAL
It is imperative to seed managed areas with competitive grasses such as thickspike wheatgrass and streambank wheatgrass. The combination of herbicide spraying and seeding competitive grasses controls Dalmatian toadflax better than spraying alone. (K.G. Beck, CSU)

BIOLOGICAL
Calophasia lunula, a predatory noctuid moth, feeds on leaves and flowers of Dalmatian toadflax. Eteobalea intermediella, a root boring moth, and Mecinus janthinus, a stem boring weevil, are also available. For more information, contact the Palisade Insectary of the Colorado Department of Agriculture at 970-464-7916.

MECHANICAL
For small infestations, pulling toadflax by hand can be effective. Pull every year for 5 to 6 years to deplete the reserves of the root system. Monitor the site for 10 - 15 years to remove seedlings produced from dormant seeds.

Integrated Weed Management:

Because of the high genetic variability of the toadflax species, it is critical to integrate as many management strategies as possible into the control program. Two local populations may respond differently to the same herbicides.

Keys to management are to prevent seed formation and vegetative spread by roots. Controlling toadflaxes is expensive and difficult, prevention is the best option.

HERBICIDES

NOTE: The following are recommendations for herbicides that can be applied to range and pasturelands. Rates are approximate and based on equipment with an output of 30 gal/acre. Please read label for exact rates. **Always read, understand, and follow the label directions. The herbicide label is the LAW!**

HERBICIDE	RATE	APPLICATION TIMING
Picloram (Tordon 22K) *Avoid spraying near trees and/or water	2-4 pints/acre	Apply when flowering in spring and/or in the fall. Add non-ionic surfactant @ 0.32oz/gal water or 1 qt/100 gal water.
Chlorsulfuron (Telar)	2-3 oz./acre	Apply at flower stage in spring and/or in the fall. Add non-ionic surfactant @ 0.32 oz/gal. water or 1 qt./100 gal. water.
2,4-D + Dicamba (Rangestar)	2 qt. + 2 qt/ acre	Apply during pre-bloom to flower stage in spring. Add non-ionic surfactant @ 0.32 oz/ gal. water or 1 qt/100gal water. Retreatment is required for several years.

Top photo, © Kelly Uhing, Colorado Department of Agriculture. *Calophasia lunula* larva photo © Bob Richard, USDA APHIS, Invasive.org. Handpulling toadflax photo © Lake Tahoe Environmental Education Coalition.

List B Species

Rangeland, pasture, and riparian site recommendations

1

Diffuse knapweed

Centaurea diffusa

Colorado Department of Agriculture

305 Interlocken Pkwy
Broomfield, CO 80021

(303) 869-9030
weeds@state.co.us

Diffuse knapweed Identification and Management

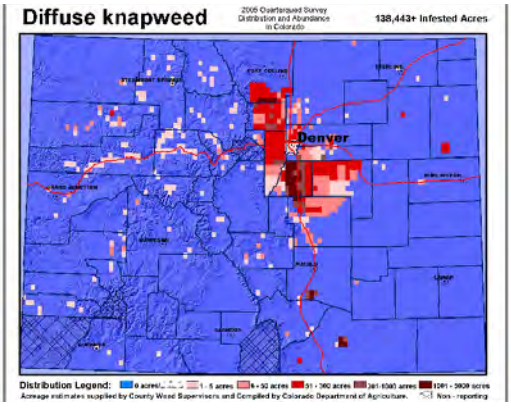
Identification and Impacts

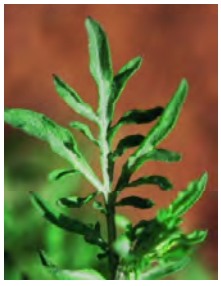
Diffuse knapweed *(Centaurea diffusa)* is a non-native biennial forb that reproduces solely by seed. A biennial is a plant that completes its lifecycle within two years. During the first year of growth, diffuse knapweed appears as a rosette in spring or fall. During the second year in mid to late spring – the stem bolts, flowers, sets seed, and the plant dies. Once the plant dries up, it breaks off at ground level and becomes a tumbleweed which disperses the still viable seeds over long distances. A prolific seed producer, diffuse knapweed can produce up to 18,000 seeds per plant. Therefore, the key to managing this plant is to prevent seed production. Diffuse knapweed can grow 1 to 3 feet tall, and is diffusely branched above ground. This gives the plant a ball-shaped appearance and tumble-weed mobility when broken off. Leaves are small, and are reduced in size near the flowering heads. Flowers are mostly white, sometimes purple, urn-shaped, and are located on each branch tip. Bracts that enclose the flowerheads are divided like the teeth of a comb, and are tipped with a distinct slender spine. Upon drying, the bracts become rough, rendering them injurious to the touch. Flowers bloom July through August. Seed set usually occurs by mid-August.

Diffuse knapweed tends to invade disturbed, overgrazed areas. Other habitats may also include rangeland, roadsides, riparian areas, and trails. It is a tough competitor on dry sites and rapidly invades and dominates disturbed areas. Once established, diffuse knapweed outcompetes and reduces the quantity of desirable native species such as perennial grasses. As a result, biodiversity and land values are reduced, and soil erosion is increased.

The key to effective control of Diffuse knapweed is to prevent the plant from flowering and going to seed. An integrated weed management approach dealing with Diffuse knapweed is highly recommended. There are many options of mechanical, chemical, and biological controls, available. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

Diffuse knapweed is designated as a "List B" species on the Colorado Noxious Weed Act. It is required to be either eradicated, contained, or suppressed depending on the local infestations. For more information, visit www.colorado.gov/ag/csd and click on the Noxious Weed Program link or call the State Weed Coordinator at the Colorado Department of Agriculture, Conservation Services Division at 303-239-4100.





Key ID Points

1. Floral bracts have yellow spines with teeth appearing as a comb and a distrinct terminal spinte.
2. Flowers are white or lavender.
3. Seedlings have finely divided leaves

Plant photo, top © Kelly Uhing. Infestation map above, Crystal Andrews. Flower photo © Cindy Roche. Rosette and leaf photos © Dale Swenarton.

Updated on: 08/08

Management Recomendations

CULTURAL
Establishment of selected grasses can be an effective cultural control of diffuse knapweed. Contact your local Natural Resources Conservation Service for seed mix recommendations. Maintain healthy pastures and prevent bare spots caused by overgrazing. Bareground is prime habitat for weed invasions.

BIOLOGICAL
The seedhead weevil (*Larinus minutus*) and the root weevil fly (*Cyphocleonus achates*) provide fair to good control when used in combination with each other. Expect to wait at least 3 to 5 years for the insects to establish and achieve optimum results. This is an option for large infestations. To obtain the insects, contact the Colorado Department of Agriculture, 970-464-7916.

MECHANICAL
Any mechanical or physical method that severs the root below the soil surface will kill diffuse knapweed. Mowing or chopping is most effective when diffuse knapweed plants are at full-bloom. Be sure to properly dispose of the flowering cut plants, since seeds can mature and become viable after the plant has been cut down.

Integrated Weed Management:

Diffuse knapweed is best controlled in the rosette stage. It is imperative to prevent seed production. Do not allow diffuse knapweed flowers to appear. Management must be persistent in order to deplete the seed bank in the soil.

Diffuse knapweed

HERBICIDES : The following are recommendations for herbicides that can be applied to range and pasturelands. Always read, understand, and follow the label directions. Rates are approximate and based on equipment with an output of 30 gal/acre. Please read label for exact rates. **The herbicide label is the LAW!**

HERBICIDE	RATE	APPLICATION TIMING
Aminopyralid (Milestone)	5-7 ounces/acre or 1 teaspoon/gal water	Spring at rosette to early bolt stage and/or in the fall to rosettes. Add non-ionic surfactant @ 0.32oz/gal water or 1 qt/100 gal water.
2,4-D Amine	1 qt./acre or 1 oz/gal water	Apply to spring/fall rosettes - before flowering stalk lengthens. DO NOT apply when outside temperatures will exceed 85 degrees. Add non-ionic surfactant @ 0.32oz/gal water or 1qt/100 gal water.
Clopyralid + Triclopyr (Redeem R&P)	1.5-2 pints/acre or 0.75 oz/gal water	Apply from rosette to early bolt stage of growth and/or in the fall to rosettes. Add non-ionic surfactant @ 0.32oz/gal water or 1qt/100 gal water.
Picloram (Tordon 22K *this is a Restricted Use Pesticide*)	1-2 pts/acre or 0.75 oz/gal water	Apply to spring rosettes through mid-bolt and in fall to rosettes. DO NOT apply near trees/ shrubs/high water table.

Field bindweed

Colorado Department of Agriculture

305 Interlocken Pkwy
Broomfield, CO 80021

(303) 869-9030
weeds@state.co.us

Key ID Points

1. Leaves are shaped like arrowheads.
2. Flowers are funnel-shaped, white to pink, and have two small bracts one inch below the flower base.

Field bindweed Identification and Management

Identification and Impacts

Field bindweed (*Convolvulus arvensis*) is a non-native deep-rooted perennial that reproduces from seed and creeping, horizontal roots (rhizomes). Field bindweed stems are prostrate (grows low to the ground) and twining, and grow up to 6 feet long. Leaves are distinguishable by their arrowhead shape. The flowers are bell or trumpet-shaped, white to pink in color, and are about 1 inch long. Field bindweed seeds can remain viable in the soil for up to 40 years.

Field bindweed emerges from its root system in the spring. Flowering occurs from June to September and until the first fall frost. The number of seeds produced per plant ranges from 25 to 300 and seed production is variable depending on environmental conditions. Field bindweed is an extremely difficult noxious weed to control because, in part, of its taproot that may go 20 feet deep into the soil, and which repeatedly gives rise to numerous long rhizomes.

Field bindweed is a problem throughout Colorado. It is one of the most competitive perennial weeds. It is widespread in cultivated areas, pastures, lawns, gardens, roadsides, and waste areas from 4,000 to 8,000 feet in elevation.

To successfully manage field bindweed, containment and persistence in controlling existing stands are necessary in order to exhaust the root system and deplete the soil seed bank. This weed needs to be continually stressed, forcing it to exhaust root nutrient stores and eventually die. Of all control methods, prevention is most important. Maintain healthy pastures and rangeland and continually monitor your property for new infestations. A healthy cover of desirable perennial plants will assist in discouraging field bindweed establishment.

Field bindweed is designated as a "List C" species on the Colorado Noxious Weed Act. It is required to be either eradicated, contained, or suppressed depending on the local jursidictions managing this species.

On the back of this sheet are field bindweed management recommendations. For more information, visit www.ag.state.co.us/csd/csdhome.html. Or call the State Weed Coordinator at the Colorado Department of Agriculture, Conservation Services Division, 303-239-4100.

White flower © Mary Ellen Harte, Invasive.org.
All other photos © Kelly Uhing.

Convulvulus arvensis

Management Recomendations

Field bindweed

CULTURAL
Establishment of selected grasses can be an effective cultural control of field bindweed. Contact your local Natural Resources Conservation Service for seed mix recommendations. Maintain healthy pastures and prevent bare spots caused by overgrazing. Bareground is prime habitat for **weed invasions.**

Bindweed mite damage

BIOLOGICAL
The bindweed gall mite, *Aceria mahlerbae*, has proven to be effective in reducing field bindweed infestations. This is an option for large infestations. To obtain a mite release, contact the Colorado Department of Agriculture, 970-464-7916.

MECHANICAL
Cutting, mowing, or pulling has a negligible effect unless the plants are cut below the surface in the early seedling stage. Well-established populations have a large seed bank in the soil that can remain viable for over 40 years.

Integrated Weed Management:

Field bindweed requires active management once it is established because of its potential to regenerate rapidly. Even small infestations should be viewed as a serious threat and managed aggressively.

Contain and persistently control infestations in order to exhaust the root system and deplete the soil seed bank.

Maintain a healthy cover of perennial plants to discourage field bindweed establishment.

HERBICIDES: The following are recommendations for herbicides that can be applied to range and pasturelands. *Rates are approximate and based on equipment with an output of 30 gallons per acre. Please read label for exact rates.* Always read, understand, and follow the label directions. **The herbicide label is the LAW!**

HERBICIDE	RATE	APPLICATION TIMING
Clarity + 2,4-D Amine	1 qt./acre or 1 oz/gal water	Just after full-bloom and/or fall. DO NOT apply near or under trees/shrubs or where soils have rapid permeability. DO NOT apply when outside temperatures will exceed 85 degrees. Add non-ionic surfactant @ 0.32oz/gal water or 1 qt/100 gal water.
Tordon 22K *this is a Restricted Use Pesticide*	1 qt./acre or 1 oz/gal water	Just after full-bloom and/or fall. DO NOT apply near or under trees/shrubs or where soils have rapid permeability. Add non-ionic surfactant @ 0.32oz/gal water or 1qt/100 gal water.
Roundup Ultra *non-selective herbicide, will kill all vegetation*	4 - 5 qts./acre or 4 - 5 oz/gal water	Apply at full-bloom and/or fall. Add non-ionic surfactant @ 0.32oz/gal water or 1qt/100 gal water. Use caution when applying near grasses or other desirable vegetation.

List B Species

Rangeland, pasture, and riparian site recommendations

1

Hoary cress

Colorado Department of Agriculture

305 Interlocken Pkwy
Broomfield, CO 80021

(303) 869-9030
weeds@state.co.us

Hoary cress
Identification and Management

Key ID Points

1. White flowers.
2. Grows erect 10-24" in height.
3. Leaf is 3/4-4" long with blunt end and fine white hairs.

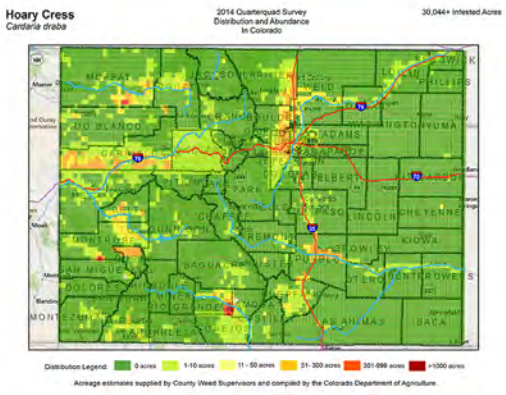
Identification and Impacts

Hoary cress *(Cardaria draba),* commonly known as whitetop, is a creeping perennial that is a member of the mustard family and native to Europe. The stems, in the rosette stage, may grow up to 2 inches in height and produce grayish-green leaves that are lance shaped. The leaves are alternate and 3/4 to 4 inches long. The upper leaves have 2 lobes that clasp the stem. The plant has numerous small, white flowers with 4 petals on stalks radiating from a stem. Seed capsules are heart-shaped with two small, flat, reddish brown seeds. One plant can produce from 1,200 to 4,800 seeds. The plants emerge in early spring with stems emerging from the center of each rosette in late April. Hoary cress flowers from May to June and plants set seed by mid-summer.

Habitats for Hoary Cress include: fields, waste places, meadows, pastures, croplands and along roadsides. It is typically found on unshaded, generally open areas of disturbed ground. It generally does better with moderate amounts of precipitation and grows well on alkaline soils.

The key to effective control of Hoary cress is prevention. Preventing the encroachment of these weeds is the most cost-effective management. Preventing invasions by limiting seed dispersal, monitoring and using weed free hay, and quarantine animals that may have grazed in infested areas. Beyond prevention, the key is early detection when infestations are small, and aggressive management. Integrated Weed Management is required for proper control. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

Hoary cress is designated as a "List B" species in the Colorado Noxious Weed Act. It is required to be either eradicated, contained, or suppressed depending on the local infestations. For more information visit www.colorado.gov/ag/weeds and click on the Noxious Weed Management Program. Or call the State Weed Coordinator at the Colorado Department of Agriculture, Conservation Services Division, 303-239-4100.



Photos © Kelly Uhing, Colorado Department of Agriculture; Mark Schwarzlander, University of Idaho, Above map: Crystal Andrews, Colorado Department of Agriculture,

Updated on: 05/09

Cardaria draba

Management Recommendations

CULTURAL
Prevent the establishment of new infestations by minimizing disturbance and seed dispersal, eliminating seed production and maintaining healthy native communities. Contact your local Natural Resources Conservation Service for seed mix recommendations. Planting competitive legumes, such as alfalfa, can reduce Hoary cress in crop rotations.

BIOLOGICAL
There is no biological control avaiable for Hoary cress. Since biological control agents take years to research, develop and release, no releases are expected in the foreseeable future. For more information, contact the Palisade Insectary of the Colorado Department of Agriculture at 970-464-7916.

MECHANICAL
Mowing several times before the plants bolt stresses Hoary cress and forces the plant to use nutrient reserves stored in the root system. Combining mowing with herbicides will further enhance control of this weed. Mow repeatedly during the summer, then apply a herbicide in the fall.

Integrated Weed Management:

No single treatment provides effective, long term control. The best and first defense is always prevention. Once established, integrate a variety of combinations of competitive planting, crop rotations, and herbicides. This can reduce Hoary cress to manageable levels.

Hoary cress

HERBICIDES

NOTE: The following are recommendations for herbicides that can be applied to range and pasturelands. Rates are approximate and based on equipment with an output of 30 gal/acre. Please read label for exact rates. Always read, understand, and follow the label directions. The herbicide label is the LAW!

HERBICIDE	RATE	APPLICATION TIMING
Metsulfuron (Escort XP)	1 oz. product/acre 0.25 v/v non-ionic surfactant	Apply at the early bud growth stage; i.e. "broccoli" growth stage. (Early Spring to Early Summer)
Chlorsulfuron (Telar)	1 oz. product/acre 0.25 v/v non-ionic surfactant	Apply at the early bud growth stage; i.e. "broccoli" growth stage. (Early Spring to Early Summer)
Imazapic (Plateau)	12 fl. oz./acre + 2 pints/acre methylated seed oil or crop oil concentrate	Apply at late flower to post-flower growth stage. (Late Spring to Mid Summer)

Colorado State University

CDA CO

Houndstongue

Colorado Department of Agriculture

305 Interlocken Pkwy
Broomfield, CO 80021

(303) 869-9030
weeds@state.co.us

Key ID Points

1. Panicles of reddish-purple flowers with 5 petals and 5 soft, hairy sepals.
2. Velcro-like seeds with 4 nutlets.

Updated on: 08/08

Houndstongue Identification and Management

Identification and Impacts

Houndstongue (*Cynoglossum officianale)* is a short lived perennial or biennial forb. It produces rosettes in the first year, and bolts a stout, erect stem that is 1 to 4 feet tall, by mid-summer of the second year. Then it flowers and produces fruit. Flowers are reddish-purple (occasionally white) and droop slightly from densely clustered panicles. The five rounded petals are cupped by five sepals covered with long, soft white hairs. Flowering occurs May to July. The simple leaves are lance or oblong shaped, with a smooth edge and no teeth or lobes. Leaves are alternate, 1 to 12 inches long and 1 to 3 inches wide. The leaf tip is sharply pointed, like a hound's tongue, yet are covered with long-soft white hairs. Leaves often appear dusty and insect-ridden. A thick, dark, woody taproot can reach 3 to 4 feet deep.

Reproduction is solely by seeds. Seeds are 4 prickly teardrop-shaped nutlets, which are packed in a pyramid-shaped receptacle. Most seeds fall close to the parent plant, but the seeds can travel great distances. The seeds have barbs like Velcro, with a hooked tip that clings to animals, clothing and machinery. A mature plant can produce 2,000 seeds. Seed viability is 1 to 3 years. Houndstongue is poisonous. Toxic pyrrolizidine alkaloids in Houndstongue stop liver cells from reproducing. Livestock and wildlife may live up to six months after ingesting a lethal dose. Though the plant has a distinctive odor that repels animals, it is more palatable when dried. Animals rarely eat it unless it is dried and mixed with hay. Houndstongue's toxicity effects horses and cattle more severely, sheep seem more resistant. Burs will reduce the value of sheep wool if present.

Habitats for Houndstongue are open to shady, moist, disturbed areas, along trails, roadsides, fields, pasture, rangeland, along the edge of forests, sand dunes and ditch banks. Houndstongue prefers moist areas, but often grows on sandy or gravelly alkaline soil up to 9,000 feet elevation. Areas with more than 10% bare ground are particularly vulnerable to Houndstongue invasions.

The key to effective control of Houndstongue is preventing establishment and to prevent seed production. Planting competing and desirable grasses and forbs can be effective. Helping with reestablishment of disturbed sites. An integrated weed management approach can also be successful. Chemical, mechanical, and biological controls can be effective when dealing with Houndstongue. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

Houndstongue is designated as a "List B" species in the Colorado Noxious Weed Act. It is required to be either eradicated, contained, or suppressed depending on the local infestations. For more information visit www.colorado.gov/ag/csd and click on the Noxious Weed Management Program. Or call the State Weed Coordinator at the Colorado Department of Agriculture, Conservation Services Division, 303-239-4100.

Photos: top left Aspen County, CO; all other Kelly Uhing , Colorado Department of Agriculture.

Cynoglossum officianale

Management Recommendations

CULTURAL
Prevent the establishment of new infestations by minimizing disturbance and seed dispersal, eliminating seed production and maintaining healthy native communities. Contact your local Natural Resources Conservation Service for seed mix recommendations. Maintain healthy pastures and prevent bare spots caused by overgrazing.

BIOLOGICAL
A root weevil, *Mogulones cruciger*, has been successful in Canada and introduced in Montana, but has not yet been approved for use in Colorado. For more information, contact the Palisade Insectary of the Colorado Department of Agriculture at 970-464-7916.

MECHANICAL
Cut or pull plants, and remove entire root crown when plants are in the rosette stage. Remove dense litter layer (up to 4 inches) to stimulate germination of desired plants. To reduce seed production, mow or cut flowering stems before seed nutlets develop, this can significantly reduce seed production.

Integrated Weed Management:

Prevention is the best option when dealing with Houndstongue. Use only certified weed-free hay. If an infestations does occur, reducing the seed production is key in controlling Houndstongue. Chemical, mechanical and the developing biological controls can also be effective management techniques.

Houndstongue

HERBICIDES

NOTE: The following are recommendations for herbicides that can be applied to specific areas. Rates are approximate and based on equipment with an output of 30 gal./acre. **Always read, understand, and follow the label directions. The herbicide label is the LAW!**

HERBICIDE	RATE	APPLICATION TIMING
Metsulfuron Methyl + Chlorsulfuron (Cimarron X-tra)	2.0 oz. product/acre + 0.25% v/v non-ionic surfactant	Apply in spring rosette to early bud growth stages.
Picloram + 2,4-D (Grazon P+D)	4 pints/acre + 0.25% v/v non-ionic surfactant	Apply in spring rosette stage.

Top photo, © Kelly Uhing, Colorado Department of Agriculture. *Mogulones cruciger* photo ©H. Goulet. Mechanical management by Kelly Uhing.

Leafy spurge

Euphorbia esula

Colorado Department of Agriculture

305 Interlocken Pkwy
Broomfield, CO 80021

(303) 869-9030
weeds@state.co.us

Leafy spurge Identification and Management

Key ID Points

1. Flowers are yellowish-green and have a pair of heart shaped yellow-green bracts below each inconspicuous flower.
2. The entire plant contains white, milky latex.

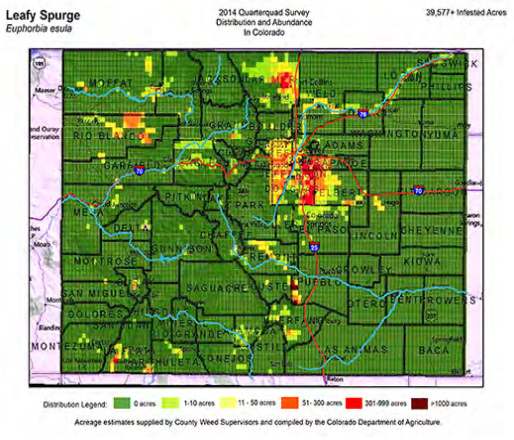
Identification and Impacts

Leafy spurge (*Euphorbia esula*) is a non-native deep-rooted perennial that spreads by seed and extensive, creeping roots. The roots can extend as deep as 30 feet into the soil and are extremely wide-spreading. The roots are brown and contain numerous pink buds that generally produce new shoots or roots. Leafy spurge can grow from 1 to 3 feet in height. The stems are smooth, pale green, and thickly clustered. Leaves are alternate, narrow, linear, and 1 to 4 inches long. The flowers are very small and yellowish-green. They are enclosed by very visible yellowish-green, heart-shaped bracts. The entire plant contains white, milky sap that exudes readily upon stem or leaf breakage. This sap can damage eyes and sensitive skin. Leafy spurge is one of the earliest plants to emerge in the spring. Flower clusters develop 1 to 2 weeks after stem emergence which is from mid-April to late May. One large leafy spurge plant can produce up to 130,000 seeds. Three-sided seed capsules explode when ripe and project the seeds up to 15 feet away from the parent plant.

Leafy spurge has adapted to a wide variety of habitats in the state and is very competitive with other plant species. Where it becomes established in rangeland, pasture, and riparian sites, it crowds out practically all other vegetation. The competitive, rapidly growing, and extensive root system makes leafy spurge very difficult to manage. Develop a management plan that uses several control methods that are compatible with your site.

The most effective method of control for Leafy spurge is to prevent its establishment through proper land management. Maintain healthy pastures and rangeland and continually monitor your property for new infestations. New infestations are much more easily controlled than established infestations. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

Leafy spurge is designated as a "List B" species on the Colorado Noxious Weed Act. It is required to be either eradicated, contained, or suppressed depending on the local infestations. On the back of this sheet are leafy spurge management recommendations. For more information, please visit www.colorado.gov/ag/csd and click on the Noxious Weed Program link. Or contact the State Weed Coordinator at the Colorado Department of Agriculture, Conservation Services Division, 303-239-4100.



Flower photo, top, © Norman Rees, USDA, APHIS. Invasive.org. All other photos © Kelly Uhing.

Updated on: 08/08

Management Recomendations

Leafy spurge

CULTURAL
Establishment of selected grasses can be an effective cultural control of leafy spurge. Contact your local Natural Resources Conservation Service for seed mix recommendations. Maintain healthy pastures and prevent bare spots caused by overgrazing. Bareground is prime habitat for weed invasions.

BIOLOGICAL
Both sheep and goats can be effective grazers of leafy spurge. The flea beetles *Apthona nigriscutis*, *A. lacertosa*, and *A. cyparissiae*, are effective especially when combined with grazing and/or herbicides. For more information, contact the Palisade Insectary of the Colorado Department of Agriculture, 970-464-7916.

Photo © USDA.

MECHANICAL
Due to the extensive root system, hand-pulling this plant is not a viable option. Mowing will reduce seed production if repeated every 2 to 4 weeks during the growing season, but will provide little long-term control.

Integrated Weed Management:

Persistent monitoring of areas with known or potential infestations is crucial to managing leafy spurge. A combination of management methods in a long-term management plan is imperative. The management objective is to exhaust the root system and deplete the soil seed bank.

HERBICIDES

NOTE: The following are recommendations for herbicides that can be applied to range and pasturelands. Rates are approximate and based on equipment with an output of 30 gallons per acre. Please read label for exact rates. **Always read, understand, and follow the label directions. The herbicide label is the LAW!**

HERBICIDE	RATE	APPLICATION TIMING
Fosamine (Krenite S)	1.5 gal/acre or 6.5 oz/gal water	Spring only, during bloom to post-bloom stage. Add non-ionic surfactant @ 0.32oz/gal water or 1 qt/100 gal water.
Picloram (Tordon 22K *this is a Restricted Use Pesticide*)	1 qt./acre or 1 oz/gal water	Spring, just after full-bloom and/or fall. DO NOT apply near or under trees/shrubs or where soils have rapid permeability. Add non-ionic surfactant @ 0.32oz/gal water or 1qt/100 gal water.
Imazapic (Plateau)	12 oz/acre or 0.4 oz/gal water	Fall only treatment prior to hard freeze. Add a methylated seed oil surfactant (MSO) @ 0.32oz/gal water or 1 qt./100 gal water.
2,4-D Amine	2-3 qts/acre or 2-3 oz/gal water	Apply early spring and fall. Prevents seed formation only. Retreatment will be necessary. DO NOT apply when outside temperatures will exceed 85 degrees. Add non-ionic surfactant @ .32oz/gal water or 1qt/100 gal water.

List A Species

Rangeland, pasture, and riparian site recommendations

1

Mediterranean sage

Salvia aethiopis

Colorado Department of Agriculture

305 Interlocken Pkwy
Broomfield, CO 80021

(303) 869-9030
weeds@state.co.us

Mediterranean sage Identification and Management

Identification and Impacts

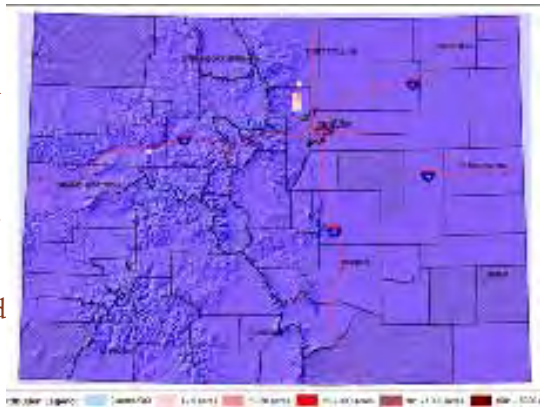
Mediterranean sage *(Salvia aethiopis)* is a biennial that is an erect, coarse biennial or short-lived perennial, with a stout taproot. First year rosettes are blue-green, and are covered with woolly white hairs. Second year plants produce more leaves with a flowering stem. Leaves have a pungent odor when crushed. The flower stem can grow 2 to 3 feet tall and branch 2 to 3 feet wide resembling a candalabra. The stem breaks off in the fall and forms a tumbleweed dispersing thousands of seeds. Mature plants can produce 100,000 seeds each. The flowers are white to yellowish-white and appear in clusters.

Mediterranean sage is native to the Mediterranean region and northern Africa. Mediterranean sage invades primarily rangeland, but will easily invade riparian areas, forests, roadsides, and dry pastures. This invasive ornamental plant prefers south-facing slopes in loose, gravelly, well drained soils. Mediterranean sage initially invades disturbed sites, but quickly spreads to non-disturbed and natural sites. It adapts to a wide variety of environmental conditions and quickly displaces native vegetation. The plant is unpalatable to most grazing animals and is capable of forming dense monocultures. The seed viability for Mediterranean sage is unknown. The site must be monitored for at least 10 years after the last flowering adult plants have been eliminated and treatments repeated when necessary.

The key to effective control of Mediterranean sage is preventing the establishment of plant communities through the use of sound land management practices. Maintain healthy pastures and rangeland and continually monitor your property for new infestations, especially near current known infestations since tumbleweed mobility of this plant can spread the seeds far and wide. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

Mediterranean sage is designated as a "List A" species in the Colorado Noxious Weed Act. It is required to be eradicated wherever found in the State. For more information visit www.colorado.gov/ag/weeds and click on the Noxious Weed Management Program. Or call the State Weed Coordinator at the Colorado Department of Agriculture, Conservation Services Division, 303-239-4100.

Map of Mediterranean sage infestation.



Key ID Points

1. Leaves have a pungent odor when crushed.
2. Leaves are very hairy.
3. White to yellowish-white flower clusters.

Updated on: 7/2015

Management Recommendations

CULTURAL
Preventing overgrazing and promoting healthy plant communities is crucial. Disturbed, bare ground areas are prime habitat for weed invasions. Contact your local Natural Resource Conservation District for seed mix recommendations for your area.

BIOLOGICAL
Biocontrol agents are not included in the prescribed management plans by the State for List A Species. Eradication is the management objective of all List A's. For information on biocontrol in Colorado, please contact the Palisade Insectary of the Colorado Department of Agriculture at 970-464-7916.

MECHANICAL
Hand pull or shovel when soil is moist. Make certain to pull up all the roots or sever at least 2 to 3 inches of taproot with a shovel. Shake excess soil from specimens and turn over to dry out. Bag specimens carefully so as to not scatter seeds if flowering.

Integrated Weed Management:

Since Mediterranean sage reproduces solely by seed, it is imperative to prevent seeds from producing as well as depleting the soil seed bank. Combining mechanical and herbicide treatments to rosettes or bolting plants can be very effective. If flowering, mechanically remove plants and bag them. Survey properties on the perimeter of known infestations to detect new infestations early.

Mediterranean sage

HERBICIDES

NOTE: The following are recommendations for herbicides that can be applied to range and pasturelands. Rates are approximate and based on equipment with an output of 30 gal/acre. Please read label for exact rates. **Always read, understand, and follow the label directions. The herbicide label is the LAW!**

Herbicide	Rate	Application Timing
Aminopyralid (Milestone)	7 oz. product/acre + 1% v/v methylated seed oil	Apply in spring during rosette to bolting (early flowering) growth stages.
Metsulfuron (Escort or Cimarron) + 2,4-D	1 oz. product/acre (metsulfuron) + 1 qt./acre (2,4-D) + 0.25% v/v non-ionic surfactant	Apply in spring during rosette to bolting (early flowering) growth stages.
Picloram (Tordon/Picloram 22K - Restricted use pesticide) + Chlorsulfuron (Telar)	1 qt. product/acre (Tordon) + 1 oz. product/ acre (Telar) + 0.25% v/v non-ionic surfactant	Apply in spring during rosette to bolting (early flowering) growth stages. DO NOT use near trees, desirable shrubs, water, or high water table.
Additional herbicide recommendations for other species can be found at: www.colorado.gov/agconservation/CSUHerbicideRecommendations.pdf		

Top to bottom photos, © A. Murray, Univ. of Florida; USDA ARS Archives.

List B Species

Rangeland, pasture, and riparian site recommendations

1

Musk thistle

Carduus nutans

Colorado Department of Agriculture

305 Interlocken Pkwy
Broomfield, CO 80021

(303) 869-9030
weeds@state.co.us

Musk thistle
Identification and Management

Key ID Points

1. Broad, spine-tipped bracts located under the flower
2. Flowering heads are terminal, solitary, and usually nodding
3. Grows up to 6 feet tall

Identification and Impacts

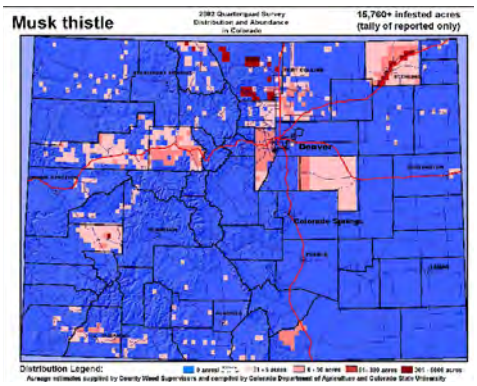
Musk thistle *(Carduus nutans)* is a non-native biennial forb that reproduces solely by seed. A biennial is a plant that completes its lifecycle within two years. During the first year of growth, musk thistle appears as a rosette in spring or fall. During the second year in mid to late spring, the stem bolts, flowers, sets seed, and the plant dies. Musk thistle produces many flower heads. The terminal, or tallest, shoots flower first, then lateral shoots develop in leaf axils. A robust plant may produce 100 or more flowering heads. A prolific seed producer, musk thistle can produce up to 20,000 seeds per plant, only one-third being viable. Because musk thistle reproduces solely from seed, the key for successful management is to prevent seed production.

Musk thistle can grow up to 6 feet tall. The leaves are spiny, waxy, and dark green in color with a light green midrib. The flowers are purple, large in size (1.5 to 3 inches in diameter), nodding, and terminal. The flowers are surrounded by numerous, lance-shaped, spine-tipped bracts. You can expect to see flowers from late May and June. Seed set usually occurs in June or July and effective management options will then become limited.

Habitats for Musk thistle include disturbed, overgrazed areas. Once a pasture is infested, the livestock carrying capacity for that area is significantly decreased. The plant may also occur on rangeland, roadsides, ditches, riparian areas, and trails.

The key to effective control of Musk thistle is to prevent the plant's seed production, Planting desirable grasses and forbs to out compete Musk thistle can also be effective. Dense Musk thistle stands can be treated by spot treatments of herbicides and by a persistent mechanical program. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

Musk thistle is designated as a "List B" species in the Colorado Noxious Weed Act. It is required to be either eradicated, contained, or suppressed depending on the local infestations. For more information visit www.colorado.gov/ag/csd and click on the Noxious Weed Management Program. Or call the State Weed Coordinator at the Colorado Department of Agriculture, Conservation Services Division, 303-239-4100.



Photos © Kelly Uhing, Colorado Department of Agriculture; map above by Crystal Andrews, Colorado Department of Agriculture.

Updated on:
08/08

Musk thistle

Management Recommendations

CULTURAL
Establishment of selected grasses can be an effective cultural control of Musk thistle. Contact your local Natural Resources Conservation Service for seed mix recommendations. Maintain healthy pastures and prevent bare spots caused by overgrazing. Bareground is prime habitat for weed invasions.

BIOLOGICAL
Livestock tend to avoid grazing on musk thistle, although horses and cattle have been known to eat the flowerheads. Biological control insects, such as the seed head weevil and the crown weevil are effective on large infestations. When used together, these insects provide fair to good control. Contact the Insectary, Colorado Department of Agriculture to get complete information at 970-464-7916. Or visit www.colorado.gov/ag/csd.

MECHANICAL
Any mechanical or physical method that severs the root below the soil surface will kill Musk thistle. Mowing or chopping is most effective when Musk thistle plants are at full-bloom. Be sure to properly dispose of the flowering cut plants since seeds can mature and become viable after the plant has been cut down.

Integrated Weed Management:

The key to managing Musk thistle is to prevent seed production. Dense Musk thistle stands can be treated by spot use of herbicides and by a persistent mechanical program. 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 an infestation.

HERBICIDES

NOTE: The following are recommendations for herbicides that can be applied to range and pasturelands. Rates are approximate and based on equipment with an output of 30 gal/acre. Please read label for exact rates. **Always read, understand, and follow the label directions. The herbicide label is the LAW!**

HERBICIDE	RATE	APPLICATION TIMING
Picloram (Tordon 22K - *Restricted use chemical*)	1 pint/acre + 0.25% v/v non-ionic surfactant	Apply in spring to rosettes.
Aminopyralid (Milestone)	5 fl. oz./acre + 0.25% v/v non-ionic surfactant	Apply in spring rosette to early bolting growth stages or in fall to rosettes.
Metsulfuron (Escort XP)	1 oz. product/acre + 0.25% v/v non-ionic surfactant	Apply in spring from rosette through very early flower growth stages. (Can prevent viable seed formation if applied no later than the first viable flowers begin to open.)
Chlorsulfuron (Telar)	1 oz. product/acre + 0.25% v/v non-ionic surfactant	Apply in spring from rosette through very early flower growth stages. (Can prevent viable seed formation if applied no later than the first viable flowers begin to open.)

Top to bottom photos, © Norman E. Rees, USDA Agricultural Research Service; Whitney Cranshaw, Colorado State University, Bugwood.org; and Kelly Uhing, Colorado Department of Agriculture.

List A Species

Rangeland, pasture, and riparian site recommendations

1

Myrtle spurge

Euphorbia myrsinites

Colorado Department of Agriculture

305 Interlocken Pkwy
Broomfield, CO 80021

(303) 869-9030
weeds@state.co.us

Myrtle spurge Identification and Management

Identification and Impacts

Myrtle spurge *(Euphorbia myrsinites)* is a low growing perennial with trailing fleshy stems. The leaves are fleshy, blue-green and alternate. Flowers are inconspicuous with yellow-green, petal-like bracts that appear from March to May. Myrtle spurge spreads by seed and plants are capable of projecting seeds up to 15 feet. The plant grows from a taproot, with new stems emerging in early spring and dying back in the winter. Plants can grow up to 8-12 inches high and 12-18 inches in width.

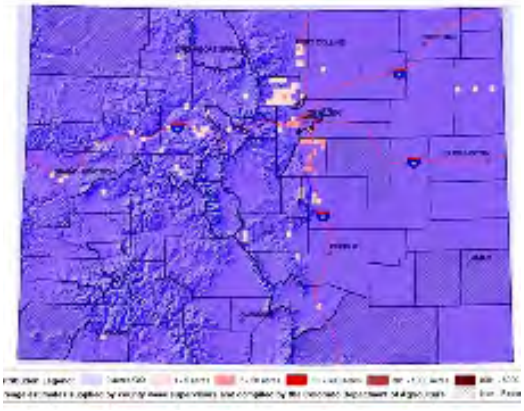
Myrtle spurge contains a toxic, milky sap which can cause severe skin irritations, including blistering. This plant is poisonous if ingested; causing nausea, vomiting and diarrhea. Wearing gloves, long sleeves, shoes, and eye protection is highly recommended when in contact with myrtle spurge, as all plant parts are considered poisonous.

Myrtle spurge is an invasive ornamental that is native to Eurasia. It is popular with xeriscapes and rock gardens, preferring sunny to partly sunny areas and well drained soils. Myrtle spurge rapidly escapes gardens and invades sensitive ecosystems, out competing native vegetation and reducing wildlife forage. Alternatives to planting myrtle spurge include native plants such as sulphur flower (*Erigonum umbellatum*), Kinnikinnick *(artcostaphylos uvursi*), or creeping mahonia (*Mahonia repens*). The soil seed reserve of myrtle spurge is estimated to be eight years. The site must be monitored for at least nine years after the last flowering adult plants have been eliminated and treatments repeated when necessary.

The key to effective control of myrtle spurge is to remove plants prior to seed set and to detect and remove new populations in natural areas early on. Small areas can be easily removed by mechanical means but should be done early to prevent triggering seed launching. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

Myrtle spurge is designated as a "List A" species in the Colorado Noxious Weed Act. It is designated for statewide eradication. For more information visit www.colorado.gov/ag/weeds and click on the Noxious Weed Management Program. Or call the State Weed Coordinator at the Colorado Department of Agriculture, Conservation Services Division, 303-239-4100.

Map of myrtle spurge infestation.



Key ID Points

1. Low growing plant with blue-green, waxy leaves.
2. Flowers are yellow-green petal like bracts that appear from March to May.

Photos © Kelly Uhing, Colorado Department of Agriculture and (above) Crystal Andrews, Colorado Department of Agriculture.

Updated on: 7/2015

Management Recommendations

CULTURAL
Keeping desirable vegetation healthy and thick will help keep invaders out. Prevent the establishment of new infestations by minimizing disturbance and seed dispersal. Survey your land regularly to detect new invaders and eradicate any new populations quickly.

BIOLOGICAL
Biocontrol is not an approved method of contol for State List A species. Eradication as the management objective for all List A species. For more information on insect biocontrol in Colorado, please contact the Palisade Insectary of the Colorado Department of Agriculture at 970-464-7916

MECHANICAL
Hand pull or dig when soil is moist. Make certain to pull all the roots and wear rubber gloves and eye protection to protect yourself from the toxic milky sap. Treatment follow up is important to check root fragment resprouts that will occure when the tap root is severed too shallow.

Integrated Weed Management:

Since Myrtle spurge spreads mainly by seed, it is very important to prevent seed production and deplete the seed bank. Remove mature plants prior to setting seed and seedlings whenever present.

Populations can be managed mechanically and by spot treatment of herbicides. It is important to be persistent with follow up treatments for many years.

Myrtle spurge

HERBICIDES

NOTE: The following are recommendations for herbicides that can be applied to range and pasturelands. Rates are approximate and based on equipment with an output of 30 gal/acre. Please read label for exact rates. **Always read, understand, and follow the label directions. The herbicide label is the LAW!**

Herbicide	Rate	Application Timing
2,4-D ester	2 qt./acre + 1% v/v methylated seed oil	Use a 2,4-D ester formulation that has a 4.0 lbs. active ingredient/acre. Apply during spring or during fall regrowth.
Dicamba + 2,4-D	1 pint/acre dicamba + 2-3 pints/acre 2,4-D (amine or ester)	Use a 2,4-D formulation that has a 4 lbs. active ingredient/gallon. Apply during spring or during fall regrowth.
Picloram (Tordon/Picloram 22K - Restricted use pesticide) + 2,4-D	20 oz./acre + 2-3 pints/acre 2,4-D (amine or ester)	Apply at flowering growth stage during spring or to fall regrowth. DO NOT use near trees, desirable shrubs, water, or high water table.
Additional herbicide recommendations for other species can be found at: www.colorado.gov/agconservation/CSUHerbicideRecommendations.pdf		

Top to bottom photos © Unknown, A. Murray, Univ. of Florida; USDA ARS Archive; and unknown.

List B Species

Rangeland, pasture, and riparian site recommendations

1

Perennial pepperweed

Colorado Department of Agriculture

305 Interlocken Pkwy
Broomfield, CO 80021

(303) 869-9030
weeds@state.co.us

Key ID Points

1. White flowers in dense round clusters at branch tips.
2. Leaves are waxy with a white midrib.

Updated on: 08/08

Perennial pepperweed Identification and Management

Identification and Impacts

Perennial pepperweed (*Lepidium latifolium*) is an extremely invasive perennial forb introduced from Europe and Asia in 1900 as a containment in sugar beet seed. Pepperweed reproduces both by seed and vegetatively by roots and shoots. Root fragments as small as 0.5 inch can grow into new plants. A serious threat, pepperweed alters ecosystems by acting as a "salt pump" absorbing salts from deep in the soil. The plant then excretes the salt through the leaves and deposits it on the surface soil. Since most desirable plants do not tolerate high saline concentrated soils, the entire plant composition and diversity of the area changes.

Growing 1 to 5 feet high, pepperweed has tiny white flowers. The flowers have four spoon-shaped petals in dense, rounded clusters on branch tips of erect stems. Stems emerge from deep, thick, woody root stocks that can penetrate 10 feet into the soil. Leaves of the mature plant are alternate, and lance or oblong in shape with serrated edges that are slightly wavy. They are glabrous (not hairy) and green to gray-green in color, with a distinctive white midrib. Upper leaves are smaller than basal leaves and have no stalks.

Perennial pepperweed invades a wide variety of habitats, from intermountain, mountainous areas and marshes. It is frequently found in riparian areas, wetlands, marshes, irrigation ditches, canals, and floodplains. If introduced, it can also invade roadsides, hay and alfalfa fields and rangeland. It readily invades disturbed and bareground areas. It can thrive in either low or high-saline soils. Large monocultures and dense litter layers prevent native plants from regenerating. Pepperweed displaces native plants and wildlife habitats, reduces food quality for wildlife and reduces agricultural and pasture production.

Perennial pepperweed rarely produces seedlings in the field, even with extensive seed crops. Research is underway, but the lack of seedlings may be due to seeds rapidly losing viability in the field (but not in the laboratory). Reproduction is primarily from deep, perennial roots and root pieces which break off and sprout new plants. However, preventing seed production is still recommended until further research is done.

The key to effective control of Perennial pepperweed is preventing establishment of large populations. Early detection and removal of plants if found, is the key to prevention. Planting desirable and competing grasses and forbs can aid in limiting the spread of Perennial pepperweed. Herbicide treatments are a good option if used during the bud to flowering stage of the plant. Once established, containment is key. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

Perennial pepperweed is designated as a "List B" species in the Colorado Noxious Weed Act. It is required to be either eradicated, contained, or suppressed depending on the local infestations. For more information visit www.colorado.gov/ag/csd and click on the Noxious Weed Management Program. Or call the State Weed Coordinator at the Colorado Department of Agriculture, Conservation Services Division, 303-239-4100.

Photos courtesy of Kelly Uhing, Colorado Department of Agriculture.

Lepidium latifolium

Perennial pepperweed

Management Recommendations

CULTURAL
Prolonged spring flooding of new growth will kill pepperweed. Grazing is not recommended because the plant may be toxic. Reestablishing the native or desired plants can take years, so repeat plantings must be repeated, but it can aid in controlling populations. Contact your local Natural Resources Conservation Service for seed mix recommendations.

BIOLOGICAL
Biological control is not a viable option because 11 other species of native Lepidium are on the Endangered species list, and the risk to these species as well as agricultural species is too great. For more information, contact the Palisade Insectary of the Colorado Department of Agriculture at 970-464-7916.

MECHANICAL
Due to the deep, brittle root, most mechanical methods are not recommend, and can actually propagate, spread and increase the density of pepperweed. Hand pulling can also bring seeds to the soil surface, and spread pieces of root, which will sprout. However, spring mowing combined with chemical treatments can be effective.

Integrated Weed Management:

Because of the deep roots and persistence of pepperweed, it is critical to combine repeated herbicide application with monitoring and revegation of the area. Control of Perennial pepperweed can be difficult, so prevention is the best option. Early detection, eradication and containment of small populations and their source are vital.

HERBICIDES

NOTE: The following are recommendations for herbicides that can be applied to specific areas. Rates are approximate and based on equipment with an output of 30 gal./acre. **Always read, understand, and follow the label directions. The herbicide label is the LAW!**

HERBICIDE	RATE	APPLICATION TIMING
Chlorsulfuron (Telar)	1 oz product/ac. + 0.25 v/v non-ionic surfactant	Apply when plant is in bolting to early flower growth stages. (Early Spring to Early Summer)
Metsulfuron (Escort XP)	1 oz product/ac. + 0.25 v/v non-ionic surfactant	Apply when plant is in botling growth stage. (Spring)
Imazapyr (Plateau)	12 fl oz/ac. + 2 pt/ac. methylated seed oil	Apply when plant is in flower to late flower growth stages. (Early Summer to Mid Summer)

NOTE: Herbicides, when applied at the flower bud stage, are extremely effective to control pepperweed. **Repeat applications for up to five years. However, the waxy leaf surface and the dense growth of this weed can make it difficult to obtain adequate coverage with the herbicide, so apply the chemical carefully and thoroughly for effective control.**

Top photo, © Kelly Uhing, Colorado Department of Agriculture. *Calophasia lunula* larva photo © Bob Richard, USDA APHIS, Invasive.org. Root system, Nature Conservancy.

List C Species

Rangeland, pasture, and riparian site recommendations

1

Perennial sowthistle

Colorado Department of Agriculture

305 Interlocken Pkwy
Broomfield, CO 80021

(303) 869-9030
weeds@state.co.us

Key ID Points

Updated on:
08/09

Identification and Management

Identification and Impacts

Perennial sowthistle (Sonchus arvensis) is a perennial forb native to Eurasia. The plants erect stems can grow 2 to 5 feet tall, they are hollow, and have a milky juice that appears when the plant is injured. The plant branches near the top of the stem and will exhibit a showy yellow disc flower about 1 1/2 inches in size, and resembles a dandelion. The flowers are borne out of bracts that are sticky and slightly hairy. Seeds are produces out of the flower bract and are red to brown in color, and have ribs that run lengthwise on the seed. The seeds are connected to a silky, parachute-like tuft of white hair and travel very easily in the wind. Leaves of the plant are alternate and clasping to the stem. The leaves vary in size generally getting smaller the higher up on the stem. Leaves are deeply lobed to whole and have prickly margins. Perennial sowthistle grows from a deep-taproot that exhibits horizontal rizome-like roots that will produce other stems.

Habitats for Perennial sowthistle include roadsides, fertile waste areas, cultivated fields, gardens, woods, lawns, ditches, and rivers.

Perennial sowthistle produces by seeds and the rhizometous root systems. Plants overwinter and begin to appear in early spring, seeds will germinate at this same time. Plants are palatable to grazing animals and can assist in control.

The key to effective control of Perennial sowthistle preventing the establishment of the plant populations. Reducing the production of seeds can assist in the control of Perennial sowthistle. Mechanical, chemical and grazing controls will also assist in control plant populations. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

Perennial sowthistle is designated as a "List C" species on the Colorado Noxious Weed Act. It is required to be either eradicated, contained, or suppressed depending on the local jurisdictions managing this species. For more information, visit www.colorado.gov/ag/weeds or call the State Weed Coordinator at the Colorado Department of Agriculture, Conservation Services Division, 303-239-4100.

Photos © From Bottom left; Steve Dewey, Utah State University; (Next 2) Ohio Weed Lab State Archive, Ohio State University; John Cardina, Ohio State University; Michael Rasy, University of Alaska; (All Bugwood.org)

Sonchus arvensis

Integrated Weed Management recommendations

List C Species

Perennial sowthistle

Management Recommendations

CULTURAL
Maintaining healthy plant populations and minimizing disturbance is a good way prevent weed populations. For specific seed recommendations contact your local Natural Resources Conservation Services for seed mixes.

BIOLOGICAL
Currently there is not any biocontrol available for Common burdock. Biocontrol takes many years of research and development. For more information, contact the Palisade Insectary of the Colorado Department of Agriculture at 970-464-7916.

MECHANICAL
Tilling plant populations where possible can assist with controlling Perennial sowthistle. Smaller root fragments have a harder time producing viable rosettes. The optimum time to treat mechanically is in the leaf rosette stage. Mowing can assist with control in depleting the root reserves for the plants.

Integrated Weed Management:

Combing mechanical and chemical control methods can assist with controlling Perennial sowthistle. Plant are palatable to grazing animals, this can also assist in controlling plant populations.

HERBICIDES

NOTE: The following are recommendations for herbicides that can be applied to range and pasturelands. Rates are approximate and based on equipment with an output of 30 gal/acre. Please read label for exact rates. Always read, understand, and follow the label directions. The herbicide label is the LAW!

HERBICIDE	RATE	APPLICATION TIMING
2 4-D + Dicamba (Rangestar)	1 to 2 pt/acre	Apply to rosettes or early bolting stage. Add non-ionic surfactant @ 0.32 oz/gal of water or 1 pt/100 gal of water.
Aminopyralid (Milestone)	3 to 5 oz/acre	Apply to rosettes or early growth under favorable growing conditions. Add non-ionic surfactant @ 0.32 oz/gal of water or 1 pt/100 gal of water.
Clopyralid (Stinger)	5 to 11 oz/acre	Apply to rosette to bud stages of plant growth. Add non-ionic surfactant @ 0.32 oz/gal of water or 1 pt/100 gal of water.
Picloram (Tordon 22K *this is a restricted use herbicide*)	4 pt/acre	Apply to rosette to early boting stage. Add non-ionic surfactant @ 0.32 oz/gal of water or 1 pt/100 gal of water.

Photos © Top to Bottom; Theodore Webster, USDA Agricultural Research Service, Bugwood.org; Whitney Cranshaw, Colorado State University, Bugwood.org; Kelly Uhing, Colorado Department of Agriculture

List B Species

Rangeland, pasture, and riparian site recommendations

1

Plumeless thistle

Carduus acanthoides

Colorado Department of Agriculture

305 Interlocken Pkwy
Broomfield, CO 80021

(303) 869-9030
weeds@state.co.us

Plumeless thistle Identification and Management

Key ID Points

1. Flower heads cluster 2-5 and are purple to dark red in color.
2. Leaves are alternate, stalk-less and hairy underneath.

Identification and Impacts

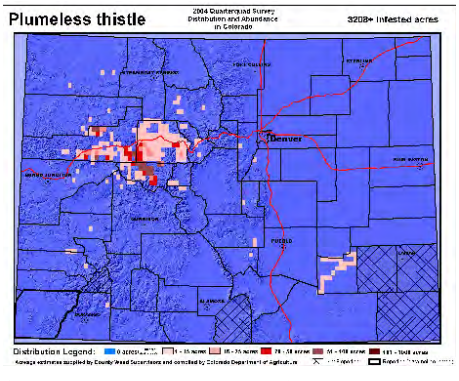
Plumeless thistle *(Carduus acanthoides)* is a winter annual or biennial that is native to Europe and Asia. Plumeless thistle rosettes have wavy leaves with yellow spines along the white-colored leaf margins. The stems are covered with leaf-like, winged spines that extend up to the flowering heads. The flower heads, in clusters of 2 to 5, are alone at the end of the branches. They are purple to dark red in color and are 1/2 to 1 inch in diameter. Leaves are alternate, stalk-less, hairy underneath and blend into the stem. Mature plants can grow taller than 5 feet and can produce upwards of 9,000 seeds.

Habitats for Plumeless thistle include pastures, fields, disturbed lands, logged-over areas, river valleys, along roadsides and in native grasslands. Plumeless thistle out competes native species and forage crops. It is one of the most aggressive thistles, due to its high seed production. Plumeless thistle is unpalatable to livestock and it may accumulate nitrates.

Plants over winter and grow from seeds and rosettes. The seed viability for Plumeless thistle is unknown. The site must be monitored for at least 10 years after the last flowering adult plants have been eliminated and treatments repeated when necessary.

The key to effective control of Plumeless thistle is very similar to Musk thistle. Preventing Plumeless thistle seed production and planting desirable grasses and forbs to out compete plumeless thistle is effective. An integrated weed management approach is an effective tool when dealing with plumeless thistle; using herbicide, biological and cultural control methods. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

Plumeless thistle is designated as a "List B" species in the Colorado Noxious Weed Act. It is required to be either eradicated, contained, or suppressed depending on the local infestations. For more information visit www.colorado.gov/ag/csd and click on the Noxious Weed Management Program. Or call the State Weed Coordinator at the Colorado Department of Agriculture, Conservation Services Division, 303-239-4100.



Photos © Map above: Crystal Andrews, Colorado Department of Agriculture; All other photos: Kelly Uhing, Colorado Department of Agriculture.

Updated on: 08/08

Management Recommendations

CULTURAL
Establishment of selected grasses can be an effective cultural control of Musk thistle. Contact your local Natural Resources Conservation Service for seed mix recommendations. Maintain healthy pastures and prevent bare spots caused by overgrazing. Bareground is prime habitat for weed invasions.

BIOLOGICAL
Biological control insects, such as the seed head weevil and the crown weevil are effective on large infestations. When used together, these insects provide fair to good control. These insects have been known to threaten native thistle populations. Contact the Insectary of Colorado Department of Agriculture to get complete information at 970-464-7916. Or visit www.colorado.gov/ag/csd.

MECHANICAL
Any mechanical or physical method that severs the root below the soil surface will kill Plumeless thistle. Mowing or chopping is most effective when Plumeless thistle plants are at full bloom. Be sure to properly dispose of the flowering cut plants since seeds can mature and become viable after the plant has been cut down.

Integrated Weed Management:

The key to managing Plumeless thistle is to prevent seed production. Dense Plumeless thistle stands can be treated by spot use of herbicide programs. Due to the unknown seed viability of plumeless thistle, monitoring up to 10 years, and repeating control methods may need to occur for many years to completely eliminate an infestation.

HERBICIDES

NOTE: The following are recommendations for herbicides that can be applied to range and pasturelands. Rates are approximate and based on equipment with an output of 30 gal/acre. Please read label for exact rates. **Always read, understand, and follow the label directions. The herbicide label is the LAW!**

HERBICIDE	RATE	APPLICATION TIMING
Aminopyralid (Milestone)	5 fl oz product/acre	Apply in spring to early summer rosette to bolting growth stages or in the fall.
Clopyralid (Transline)	0.67 pint product/acre	Apply when plants are in the rosette growth stage. (Spring or Fall rosettes)
Clopyralid +2,4-D (Curtail)	2 quarts product/acre	Apply when plants are in the rosette growth stage. (Spring or Fall rosettes)
Picloram (Tordon - *restricted use herbicide*)	1-2 pints product/acre	Apply when plants are in the rosette growth stage. (Spring or Fall rosettes)
2, 4-D	1 quart/acre	Apply when plants are in the rosette growth stage. (Spring or Fall rosettes)

Photos Top to bottom © Loke T. Kok, Virginia Polytechnic Institute and State University, Bugwood.org; Richard Old, XID Services, Inc., Bugwood.org; and Kelly Uhing, Colorado Department of Agriculture.

Plumeless thistle

Colorado State University

CDA CO

Purple loosestrife

Lythrum salicaria

Colorado Department of Agriculture

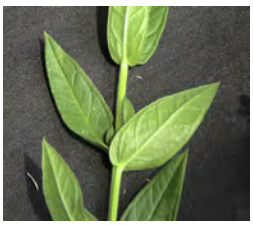
305 Interlocken Pkwy
Broomfield, CO 80021

(303) 869-9030
weeds@state.co.us

Purple loosestrife Identification and Management

Identification and Impacts

Purple loosestrife *(Lythrum salicaria)* is a non-native, tap-rooted, perennial forb. It is native to Europe and was introduced to North America as an ornamental plant for gardens. It has escaped into natural areas such as streambanks and shallow ponds. Purple loosestrife reproduces primarily by seed. A single, mature plant can produce up to three million seeds per year. The seeds can remain viable in the soil for 5 to 20 years. Pieces of roots or stems also can produce new plants. Purple loosestrife produces multiple four-sided stems that can grow two to eight feet tall. Leaves are two to five inches long, lance-shaped and whorled on the stems. Flowers are tightly grouped in long, vertical heads; they bloom from the bottom up. They are reddish-purple in color, about one inch long, and have five to seven petals. Flowers appear from late June through September.



Key ID Points

1. Showy rose-purple flowers bloom in long vertical racemes.
2. Lance-shaped leaves have smooth edges.

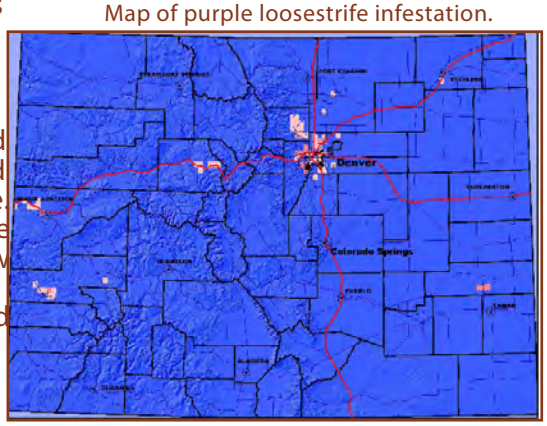
Purple loosestrife can be found along riverbanks, ditches, and wet meadows throughout the state. Infestations rapidly replace native vegetation, can impede water flow in canals and ditches, and have little wildlife habitat value. Infested wetlands eventually become a monoculture of loosestrife.

If purple loosestrife is growing in your garden, remove plants immediately and consider a substitute. There are many planting alternatives that are better suited to Colorado and beneficial to wildlife. Alternatives include spotted gayfeather, Rocky Mountain Penstemon, beebalm, purple coneflower, and Colorado Columbine. For more information refer to Colorado Native Plant Society's website, www.conps.org.

The key to effective control of purple loosestrife is early detection when infestations are small. It is fairly easy to control small numbers of loosestrife plants when the seed bank in the soil is low. Eradicating large populations is much more difficult. Persistent management and monitoring of site is a long-term program to ensure eradication. Small loosestrife infestations should be eradicated by hand-pulling/cutting in combination with herbicide application. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

Purple loosestrife is designated as "List A" species on the Colorado Noxious Weed Act. It is required to be eradicated wherever found in the State. For more information visit www.colorado.gov/ag/csd and click on the Noxious Weed Program link or call the State Weed Coordinator at the Colorado Department of Agriculture, Conservation Services Division, 303-239-4100.

Map of purple loosestrife infestation.



All photos © Kelly Uhing. Infestation map above, Crystal Andrews, Colorado Department of Agriculture.

Updated on: 7/2015

Integrated Weed Management recommendations

Purple loosestrife

Management Recommendations

CULTURAL
Prevent the establishment of new infestations by minimizing disturbance and seed dispersal.

BIOLOGICAL
Biocontrol agents are not included in the prescribed management plans by the State for List A Species. Eradication is the management objective of all List A's. For more information on biocontrol in Colorado, please contact the Palisade Insectary of the Colorado Department of Agriculture at 970-464-7916.

MECHANICAL
Hand removal of isolated individuals can be effective on small infestations. Hand removal should be performed prior to seed set. It is important to remove the entire rootstalk of the plant to avoid regrowth from root fragments. During the flowering stage, flowerheads must be cut and disposed of properly before a herbicide is applied. This will prevent or reduce seed production.

Integrated Weed Management:

Since purple loosestrife has been identified in Colorado, preventing the populations from spreading is important in management of the weed. Prevent new seeds from being added to the seed bank by managing purple loosestrife before it flowers or by clipping and disposing of the flowerheads prior to seed set and using herbicides to control plants.

Follow up control efforts the same growing season and for several years afterwards. Maintain a healthy cover of perennial plants.

HERBICIDES

The following are recommendations for herbicides that can be applied to range and pasturelands. Always read, understand, and follow the label directions. Rates are approximate and based on equipment with an output of 30 gallons per acre. Please read label for exact rates. The herbicide label is the LAW!

Herbicide	Rate	Application Timing
Triclopyr (Garlon 3A)	6-8 qt./acre OR 1.3-1.9 oz./gal water + 0.25% v/v non-ionic surfactant	Apply in summer. If plants are flowering, cut and properly dispose of flowerheads before applying Garlon 3A.
Glyphosate (Rodeo*, Habitat* - aquatic safe)	4 qt./acre OR 1.3-1.9 oz./gal water + 0.25% v/v non-ionic surfactant	Apply in summer during the flowering stage. Cut and properly dispose of flowerheads before applying Rodeo.
Aquatic 2,4-D Amine	1-2 qt./acre or 1.3-2.5 oz./gal water + 0.25% v/v non-ionic surfactant	Early spring - prevents seed formation only. Retreatment will be necessary. DO NOT apply when outside temperatures will exceed 85 degrees.
Note: *These herbicide products are nonselective and will kill any vegetation contacted.		
Additional herbicide recommendations for other species can be found at: www.colorado.gov/agconservation/CSUHerbicideRecommendations.pdf		

Russian Knapweed Identification and Management

List B

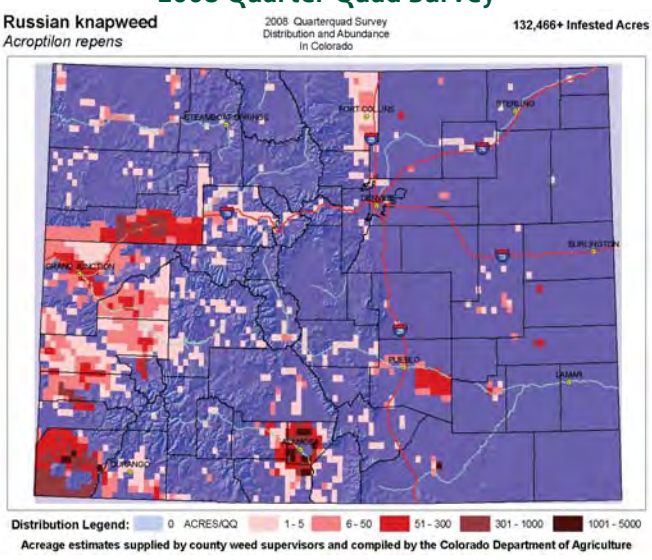
Russian knapweed (*Acroptilon repens*) is a non-native, deep-rooted perennial that spreads by aggressive, creeping, horizontal roots (rhizomes) and seeds. The roots are brown to black with a scaly appearance. Russian knapweed can grow up to 3 feet in height. The stems and leaves are covered with short gray hairs. The flowers are urn-shaped, pink to purple in color, and are solitary at the tips of the upper branches. Russian knapweed can be distinguished from other knapweeds by the smooth, papery, rounded bracts that surround the flowers. Russian knapweed emerges in early spring after soil temperatures remain above freezing. It produces flowers from June to August and sets seed in late summer to early fall. The seeds are viable for two to three years. Russian knapweed reproduces primarily from its root system. Buds on the horizontal roots can form adventitious shoots, August through the winter, that can grow to become independent plants. Once rosettes emerge in the spring, remaining root buds slough-off until they develop again in late summer. Additionally, root fragments can develop into new plants.

Russian knapweed is allelopathic, which means it contains a toxic substance that inhibits the growth of competing plants. This weed may also be toxic to horses resulting in serious injury or possibly death of the animal. Russian knapweed displaces native vegetation and reduces forage values on range and pasturelands.

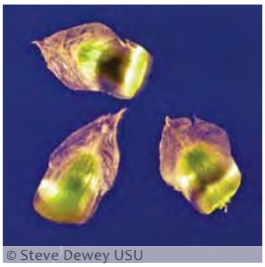
Habitat for Russian knapweed includes roadsides, ditch banks, riparian zones, pastures, rangeland, saline soils, clear cuts, and cropland. It typically invades degraded areas and sites with full sun.

The most effective method of control for Russian knapweed is to prevent its establishment through proper land management. Maintain healthy pastures and rangeland and continually monitor your property for new infestations. If Russian knapweed is already established, using an integrated weed management approach proves to be effective. Russian knapweed can be managed with herbicides or biocontrol insects, but long-term control must include planting competitive plant species to occupy bare ground once infested by the weed. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

2008 Quarter Quad Survey



Russian knapweed is designated as a "List B" species in the Colorado Noxious Weed Act. It is required to be either eliminated, contained, or suppressed depending on the local infestations. For more information, visit www.colorado.gov/ag/weeds and click on the Noxious Weed Program link or call the State Weed Coordinator at the Colorado Department of Agriculture, Conservation Services Division, 303-869-9030.


© Steve Dewey USU


Black, scaly root

Key ID Points

1. Distinguished from other knapweeds by the flower's smooth, papery bracts.
2. Roots are brown to black with scaly appearance.
3. Rosettes and lower leaves deeply lobed.
4. Upper leaves are smaller, smooth margined, and not lobed.

Russian knapweed

Acroptilon repens

List B

Integrated Weed Management Recommendations

The most effective control for Russian knapweed is to prevent its establishment through proper land management. An integrated weed management approach can be effective when dealing with Russian knapweed. It can be managed with herbicides or insects, but long-term control must include planting competitive plant species to occupy bare ground once infested by the weed.

Russian knapweed

Acroptilon repens

CULTURAL

Maintain healthy pastures and prevent bare spots caused by overgrazing. Bare ground is prime habitat for weed invasions. Establishing sod-forming grasses or vegetation with dense shade can be an effective cultural control of Russian knapweed. Contact your local Natural Resources Conservation Service for seed mix recommendations.

BIOLOGICAL

The gall midge, *Jaapiella ivannikovi*, is a fly that lays eggs in the shoot tips of Russian knapweed. It forms galls that reduce flowering, seed production, and stunts the plants' growth. This biocontrol will stress the stand of Russian knapweed but will not likely eliminate it. The Colorado Department of Agriculture - Palisade Insectary, 970-464-7916, is currently establishing this biocontrol . It is not yet available to the public.

MECHANICAL

Mowing several times before the plants bolt stresses Russian knapweed and forces it to use nutrient reserves stored in the root system. However, mowing alone will not eliminate the infestation and it can stimulate shoot sprouting the following year. Mowing combined with a fall herbicide application will enhance control. Tilling and disking can create root fragments that can sprout. However, repeated deep tillage (1 feet) over 3 years can kill much of the root system.

CHEMICAL

The following are recommendations for herbicides that can be applied to range and pasturelands. Always read, understand, and follow the label directions. Please read label for exact rates. The herbicide label is the LAW!

HERBICIDE	RATE	APPLICATION TIMING
Aminopyralid (Milestone)	5-7 oz/acre	Apply in the fall when above-ground stems die back and root buds are highly susceptible; can also apply in the bud to senescence stages. Add non-ionic surfactant @ 0.32 oz/gal water or 1 qt/100 gal water.
Aminocyclopyrachlor + chlorsulfuron (Perspective)	4.75 to 8 oz product/A + adjuvant	Apply in the fall when above-ground stems die back and root buds are highly susceptible; can also apply in the bud to senescence stages. Important: Applications greater than 5.5 oz product/A exceeds the threshold for selectivity. DO NOT treat in the root zone of desirable trees and shrubs.
Picloram (Tordon 22K *this is a Restricted Use Pesticide*)	1 qt/acre or 1 oz/gal water	Apply in the fall when above-ground stems die back and root buds are highly susceptible; can also apply in spring to bud/early flower stage and/or fall rosette. Add non-ionic surfactant @ 0.32 oz/gal water or 1 qt/100 gal water.

Colorado Department of Agriculture - Conservation Services
305 Interlocken Parkway
Broomfield, CO 80021
(303) 869-9030
www.colorado.gov/ag/weeds

Rev. 9/14

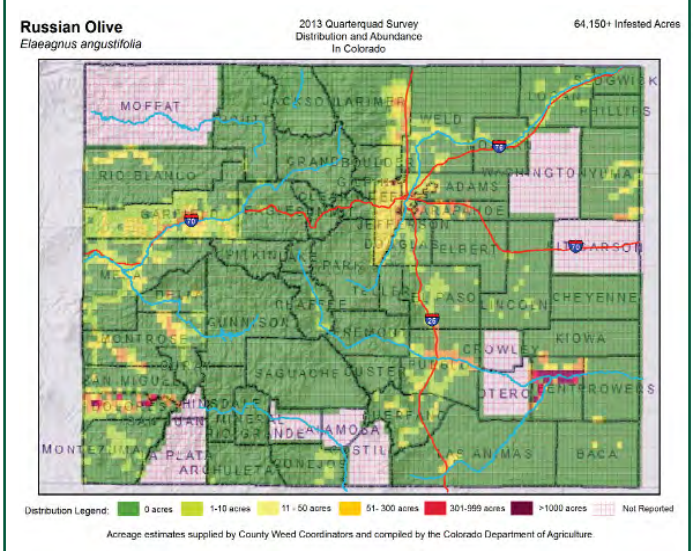
Russian Olive Identification and Management

List B

Russian olive (*Elaeagnus angustifolia*) is a perennial tree or shrub that is native in Europe and Asia. The plant has olive-shaped fruits, silver color at first then becoming yellow-red when mature. Russian olive can reproduce by seed or root suckers. Seeds are readily spread by birds and can remain viable for up to 3 years. Spring moisture and slightly alkaline soil tend to favor seedling growth. The plant's extensive root system sprouts root suckers frequently. The tree can reach up to 30 feet in height with branches that have 1 to 2 inch thorns. Leaves are 2 to 3 inches long, alternate, narrow, and have simple blades with smooth edges. The leaf's lower surface is silvery white, while the upper surface is light green in color. Flowers are 4 small sepals in light yellow clusters, fragrant, and appear May through June. Fruits mature from September to November. Russian olive twigs are flexible, reddish, and have surfaces coated with gray and scaly pubescence, becoming smooth.

Once thought to be a beneficial windbreak tree, it since has been deemed detrimental to the environment. Russian olive can grow in a variety of soil and moisture conditions, but prefers open, moist, riparian zones. It is shade tolerant and can be found along streams, floodplains, fields and open areas up to approximately 8,000 feet in elevation. Russian-olive can outcompete native plants, interfere with natural plant succession and nutrient cycling, and tax water reserves. Because Russian olive is capable of fixing nitrogen in its roots, it can grow on bare, mineral substrates and dominate riparian vegetation. Although Russian olive provides a plentiful source of edible fruits for birds, ecologists have found that bird species richness is actually higher in riparian areas dominated by native vegetation.

The key to effective control of Russian olive is preventing establishment of the trees or shrubs. If plants are already present, control options include cut-stump treatments and mechanical mowing. These treatments depend on size and location of the plant. Details on the back of this sheet can help you create a management plan compatible with your site ecology.



Russian olive is designated as a "List B" species in the Colorado Noxious Weed Act. It is required to be either eradicated, contained, or suppressed depending on the local infestations. For more information visit www.colorado.gov/ag/weeds and click on the Noxious Weed Management Program. Or call the State Weed Coordinator at the Colorado Department of Agriculture, Conservation Services Division, 303-239-4100.

© Patrick Breen, OSU

© Patrick Breen, OSU

Key ID Points

1. Leaves are silvery white.
2. Branches have 1 to 2 inch thorns.
3. Yellow-red fruits on mature plants.
4. Mature trees have shedding, reddish-brown bark.

Russian olive

Elaeagnus angustifolia

List B

Integrated Weed Management Recommendations

Integrated weed management offers the most effective combination of control efforts through the "cut stump" treatment. Trees are cut down with a hatchet or chainsaw, then immediately treated with an approved herbicide on the surface of the cut stump. The most effective timing is late summer/early fall for herbicide transfer into the roots.

Russian olive
Elaeagnus angustifolia


© John Randall, TNC


© James Miller, USFS


© Chris Ness, Adams County


© Scott Peterson, USDA

CULTURAL

Replace Russian olives with native trees. Prevent establishment of new trees by removing seedlings and saplings before they mature. Contact your local Natural Resources Conservation Service for recommendations of other possible trees or shrubs.

BIOLOGICAL

Tubercularia canker is an unapproved biocontrol. However, it overwinters on infected stems and spreads via rain-splash, animals, or pruning implements to open wounds in the bark. Infected tissue becomes discolored or sunken. Entire stems may be girdled and killed, and the disease can deform or kill stressed plants over time.

MECHANICAL

Saplings can be pulled with a weed-wrench or cut with brush-cutters. Trees can be girdled or cut with chainsaws. However, stump sprouting commonly occurs after cutting down the tree; and stump excavation without removing all parts of the roots can result in root sprouting. Treating cut-stumps with an herbicide can eliminate sprouting. Stump burning is practical when conditions support a long, hot fire and most effective in summer or early fall. Saplings are most sensitive to mechanical treatment.

CHEMICAL

The table below includes recommendations for herbicides that can be applied to range and pasturelands. Always read, understand, and follow the label directions. The herbicide label is the LAW!

HERBICIDE	RATE	APPLICATION TIMING
Triclopyr (Garlon 4, Remedy)	Undiluted (100% solution)	Apply to the cambial layer of the tree immediately after the cut-stump treatment.
Imazapyr + Water (Habitat + Water or Arsenal + Water)	Diluted by mixing 8 to 12 fl. oz / 1 gallon of water	Apply to the cambial layer of the tree immediately after the cut-stump treatment.
Imazapyr (Habitat or Arsenal)	4 to 6 pt./acre	Broadcast spray/spraying individual trees; low or high volume spray.

Colorado Department of Agriculture - Conservation Services
305 Interlocken Parkway
Broomfield, CO 80021
303-869-9030
www.colorado.gov/ag/weeds

Rev. 9/2013

List B species

Rangeland, pasture, and riparian site recommendations

1

Saltcedar

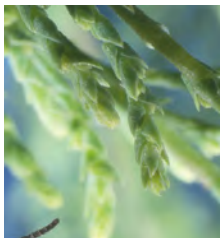
Tamarix spp.

Colorado Department of Agriculture

305 Interlocken Pkwy
Broomfield, CO 80021

(303) 869-9030
weeds@state.co.us

Saltcedar Identification and Management



Key ID Points

1. Saltcedar is a tall shrub or small tree that has white to pink flowers in clusters called racimes.
2. Leaves are small and scaly.

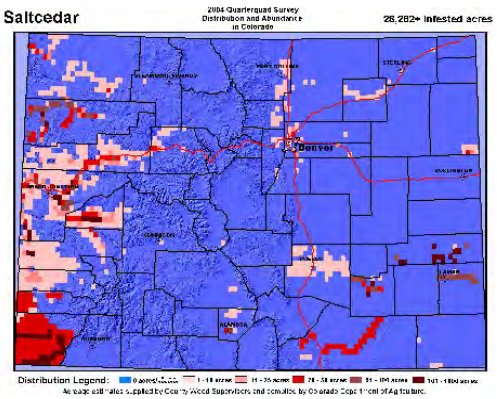
Identification and Impacts

Saltcedar, or tamarisk (*Tamarix spp.*), is a non-native deciduous evergreen shrub or small tree that grows from 5 to 20 feet tall. The bark on saplings and stems is reddish-brown. The leaves are small, scale-like and bluish-green in color. Tiny pink to white flowers have five petals and grow on slender racemes. Saltcedar reproduces by seeds as well as vegetatively. A mature plant can produce up to 600,000 seeds per year. Seeds are viable for up to 45 days under ideal conditions. Saltcedar buds break dormancy in February or March. Flowering occurs anytime between April and August. Ideal conditions for saltcedar seedling survival are saturated soil during the first few weeks of life, a high water table, and open sunny ground with little competition from other plants.

Saltcedar was introduced from central Asia, northern Africa, and southern Europe for ornamental purposes and for stream bank stabilization. It is now widespread in the United States. Saltcedar crowds out native stands of riparian and wetland vegetation. Saltcedar increases salinity of surface soil, rendering the soil inhospitable to native plant species. Saltcedar can be found along floodplains, riverbanks, streambanks, marshes, and irrigation ditches. It's heavy use of water has contributed to the intensity of the drought.

The most effective method of control for saltcedar is to prevent its establishment through proper land management. Monitor susceptible areas for new infestations. An integrated weed management approach has proven to be an effective control when dealing with saltcedar. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

Saltcedar is designated as a "List B" species on the Colorado Noxious Weed Act. It is required to be either eradicated, contained, or suppressed depending on the local infestations. For more information, please visit www.colorado.gov/ag/csd and click on the Noxious Weed Program link. Or call the State Weed Coordinator of the Colorado Department of Agriculture, Conservation Services Division, 303-239-4100.



Plant and flower photos © Kelly Uhing. Leaf photo © USDA Aphis PPQ. Infestation photo above, © Steve Dewey, Invasive.org. Tamarisk branch © Stevens County, WA Noxious Weed Control Board

Updated on:
08/08

Management Recomendations

CULTURAL
After a saltcedar infestation is managed, revegetation is necessary in order to protect the soil resource and reduce the threat of reinvasion. Seeded grasses, willow stakes, and cottonwood cuttings can reduce the chances of saltcedar reinvading managed sites.

BIOLOGICAL
The saltcedar leaf beetle (*Diorhabda elongata*) larvae and adults feed on foliage. This causes stem dieback and potential death of the plant if defoliation is consistent. The leaf beetle should be available for limited distribution. For more information, contact the Palisade Insectary of the Colorado Department of Agriculture, 970-464-7916.

MECHANICAL
A bulldozer or prescribed fire can be used to open up large stands of saltcedar. These methods must be followed up with a herbicide treatment of the resprouts when they are 1 to 2 meters tall. Chainsaws, or loppers for smaller plants, are effective for cut-stump treatments to smaller infestations or in environmentally-sensitive management areas.

Integrated Weed Management:

Select the appropriate control method based on the size of the area and other environmental or cultural considerations. Re-seed controlled areas with desirable species to protect the soil resource and to prevent or slow saltcedar reinvasion. Follow up control efforts the same growing season and for several years afterwards.

Saltcedar

HERBICIDES: The following are recommendations for herbicides that can be applied to range and pasturelands. Rates are approximate and based on hand-held equipment with an output of 30 gallons per acre. Always read, understand, and follow the label directions. **The herbicide label is the LAW!**

HERBICIDE	RATE	APPLICATION TIMING
Triclopyr (Garlon 4 *approved aquatic label*)	Foliar - 2-4 qts./acre Cut-stump - undiluted 100% Basal bark treatment 1:3 of herbicide:natural oil	Foliar treatments - late spring to early fall Cut-stump - anytime except when snow is present Basal bark - anytime except when snow is present
Glyphosate (Rodeo *approved aquatic label* **nonselective, will kill all vegetation it contacts**)	Cut-stump - undiluted 100%	Treat anytime except when snow is present. Treat the cambium immediately after being cut. Thoroughly wet the surface, but not to the of run-off.
Imazapyr (Arsenal or Habitat *Habitat is approved for use in aquatic sites*)	Cut-stump - 8-12oz/gal water Foliar - 0.5-6.5oz/gal water + nonionic surfactant or methylated seed oil	Cut-stump - anytime except spring during heavy sap flows. Foliar - late spring to late summer. Spray entire crown and 70% of plant. Avoid spray solution run-off. After application, do not disturb saltcedar for 2 years or overall control will be reduced.

List B Species

Rangeland, pasture, and riparian site recommendations

1

Scotch thistle

Colorado Department of Agriculture

305 Interlocken Pkwy
Broomfield, CO 80021

(303) 869-9030
weeds@state.co.us

Key ID Points

1. Flower heads cluster 2-5 and are purple to dark red in color.
2. Leaves are alternate, stalk-less and hairy underneath.

Updated on: 08/08

Scotch thistle Identification and Management

Identification and Impacts

Scotch thistle *(Onopordum acanthium or O. tauricum)* is a non-native biennial forb that reproduces solely by seed. A biennial is a plant that completes its lifecycle within two years. During the first year of growth, Scotch thistle appears as a rosette in spring or fall. Rosettes can be 1 to 2 feet in diameter. During the second year in mid to late spring the stem bolts, flowers, sets seed, and the plant dies. A prolific seed producer, Scotch thistle can produce up to 14,000 seeds per plant.

Scotch thistle can grow up to 12 feet tall. Stems are numerous, branched, and have broad, spiny wings. The leaves of species *acanthium* are large, grayish-green, spiny, and covered with fine dense hair giving the leaf a woolly appearance. The leaves of the species *tauricum* are similar in size, but are not hairy, smooth and bright green. On both species, the leaves have a distinct mid-rib. The flowers are violet to reddish in color, numerous (70-100/plant), and are surrounded by spine-tipped bracts. The plants flower from mid-June to September.

Due to the robust, spiny nature of Scotch thistle, this plant can act as a living barbed wire fence, making areas impassible for wildlife, livestock, and people. Scotch thistle invades rangeland, overgrazed pastures, roadsides, and irrigation ditches. It also prefers high-moist soil areas adjacent to creeks and rivers.

The key to effective control of Scotch thistle is maintaining healthy pastures and rangeland, guarding against disturbance or overuse, and as with most biennials limit seed production. To reduce seed production, plants with buds or flowers should be collected and immediately disposed of or destroyed. Chemical control is most effective when plants are in rosette stage, spring or early fall. Mechanical controls can be used to eliminate small patches or plants in a later growth stage. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

Scotch thistle is designated as a "List B" species in the Colorado Noxious Weed Act. It is required to be either eradicated, contained, or suppressed depending on the local infestations. For more information visit www.colorado.gov/ag/csd and click on the Noxious Weed Management Program. Or call the State Weed Coordinator at the Colorado Department of Agriculture, Conservation Services Division, 303-239-4100.

Photos © Map above: Crystal Andrews, Colorado Department of Agriculture; All other photos: Kelly Uhing, Colorado Department of Agriculture.

Onopordum acanthium or O. tauricum

Management Recommendations

CULTURAL
Establishment of selected grasses can be an effective cultural control of Scotch thistle. Contact your local Natural Resources Conservation Service for seed mix recommendations. Maintain healthy pastures and prevent bare spots caused by overgrazing. Bareground is prime habitat for weed invasions.

BIOLOGICAL
Urophora stylata, a fly predator, is used to help control this thistle. The female fly lays eggs in the seed head of the thistle. The maggot then consumes the seed in the flower. This species has overwintered in Colorado but the limited numbers will not allow for general redistribution. For more information, contact the Palisade Insectary of the Colorado Department of Agriculture at 970-464-7916.

MECHANICAL
Any mechanical or physical method that severs the root below the soil surface will kill Scotch thistle. Mowing or chopping is most effective when Scotch thistle plants are at full-bloom. Be sure to properly dispose of the flowering cut plants since seeds can mature and become viable after the plant has been cut down.

Integrated Weed Management:

Scotch thistle is best controlled in the rosette stage. For small infestations, 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. It is imperative to prevent seed production. Do not allow Scotch thistle flowers to appear.

Scotch thistle

HERBICIDES

NOTE: The following are recommendations for herbicides that can be applied to range and pasturelands. Rates are approximate and based on equipment with an output of 30 gal/acre. Please read label for exact rates. Always read, understand, and follow the label directions. The herbicide label is the LAW!

HERBICIDE	RATE	APPLICATION TIMING
Picloram (Tordon 22K - *Restricted Use*)	1 pint/acre + 0.25-0.5% v/v non-ionic surfactant	Apply spring or fall in the rosette stage.
Aminopyralid (Milestone)	7 fl. oz./acre + 0.25-0.5% v/v non-ionic surfactant	Apply spring or fall in the rosette stage.
Metsulfuron (Cimarron X-tra)	2 oz. product/acre 0.25-0.5% v/v non-ionic surfactant	Apply rosette to early bolt stages of growth. (Spring)

Spotted Knapweed Identification and Management

List B

Spotted knapweed (*Centaurea stoebe*) is a non-native, short-lived perennial forb that reproduces mainly by seed. A prolific seed producer, spotted knapweed can grow up to 900 seeds per plant annually that are viable for up to 8 years. The key to distinguishing spotted from other knapweeds is the black-tipped, spiny, involucral bracts (phyllaries) at the base of the flower. Unlike diffuse knapweed, it does not have a long, distinct terminal spine at the tip of the bracts. Spotted knapweed can grow up to 3 feet tall on ridged stems that are openly branched on the upper half of the plant. Urn-shaped flowers are solitary on the tip of each branch. Flowers are pink to purple, and rarely white. Leaves on the stem are alternate, deeply lobed, and become smaller and simple near the tips of the stem. Basal rosette leaves are deeply lobed and up to 6 inches long.

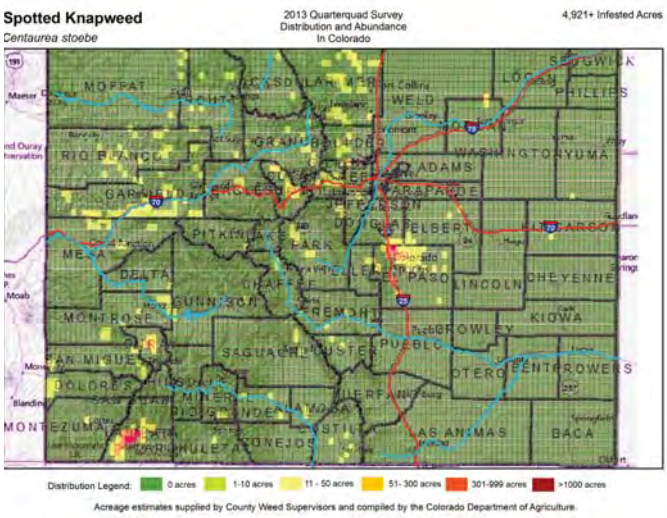
Flowers bloom from June to October and seed-set usually occurs by mid-August. Spotted knapweed can also reproduce vegetatively from lateral roots.

Spotted knapweed tends to invade disturbed, overgrazed areas. It also occurs in grasslands, pastures, foothill clearings, logged areas, roadsides, sandy soils, and floodplains. Since it can tolerate both dry conditions and moist areas it is an especially versatile invader. Spotted knapweed and diffuse knapweed infestations often occur together in Colorado and plants can hybridize. Once established, spotted knapweed reduces livestock and wildlife forage by out-competing native and desirable species.

The most effective method of control for spotted knapweed is to prevent seed production and establishment through proper land management. Maintain healthy pastures, rangeland, and forests; and continually monitor for new infestations. If spotted knapweed is already established, applying an integrated weed management approach is effective. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

Spotted knapweed is designated as a "List B" species as described in the Colorado Noxious Weed Act. It is required to either be eliminated, contained, or suppressed depending on the local infestations. For more information please visit www.colorado.gov/ag/weeds and click on the Noxious Weed Program link or call the State Weed Coordinator, Colorado Department of Agriculture at 303-869-9030.

2013 Quarter Quad Survey



Key ID Points

1. Floral bracts have black tips, with comb-like spines of equal length.
2. Flowers are pink to purple, and rarely white.
3. Basal and stem leaves are deeply lobed, but become simple and oblong towards the tips of the stem.

Spotted knapweed

Centaurea stoebe

List B

Spotted knapweed
Centaurea stoebe

Integrated Weed Management Recommendations

Spotted knapweed is best controlled at the rosette stage with mechanical or chemical techniques in the spring and fall. A key goal is to prevent seed production. Management must be intense and persistent in order to deplete the seed bank in the soil.


© Patrick J. Alexander


Hybrid spotted-diffuse knapweed flower

CULTURAL
Bareground is prime habitat for weed invasions. Maintaining healthy pastures and forests, while minimizing disturbance and overgrazing, is crucial. Contact your local Natural Resources Conservation Service for seed mix recommendations.

BIOLOGICAL
Root and seed head weevils (*Cyphocleonus achates* and *Larinus minutus*) attack the roots and reduce seed production in spotted and diffuse knapweeds. This is an option for large infestations, though optimum results take 3-5 years. To obtain the insects, contact the Colorado Department of Agriculture's Insectary in Palisade, Colorado at 970-464-7916.

MECHANICAL
Dig when the soil is moist; remove the root crown, 2-4 inches of taproot, and lateral roots. Digging alone requires several years of multiple treatments within a growing season. Mowing spotted knapweed when flower buds or early flowers are present will stress the plant, but not kill it. Do not mow after seed-set because it can disperse the seeds. Annual cultivation can eliminate spotted knapweed.

CHEMICAL
The table below includes recommendations for herbicides that can be applied to rangeland and some pastures. Always read, understand, and follow the label directions. The herbicide label is the LAW!

HERBICIDE	RATE	APPLICATION TIMING
Aminopyralid (Milestone)	5-7 ounces/acre or 1 teaspsoon/ gal water	Spring at rosette to early bolt stage and/or in the fall to rosettes. Add 0.25% v/v non-ionic surfactant (equivalent to 0.32oz/gal water or 1 qt/100 gal water).
Aminocyclo-pyrachlor + chlorsulfuron (Perspective)	4.75 to 8 oz product/acre	Apply in the fall when above-ground stems die back and root buds are highly susceptible; can also apply in the bud to senescence stages. Important: Applications greater than 5.5 oz product/acre exceeds the threshold for selectivity. DO NOT treat in the root zone of desirable trees and shrubs. Add 0.25% v/v non-ionic surfactant.
Clopyralid (Transline, Stinger)	2/3 to 1 pint/ acre	Apply to spring/fall rosettes before flowering stalk lengthens. Add 0.25% v/v non-ionic surfactant.
Clopyralid + 2,4-D (Curtail)	2-3 qts. product/acre	Apply in spring and fall to rosettes. Add 0.25% v/v non-ionic surfactant.

Colorado Department of Agriculture - Conservation Services
305 Interlocken Parkway
Broomfield, CO 80021
(303) 869-9030
www.colorado.gov/ag/weeds

Rev. 10/14

List A Species

Rangeland, pasture, and riparian site recommendations

1

Yellow starthistle

Centaurea solstitialis

Colorado Department of Agriculture

305 Interlocken Pkwy
Broomfield, CO 80021

(303) 869-9030
weeds@state.co.us

Yellow starthistle Identification and Management

Identification and Impacts

Yellow starthistle *(Centaurea solstitialis)* originated from Northern Spain. It is a winter annual that is blue-green in color, has a vigorous taproot, and produces bright yellow flowers with sharp, stiff spines surrounding the base of the flower that extend up to ¾ of an inch long. Yellow starthistle grows from 1 inch tall to 4 feet tall. Basal leaves are 1-3 inches long and deeply lobed while upper leaves are smaller and narrower. Stems appear winged and both stem and leaves have a slight whitish nap covering them. Yellow starthistle spreads by seed with a single large plant producing up to 100,000 seeds. Plumed and plumeless seeds disperse at different times.

Yellow starthistle typically germinates in the fall with increased moisture, overwinters as a seedling, and forms its rosette beginning in March through May. It can however, germinate extremely fast with optimal conditions throughout the entire summer (16 hours or less with ~ 70 degrees F and ample moisture). Flowering generally occurs from June to September and often later.

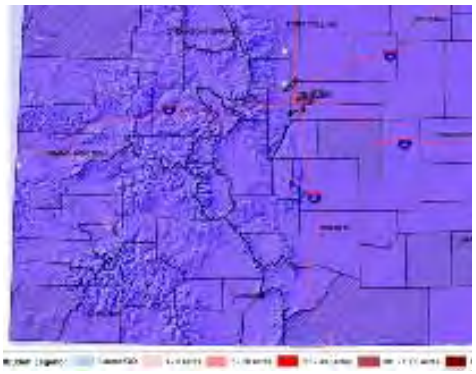
Habitats for yellow starthistle include rangelands, pastures, roadsides, wastelands, and lower elevations. Over utilized grasslands are particularly susceptible to invasion.

Yellow starthistle is fatally poisonous to horses (causing chewing disease) and is considered poor forage for all livestock and wildlife. It also destroys native plant communities. The seed bank of yellow starthistle is not completely understood. The site must be monitored for at least 15 years after the last flowering adult plants have been eliminated and treatments repeated when necessary.

The key to effective control of yellow starthistle is to prevent seed set from occurring in existing populations, monitoring your land for new infestations frequently, treating newly detected invasions rapidly, and preventing new introductions from occurring. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

Yellow starthistle is designated as a "List A" species in the Colorado Noxious Weed Act. It is designated for statewide eradication. For more information visit www.colorado.gov/ag/weeds and click on the Noxious Weed Management Program. Or call the State Weed Coordinator at the Colorado Department of Agriculture, Conservation Services Division, 303-239-4100.

Map of yellow starthistle infestation.



Key ID Points

1. Bright yellow ray and disk flowers.
2. Winged stems.
3. Stiff spines at flower base
4. Plant has a unique blue-green color.

Photos clockwise from lower left © (3 on left side) Kelly Uhing, Colorado Department of Agriculture, Steve Dewey, Utah State University, Bugwood.org; and map by Crystal Andrews, Colorado Department of Agriculture.

Updated on: 7/2015

Integrated Weed Management recommendations

Yellow starthistle

Management Recommendations

CULTURAL
Following initial control, establishment of selected grasses can be an effective cultural control of yellow starthistle. Contact your local Natural Resource Conservation Service for seed mix recommendations. Maintain healthy pastures and prevent bare spots caused by overgrazing. Bare ground is prime habitat for weed invasions.

BIOLOGICAL
Insect biocontrol agents exist but are not included in the state prescribed management plan. Eradication is the management objective for all List A species. For more information on biocontrol in Colorado, contact the Palisade Insectary of the Colorado Department of Agriculture at 970-464-7916.

MECHANICAL
Hand pull when soil is moist and make certain to pull all the roots. Bag specimens carefully so as to not scatter seeds if flowering. Plants vary greatly in size so be sure to look for plants that are only a few inches tall, as well as plants that are several feet tall. Include dried skeletons as they may still contain seed. Mowing is not advisable and may extend life of the plant and stimulate additional flowering.

Integrated Weed Management:

The sheer number of seeds, high seed viability, and fast growth of yellow starthistle requires a persistent control program. Using herbicides and mechanical techniques to control the invasion followed by establishing a desirable plant community can be effective.

Management must be persistent to deplete the seed bank in the soil.

It is imperative to prevent seed production. Do not allow yellow starthistle plants to go to seed.

HERBICIDES

NOTE: The following are recommendations for herbicides that can be applied to range and pasturelands. Rates are approximate and based on equipment with an output of 30 gal/acre. Please read label for exact rates. **Always read, understand, and follow the label directions. The herbicide label is the LAW!**

Herbicide	Rate	Application Timing
Aminopyralid (Milestone)	7 oz. product/acre	Apply during rosette growth and bolting growth stages. (Early spring to early summer)
Aminocyclopyrachlor + chlorsulfuron (Perspective)	3-5 oz. product/acre + 0.25% v/v non-ionic surfactant	Apply during rosette growth and bolting growth stage; most effective at the seedling to the rosette stages. IMPORTANT: Applications greater than 5.5 oz. product/acre exceeds the threshold for selectivity. DO NOT treat in the root zone of desirable trees and shrubs. Not permitted for use in the San Luis Valley.
Clopyralid (Transline)	1.33 pints product/acre	Apply during rosette growth and bolting growth stages. (Early spring to early summer)
Additional herbicide recommendations for this and other species can be found at: www.colorado.gov/agconservation/CSUHerbicideRecommendations.pdf		

Photos, top to bottom © Stephen Ausmus, USDA Agricultural Research Service, Bugwood.org; University of Idaho Archive, University of Idaho, Bugwood.org; and Jerry Asher, USDI Bureau of Land Management, Bugwood.org.

List B Species

Rangeland, pasture, and riparian site recommendations

1

Yellow toadflax

Linaria vulgaris

Colorado Department of Agriculture

305 Interlocken Pkwy
Broomfield, CO 80021

(303) 869-9030
weeds@state.co.us

Key ID Points

1. Yellow flowers that are like snapdragons with deep orange centers.
2. Stems that are woody at the base and smooth to the top.

Updated on: 02/08

Yellow toadflax Identification and Management

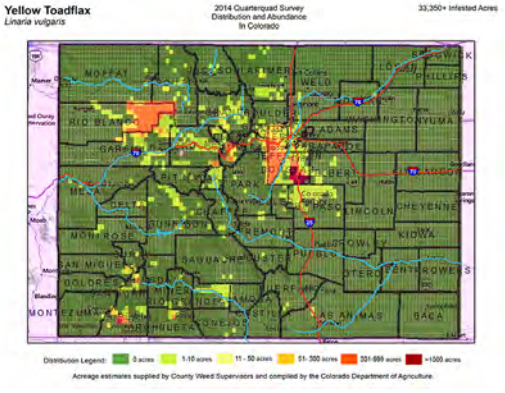
Identification and Impacts

Yellow toadflax (Linaria vulgaris) is a perennial escaped ornamental plant that is native to the Mediterranean region. The leaves are narrow, linear, and 1 to 2 inches long. The stems are woody at the base and smooth toward the top. Sparingly branched and 1 to 3 feet tall. The showy snapdragon-like flowers are bright yellow with a deep orange center and have a spur as long as the entire flower. It develops an extensive root system, making control options varied. Yellow toadflax displaces desirable plant communities reducing ecological diversity and rangeland value. Decreases forage for domestic livestock, some big game species and decreases habitat for associated animal communities. The plant is known to be mildly poisonous to cattle. Goats and sheep have been known to graze the plants with little effect.

Habitats for Yellow toadflax include roadsides, vacant lots, gravel pits, fields, waste areas, other disturbed sites and rangeland. It has adapted to a variety of site conditions, from moist to dry and does well in all types of soil. The plant can even establish in areas of excellent condition in natural disturbances or small openings.

The key to effective control of Yellow toadflax is prevention and integrating as many management strategies as possible. Prevention is always desirable when dealing with Yellow toadflax. Early detection and eradication can keep populations from exploding, making more management options available. With the plants varying genetically using many different approaches is important such as; herbicide, mechanical, cultural and biological methods. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

Yellow toadflax is designated as a "List B" species in the Colorado Noxious Weed Act. It is required to be either eradicated, contained, or suppressed depending on the local infestations. For more information visit www.colorado.gov/ag/weeds and click on the Noxious Weed Management Program. Or call the State Weed Coordinator at the Colorado Department of Agriculture, Conservation Services Division, 303-239-4100.



Infestation photo, above,© John M. Randall, The Nature Conservancy. Infestation map, Crystal Andrews, Colo.Dept.of Agriculture. Flower photo, top, © Missouri Extension. Flower bract photo, left,© Paul Slichter, University of Wisconsin, Stevens Point. Leaves photo © Gary Fewless, Unviersity of Wisconsin, Stevens Point.

Management Recommendations

CULTURAL
Establish select grasses and forbs as an effective cultural control of Yellow toadflax. Contact your local Natural Resources Conservation Service for seed mix recommendations. Bareground is prime habitat for weed invasions, so maintain healthy pastures and prevent bare spots caused by overgrazing.

BIOLOGICAL
Calophasia lunula, a predatory noctuid moth, feeds on leaves and flowers of Yellow toadflax. Eteobalea intermediella, a root boring moth and Mecinus janthinus a stem boring weevil are also available. For more information, contact the Colorado Department of Agriculture's Insectary in Palisade, Colorado at 970-464-7916.

MECHANICAL
Handpulling or digging is not recommended for eradication of Yellow toadflax because it's unlikely that the entire root will be excavated and a new plant is likely to occur. A single new plant might be an exception. Tillage is not recommended due to the creeping root system.

Integrated Weed Management:

Because of the high genetic variability of the toadflax species it is critical to integrate as many management strategies as possible into the control program. Two local populations may respond differently to the same herbicides.

Keys to management are to prevent seed formation and vegetative spread by roots. Controlling is expensive and difficult to treat toadflaxes, prevention is the best option.

Yellow toadflax

HERBICIDES

NOTE: The following are recommendations for herbicides that can be applied to range and pasture-lands. *Rates are approximate and based on equipment with an output of 30 gallons per acre.* Always read, understand, and follow the label directions. The herbicide label is the LAW!

Herbicide	Rate	Application Timing
Chlorsulfuron (Telar - general use)	Apply 1-3 oz/A product plus 0.50% v/v MSO Silicone Blend surfactant (multiple brands available)	Apply at mid-flowering through fall. Telar has grazing restrictions above 1 1/3 oz/A rate. Please refer to the label for more detail.
Picloram + Chlorsulfuron (Tordon 22K - *restricted use* + Telar - general use)	Apply at 1 qt/Acre Picloram + 1.25 oz/A Telar plus 0.25% v/v non-ionic surfactant.	Apply at flowering through fall. Typically late August through September application timing has shown best results. Re-treatment may be necessary. Refer to label for grazing restrictions on Telar.
Picloram (Tordon 22K - *re-stricted use*)	Apply at 1.5 qt/A plus 0.25% v/v non-ionic surfactant or 1 qt/A crop oil concentrate	Apply in fall (late August through September). Re-treatment may be necessary.

APPENDIX II

GOOSE HAVEN RESERVOIR

WEED INVENTORY SHEET

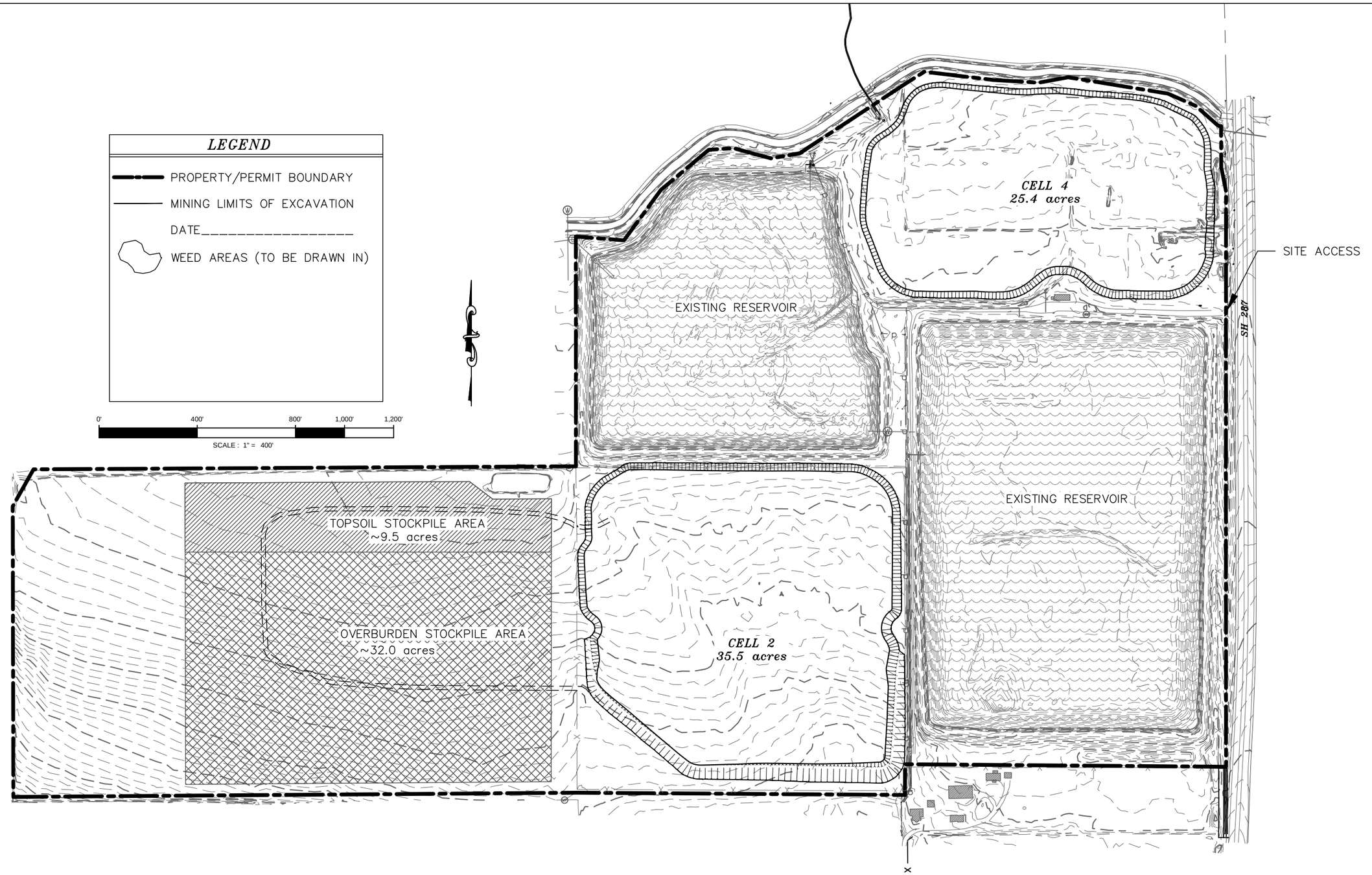
DATE	TIME	Conducted by	WEED IDENTIFICATION /DESCRIPTION	NUMBER REFERENCE FROM MAP	TREATMENT (y/n)

LEGEND

- PROPERTY/PERMIT BOUNDARY
- MINING LIMITS OF EXCAVATION
- DATE_____
- WEED AREAS (TO BE DRAWN IN)

0' 400' 800' 1,000' 1,200'

SCALE : 1" = 400'



REVISIONS			
REV	DESCRIPTION	DATE	APPROVED

Weiland, Inc.
Environmental & Engineering

PO BOX 18087
BOULDER, CO, 80308
ph 303-443-9521

GOOSE HAVEN RESERVOIR #2 - COMPLEX EXPANSION

WEED MANAGEMENT PLAN

LAFAYETTE, CO

PREPARED FOR: ROCK PRODUCTS, LLC

FIELD WEED INVENTORY MAP

SCALE	DWG NO.	REV.
1"=400'	FIGURE 2.DWG	REV

DRAWN BY:	CHECKED BY:	DATE:	SHEET
CTW	PFW	11/02/16	1 OF 1