

Revegetation Plan

for

Ebba Solar Project

Lincoln County, Colorado

Prepared for:

BRP Rhodochrosite 1, LLC

a wholly owned subsidiary of:



BALANCED ROCK
POWER

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L O G A N S I M P S O N

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Introduction

The Ebba Solar Project (the Project) proposes to generate up to 300-megawatt alternating current (MWac) solar photovoltaic (PV) renewable energy, spread over two 150 MWac phases. The Project will also include two Battery Energy Storage Systems (BESS) of 74 MWs, coinciding with each solar phase. The Project would interconnect to Tri-States Lincoln Substation, which is located directly north of the Project. The energy produced by the Project would provide electricity to approximately 87,000 homes in Colorado. The Project will also include the following components:

- On-site substation
- Operations and Maintenance area and building
- Communications facilities
- One or more meteorological stations
- Site security and fencing

Purpose

The purpose of the Revegetation Plan for the Project is to outline Best Management Practices (BMPs) and specifications as they relate to surface disturbing activities during the pre-construction, construction, and post-construction phases of the Project. The following sections detail existing site conditions, revegetation specifications, and BMPs for topsoil salvage and storage, erosion control, seedbed preparation, seeding, maintenance and monitoring, and weed management.

Site Description

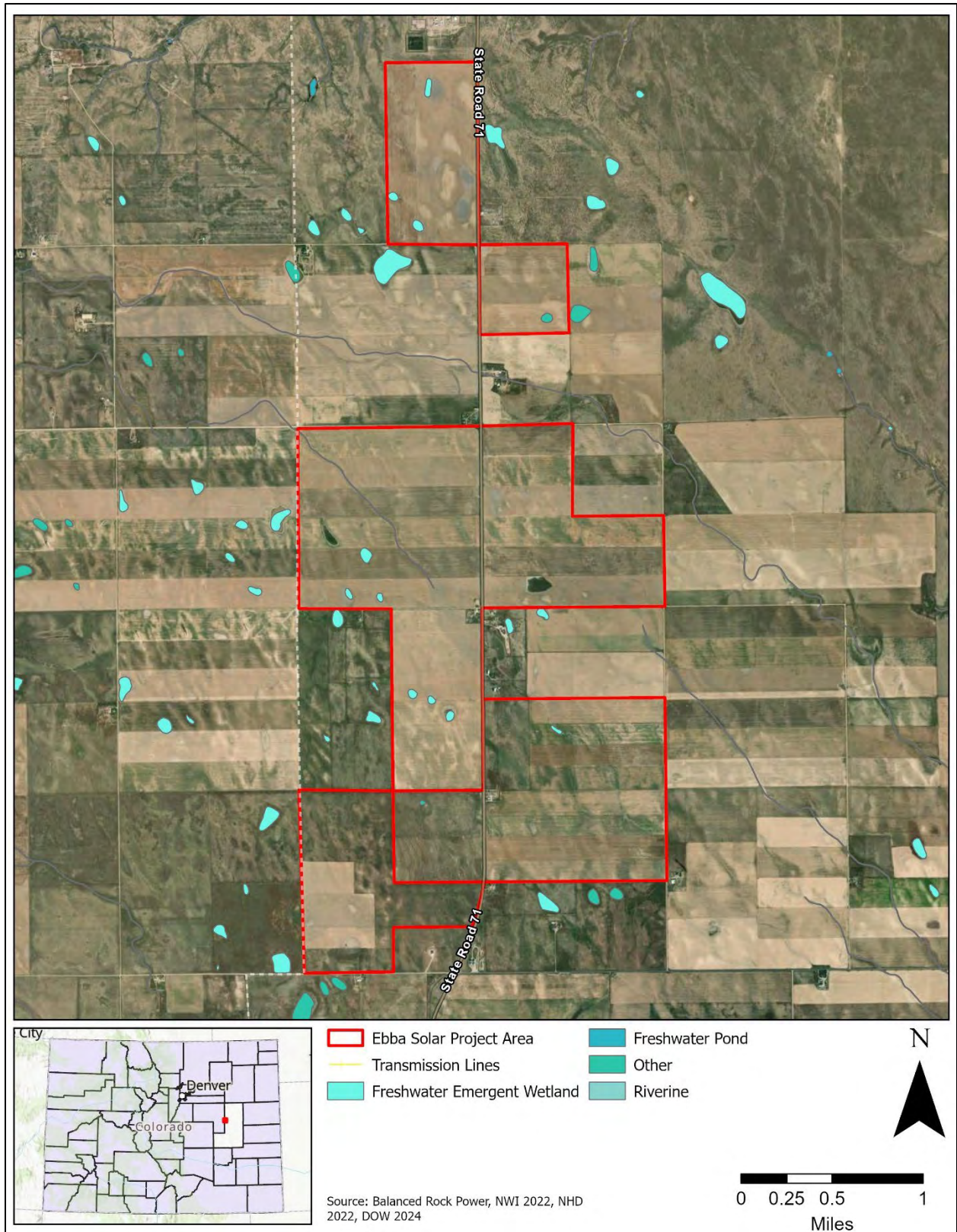
Lincoln County is within the eastern plains region of Colorado, which is historically dominated by shortgrass prairie species. The Project area is located approximately 4 miles south of Limon, Colorado, on 3,110 acres of privately owned land. State Road 70 bisects the Project area (Figure 1). Local weather for the site is detailed in Table 1.

Table 1. Annual weather for Limon, Colorado.

Weather Parameter	Min	Mean	Max
Temperature (°F)	-17.0	46.6	104
Precipitation (inches)	9.83	13.9	21.18
Snowfall (inches)	0	3.5	9

Source: NOAA, Limon Station (2000-2024)

Figure 1. Project location in Lincoln County, Colorado.



Soils

The major soil unit within the Project area is Ascalon sandy loam, on 0 to 3% slopes (Table 2, Figure 2). Ascalon sandy loam covers approximately 25% of the Project area and is predominately found on interdunes and interfluves (NRCS 2022). Interdune features may indicate a current loss of topsoil, making revegetation efforts harder to implement. To determine erosion potential of soils within the Project site, Wind Erodibility Groups (WEGs) and KFactor were analyzed to determine susceptibility of soils to erosion by wind and water, respectively. WEGs consist of soils that have similar properties influencing their susceptibility to erosion by wind in cultivated areas, while K Factor measures the potential for soil particles to detachment and transport from rainfall and/or runoff (NRCS 2022). Approximately 24% of the Project area is highly susceptible to wind erosion, falling within WEGs 1-3 and 43% of the Project area is highly susceptible to erosion from water, with KFactor greater than 0.40 (Table 2).

Table 2. Characteristics of soil units within the Project boundary.

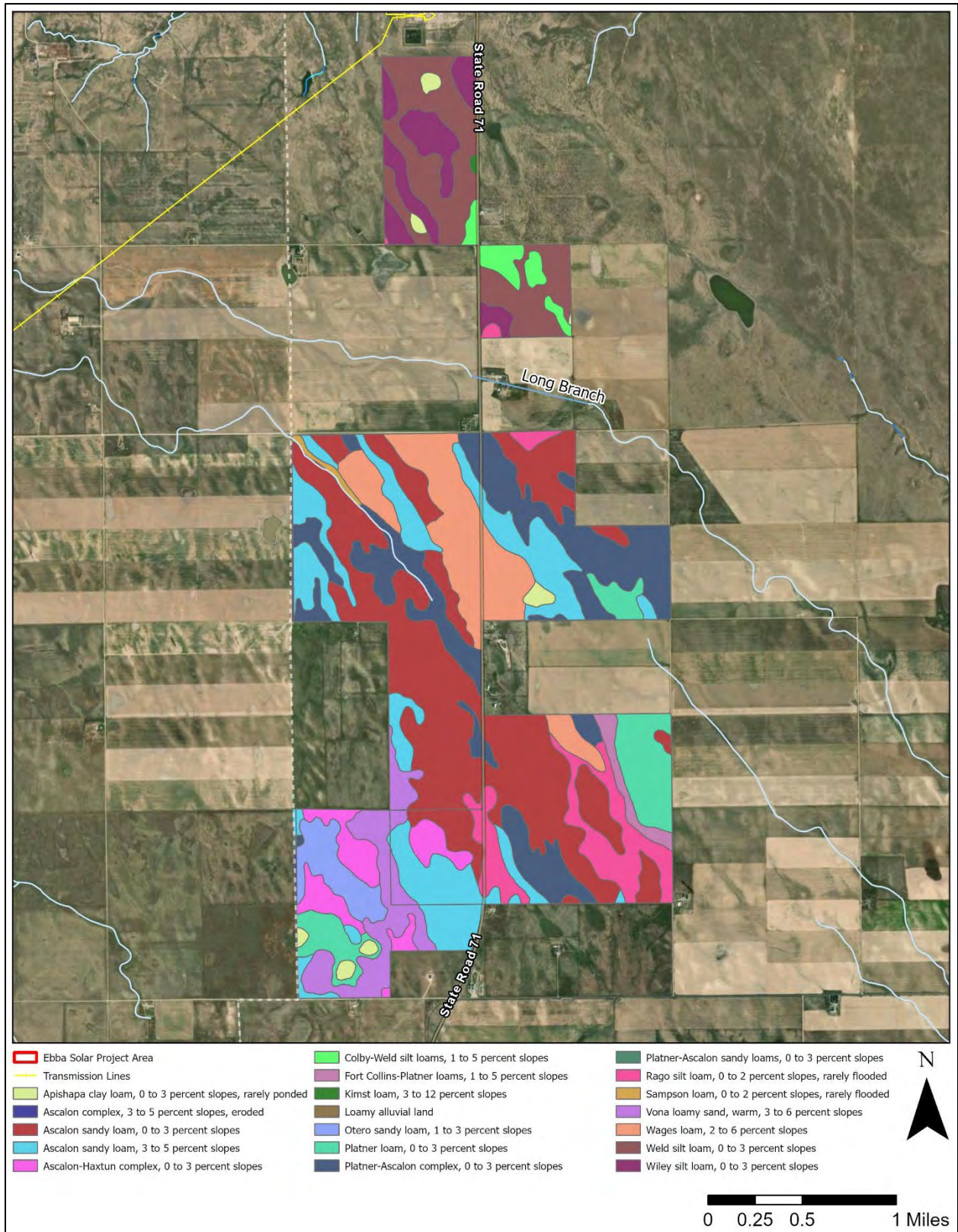
Soil Unit Name	Area (acres)	% of Project	WEG ⁺	K Factor [*]
Ascalon sandy loam, 0 to 3 percent slopes	786	25%	4L	.17
Platner-Ascalon complex, 0 to 3 percent slopes	438	14%	5	.43
Ascalon sandy loam, 3 to 5 percent slopes	401	13%	3	.17
Wages loam, 2 to 6 percent slopes	276	9%	5	.43
Weld silt loam, 0 to 3 percent slopes	273	9%	5	.49
Platner loam, 0 to 3 percent slopes	169	5%	5	.43
Rago silt loam, 0 to 2 percent slopes, rarely flooded	171	5%	6	.37
Vona loamy sand, warm, 3 to 6 percent slopes	152	5%	2	.15
Ascalon-Haxtun complex, 0 to 3 percent slopes	110	4%	3	.17
Wiley silt loam, 0 to 3 percent slopes	134	4%	4L	.43
Colby-Weld silt loams, 1 to 5 percent slopes	50	2%	4L	.43
Otero sandy loam, 1 to 3 percent slopes	76	2%	3	.10
Apishapa clay loam, 0 to 3 percent slopes, rarely ponded	32	1%	8	.20
Ascalon complex, 3 to 5 percent slopes, eroded	5	0%	5	.17
Kimst loam, 3 to 12 percent slopes	2	0%	4L	.28
Loamy alluvial land	0	0%	4L	.37
Platner-Ascalon sandy loams, 0 to 3 percent slopes	1	0%	5	.55
Sampson loam, 0 to 2 percent slopes, rarely flooded	10	0%	6	.24
Totals:	3,118	100%		

Source: NRCS 2022

*Wind Erodibility Groups: Soils in group 1 are most susceptible to wind erosion and those in group 8 are least susceptible.

*K Factor: Ranges from 0.02 to 0.69, with the higher the value, the more susceptible to erosion by water. Values over 0.4 are generally considered highly erodible by water.

Figure 2. Soil units within the Project boundary.

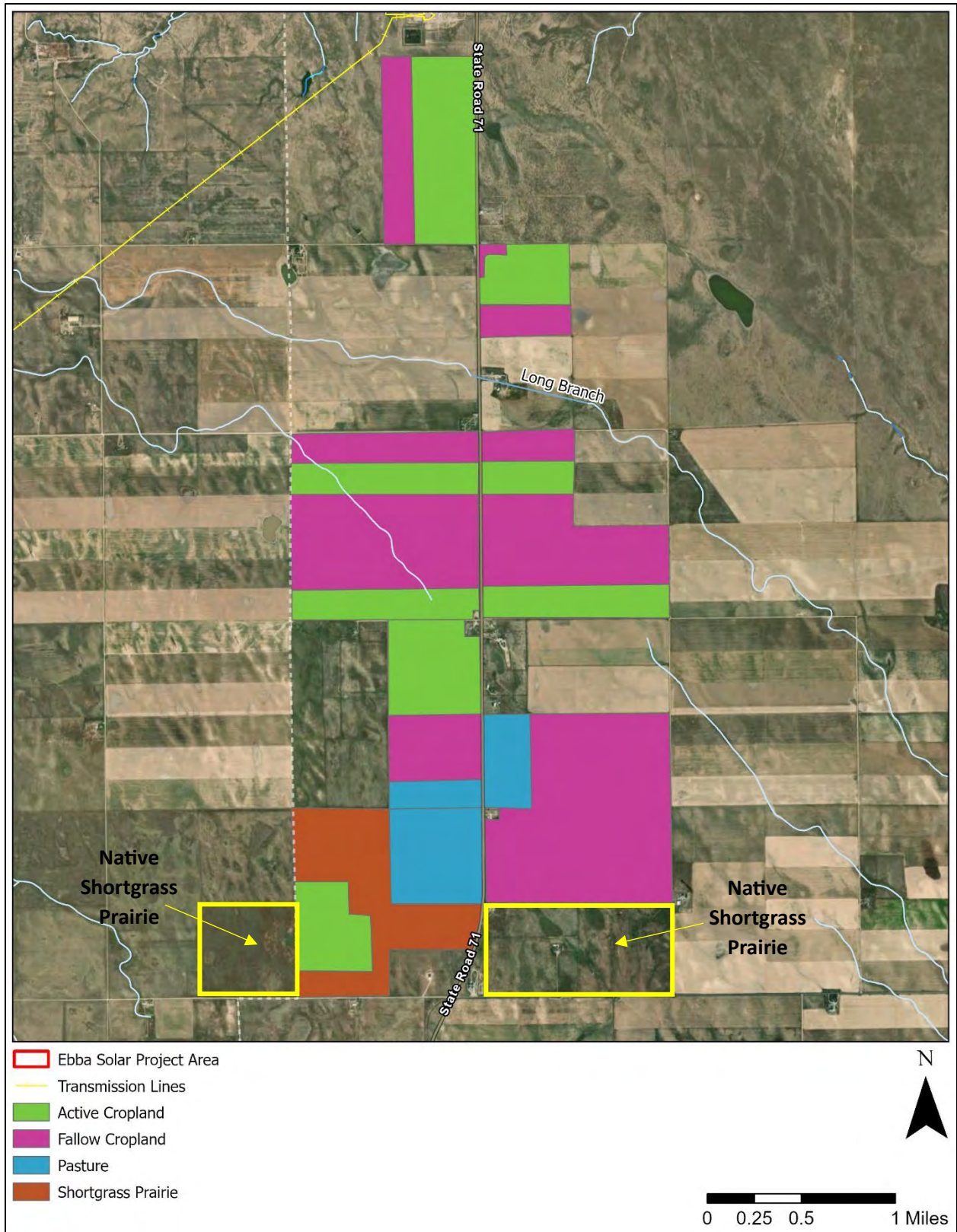


Source: NRCS 2022.

Existing Conditions

A site visit was conducted by Logan Simpson Ecologist, Sarah Smith, on April 9, 2024. Figure 3 shows the results of field observations. Approximately 50% of the Project area is fallow cropland and 21% is being actively farmed. Crop species included sorghum, corn, and wheat. Approximately 9% of the Project area, as well as several parcels adjacent to the southern portions of the Project boundary, were dominated by native shortgrass prairie species (e.g., blue grama, sideoats grama, switchgrass, little bluestem, etc.) (Figure 3). These areas could be potential seed sources for the permanent seed mix outlined below. The benefit of utilizing these areas for seed collection would be to ensure ecotypic seed is used (i.e., species are already adapted to the temperature and moisture regimes of the area, elevation, pests, and other environmental factors).

Figure 3. Results of field assessment conducted by Logan Simpson.



Revegetation Specifications and Best Management Practices

The goal of revegetation is to maintain a desired vegetation community that maximizes ecosystem services while minimizing erosion and the risk of wildland fire. A desired seed mix will be agreed upon with the landowners and County to revegetate areas disturbed by construction. This plan will establish a vegetation management approach that maintains a buffer around access points and electrical equipment that will remain void of vegetation (i.e., defensible spaces).

Revegetation efforts at the site would begin as soon as practicable after completing soil disturbing activities. For locations that may be disturbed again during the construction phase, a temporary seed mix, erosion control, and weed monitoring should occur until more permanent revegetation efforts can be applied.

All revegetation efforts should be implemented within one week after disturbance of a site has concluded and prior to the typical spring rainy season. This would minimize the potential for soil loss and establishment of noxious weeds, as well as maximize revegetation efforts. If satisfactory revegetation is challenging, Balanced Rock Power would coordinate with the landowner and Lincoln County to improve success.

Reference Communities

Defining a reference community that represents pre-disturbance conditions for the Project area informs revegetation strategies. Reference communities appropriate for the Project area were determined by ecological sites identified by the Ecosystem Dynamics Interpretive Tool (EDIT), which details past, present, and future ecological states based on land use, soils, and climate (NRCS, JER, and NMSU 2021).

The Project area falls within Major Land Resource Area (MLRA) 067B – Central High Plains, Southern Part. MLRA 067B is characterized by shallow to deep, loamy or clayey soils with a mesic soil temperature regime and arid soil moisture regime (NRCS, JER, and NMSU 2021). Much of this area supports species characteristic of shortgrass prairies. Most of the land within this MLRA is in agricultural use (NRCS 2006).

As a result of proposed solar arrays, in combination with revegetation strategies, soil health should be improved over the lifetime of the project, as the lack of continued disturbance will increase soil carbon, water retention and infiltration, and reduce surface run-off (Nordberg et al. 2021). Within the Project area, four ecological sites occur: loamy plains, sandy plains, closed depressed, and overflow (Figure 3).

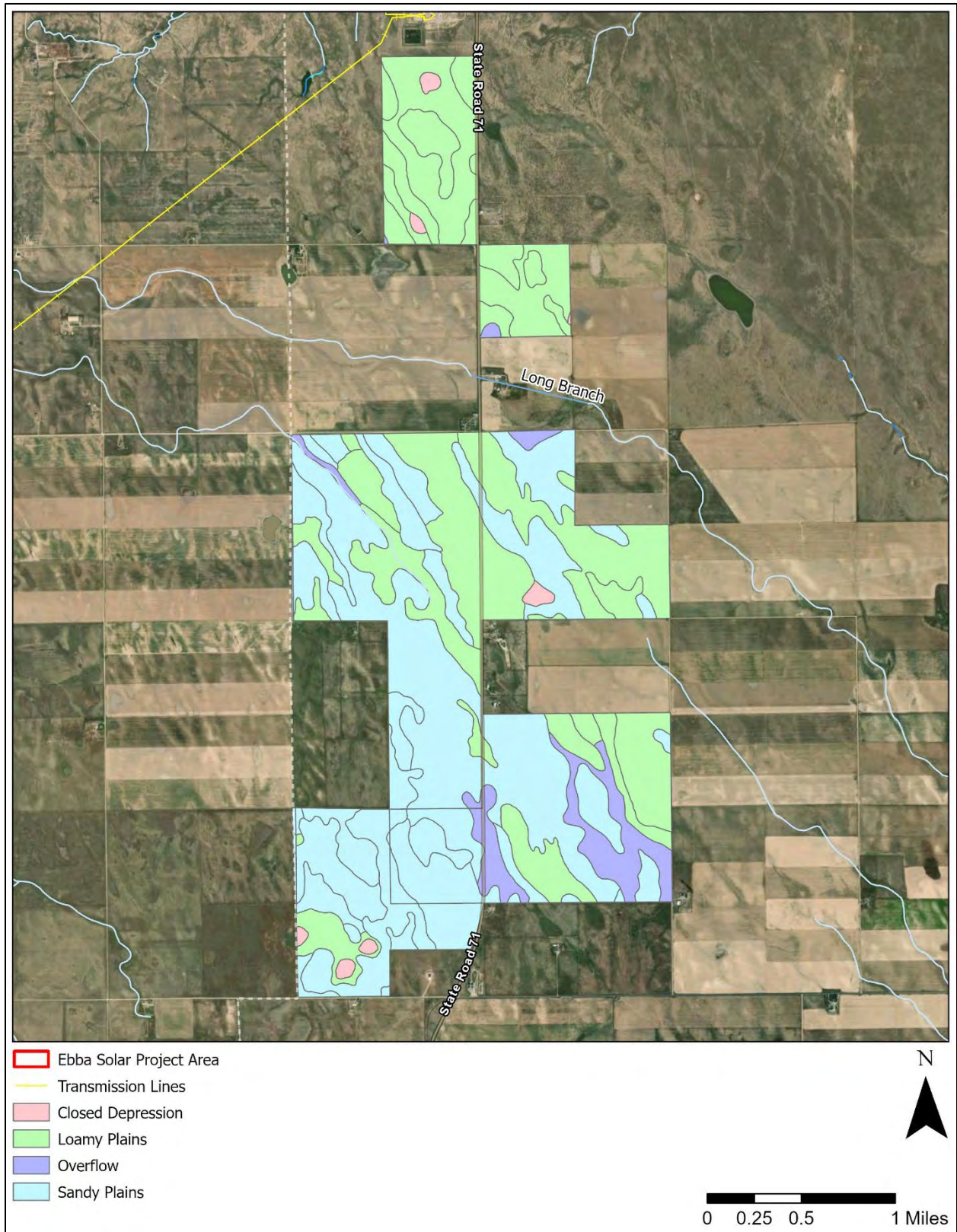
Table 3 describes the characteristics of the ecological sites within the Project that will be used to inform seed mixes. Sandy plains and loamy plains are the dominant ecological sites, covering 93% of the Project area (Table 3). Loamy plains are more common in the northern half of the Project area, while sandy plains are more common in the southern half.

Table 3. Ecological Sites within the Project area used to inform seed mixes.

Ecological Site Name	Soil Association	Area (acres)	% of Project Area	Landform	Dominant Species
Sandy Plains	Ascalon sandy loam, Ascalon-Haxtun complex, Otero sandy loam, Vona loamy sand, Ascalon complex, Platner-Ascalon sandy loams	1,533	49%	Interdune, Interfluve, Terrace	spreading buckwheat (<i>Eriogonum effusum</i>), blue grama (<i>Bouteloua gracilis</i>), prairie sandreed (<i>Calamovilfa longifolia</i>)
Loamy Plains	Colby-Weldt silt loam, Kimst loam, Platner loam, Platner-Ascalon complex, Wages loam, Weld silt loam, Wiley silt loam	1,373	44%	Interfluve, Terrace	fourwing saltbush (<i>Atriplex canescens</i>), winterfat (<i>Krascheninnikovia lanata</i>), western wheatgrass (<i>Pascopyrum smithii</i>), blue grama (<i>Bouteloua gracilis</i>)
Overflow	Rago silt loam, Sampson loam, Loamy alluvial land	181	6%	Floodplain, Drainageway, Draw	fourwing saltbush (<i>Atriplex canescens</i>), winterfat (<i>Krascheninnikovia lanata</i>), western wheatgrass (<i>Pascopyrum smithii</i>), green needlegrass (<i>Nassella viridula</i>)
Closed Depression	Apishapa clay loam	32	1%	Playa, Depression	fourwing saltbush (<i>Atriplex canescens</i>), winterfat (<i>Krascheninnikovia lanata</i>), western wheatgrass (<i>Pascopyrum smithii</i>), blue grama (<i>Bouteloua gracilis</i>)
Totals:		3,118	100%		

Source: NRCS, JER, and NMSU (2021)

Figure 4. Ecological sites within the Project area.



Source: NRCS, JER, and NMSU (2021)

Topsoil Salvage and Storage

Stockpiled or salvaged topsoil should be used to ensure grading contours match 100% construction documents. Due to historic and existing land use, it is unlikely that salvaged topsoil and its associated seed bank will have sufficient supply of native seed; therefore, the approved temporary and/or permanent seed mix shall be used. However, topsoil removal will be minimized as much as possible during construction of the Project. If topsoil in general is not sufficiently available, it may need to be purchased from nearby to support revegetation. The seed mix shall be certified weed-free of noxious and undesirable species, obtained from local vendors, and comprised of native cultivars that originate from within 500 feet elevation of the Project site (locally adapted), if possible.

BMP's and specifications for topsoil removal and storage are as follows:

- Depth of topsoil shall be field verified to determine appropriate excavation depths.
- Stockpile locations shall be at least 25 feet from waterways, wetlands, or drainage/sewer systems.
- Sediment control shall be placed around stockpiles (e.g., silt fencing, sediment control logs, straw bales, or sandbags).
- Stockpiled soil shall not exceed 10 feet in height.
- Soils stockpiled for 30-60 days shall be stabilized with surface roughening, erosion control blankets or mulch, or soil binders.
- Soils stockpiled for more than 60 days shall be seeded and mulched with a temporary seed mix within 7 days.

If topsoil is unsalvageable or unavailable for areas of the site, (i.e., where dunes currently exist), topsoil can be obtained from local suppliers. Topsoil should be sourced from areas with similar vegetation composition and climate, typically from areas with similar or associated ecological sites, and from areas within Colorado. Purchase of commercial topsoil is not recommended. Additional topsoil can be stored at the site in a similar manner as described above to prevent loss from erosion or contamination from weeds and other undesirable vegetation.

Seedbed Preparation

The following appropriate soil/seedbed preparation specifications and BMPs shall be used for all disturbed areas that will undergo temporary and/or permanent seeding to increase the likelihood of successful seed establishment.

Decompaction

- All ripping and tilling shall be done in a direction which follows the natural contour of the land.
- Prior to spreading salvaged topsoil and/or seeding, thoroughly till or rip to a depth of 12 inches all areas compacted by access, staging, or construction traffic. Other, non-compacted areas shall be tilled to a depth of 6 inches. Soils shall be worked until no clods greater than 2 inches in diameter remain. Rocks and other objects 3 inches and greater in any dimension shall be removed.
- Areas receiving salvaged topsoil shall be spread to depths required to meet grades and elevations as shown in the 100% construction drawings.
- Prior to seeding, areas to be seeded shall be graded to a smooth, even surface, with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finished grades as depicted in the 100% construction drawings.

Soil Amendments

- A representative soil test shall be sent to a laboratory to determine pH, organic matter content, electrical conductivity, and concentrations of carbon, phosphorus, and nitrogen to determine appropriate soil amendment product for application.
 - Recommended Vendor: CSU Soil Water and Plant Testing Laboratory, Fort Collins, Colorado
- Soil amendments shall be applied on the surface of the spread topsoil and/or decompacted soils and tilled thoroughly to a depth of 4 inches, prior to seeding.
- Soil amendments, such as Richlawn or Biosol, shall be applied at a rate of 500 lbs per acre.
- If organic compost or humic acid is deemed necessary, the material shall be applied at a rate of 15 cubic yards per acre.
 - Recommended Vendor: A1 Organics, Eaton, Colorado

Seeding

Temporary and permanent seed mixes were developed based on the Project site’s elevation, hydrology, sandy/course textured soils, occurrence in Lincoln County, and known vendor availability. Species included in seed mixes are low maintenance (i.e., do not require mechanical treatments) and low water use.

Temporary Seed Mix

The recommended temporary seed mix (Table 4) includes species that are native and/or sterile, establish quickly, and have root structures suitable for erosion control. The temporary seed mix shall be used on soil stockpiles and any area that will not be disturbed for 30 days or more. Contractor shall follow PLS application rates outlined by the seed vendor.

Table 4. Temporary seed mix.

Scientific Name	Common Name	Season	Growth Habit	% Mix
	*Regreen OR Quickguard	NA	Bunchgrass	20
<i>Buchloe dactyloides</i>	Buffalograss	Warm	Rhizomatous	12
<i>Distichlis spicata</i>	Saltgrass	Warm	Rhizomatous	12
<i>Elymus lanceolatus</i>	Thickspike wheatgrass	Cool	Rhizomatous	12
<i>Elymus trachycaulus</i>	Slender wheatgrass	Cool	Rhizomatous	12
<i>Panicum virgatum</i>	Switchgrass	Warm	Rhizomatous	12
<i>Pascopyrum smithii</i>	Western wheatgrass	Cool	Rhizomatous	20
Total:				100%

*Can use either Regreen or Quickguard.

Permanent Seed Mix

The recommended permanent seed mix (Table 5) includes species with multiple life history traits (i.e., perennial vs annual, grass vs forb) to increase biodiversity in the area. The height of plants at maturity was also considered and largely limited to 2 feet to limit interference with solar array infrastructure; however, some taller species were included (primarily forbs) as they have the ability to resprout and still reproduce after cutting (i.e., mowing), especially those adapted to prairie ecosystems. Contractors shall follow pure live seed (PLS) application rates and germination recommendations outlined by the seed vendor.

Table 5. Permanent seed mix.

Scientific Name	Common Name	Life History	% Mix
	*Regreen <i>OR</i> Quickguard	Sterile cover crop	10
<i>Bouteloua curtipendula</i>	Sideoats grama	Native perennial grass	10
<i>Bouteloua gracilis</i>	Blue grama	Native perennial grass	10
<i>Buchloe dactyloides</i>	Buffalograss	Native perennial grass	10
<i>Calamovilfa longifolia</i>	Prairie sandreed	Native perennial grass	10
<i>Elymus elymoides</i>	Squirreltail	Native perennial grass	10
<i>Elymus lanceolatus</i>	Thickspike wheatgrass	Native perennial grass	10
<i>Nassella viridula</i>	Green needlegrass	Native perennial grass	10
<i>Achnatherum hymenoides</i>	Indian ricegrass	Native perennial grass	5
<i>Hordeum pusillum</i>	Little barley	Native annual grass	5
<i>Achillea millefolium</i>	Yarrow	Native perennial forb	1
<i>Vicia americana</i>	American vetch	Native perennial forb	1
<i>Artemisia frigida</i>	Prairie sagewort	Native perennial forb	1
<i>Atriplex canescens</i>	Fourwing saltbush	Native perennial shrub	1
<i>Krascheninnikovia lanata</i>	Winterfat	Native perennial shrub	1
<i>Eriogonum effusum</i>	Spreading buckwheat	Native perennial forb	1
<i>Adenolinum lewisii</i>	Lewis flax	Native perennial forb	1
<i>Erigeron eatonii</i>	Eaton's fleabane	Native perennial forb	1
<i>Rudbeckia hirta</i>	Black-eyed susan	Native biannual forb	1
<i>Sphaeralcea coccinea</i>	Scarlett globemallow	Native perennial forb	1
Total:			100%

Seeding Options

Seeding should follow the PLS guidelines provided by the seed vendor. Drill seeding is recommended where feasible to reduce potential losses from wind erosion or herbivory while plants establish. However, drill seeding is more expensive to implement and may not be feasible in areas with steep slopes or rockier soils. The ideal times to seed are in the fall before the first major freeze of the season or in the spring, between March and June.

Drill Seeding

- All seed is to be drilled ¼ inch to ½ inch into the soil at the specified PLS per acre rate with a mechanical drill with depth bands and an agitator in the seed box.
- Rows shall be spaced not more than 7 inches apart.

Broadcast Seeding

- If areas of the Project are inaccessible to drill seeding, broadcast seeding shall be utilized.
- Seed shall be uniformly broadcast at twice the specified PLS per acre and covered with soil to a depth of ¼ inch to ½ inch by hand raking or harrowing by some other means acceptable.
- Broadcast seeding shall be accomplished using hand-operated “cyclone type” seeders or rotary broadcast equipment attached to construction or revegetation machinery. All machinery shall be equipped with metering devices.

- Broadcasting by hand shall be acceptable on small, isolated sites. Prior to hand broadcast seeding, the seed shall be divided into two halves, with the first half of the seed being applied, followed by the second half of the seed to ensure complete coverage.
- When using hopper type equipment, seed shall be frequently mixed within the hopper to discourage seed settling and uneven planting distribution of species.
- Broadcast seeding shall take place immediately following the completion of final seedbed preparation techniques.
- Broadcast seeding shall not be conducted when wind velocities would prohibit seed to soil contact and/or even seed distribution (wind speeds higher than 8 mph).

Seed Vendor Requirements

To reduce the likelihood of additional non-native and/or noxious species being introduced to the Project site, seed shall be purchased with the following specifications and BMPs:

- Seed shall be purchased from a local vendor (see recommendations below) and all seed shall be reported in Pure Live Seed per pound.
- Vendor shall provide weed content by species for each seed lot. If any noxious species occur within an individual lot, the species shall be removed from use and % mix shall be adjusted to accommodate the loss.
- Vendor shall provide dormancy and germination information for each lot.
- Vendor shall disclose if any stratification or other seed preparation is required prior to applying seed on site.
- Recommended Vendor: Western Native Seed, Coaldale, Colorado. Stevenson Intermountain Seed, Inc. Ephraim, Utah. Granite Seed or Arkansas Valley in Denver, Colorado can be used for Regreen or Quickguard.

Post Seeding Soil Surface Protection and Erosion Control

To reduce the potential for fugitive dust, erosion, and/or loss of applied seed, soil surface protection/erosion control techniques and BMPs shall be implemented after seeding is completed. Three soil surface protection/erosion control methods are recommended: certified weed-free straw, erosion control blanket (ECB), or wood straw.

Certified Weed-Free Straw

- Straw shall be certified weed free by the vendor to ensure non-native and/or noxious weed species are introduced to the Project site.
- Straw shall be applied immediately after seeding has been completed with a mechanical spreader at a rate not less than 1.5 tons per acre and not more than 2 tons per acre.
- Straw mulch shall be anchored to the soil with a standard commercial crimper, which shall crimp straw 4 inches or more into the soil.
- Straw shall only be utilized on flat areas or slopes less than 3:1.
- Recommended Vendor: HayCo, LLC, Monument, Colorado

Erosion Control Blanket (ECB)

- ECB shall be manufactured with fully biodegradable materials, such as jute, hemp, or coconut fibers. Photodegradable ECB shall not be utilized, such as the photonetting traps wildlife.
- Slopes of 3:1 or steeper, concave areas, drainage swales, or areas along the edges of hard surfaces (e.g., trails, roads), and any other areas with the potential to rill, shall have ECB installed.

- All clods and rock shall be removed from area, and grade shall be smoothed prior to installation of ECB so that blanket to soil contact is maximized and potential for holes/pockets is minimized.
- The edges of the fabric shall be secured by 2-foot wooden stakes, installed 2 feet on center along all edges and seams.
- Seams shall overlap 1 foot and the body of the fabric shall be further secured to the soil surface with 12-inch eco-stakes in a diamond pattern 3 feet on center.
- The top of ECB shall be trenched with 2-foot wedge stakes 2 feet on center.
- Recommended Vendors: Grainger Industrial Supply, Fort Collins, Colorado, Ferguson Waterworks, Aurora, Colorado, American Excelsior, Arlington, Texas

Wood Straw

- Wood straw shall be applied at a rate of 276 bales per acre and shall be spread to achieve 70% ground cover.
- No crimping or tackifier is required for wood straw application (unless using aspen straw).
- Wood straw shall only be utilized on flat areas or slopes less than 3:1.
- Recommended Vendor: Mountain Pine Manufacturing, Craig, Colorado

Monitoring and Maintenance

Areas that have received temporary and permanent seeding shall be monitored for adequate cover. Adequate cover within the Project area is quantified by bare ground cover of 3% or less, with bare patches ranging from 3 to 5 inches in diameter (NRCS, JER, and NMSU 2021). If seeded areas do not meet these criteria, a qualified Plant Ecologist will need to conduct a site visit to make recommendations on if additional topsoil, soil amendments, seed, or combination is needed.

To enhance revegetation efforts, site maintenance in the form of mowing may need to be restricted to ensure seeded species are able to adequately grow to maturity and reproduce.

Weed Monitoring and Management

Monitoring Methods

Colorado listed noxious weed species with the potential to occur in the Project area are listed in Table 6. Appendix A includes identification and treatment information regarding each species listed below. Any additional information can be found on the Colorado Department of Agriculture Noxious Weed Species ID website ([Noxious Weed Species ID | Department of Agriculture \(colorado.gov\)](https://www.colorado.gov/department-of-agriculture/noxious-weed-species-id)). For non-native species that are not listed by the State of Colorado, the [California Invasive Plant Council](https://www.californiainvasiveplantcouncil.org/) provides additional materials and management recommendations.

The Lincoln County point of contact for the Lincoln County Noxious Weed Program is County Weed Coordinator, Patrick Leonard (719-743-2258).

To determine all noxious and undesirable weed species present, and the extent of these occurrences in the Project area, a survey should be conducted prior to surface disturbing activities by qualified Botanists/Plant Ecologists, including all construction areas and areas adjacent to the Project. This survey would focus on identifying and mapping populations of noxious and undesirable weed species, as listed by the Colorado Department of Agriculture based on the Colorado Noxious Weed Act (CNWA, Title 35, Article 5.5 §§101-119). Weed populations would be mapped with a hand-held global positioning system (GPS) unit. All identified weed occurrences would be treated using the methods provided in fact sheets

provided in Appendix A prior to ground-disturbing activities to reduce the likelihood of spreading to other areas or remaining viable in the soil (if within the growing season).

Table 6. List B and C noxious weed species with potential to occur in and surrounding the project area¹.

Scientific Name	Common Name	List Status
<i>Acroptilon repends</i>	Russian knapweed	B
<i>Aegilops cylindrica</i>	Jointed goatgrass	B
<i>Anthemis cotula</i>	Mayweed chamomile	B
<i>Artemisia wormwood</i>	Absinth wormwood	B
<i>Carduus acanthoides</i>	Plumeless thistle	B
<i>Carduus nutans</i>	Musk thistle	B
<i>Carum carvi</i>	Wild caraway	B
<i>Centaurea diffusa</i>	Diffuse knapweed	B
<i>Centaurea stoebe</i>	Spotted knapweed	B
<i>Cirsium arvense</i>	Canada thistle	B
<i>Cirsium vulgare</i>	Bull thistle	B
<i>Clematis orientalis</i>	Chinese clematis	B
<i>Cynoglossum officinale</i>	Houndstongue	B
<i>Cyperus esculentus</i>	Yellow nutsedge	B
<i>Dipsacus fullonum and D. laciniatus</i>	Common & Cutleaf teasel	B
<i>Eleagnus angustifolia</i>	Russian olive	B
<i>Euphorbia esula</i>	Leafy spurge	B
<i>Hesperis matronalis</i>	Dames rocket	B
<i>Hyoscyamus niger</i>	Black henbane	B
<i>Lepidium draba</i>	Hoary cress	B
<i>Lepidium latifolium</i>	Perennial pepperweed	B
<i>Leucanthemum vulgare</i>	Oxeye daisy	B
<i>Linaria dalmatica and L. genistifolia</i>	Dalmatian toadflax	B
<i>Linaria vulgaris</i>	Yellow toadflax	B
<i>Onopordum acanthium</i>	Scotch thistle	B
<i>Potentilla recta</i>	Sulfur cinquefoil	B
<i>Saponaria officinalis</i>	Bouncingbet	B
<i>Tamarix chinensis</i>	Salt cedar	B
<i>Tanacetum vulgare</i>	Common tansy	B
<i>Tripleurospermum inodorum</i>	Scentless chamomile	B
<i>Verbascum blattaria</i>	Moth mullein	B
<i>Abutilon theophrasti</i>	Velvetleaf	C
<i>Ailanthus altissima</i>	Tree of heaven	C
<i>Arctium minus</i>	Common burdock	C
<i>Bromus tectorum</i>	Cheatgrass	C
<i>Cichorium intybus</i>	Chicory	C
<i>Convolvulus arvensis</i>	Field bindweed	C
<i>Elymus repens</i>	Quackgrass	C
<i>Erodium cicutarium</i>	Redstem filaree	C

Scientific Name	Common Name	List Status
<i>Panicum miliaceum</i>	Wild-proso millet	C
<i>Sonchus arvensis</i>	Perennial sowthistle	C
<i>Sorghum halepense</i>	Johnsongrass	C
<i>Tribulus terrestris</i>	Puncturevine	C
<i>Ulmus pumila</i>	Siberian elm	C
<i>Verbascum thapsus</i>	Common mullein	C

¹If additional noxious weeds not presented in this table are identified within the Project area, they would be treated using appropriate methods, as identified in this plan.

Integrated Weed Management

Integrated Weed Management (IWM) involves a combination of methods to prevent, and control weed populations on a site (Knezevic et al. 2017). Primary methods include mechanical (e.g., mowing, hand pulling) and chemical (i.e., use of species-specific herbicides). Combining treatment methods increases the effectiveness of controlling weed populations throughout the site. The Project would generally adhere to the BMPs provided by the CDA.

Additional non-native weed species identified in the Project area that are not on the noxious weed list may also be evaluated for treatment using field observations and professional judgment. All vegetation in the Project area, including weed species not required to be treated under the Colorado Noxious Weed Act (CNWA), would be treated with mechanical control methods (mower or string trimmer) periodically throughout the growing season to maintain a height less than or equal to 2 feet to mitigate fuels and reduce fire hazards.

The selection and use of various weed control methods is based on a variety of factors, including the biology of the target species, the application method, and consideration for surrounding resource concerns. Prior to treatment of specific non-native weed species, a detailed treatment plan should be prepared to outline which methods will be used, where they will be used, and when they will be used. Maintaining detailed treatment records are needed to determine the effectiveness of treatments and may be required by Lincoln County and the CDA.

Preventative Methods

The prevention of weed establishment is the most effective weed management practice. Preventing or reducing the potential for weed establishment reduces additional effort, cost, and time invested in subsequent weed control or eradication measures. Several measures, such as washing construction equipment undercarriages prior to entering the Project area; using certified weed-free materials for site stabilization and revegetation; cleaning boots of workers and equipment; and restricting vehicle travel to established routes have proven to be effective toward preventing the spread and establishment of weeds and would be implemented during surface disturbing activities. Additionally, maintaining native plant cover is a preventative method for controlling weeds.

Mechanical Methods

Mechanical treatments use physical means to remove plants, reproductive parts, or propagules. Mechanical treatments include manual methods (e.g., pulling weed plants from the soil), use of hand tools and hand-held power tools, mowing, and other methods involve removing above and below ground plant structures. The designation of the appropriate mechanical treatment depends on variables, including season, weed species, their biology, and the size of each population. Mechanical methods

would be used in conjunction with chemical applications to eradicate noxious weeds on the site. Mowing would be used for all vegetation to maintain a maximum height of 2 feet on the site.

Chemical Methods

Chemical treatments involve the use and application of herbicides. The use of herbicides is highly regulated and involves a variety of specific protocols, safety measures, and precautions for eliminating, reducing, and mitigating uncontrolled releases. Chemical herbicides shall only be applied by individuals who hold a State of Colorado Applicator License or are working under a Qualified Supervisor (Colorado Dept. of Agriculture 2023). Applicators shall adhere to all directions and safety protocols outlined on herbicide labels. Selection of the appropriate herbicide to use for noxious weed control depends on the weed's biology and the herbicides mechanism of action on the target species. Care should be taken to avoid and reduce potential applications to native plants remaining on the site. Depending on the size of the weed population, application methods can range from backpack application or broadcast application from all-terrain vehicles/trucks.

Post Construction

Noxious weed monitoring should begin during the growing season immediately following surface disturbance at all disturbed sites at least once a year for three consecutive years after the Project's completion. Identified noxious weed occurrences should be noted and recorded in the same manner as described above for preconstruction inventories.

Ongoing Monitoring

Noxious weed monitoring would occur on an ongoing basis during operation of the Project. Qualified and appropriately trained personnel would use the results of the initial noxious weed inventory to monitor known occurrences (or populations) and would observe activity areas for new occurrences. During construction, maintenance of weed populations is the responsibility of the Engineering, Procurement, and Construction (EPC). Once construction is complete and the EPC has demobilized, the Owner of the property may be in charge of maintenance of Developer's seed mix.

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Appendix A – Noxious Weeds Fact Sheets

Absinth wormwood

Colorado Department of
Agriculture

305 Interlocken Pkwy
Broomfield, CO 80021

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



Key ID Points

1. Absinth is well branched and gets 3 feet tall and 2 feet across.
2. Silver-grey leaves and small yellow flowers.

Absinth wormwood Identification and Management



Identification and Impacts

Absinth wormwood (*Artemisia absinthium*) is native to Eurasia, the Middle East and North Africa. It was introduced to North America in the early 19th century to be cultivated for medicinal use. It was first reported outside cultivated gardens in 1841, along roadsides and waste grounds.

Absinth wormwood is a long-lived perennial that possesses a strong sage odor and bitter taste. Plants grow 2 to 4 feet in height and are prolific seed producers. It has a taproot that can reach 2 inches in diameter and shallow lateral fibrous root branches that can extend up to 6 feet long in all given directions. Plants are woody at the base and regrow from the soil level each spring. The stems are numerous and are covered with fine, gray hairs while the leaves are blue-olive green, alternate and highly divided. Flowers are small, yellowish and arranged in large, spike-like panicles. The seed viability is estimated to be 3 to 4 years and are easily scattered by wind, water, animals, and in hay. The seeds are less than 1/6 inch long, smooth, flattened and light gray.

Habitats for Absinth wormwood include disturbed sites, moist soils, and is also shade tolerant. It can occur in 5,000 to 7,000 feet elevation and is considered a weed in pastureland, cropland, and rangeland. Absinth wormwood is listed as poor palatability in horses, but good for sheep.

The key to effective control of Absinth wormwood is a combination of control methods. Compared to most perennials, it is fairly easy to control with chemicals in combination with mechanical control. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

Absinth wormwood 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; and map above by Crystal Andrews, Colorado Department of Agriculture.

Artemisia absinthium L.

**CULTURAL**

Cultural controls are possible in theory, but are very time consuming and expensive. Complete removal of any seedlings or newly established plants by continual hand pulling is also possible.

**BIOLOGICAL**

There is no biological control available for Absinth wormwood. 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**

Hand pull or dig when soil is moist. Make certain to pull all the roots, including short horizontal roots. Bag specimens carefully so as to not scatter seeds if removed during or after flowering. Multiple mowings prior to seed generation can cause stress and may provide a control option.

Integrated Weed Management:

Absinth Wormwood is easily controlled using a combination of methods such as chemical and mechanical.

Compared to most perennials, it is fairly easy to control.

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 + 0.25% v/v non-ionic surfactant	Apply late spring into summer though the flowering growth stage.
Aminopyralid* + Metsulfuron (Opensight)	3.3 oz. product/acre	Apply late spring into summer though the flowering growth stage.
Aminopyralid* + 2,4-D (Forefront HL)	2 pints product/acre	Apply late spring into summer though the flowering growth stage.
Clopyralid (Transline)	0.66 pint/acre	Apply late spring into summer though the flowering growth stage. Provides greater selectivity when applying near trees and shrubs.
Picloram* + 2,4-D (Tordon/Picloram 22K - Restricted use pesticide)	1 pint product/acre + 1 qt./acre 2,4-D	Apply late spring into summer though the flowering growth stage. DO NOT use near trees, desirable shrubs, water, or high water table.
*Product not permitted for use in the San Luis Valley.		
Additional herbicide recommendations for other species can be found at: www.colorado.gov/agconservation/CSUHerbicideRecommendations.pdf		

Top to bottom photos, © Chris Evans, River to River CWMA, Bugwood.org; Mary Ellen (Mel) Harte, Bugwood.org; and Richard Old, XID Services, Inc., Bugwood.org.

Absinth wormwood



Black henbane

Colorado Department of
Agriculture

305 Interlocken Pkwy
Broomfield, CO 80021

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



Key ID Points

1. Shallow lobed leaves that have sticky hairs.
2. Flowers have purple centers and veins.

Black henbane Identification and Management



Identification and Impacts

Black henbane (*Hyoscyamus niger*) was introduced from Europe as an ornamental and medicinal herb. In Colorado it is mostly found on the western slope. The plant blooms June through September and may be an annual or biennial. A mature plant reaches 1 to 3 feet in height with foliage that has a fowl odor. Leaves are shallowly lobed to coarsely toothed with sticky hairs. The outer part of the flower is brownish yellow in color with a purple center and veins. Fruits are approximately 1 inch long with 5 lobes.

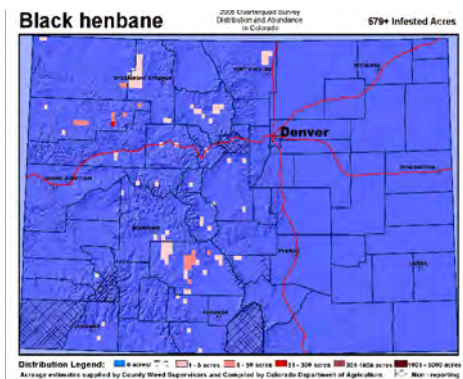
All parts of Black henbane are poisonous to both livestock and humans when ingested. However; the plant is usually avoided by livestock due to the foul odor. The plant is a strong competitor for moisture and nutrients and produces a persistent litter effecting germination and growth of native plants. Black henbane invades disturbed and overgrazed sites. A good preventable measure is to guard against overuse.

Habitats for Black henbane included disturbed open spaces, roadsides, fields, waste places and abandoned gardens. It grows in most soil types but likes sandy or well

drained loam soils. The seed viability or longevity is considered to be 1 to 5 years.

The key to effective control of Black henbane is guarding against disturbance and overuse, this can prove to be a good preventative measure against black henbane. Mechanical control and chemicals are the most commonly recommended method. Controlling plants in the spring or early summer prior to seed production is most effective, follow-up treatments are recommended to pick up missed or late bolting plants. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

Black henbane 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 © (2 on bottom, left): Steve Dewey, Utah State University; (Top left and top center): Mary Ellen Harte, forestryimages.com and Map above by Crystal Andrews, Colorado Department of Agriculture.

Hyoscyamus niger

**CULTURAL**

Cultural controls are possible in theory, but are very time consuming and expensive. Complete removal of any seedlings or newly established plants by continual hand pulling is also possible.

**BIOLOGICAL**

There is no biological control available for Black henbane. 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**

Hand pull or dig from moist soil, so the entire tap root system can be removed. Tillage will control henbane, but is usually not recommended due to the land it occupies: rangeland, roadsides and pastures. Be sure to bag specimens carefully if removed during or after flowering.

Integrated Weed Management:

Controlling plants in the spring or early summer prior to seed production is most effective, follow-up treatments are recommended to pick up missed or late bolting plants.

Constant monitoring of site after last adult flowering plant is removed is suggested since seed viability can be up to 5 years.

Black henbane

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	Surfactant absolutely necessary. Apply late bolt to early flower. (Summer to Early Fall)
Chlorsulfuron* (Telar)	1 oz. product/acre + 0.25% v/v non-ionic surfactant	Apply late bolt to early flower. (Summer to Early Fall)
Chlorsulfuron + Metsulfuron (Cimarron Plus)	0.625-1.25 oz./acre + 0.25% v/v non-ionic surfactant	Apply late bolt to early flower. (Summer to Early Fall)
Note: *This herbicide has residual soil activity that will affect all broadleaf seedlings germinating after application has occurred.		
Additional herbicide recommendations for other species can be found at: www.colorado.gov/agconservation/CSUHerbicideRecommendations.pdf		

Top to bottom photos, © (Top 2 photos) Stevens County (Washington State) Noxious Weed Control Board; and bottom photo David Hallinan, Bannock County Weed Superintendent, Idaho Weed Awareness Campaign.



© Mike LeValley

Petals are usually pink to white and are recurved to reflexed, which makes the stamens exposed and the two styles centrally protruding. Within one season, flowers transition from a smaller paler staminate-phase to a larger pinker pistillate-phase, likely to avoid self-pollination (Davis et al. 2014). The five sepals are fused at the base to form a tube-like calyx. In Colorado, bouncingbet greens up in April, flowers emerge starting in June, and sets seed through October. Bees and wasps pollinate bouncingbet flowers (Davis et al. 2014). The fruits are capsules with dull black roundish to kidney-shaped seeds. Seed longevity is unknown. Bouncingbet forms densely thick taproot and rhizomes. With its robust root structure, bouncingbet can form dense colonies. It spreads by root and seed.

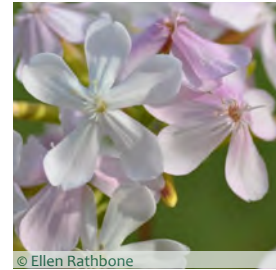
Bouncingbet (*Saponaria officinalis* L.) is a perennial forb in the Caryophyllaceae family, also known as soapwort or sweet William.

Mature plants grow up to three feet tall. Like other plants in the Carnation family, the leaves are opposite and smooth, about 2 to 4 inches long, and have an ovate to elliptic shape. Leaves have three very distinct deeply cleft parallel veins, with smaller lateral faint veins. They are fused at the base around the stem, which forms swollen nodes, similar to carnations. Like the leaves, the stems are smooth and erect. They are sparingly branched.

Showy bouncingbet flowers form at the end of an upright stem to form a cyme. Flowers are usually in pairs. Each flower has five petals per corolla; cultivare petals vary. The petals have a distinct notch on the petal margin, making it bi-lobed.

Originally, bouncingbet was introduced from Europe as a garden ornamental. In Colorado, bouncingbet occurs mainly municipal areas as a cultivated ornamental and escapee, such as in residential gardens, abandoned lots, exurban areas, and other sites that offer moist, well-drained soil, full to partial sun, such as roadsides and wetlands (EDDMapS 2018).

Bouncingbet contains saponin, which when wet produces lather, and thus was cultivated for this purpose (Chal-linor and De Voss 2012). Other chemical compounds in bouncingbet are investigated for "cytotoxic activity against human cancer cell lines" and other pharmacological or homeopathic uses (Chal-linor and De Voss 2012). While generally unpalatable to livestock, in large doses bouncingbet can be poisonous to livestock. The sapogenic glycosides can cause gastrointestinal irritation and destroy red blood cells when absorbed in the blood streams of grazing animals. In humans, it can be toxic when overdosed, however may be a culinary additive in some cultures (Wikipedia 2018).



© Ellen Rathbone



© Davis et al. 2014



Bouncingbet

Saponaria officinalis L.

bouncingbet
Saponaria officinalis
2016 Statewide Distribution in Colorado
Based on 2016 Quarterquad and EDDMapS Field Survey Data
Approximately 1,170 Infested Acres



Acres estimated by County Weed Supervisors and Other Data Sources. Compiled by Colorado Department of Agriculture
Department of Agriculture
0 acres 1-10 acres 11-50 acres
Scale: 0 20 40 Miles

Key ID Points

1. Five petals with notched margins
2. Pale staminate flowers and pinker pistillate flowers
3. Three parallel veins in leaves
4. Opposite leaves fused at the base with swollen nodes

Integrated Weed Management Recommendations

Effective integrated management means using a variety of eradication methods in the same site along with restoration, prevention of seed production and dispersal, and monitoring. Maintain robust healthy native landscapes. Restore degraded sites. Avoid soil disturbance. Prevent seed production and seed dispersal, e.g. on contaminated equipment. Rest sites until restored. Modify land use practices. Use methods appropriate for the site, including land use practices.



CULTURAL

Most bouncingbet seeds remain close to parent plants; spread is mainly by root or ornamental introductions. Cultural methods should follow other methods. Maintain or restore a competitive assemblage of shrubs, forbs, cool and warm season grasses that form large root biomass to crowd out bouncingbet roots. Implement whole site restoration of soils, plants and water regimes where dense colonies exist. Use locally adapted species that are ecologically appropriate for the site to improve competitiveness, including annual and perennial species. Incorporate soil amendments, soil microbes and mycorrhizal fungi in restoration efforts for natives. Minimize soil compaction and disturbance, especially in wetlands and moist soil.



© Deb Maxwell

BIOLOGICAL

Bouncingbet is not palatable to sheep, cattle or horses because of its saponin chemical content. If grazed, bouncingbet may resprout. Properly managed grazing can improve vigor of desired species and indirectly prevent bouncingbet. There are no biological control agents for bouncingbet authorized in Colorado that would effectively control it. For more information about biological control agents, visit the CDA Palisade Insectary website at: www.colorado.gov/ag/biocontrol



MECHANICAL

Mechanical methods are best for residential areas or small infestations, and best applied in early season or newly established plants. Completely remove all roots and root fragments in addition to above ground biomass. Repeat through the season. Mowing, chopping and deadheading leaves roots behind, stimulates more flower production; these methods require consecutive years of season-long treatments and only control but not eradicate it. Mowing when plants are flowering or producing seed disperses flowers and seeds, which expands the size of the infested area. Collect, bag, and dispose of or destroy flowers; seeds could mature and germinate if left on the ground. Low severity prescribed fires may damage above ground vegetation, leaving roots and seeds unaffected. High severity prescribed fire may not damage native plant roots; pile slash on bouncingbet to increase fire temps.



CHEMICAL

NOTE: Herbicide recommendations to control bouncingbet in pastures and rangeland are found at: <https://goo.gl/TvWnv9> Rates are approximate and based on equipment with an output of 30 gal/acre. Follow the label for exact rates. Consult local turf and ornamental experts for herbicides appropriate for residential settings. Always read, understand, and follow the label directions. The herbicide label is the LAW!

Bouncingbet

Saponaria officinalis L.



Colorado Department of Agriculture - Conservation Services

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www.colorado.gov/ag/weeds

Colorado
State
University



© Iowa Plants

like white hairs. Seeds remain viable for approximately three years. Mature plants can produce up to 4,000 seeds per plant. Bull thistle generally needs soil temperature between 50° and 80°F, moisture and canopy gaps to germinate seeds.

Bull thistle invades dry to moist environments. It prefers nitrogen-rich soils, and it grows on gravelly to clay-textured soils. It thrives in areas such as pastures, overgrazed rangeland, roadsides, and logged areas. Bull thistle infestations are heaviest in the northwestern portion of Colorado. It is widespread throughout the United States and parts of Canada.

Hheavy infestations reduce livestock forage. 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 recently disturbed areas and becoming a dominant species for several years if left untreated. It can cause hay fever in some individuals.

Maintaining healthy pastures and rangeland, guarding against disturbance or overuse is the best prevention measure against bull thistle. As with most biennials, limiting seed production is critical to effective control. Chemical control is the most effective and efficient method of eradication if applied during the rosette stage, spring or early fall. To reduce seed production, plants with buds or flowers should be collected and

Bull thistle, *Cirsium vulgare* (Savi) Ten., is a biennial forb that was introduced to North America as a seed contaminant. Flowers are in a raceme arrangement. The gumdrop-shaped disk flowers are pinkish to dark purple in color and 1 ½ to 2 inches in diameter. The pappus has feather-like bristles; the receptacle is densely bristly. The flower bracts are somewhat tapered and covered with spines 2-5 mm long. Leaves are alternate with deeply lobed margins that are spiny. In mature plants the base of the leaves clasp the stem and extend down the stem to the lower node. The plant has one short, fleshy taproot with several lateral roots. There is debate about the effectiveness of self-pollination in bull thistle; outcrossing though pollination produces an abundance of viable seed. Flower buds and heads that are removed from the stalk can still mature and become viable. Seeds are capped with a circle of plume-



© Bruce Ackley, OH State University

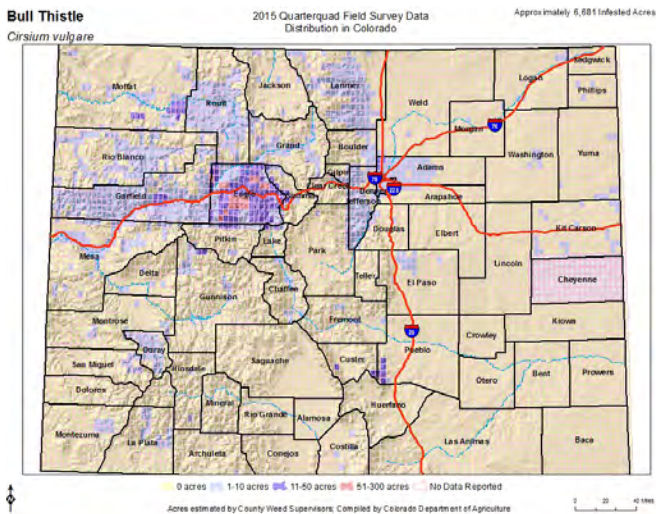


© Steve Dewey, UT State University



Bull thistle
Cirsium vulgare (Savi) Ten.

2015 Quarter Quad Survey



bagged, disposed of or destroyed. Mechanical control, such as pulling, has limited effectiveness.

Bull thistle is designated as a “List B” species in the Colorado Noxious Weed Act. It is required to be eradicated; some populations may be contained or suppressed depending on state regulations. For state regulations described for each county, refer to the most recent Rule, or visit www.colorado.gov/ag/weedcontacts for details.

Key ID Points

1. Flowers arranged in a raceme; flower is gum-drop shaped.
2. Base of leaves clasp the stem & extend down the stem to node below
3. Top surface of leaves have stiff, rough hairs

Integrated Weed Management Recommendations

Bull thistle *Cirsium vulgare* (Savi) Ten.

Effective integrated management means using a variety of eradication methods that also includes restoration, prevention of seed production and dispersal, and monitoring. Maintain robust healthy native landscapes and restore degraded sites. Avoid soil disturbance. As with most biennials, prevent seed production in the first and second year of bull thistle growth. Prevent seed from dispersing, such as on contaminated equipment. Rest sites until they are effectively restored.



© Bonnie Million, NPS

CULTURAL CONTROL METHODS

Since bull thistle germinates in canopy gaps, maintain or restore a competitive forb and cool and warm season grass assemblage to reduce spacing between plants. Use locally adapted and ecologically appropriate seeds whenever possible to improve competitiveness. Ensure annual species are included in the native seed mix as well as perennial. Incorporate soil amendments, soil microbes and mycorrhizal fungi in restoration efforts. Manage land uses so they do not cause soil disturbance or create bare mineral soil.



© Eric Coombs, OR Dept of Agriculture

BIOLOGICAL CONTROL METHODS

Horses, goats and sheep may eat flower heads on a few young individual plants, but seeds likely pass through their digestive tracks unaltered; cattle avoid bull thistle. Dense stands and large plants are usually avoided. Thus, bull thistle can become an “increaser” in over-grazed systems. Properly managed grazing can improve vigor of desired plants and indirectly reduce bull thistle. There is a biological control agent for this species, the bull thistle gall fly, *Urophora stylata*, but it was found to be ineffective in Colorado. Since it is not ethical to promote ineffective non-native insects in the state, this fly is not available in Colorado. For more information, visit the Colorado Department of Agriculture’s Palisade Insectary website at www.colorado.gov/ag/biocontrol.



© UAF Cooperative Extension

MECHANICAL CONTROL METHODS

Methods, such as hoeing, tilling and digging, are best for infestations smaller than 0.5 acres. Sever roots below the soil surface during the first year before the plant stores energy, and in the second year before seed production. Mowing, chopping and deadheading stimulates more flower production; these methods require consecutive years of season-long treatments. Flower heads and buds must be collected, bagged, and disposed of or destroyed; seeds will mature and germinate if left on the ground. Prescribed fire that leads to high soil burn severity can damage roots and above ground biomass of bull thistle but also damages desired plants. Fire favors bull thistle and is not recommended.

CHEMICAL CONTROL METHODS

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

HERBICIDE	RATE	APPLICATION TIMING
Aminopyralid* (Milestone)	6 oz. product/acre + 0.25% v/v non-ionic surfactant	Apply to rosettes through bolting stage in spring, or to fall rosettes. *Product not permitted for use in the San Luis Valley.
Chlorsulfuron** (Telar)	1 oz. product/acre (0.75 oz. active ingredient/acre)+ 0.25% v/v non-ionic surfactant	Spring from bolting to bud stages. **This herbicide has residual soil activity that will affect all broadleaf seedlings germinating after application has occurred.
Clopyralid (Transline)	0.67-1.33 pints product/acre + 0.25% v/v non-ionic surfactant	Apply to rosettes through flower bud stage in spring, or to fall rosettes.
Aminocyclopyrachlor + chlorsulfuron (Perspective)*	4.75-8 oz. product/acre + 0.25% v/v non-ionic surfactant	Apply from the seedling to the bolting stage. 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 for use on grazed or feed forage. *Product not permitted for use in the San Luis Valley.



Colorado Department of Agriculture - Conservation Services

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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 (*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



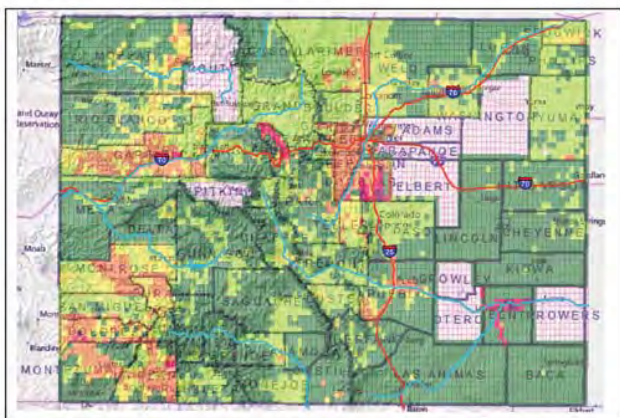
Canada thistle
Cirsium arvense

2013 Quarter Quad Survey

Canada Thistle
Cirsium arvense

2013 Quarterquad Survey
Distribution and Abundance
in Colorado

129,572+ Infested Acres



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.

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.

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. product/acre + 0.25% v/v non-ionic surfactant OR 1 teaspoon product/gal water + 0.32 oz./gal water	Apply in spring at the pre-bud growth stage until flowering and/or to fall regrowth. Can also add chlorsulfuron (Telar) at 1 oz./acre to the mix.
Clopyralid + Triclopyr (Prescott; Redeem; others)	3 pints product/acre + 0.25% v/v non-ionic surfactant OR 1.25 oz. product/gal water + 0.32 oz./gal water	Apply until flowering and/or fall regrowth.
Aminocyclopyrachlor + chlorsulfuron (Perspective)*	5.5 oz. product/acre + 0.25% v/v non-ionic surfactant	Apply to spring rosette to flower bud growth stage; or fall. 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 for use on grazed or feed forage.

Note: *Product not permitted for use in the San Luis Valley.

Additional herbicide recommendations for this and other species can be found at:
www.colorado.gov/agconservation/CSUHerbicideRecommendations.pdf

Canada thistle

Cirsium arvense

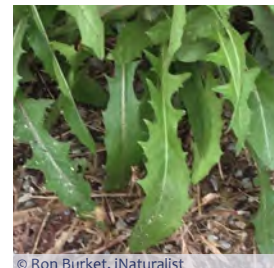


has a very robust, long taproot and rootlets.

The peduncles leading to the flowers are very short, less than 2 mm. The inflorescence is an open panicle. The green stiff phyllaries are in two rows, each series has between five and six sepals; the outer row is reduced in size. The phyllaries are lanceolate and have glandular tipped hairs visible with a hand lens. The inflorescence has only ray flowers which are ligulate with five teeth on the edge (Jepson eFlora 2019). Flower color ranges from cornflower blue to off white. The stamens, style and bilobed stigma are usually blue. The pappus on the achene is nearly absent, consisting of minute toothed scales (Leach 1921). The achene has five ribs and since it lacks a feathery pappus architecture like many other Asteraceae plants, the seeds fall near the parent plants (Leach 1921). Chicory reproduces by seed and its longevity is at least 10 years (Priestley et al. 1985).



© Andreas Stiller, iNaturalist



© Ron Burket, iNaturalist

Chicory (*Cichorium intybus* L.) is a perennial forb in the Asteraceae family, also known as coffeeweed, French endive, and succory, not to be confused with curly endive (*Cichorium endivia* L.) (iNaturalist 2019).

Mature plants can be four feet tall. Oblanceolate basal leaves range in size from 5 to 35 cm long and are persistent (SEINet 2019). Their margins are highly variable, sometimes dentate or denticulate like dandelion leaves, sometimes pinnatifid (Plants of the World Online 2019). The rigid ascending stems have stiff short hairs. Branches are widely apart. Stems are hollow, have milky sap and linear ribs (University of Wisconsin-Madison 2019). Its stem leaves are sessile, rigid, oblong to lanceolate, usually with smooth margins, and are narrower than the basal leaves; short stiff hairs are on both surfaces and leaf margins. The base of leaves clasp the stem. Chicory

Chicory is often confused with blue flax (*Linum lewisii* Pursh) mainly due to their blue flower color and overlapping distributions. Being in a different plant family, upon closer inspection it becomes apparent that it lacks basal leaves, stem leaves are slender, the five petals are bi-lobed.

Chicory is native to Mediterranean areas in Europe, Africa, and Middle East. It has a long cultivation history for pharmacology dating back to ancient Egypt, Greek and Roman eras, 2000 BC. (Bahmani et al.

2015). Modern cultivation is for coffee substitution (roots) and salad (leaves). It has worldwide distribution. It has been in Colorado since at least 1872 when Townshend Stith Brandegee collected a specimen in Fremont County (SEINet 2019). In Colorado its either under-reported or rare. It is ruderal, inhabiting roadsides and disturbed areas at elevations below 8,000 feet.



Chicory

Cichorium intybus L.

Key ID Points

1. Ligulate flowers with 5 teeth at ends
2. Blue stamens, style and bilobed stigma
3. Stiff short hairs on stems, leaves and achene
4. Persistent basal leaves resembling dandelion leaves

Integrated Weed Management Recommendations

Effective integrated management means using a variety of eradication methods in the same site along with restoration, prevention of seed production and dispersal, and monitoring. Maintain robust healthy native landscapes. Restore degraded sites. Avoid soil disturbance. Prevent seed production and seed dispersal, e.g. on contaminated equipment. Rest sites until restored. Modify land use practices. Use methods appropriate for the site, including land use practices.



© Weedsak, Alaska Bureau of Land Management



© California Department of Transportation

CULTURAL

Since chicory is sensitive to competition from grasses, maintain or drill seed bluebunch wheatgrass (*Pseudoroegneria spicata*) and Sandberg bluegrass (*Poa secunda*) with vesicular-arbuscular mycorrhizae; these are drought tolerant natives that are highly competitive against chicory but require mycorrhizae. Native shrubs with competitive robust root biomass is another option. It is ruderal so minimize soil disturbance, especially near infestations. For cultivated sites, select native plants with blue flowers instead of chicory: *Scutellaria brittonii*, *Gentiana parryi*, *Mertensia lanceolata*, *Penstemon glaber*, *Eritrichium aretoides*, or *Aconitum columbianum*. Be cautious when purchasing seed as chicory may be in mixes. Use seed pillows to disperse seeds.

MECHANICAL

Mechanical methods are best for residential areas, small infestations or soils where the entire taproot can be removed. Mowing is not recommended; it leaves roots behind, stimulates flower production, disperses seeds, and expands the size of the infested area. Chopping the inflorescence just below the root crown and bagging the biomass may reduce vigor with consecutively treatment; effectiveness is dependent on cultivare type. Collect, bag, and dispose of or destroy flowers; seeds can mature and germinate if left. Subsoiling must be deeper than 10 inches; use a subsoiler. Fall prescribed fire may kill seeds if hot enough; chicory sets seed through the growing season so timing is important. Fire is unlikely to affect its deep taproot. The effects to chicory from prescribed fire is not tested.

Chicory

Cichorium intybus L.



© EverGraze



© Aspen Public Radio

BIOLOGICAL

Chicory provides high quality forage for goats, sheep and cattle. It is sensitive to grazing; fall is best for control (Alemseged et al. 2003, Barry 1998, Li and Kemp 2005, Li et al. 2003). Properly managed grazing can improve vigor of desired species and indirectly reduce chicory. Currently there are no biological control agents for chicory authorized in Colorado. For biocontrol information, visit the Colorado Department of Agriculture's Palisade Insectary website at: www.colorado.gov/ag/biocontrol

CHEMICAL

NOTE: Herbicide recommendations to control chicory in pastures and rangeland are found at: <https://goo.gl/TvWnv9>. Rates are approximate and based on equipment with an output of 30 gal/acre. Follow the label for exact rates. Consult local turf and ornamental experts for residential settings. Always read, understand, and follow the label directions. The herbicide label is the LAW!



Colorado Department of Agriculture - Conservation Services

305 Interlocken Parkway

Broomfield, CO 80021

(303) 869-9030

www.colorado.gov/ag/weeds



Chinese clematis

Colorado Department of
Agriculture

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



Key ID Points

1. Solitary flowers with four yellow sepals.
2. A herbaceous to woody vine climbing perennial.

Updated on:
07/2015

Chinese clematis Identification and Management



Identification and Impacts

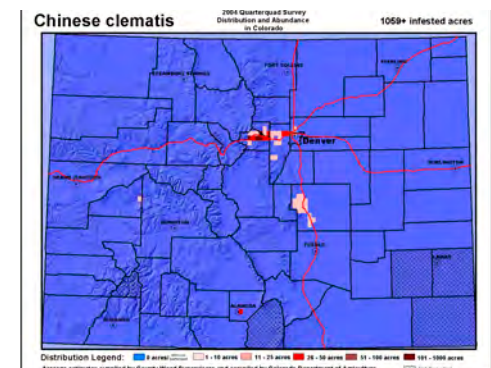
Chinese clematis (*Clematis orientalis*) is a herbaceous to woody vined perennial that is native to Eurasia. It is an escaped ornamental species that is a deciduous climber growing up to 12 feet. Solitary flowers have four yellow sepals (petal-like structures) that are often nodding. Each flower produces numerous feathery, long-tailed fruits which are conspicuous all winter. The plant flowers from August to September.

Habitats for Chinese clematis include roadsides, riparian corridors and rocky slopes. It is sometimes found in open woods. Plants prefer sunny areas but have shown to be somewhat shade tolerant. Chinese clematis prefers well-drained soils.

Chinese clematis can cause death to young trees and brush. It outcompetes native shrubs and herbaceous species. Plants will completely cover; rock walls, trees, bushes and fences. The juice of freshly crushed leaves and stems have blister causing agents.

The key to effective control of Chinese clematis is preventing the plants from going to seed. Pulling the woody stem prior to flowering can be an effective control. Chemical treatments are also effective when dealing with Chinese clematis. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

Chinese clematis 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 and Map © Colorado Department of
Agriculture.

Clematis orientalis

**CULTURAL**

Cultural controls are possible in theory, but are very time consuming and expensive. Complete removal of any seedlings or newly established plants by continual hand pulling is also possible.

**BIOLOGICAL**

There is no biological control available for Chinese clematis. 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**

Hand pull or dig when soil is moist. Make certain to pull all the roots and bag specimens carefully so as to not scatter seeds if flowering.

Integrated Weed Management:

The most effective control method for dealing with Chinese clematis is preventing the plant from going to seed. Pulling the plant from the ground, by the woody stem, prior to the plant flowering is the most effective control. Chinese clematis also responds well to chemical treatments.

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 amine	2 qts. product/acre at 4.0 lb active ingredient/gallon of product + 0.25% v/v non-ionic surfactant	Apply anytime when the plant is actively growing. Will damage neighboring brush species, if present.
Imazapic (Plateau, Panoramic)	12 oz. product/acre + 1 qt./acre methylated seed oil	Apply in the fall at flowering growth stage.
Aminopyralid (Milestone)	4 oz. product/acre + 0.25% v/v non-ionic surfactant	Apply at flowering growth stage in the fall.
Additional herbicide recommendations for other species can be found at: www.colorado.gov/agconservation/CSUHerbicideRecommendations.pdf		

Top to bottom photos, © (Top 2 photos) Stevens County (Washington State) Noxious Weed Control Board; and bottom photo David Hallinan, Bannock County Weed Superintendent, Idaho Weed Awareness Campaign.

Chinese clematis



Common burdock

Colorado Department of Agriculture

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

Identification and Management



year due to the spines and burs. The burs can easily get entangled into livestock fur, make distribution easy over large areas.

The key to effective control of minimizing soil disturbance and preventing the establishment of plants. Using an integrated weed management approach combining chemical, cultural, and mechanical methods to control these plants is effective. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

Identification and Impacts

Common burdock (*Arctium minus*) is a biennial forb that is native to Europe. The first year of growth is a basal rosette, producing large cordate, thickly hairy leaves. The second year of growth, is a coarse, multi-branched, erect stem that will grow to heights of 3 to 10 feet tall. The large, dark green leaves are alternate and appear to have toothed or wavy margins. They are broadest and the base of the leaf and diminish as they approach the tip of the leaf, and have a hairy underside. The flowers appear at the end of the branches, numerous, clustered and are pink to purple in color. At the base of the flower there are many spines that often have a hook on the end. The flower and the spines dry and become an easily dispersible bur. Flowering and seed production occur from July to October. The plant grows from a sturdy taproot that is brown and fleshy in color.

Common burdock 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.



Key ID Points

Habitats for Common burdock include roadsides, ditch banks, waste places, pastures, and fencerows. Animals will avoid eating the plant in both years of growth, the first year due to the hairy leaves and the second



Photos © All Photos from Kelly Uhing, Department of Agriculture

Arctium minus

**CULTURAL**

Minimizing soil disturbance and encouraging the establishment of desirable grasses and forbs, can assist in controlling Common burdock. 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 for more information.

**MECHANICAL**

Hand pull or dig when soil is moist, but make sure to wear gloves. Bag specimens carefully so as not to scatter seeds. Mowing is also effective, cutting the top growth of the plant. The key to effective control is to prevent seed production and/or spread.

Integrated Weed Management:

Preventing the establishment and minimizing soil disturbance is an effective way to control Common burdock. Combining treatment methods of cultural, mechanical and chemical assist with controlling these plants.

Common burdock

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)	4-7 oz/acre or 1 teaspoon/gal water	Apply in rosette stage in spring or fall. Add non-ionic surfactant @ 0.32 oz/gal water or 1 qt/100 gal water.
Clopyralid (Stinger)	1/2-1 1/3 pts/acre	Apply to young to actively growing plants in the spring. Add non-ionic surfactant @ 0.32 oz/gal water or 1 pt/100 gal water.
2,4-D Amine	2 pts/acre	Apply to young to actively growing plants in the spring. Add non-ionic surfactant @ 0.32 oz/gal water or 1 pt/100 gal water.
2,4-D Dicamba	1 pt/acre	Apply to young to actively growing plants pre-flower stages in spring. Add non-ionic surfactant @ 0.32 oz/gal water or 1 pt/100 gal water.

Photos © Top to Bottom; Kelly Uhing, Colorado Department of Agriculture; Whitney Cranshaw, Colorado State University, Bugwood.org; Kelly Uhing, Colorado Department of Agriculture

Common mullein

Colorado Department of
Agriculture

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Broomfield, CO 80021

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



Key ID Points

Identification and Management



Identification and Impacts

Common mullein (*Verbascum thapsus*) is a biennial forb native to Europe and Asia. The first year of the plant it produces a basal rosette. Basal rosettes can grow to 30 inches in diameter. The leaves are light-green in color and are covered in fine soft hairs. The woolly leaves are alternate and overlapping each other and can grow over a foot long. In spring of the second year the plant bolts an erect stem, that grows 2 to 6 feet tall. The flowers of the plant are borne in terminal spikes. These terminal spikes may reach up to 20 inches in length. The flowers are sulfur-yellow in color and have five petals. The flowers range from 3/4 of an inch to 1 1/2 inches in diameter. Numerous two chambered fruits produce 100,000 to 250,000 seeds per plant. Flowering and seed production typical occur from June to August. The plant has a deep taproot along with a fibrous root system.

Habitats for Common mullein are roadsides, waste places, right-of-ways, pastures, hay fields, and abandoned lands. It prefers gravelly soil types, but can grow in other soil types. Livestock will avoid eating

Common mullein, due to the hairy leaves of the plants. The plants were originally introduced as a medicinal plant. The Europeans used the flowers for tea, and the leaves for many remedies like burns and rashes. Both the Europeans and the Indians smoked the dried leaves to treat bronchitis.

The key to effective control of Common mullein is preventing the production of seeds. This plant is difficult to control due to the large amount of seed produced and seed bank left in the soil. Mechanical, cultural, biological and chemical treatments can be successful if utilized together in an integrated weed management plan. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

Common mullein 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 © All Photos from Kelly Uhing, Department of Agriculture; Except Bottom left Mary Ellen (Mel) Harte, United States

Verbascum thapsus

**CULTURAL**

Cultural control can be effective in assistance with other treatment options. Once the parent plants have been removed, cultivating the area with desirable grasses and forbs may outcompete Common mullein seedlings. For specific seed recommendations contact your local Natural Resources Conservation Services for seed mixes.

**BIOLOGICAL**

Gymnetron tetrum, a seed eating weevil, biological control has been found in eastern Washington State and is currently working on populations there. The weevil has not yet been approved for use in Colorado. Contact the Palisade Insectary of the Colorado Department of Agriculture at 970-464-7916 for more information.

**MECHANICAL**

Hand pull or dig when soil is moist, prior to flowering and seed production can be effective. If flowers are present, bag specimens carefully so as not to scatter any potential seeds. The key to effective control is to prevent seed production and/or spread.

Integrated Weed Management:

Preventing the establishment and the seed production of Common mullein is key to controlling populations. If the population is established, using a combination of cultural, chemical, biological and mechanical treatments can aid in suppressing population size. Since plants produce thousands of seed treatments need to occur over an extended period of time.

Common mullein

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
Chlorsulfuron (Telar XP)	1-3 oz/acre	Apply to rosette stages in spring or fall prior to bolting. Add non-ionic surfactant @ 0.32 oz/gal water or 1 pt/100 gal water.
2,4-D Picloram (Grazon P+D *this is a Restricted Use Pesticide*)	4 pts/acre	Apply to rosette stages in spring or fall prior to bolting. Add non-ionic surfactant @ 0.32 oz/gal water or 1 pt/100 gal water. DO NOT apply near trees/shrubs/high water table.
Picloram (Tordon 22K *this is a Restricted Use Pesticide*)	1-2 qts/acre	Apply to rosette stages to early growth stages in spring or fall. Add non-ionic surfactant @ 0.32 oz/gal water or 1 pt/100 gal water. DO NOT Apply near trees/shrubs/high water table.
Metsulfuron (Cimmaron)	1.0 oz/acre	Apply to rosette stages in spring or fall. Add non-ionic surfactant @ 0.32 oz/gal water or 1 pt/100 gal water.

Photos © Top to Bottom; Kelly Uhing, Colorado Department of Agriculture; Whitney Cranshaw, Colorado State University, Bugwood.org; Kelly Uhing, Colorado Department of Agriculture



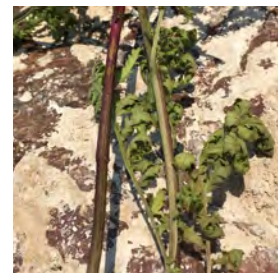
In Colorado, flowering typically starts in June lasting to September. Seeds are yellowish brown achenes with short, five-toothed crowns. One plant can produce up to about 50,000 seeds. Seeds is well adapted to cold environments with germination rates as high as 70% (Gucker 2009). Seed longevity is at least two years, and most seeds remain near the parent plant since they lack wind-dispersed structures (Gucker 2009). Roots are robust, often with rhizomes that can be woody, coiled and at least 51 inches below the soil surface (Gucker 2009). Rhizomatous spread occurs, but reproduction is primarily by seed (Gucker 2009).

Common tansy (*Tanacetum vulgare* L.) is a perennial plant in the Asteraceae family, also known as golden buttons and garden tansy.

Mature plants range from 1.5 to seven feet tall. The stem leaves are alternate and oblong. Leaves are deeply divided with four to ten pairs of leaflets. Glands appear on the leaf surface. The leaf margins are dentate. From afar, leaves have a fern-like appearance and have a strong odor when crushed. Stems are stiff, upright, ribbed often purplish-red to green in color, and hairless. Common tansy has only button-like perfect disc flowers; it lacks ray flowers. Yellow disc flowers are numerous and arranged as a flattened dense cluster at the terminal end of the stems. The outer ring of disc flowers are pistillate. Ovate shaped phyllaries that surround the head are arranged in series. Phyllary margins are lighter in color than the center.

Common tansy is often confused with *Achillea millefolium* ('Moonshine' yarrow), which is a similar height, leaf structure, and has yellow terminal flowers. When common tansy is not in flower, it can also be confused with *Conium maculatum* (poison hemlock) because of its leaf structure, the stiff ribbed stems and corymbiform flower head.

In Colorado, common tansy is mostly found along the banks of irrigation ditches, streams, seeps and roads (EDD-MapS 2018). It is also found in residential areas as an ornamental, and occasionally on semi-arid rangelands and pastures (EDDMapS 2018). It survives cold, prefers wet environments and full sun but can tolerate partial shade (Gucker 2009). Common tansy is reported predominantly in the northern portion of the United States (EDDMapS 2018).



© SEINet Herbarium of Hollis Koster

Common Tansy

Tanacetum vulgare L.

common tansy
Tanacetum vulgare
2016 Statewide Distribution in Colorado
Based on 2016 Quarterquad and EDDMapS Field Survey Data
Up to Approximately 313 Infested Acres



Acres estimated to nearest whole acre by county weed supervisors and other data sources, compiled by Colorado Department of Agriculture
 COLORADO Department of Agriculture
 0 1-10 acres 11-50 acres
 0 30 60 Miles

With adequate moisture common tansy can outcompete and displace native and desirable species; allelopathy may be a factor (Gucker 2009). When stands get robust, it can reduce irrigation water flow (Gucker 2009). Its seeds float, so water can be a vector and downstream riparian corridors and irrigation channels can become infested. It tends to be fairly aggressive and difficult to control.

Key ID Points

1. Yellow button-like composite flower heads that lack ray flowers
2. Fern-like pinnately divided alternate leaves, foul smell
3. Ribbed stiff tall stems
4. Dense woody-like root mass

Integrated Weed Management Recommendations

Effective integrated management means using a variety of eradication methods along with restoration, prevention of seed production and dispersal, and monitoring. Maintain robust healthy native landscapes. Restore degraded sites. Avoid soil disturbance. Prevent seed production and seeds from dispersing, e.g. on contaminated equipment. Rest sites until restored. Modify land use practices. Use methods appropriate for the site, other plants present and land uses.



© Kayla Malone

CULTURAL

Common tansy prefers bare mineral soil, high light and few competitors to germinate, so maintain deep mulch and litter cover and select shade producing species. Since common tansy forms robust rhizomatous roots, select plants that will have equally or more competitive below ground root structures that includes an assemblage of shrubs, forbs, cool and warm season grasses, annuals and perennials. Use locally adapted species that are ecologically appropriate for the site and ecoregion to improve competitiveness. Implement whole site restoration, where needed. Common tansy prefers frequent disturbance and flooding, so where possible, modify the hydrology and disturbance regimes until control is established, especially where dense colonies exist.



© University of Colorado Outdoor Services

BIOLOGICAL

Common tansy is toxic to cattle, not recommended for horses, however confined domestic sheep and goats eat it during early flower (Gucker 2009). Targeted grazing can be effective, but opens the canopy for new seeding or shoot growth; repeat integrated entries with chemical (Gucker 2009). Non-targeted grazing should be light, with less than 60% defoliation to maintain competitiveness against common tansy (Gucker 2009). There are no biological control agents authorized in Colorado that would effectively control this species.



© Practically Functional

MECHANICAL

Because of common tansy's robust roots and prolific seed production, mechanical methods are best for residential areas and small infestations. Remove all root biomass or sever roots below the soil surface early in the season to reduce energy storage and before seed production. Mowing, chopping, hand-pulling, and deadheading leaves roots behind and stimulates flower production, requiring consecutive years of season-long treatments. Mowing disperses seeds and expands the infested area. Collect, bag, and dispose of or destroy all flowers; seeds could mature and germinate if left on the ground. Its large size may increase fire hazard. High intensity prescribed fire may top kill plants but leave roots mildly affected (Gucker 2009). Combine prescribed fire with other methods to improve treatment efficacy (Gucker 2009).



© Dave and Karin Hanna, Techline News

CHEMICAL

NOTE: Herbicide recommendations to control common tansy in pastures and rangeland are found at: <https://goo.gl/TvWnv9>. Rates are approximate and based on equipment with an output of 30 gal/acre. Follow the label for exact rates. Consult local turf and ornamental experts for herbicides appropriate for residential settings. Always read, understand, and follow the label directions. The herbicide label is the LAW!

Common tansy

Tanacetum vulgare L.

Colorado Department of Agriculture - Conservation Services



305 Interlocken Parkway
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(303) 869-9030

www.colorado.gov/ag/weeds

Colorado
State
University



© Steve Dewey, UT State University, Bugwood

Common teasel, *Dipsacus fullonum* L., is a biennial or sometimes short-lived perennial forb. Mature plants can grow up to or over six feet tall and have a taproot. Common teasel has simple lanceolate to oblanceolate basal and stem leaves. Both leaves are conspicuously veined, wrinkled and have rough surface. Leaf margins are crenate. Stems leaves are lined with stiff prickles along the midrib. Stem leaves are opposite, net-veined, stalkless, and clasp the stem. The stem is rigid and also lined with several rows of downward turned prickles.

Flowers are range from white to violet. The flower head is generally egg-shaped, with a square base. The long thin stiff floral bracts at the base of the inflorescence are generally longer than the flower head; these also have prickles. It flowers from April to September. This species reproduces by seed. In a Canadi-

an study, common teasel resprouted 50% of the time after mechanically removing above ground vegetation. Common teasel can produce more than 2,000 seeds per plant. Plants die after production of seed has occurred. Seeds can stay viable for up to 14 years. Seeds germinate and establish readily, however, seeds don't generally disperse far from the parent plant. The fruits are a four-angled achene, each containing a single seed.

Common teasel is native to Europe where historically it had many uses. Common teasel is spreading rapidly in America. It is common along major travel corridors and previously disturbed areas. It is invasive in moist soils, such as wetlands, fens and riparian corridors. This includes roadsides, swales, irrigation ditches. Upland dry sites are also vulnerable. These include open, sunny habitats such as abandoned fields, pastures, meadows and woodlands.

Restoration of infested and degraded sites is one of the keys to eradicating common teasel. Wetlands are important but very sensitive environments. Methods and techniques used in infested wetlands should follow best management practices, such as those available at <https://www.colorado.gov/pacific/ag-conservation/noxious-weed-publications>. Preventing seed production is necessary to curtail the spread of this forb. Eradication efforts will need to continue for multiple consecutive seasons until the seed bank is depleted. Once eradication is complete, monitoring will be needed.

Common teasel is designated as a "List B" species in the Colorado Noxious Weed Act. It is required to be eradicated; some populations may be contained or suppressed depending on state regulations. For state regulations described for each county, refer to the most recent Rule, or visit www.colorado.gov/ag/weedcontacts for details.



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© Chris Evans, IL Wildlife Action Plan

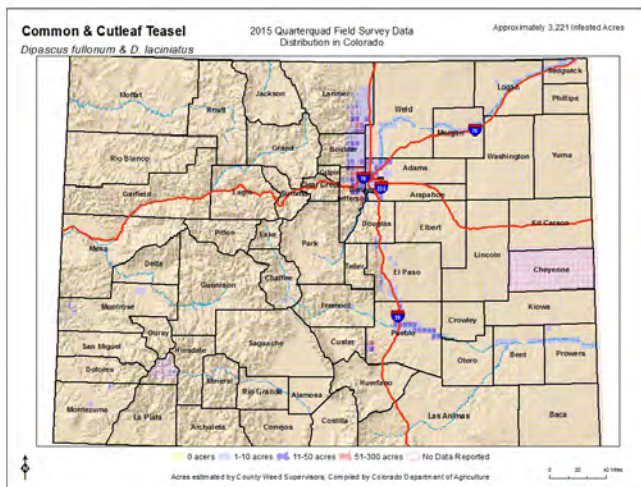


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Common teasel

Dipsacus fullonum L.

2015 Quarter Quad Survey



Key ID Points

1. Long slender floral bracts extend beyond the top of the flower head.
2. Leaves are crinkled and have prickles.
3. Stems are stiff and have rows of prickles.

Integrated Weed Management Recommendations

Common teasel *Dipsacus fullonum* L.

Effective integrated management means using a variety of eradication methods along with restoration, prevention of seed production and dispersal, and monitoring. Maintain robust healthy native landscapes. Restore degraded sites. Avoid soil disturbance. Prevent seed production in the first and second year. Prevent seed from dispersing, e.g. contaminated equipment. Rest sites until restored. Change land use practices. Use methods appropriate for the site; disturbing wetlands, fens and riparian areas is generally not advised without proper training.



© City of Watsonville

CULTURAL CONTROL METHODS

Maintain or restore a competitive assemblage of forbs, cool and warm season grasses. Implement whole site restoration of soils, plants and water regimes where stands of common teasel exist. Use locally adapted species that are ecologically appropriate for the site to improve competitiveness (e.g. wetland plants or upland plants). Include annual as well as perennial species. Incorporate soil amendments, soil microbes and mycorrhizal fungi in restoration efforts. Minimize soil compaction and disturbance, especially in wetlands and moist soil. Acquire permits for wetland restoration, if required.



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BIOLOGICAL CONTROL METHODS

Common teasel is not palatable to domestic livestock in part because of the abundance of prickles. Properly managed grazing can improve vigor of desired species and indirectly reduce common teasel. There are no biological control agents for common teasel authorized in Colorado that would effectively control common teasel. For more information about biological control agents, visit the Colorado Department of Agriculture's Palisade Insectary website at <https://www.colorado.gov/pacific/agconservation/biocontrol>



© Lady Barbaras Garden, Pintrest

MECHANICAL CONTROL METHODS

Mechanical methods are best for infestations smaller than 0.5 acres; weigh this against other plants present, ecology and site condition. Sever roots below the soil surface during the first year before the plant stores energy, and in the second year before seed production. Mowing, chopping and deadheading stimulates more flower production; these methods require consecutive years of season-long treatments. Flower heads must be collected, bagged, and disposed of or destroyed; seeds will mature and germinate if left on the ground. Fire effects are unknown. Vegetation may not carry fire. Low severity prescribed fires may only kill the above ground vegetation, leaving roots and seeds unaffected. High severity prescribed fire may kill common teasel, but could damage native species and is not recommended.

CHEMICAL CONTROL METHODS

NOTE: The following are recommendations for herbicides that can be applied to pastures and rangeland. Rates are approximate and based on equipment with an output of 30 gal/acre. Follow the 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 when in rosette or bolting growth stage. (Spring or fall rosettes, or early summer bolting)
Aminopyralid (Milestone)*	4-7 oz. product/acre (start with 7 oz.) + 0.25% v/v non-ionic 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) *Not permitted for use in the San Luis Valley.
Imazapic (Plateau)	8-12 oz. product/acre + 2 pints/acre 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)
Aminocyclopyrachlor + chlorsulfuron (Perspective)*	4.75-8 oz. product/acre + 0.25% v/v non-ionic surfactant	Apply from the seedling to the bolting stage. 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 for use on grazed or feed forage. *Product not permitted for use in the San Luis Valley.



Colorado Department of Agriculture - Conservation Services

305 Interlocken Parkway

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www.colorado.gov/ag/weeds



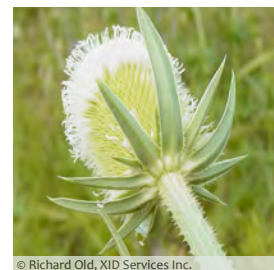


to common teasel, the bracts on cutleaf teasel are wider and generally shorter than the entire length of the flower head. Cutleaf teasel blooms from April through September and is cross-pollinated by hoverflies, bumblebees and about 40 other insects. Fruits are oblong, four-angled achenes. Each achene contains a single seed. A single teasel plant can produce over 2,000 seeds. Seeds remain viable for up to 14 years but generally are believed to germinate within a few seasons after seeds set. This species reproduces only by seed. Generally seeds remain close to the parent plant, however seeds have the ability to disperse in water, such as creeks, by animals such as birds or small mammals, or by humans. New plants tend to reoccupy the vacancy that parent plants left after dying.

Cutleaf teasel, *Dipsacus laciniatus* L., is a biennial forb, but under ideal growing conditions it may act as a short-lived perennial. Mature plants can grow over six feet tall. Cutleaf teasel has basal rosette leaves and stem leaves. First year basal leaves are conspicuously veined. Stem leaves are opposite but distinctly clasp the stem at the point of attachment to form a cup. Leaves have a lanceolate shape and a prominent white mid-rib that is lined with prickles. Leaf margins are deeply divided into narrow irregular segments. Stems are four-angled and have rows of prickles down the length of the stem. Flower heads are cream to white and bloom from the center of the head first. Individual flowers have a short four-lobed calyx and 4-lobed corolla. The green floral bracts are fused at the base, forming a cup. These bracts are linear to lanceolate shaped. They curve upward and are spine-tipped. In comparison

Cutleaf teasel is an aggressive exotic species that can out-compete native species. It can become a monoculture, and take over prairies and savannas once established. This species prefers moist soil conditions, such as fens, wetlands, riparian corridors, ditches, swales and roadsides that receive direct sun. It can also invade sunny dry upland sites, such as dryland pastures, abandoned fields, meadows and woodlands.

Restoration of infested and degraded sites and preventing seed production for consecutive multiple seasons are critical to eradicating cutleaf teasel. Monitoring sites post-treatment will be needed.



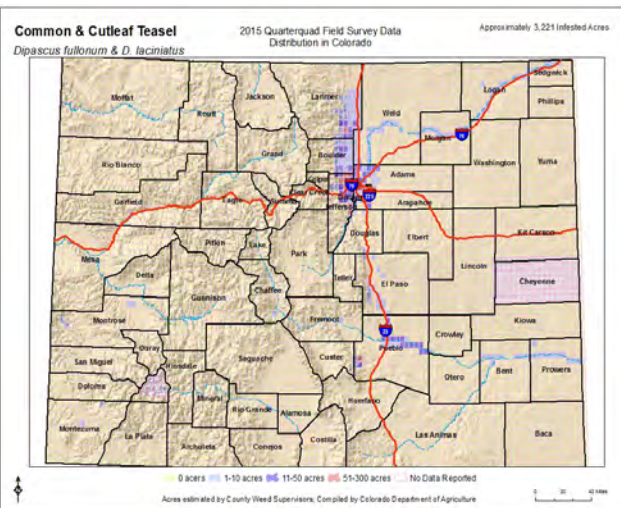
Cutleaf teasel

Dipsacus laciniatus L.

Key ID Points

1. Opposite stem leaves surround the stem and form a cup.
2. Leaves have a white mid-rib, are lined with prickles and deeply but irregularly lobed.
3. Floral bracts are wide, spine-tipped and shorter than the flower head.

2015 Quarter Quad Survey



Cutleaf teasel is designated as a "List B" species in the Colorado Noxious Weed Act. It is required to be eradicated; some populations may be contained or suppressed depending on state regulations. For management directions for each county, refer to the most recent Rule, or visit www.colorado.gov/ag/coweed-contacts for details.

Integrated Weed Management Recommendations

Cutleaf teasel *Dipsacus laciniatus* L.

Effective integrated management means using a variety of eradication methods along with restoration, prevention of seed production and dispersal, and monitoring. Maintain robust healthy pastures and native landscapes. Restore degraded sites. Avoid soil disturbance. As with most biennials, prevent seed production in the first and second year of growth. Prevent seed from dispersing, such as on contaminated equipment. Rest sites until they are effectively restored. Change land use practices. Use methods appropriate for the site.



© City of Watsonville

CULTURAL CONTROL METHODS

Maintain or restore a competitive assemblage of forbs, cool and warm season grasses. Implement whole site restoration of soils, plants and water regimes where stands of cutleaf teasel exist. Use locally adapted species that are ecologically appropriate for the site to improve competitiveness (e.g. wetland plants or upland plants). Include annual as well as perennial species. Incorporate soil amendments, soil microbes and mycorrhizal fungi in restoration efforts. Minimize soil compaction and disturbance, especially in wetlands and moist soil. Acquire permits for wetland restoration, if required.



© Sheep Sheephouse

BIOLOGICAL CONTROL METHODS

Cutleaf teasel is not palatable to domestic livestock in part because of the abundance of prickles. Properly managed grazing can increase vigor of desirable species and indirectly reduce cutleaf teasel. There are no biological control agents for cutleaf teasel authorized in Colorado that would effectively control cutleaf teasel. For more information about biological control agents, visit the Colorado Department of Agriculture's Palisade Insectary website at <https://www.colorado.gov/pacific/agconservation/biocontrol>



MECHANICAL CONTROL METHODS

Mechanical methods are best for infestations smaller than 0.5 acres; weigh this against other plants present, ecology and site condition. Sever roots below the soil surface during the first year before the plant stores energy and in the second year before seed production. Mowing, chopping and deadheading stimulates more flower production; these methods require consecutive years of season-long treatments. Flower heads must be collected, bagged, and disposed of or destroyed; seeds will mature and germinate if left on the ground. Fire effects are unknown. Vegetation may not carry fire. Low severity prescribed fires may only kill the above ground vegetation, leaving roots and seeds unaffected. High severity prescribed fire may kill cutleaf teasel, but could damage native species and is not recommended.

CHEMICAL

NOTE: The following are recommendations for herbicides that can be applied to pastures and rangeland. Rates are approximate and based on equipment with an output of 30 gal/acre. Follow the 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 when in rosette or bolting growth stage. (Spring or fall rosettes, or early summer bolting)
Aminopyralid (Milestone)*	4-7 oz. product/acre (start with 7 oz.) + 0.25% v/v non-ionic 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) *Not permitted for use in the San Luis Valley.
Imazapic (Plateau)	8-12 oz. product/acre + 2 pints/acre 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)
Aminocyclopyrachlor + chlorsulfuron (Perspective)*	4.75-8 oz. product/acre + 0.25% v/v non-ionic surfactant	Apply from the seedling to the bolting stage. 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 for use on grazed or feed forage. *Product not permitted for use in the San Luis Valley.



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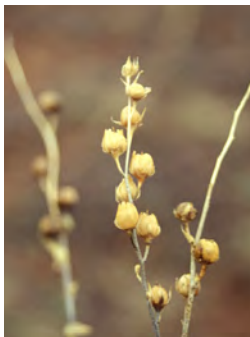


Dalmatian toadflax

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.

Dalmatian toadflax Identification and Management



Identification and Impacts

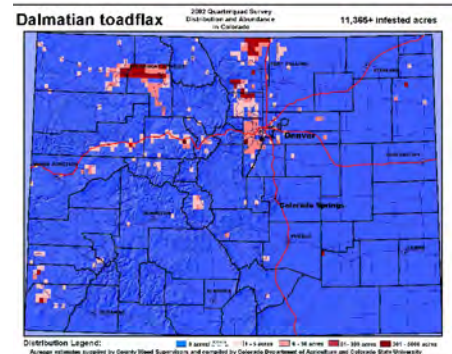
Dalmatian toadflax (*Linaria dalmatica*) is a non-native, perennial forb introduced from the Mediterranean region as a folk remedy, fabric dye and ornamental. It reproduces both by seed and by extensive, creeping rhizomes. A single plant produces 500,000 seeds, most of which fall within 18 inches of 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.

Linaria dalmatica



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
Aminocyclopyrachlor + chlorsulfuron (Perspective)*	4 oz. product/acre + 1% v/v methylated seed oil	Apply <u>when flowering</u> in spring and/or in the 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 for use on grazed or feed forage.
Picloram* (Tordon/Picloram 22K - Restricted use pesticide)	1-2 qts./acre + 1% v/v methylated seed oil	Apply <u>when flowering</u> in spring and/or in the fall regrowth. DO NOT use near trees, desirable shrubs, water, or high water table.
Chlorsulfuron** (Telar)	1.5-2 oz./acre + 1% v/v methylated seed oil	Apply <u>when flowering</u> in spring and/or in the fall regrowth.

Note: *Not permitted for use in the San Luis Valley. **This herbicide has residual soil activity that will affect all broadleaf seedlings germinating after application has occurred.

Additional herbicide recommendations for this and other species can be found at: www.colorado.gov/agconservation/CSUHerbicideRecommendations.pdf

Dalmatian toadflax





© Melissa McCormick, City of Colorado Springs

Dame's rocket (*Hesperis matronalis* L.) is a perennial plant in the Brassicaceae family, also known as dame's violet, mother-of-the-evening.

Mature plants range from one to three feet tall. The erect stems are sparingly branched with simple or forked hairs, but sometimes glabrous (Francis et al. 2009). Basal rosette leaves range from entire to dentate. Alternate stem leaves range from lanceolate with a narrowly acute apex and acute base on the upper stem, to ovate-lanceolate with a broad apex and a long petiolate base on the lower stem. Stem leaves have toothed margins and the leaf surface is pubescent. Its fibrous lateral roots are usually shallow, especially in compacted soil, such as roadsides (Francis 2009).

Like all mustards, the bisexual flowers have four separate petals symmetrically arranged. Petals range in color

from white to fuchsia, and are lollipop in shape- oval on top with long linear tail that creates the appearance of a tubular type arrangement. Four tall stamens and two short stamens surround a superior ovary with two united carpels. Similar to the petals, there are four sepals and they look tubular, though they are separate. Sepals are pubescent with perpendicular hairs. The inflorescence is arranged in a loose to corymbiform raceme, that in total, can be up to 30 cm long and erect. In Colorado, flowers bloom from mid May to mid July. Like all plants in the Brassicaceae family, seeds are the key to confirm the species' identity. The silique seed pods are narrow and from 6 to 14 cm long with one row of 20 to 35 seeds in each silique (Francis et al. 2009). Wingless seeds range from 3 to 4 mm long to 1 to 1.5 mm wide. The seedbank likely does not persist, but there are no empirical studies about seed longevity (Francis 2009). Reproduction is only by seed (Francis et al. 2009).

Although the flower is pollinated by a variety of day and night pollinators, the strong dusk-time fragrance of flowers most successfully allures syrphid fly pollinators (Majetic et al. 2009). However it appears that daytime pollination doubles seed production compared to nighttime pollination (Francis et al. 2009).

From a distance, dame's rocket is often confused with garden phlox (*Phlox paniculata*) and fireweed (*Chamaenerion angustifolium*) due to flower color and similar gestalt. Common garden phlox

has five fused petals that form a tubular corolla, five sepals, five stamens, one pistil with a superior ovary and opposite narrowly elliptic leaves that are hairless. Fireweed's flower has four broad fuchsia petals and four linear sepals of a similar color and stamens with red anthers and white vein.

In Colorado, it is found mainly in urban and suburban, disturbed areas, wet and alkaline soils.



© Minnesota Wildflowers



© Minnesota Wildflowers



© SEINet Acad. Sci. of Philadelphia

dame's rocket
Hesperis matronalis

2016 Statewide Distribution in Colorado
Based on 2016 Quarterquad and EDDMapS Field Survey Data
Approximately 583 Infested Acres



Acres estimated by County Weed Supervisors and Other Data Sources. Compiled by Colorado Department of Agriculture
Department of Agriculture
Colorado
Legend: 0 acres (yellow), 1-10 acres (orange), 11-50 acres (red)
Scale: 0, 20, 40 Miles

Dame's Rocket

Hesperis matronalis L.

- ### Key ID Points
1. Four petals, four sepals, four tall and two stamens
 2. Alternate lanceolate leaves, some petiolate, hairy stems & leaves
 3. Silique with single row of seeds
 4. Fibrous lateral roots

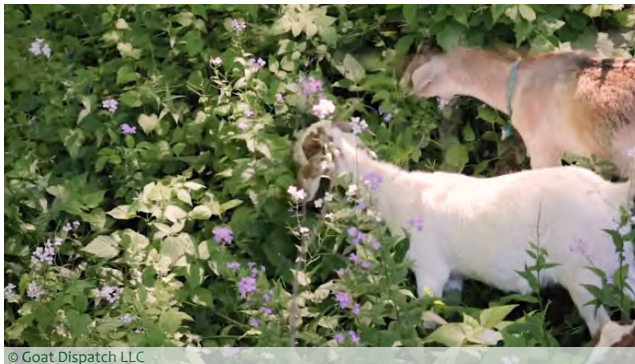
Integrated Weed Management Recommendations

Effective integrated management means using a variety of eradication methods in the same site along with restoration, prevention of seed production and dispersal, and monitoring. Maintain robust healthy native landscapes. Restore degraded sites. Avoid soil disturbance. Prevent seed production and seeds from dispersing, e.g. on contaminated equipment. Rest sites until restored. Modify land use practices. Use methods appropriate for the site and land uses.



CULTURAL

Dame's rocket has the uncanny ability to maximize use of nitrogen and especially high water availability to outcomplete and suppress native plants (Hwang and Laurenroth 2008). This remains even if one plant is present, if it is a seedling, or if natives are adults (Hwang and Laurenroth 2008). Thus, cultural methods should follow after integrating other methods. Implement whole site restoration of soils, plants and water regimes where dense colonies of dame's rocket exist. Use locally adapted species that are ecologically appropriate for the site, including annuals, perennials, shrubs, forbs, cool and warm season grasses. Do not add nitrogen or water. Give natives soil microbes and mycorrhizal fungi. Minimize disturbance. Choose garden phlox or the native fireweed for gardens and ornamental settings instead.



BIOLOGICAL

Dame's rocket is palatable to domestic goats. No information is available about targeted grazing using other livestock. Target grazing early in growing season and repeat entries through the season and years as control. There are no biological control agents for dame's rocket authorized in Colorado that would effectively control it. For more information about biological control agents, visit the Colorado Department of Agriculture's Palisade Insectary website at: www.colorado.gov/ag/biocontrol



MECHANICAL

When dame's rocket density is high, it will bolt and reproduce early (Rothfels et al. 2002). So timing mechanical methods should be based on density-dependent behaviors. Mechanical methods are best for residential areas, small infestations or seedlings. Remove as much of the lateral root mass as possible early in the season before the plant stores energy and produces seed. Mowing, chopping and deadheading leaves roots and chlorophyll structures behind, stimulates more flower production and allows energy storage; these methods require consecutive years of season-long treatments. Mowing disperses flowers and seeds, and expands the infested area. Collect and bag flowers; seeds germinate if left. Low severity prescribed fire may damage above ground vegetation, leaving roots and seeds unaffected. High severity prescribed fire may top kill plants and seeds.



CHEMICAL

NOTE: Herbicide recommendations to control dame's rocket in pastures and rangeland are found at: <https://goo.gl/TvWnv9> Rates are approximate and based on equipment with an output of 30 gal/acre. Follow the label for exact rates. Consult local turf and ornamental experts for herbicides appropriate for residential settings. Always read, understand, and follow the label directions. The herbicide label is the LAW!

Dame's rocket

Hesperis matronalis L.



Colorado Department of Agriculture - Conservation Services

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Broomfield, CO 80021

(303) 869-9030

www.colorado.gov/ag/weeds

Colorado
State
University

Diffuse knapweed

Colorado Department of
Agriculture

305 Interlocken Pkwy
Broomfield, CO 80021

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



Key ID Points

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

Diffuse knapweed Identification and Management



Identification and Impacts

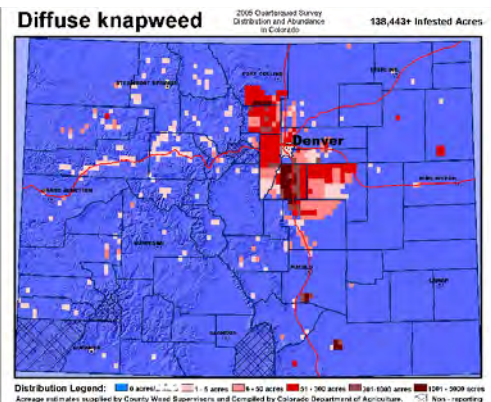
Diffuse knapweed (*Centaurea diffusa*) is a non-native biennial forb that reproduces solely by seed. A biennial is a plant that completes its lifecycle within two years. During the first year of growth, diffuse knapweed appears as a rosette in spring or fall. During the second year in mid to late spring – 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.



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

Centaurea diffusa

**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.

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
Aminocyclopyrachlor + chlorsulfuron (Perspective)*	4.75-8 oz. product/acre + 0.25% non-ionic surfactant	Pre-emergence or from seedling to mid-rosette stage. 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 for use on grazed or feed forage.
Aminopyralid* (Milestone)	5-7 oz./acre + 0.25% non-ionic surfactant	Spring at rosette to early bolt stage and/or in the fall to rosettes. Add 1 qt./acre 2,4-D or 3 oz. Perspective when treating in the bolting to flowering growth stages.
Clopyralid (Transline)	0.67-1.33 pints/acre + 0.25% non-ionic surfactant	Apply to spring/fall rosettes before flowering stalk lengthens. Add 1 qt./acre 2,4-D when treating in the bolting to flowering growth stages.

Note: *Not permitted for use in the San Luis Valley.

Additional herbicide recommendations for this and other species can be found at: www.colorado.gov/agconservation/CSUHerbicideRecommendations.pdf

Diffuse knapweed





©James Bailey, iNaturalist

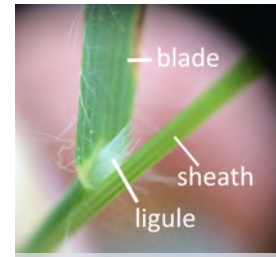
Cheatgrass (*Bromus tectorum* L.) is a winter annual grass in the Poaceae family, also known as downy brome.

Mature plants reach up to 24 inches tall. The stems are smooth but the leaf blades and sheath are hairy (downy). The ligules are fringed, short and membranous. The culms range from five to 90 cm long, can be prostrate or vertical, and have fine short hairs. Its fibrous roots can be up to 60 inches long, but the majority of root biomass is within first 12 inches of the soil surface. Roots are efficient at absorbing soil moisture, allowing cheatgrass to grow quickly early in season, while other plants are still dormant. Green up can occur twice per season. Cheatgrass has an unique spectral signature during seed set and senescence when it turns reddish purple. During these shoulder growing season events, it is easily detectable from other vegetation with satellite imagery.

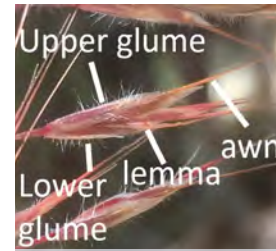
The flower is a simple one-sided panicle that characteristically flops over and hangs, branches and is open. Spikelets are usually terminal. Usually there are five to many florets; it has perfect flowers. The upper and lower glumes are usually unequal in length and shorter than florets; the lower glume ranges from 4 to 14 mm in length and is one veined. The upper glume is three-veined. The plant disarticulates above the glumes. The lemmas are usually downy, narrowly lanceolate with sharp tips and about 9 to 12 mm long. Usually there are five to many lemmas. Awns are usually present and range from 10 to 18 mm long. It is a prolific seed producer, capable of two seed crops per season. Seeds need to be buried in soil or litter and have fall moisture to germinate. The fall seed crop has greater reproductive success than spring. Seeds lack dispersal anatomy so fall close to parent plants but transport readily with animals, people and equipment. Seed longevity is about three years. Both inbreeding and cross breeding occur.

Cheatgrass is one of the most competitive non-natives in the Western US. It thrives in arid, semi arid, and cold environments. Colorado's high elevation range is not an issue for cheatgrass; plants were recently detected as high as 9,500 feet. It exhibits phenotypic plasticity and genetic diversity, making it highly adaptable to a variety of conditions, likely due to multiple introductions. Its presence has significant negative impacts throughout the West. Most notably, it alters fire regimes and thus engineers a positive fire feedback loop that favors its growth over other plants. This feedback loop is why cheatgrass forms monocultures throughout the West.

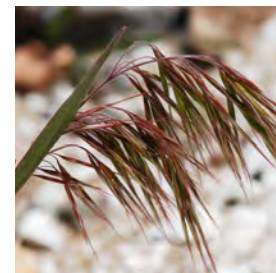
It is often confused with Japanese brome (*Bromus japonicus*), which has denser more compact spikelets, shorter awns, and changes from green to gold through the growing season.



© Priyantha Wijesinghe, iNaturalist



© Veronika Johansson, iNaturalist



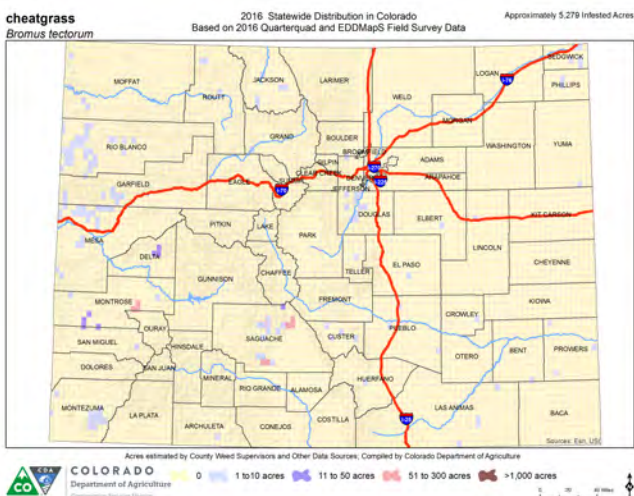
© Leslie J. Mehrhoff, University of CT

Cheatgrass

Bromus tectorum L.

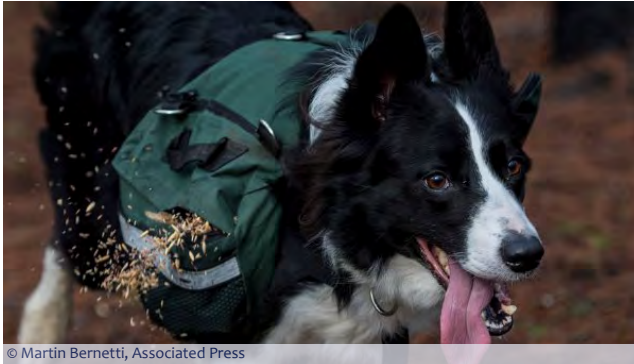
Key ID Points

1. Downy leaf blades, sheaths, ligules
2. Glumes are unequal size, lemmas are downy
3. One-sided panicle that droops, red-purple during seed set & senescence
4. Fibrous roots



Integrated Weed Management Recommendations

Effective integrated management means using a variety of eradication methods in the same site along with restoration, prevention of seed production and dispersal, and monitoring. Maintain robust healthy native landscapes. Restore degraded sites. Avoid soil disturbance. Prevent seed production and seed dispersal, e.g. on contaminated equipment. Rest sites until restored. Modify land use practices. Use methods appropriate for the site, including land use practices.



© Martin Bernetti, Associated Press



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CULTURAL

Biological soil crust is a soil health indicator of arid and semi arid sites; crusts inhibit cheatgrass seed germination. Aerial spread and cultivate soil crust where it is absent. Aerial and drill seeding bluebunch wheatgrass (*Pseudoroegneria spicata*) and Sandberg bluegrass (*Poa secunda*) with vesicular-arbuscular mycorrhizae; these are drought tolerant natives that are highly competitive against cheatgrass but require mycorrhizae. As these grasses establish and cheatgrass wanes slowly introduce additional species such as thickspike wheatgrass (*Elymus lanceolatus*), winterfat (*Krascheninnikovia lanata*), yarrow (*Achillea millefolium*) in the plant interspaces in subsequent years. Be cautious when purchasing seed as cheatgrass is often a contaminate, especially in mixes. Use seed pillows to disperse seeds.



© Stacy Litz, Associated Press

BIOLOGICAL

Sheep and cattle will select green cheatgrass which also affects desired cool-season grasses. Properly managed grazing can improve vigor of desired species and directly reduce cheatgrass. Post-fire grazing management varies depending on site potential and objectives. Currently there are no biological control agents for cheatgrass authorized in Colorado. For more biocontrol information, visit the Colorado Department of Agriculture's Palisade Insectary website at: www.colorado.gov/ag/biocontrol

MECHANICAL

Mechanical methods are best for residential areas and small infestations. Mowing and chopping are not recommended; they leave roots behind, stimulate flower production, disperse seeds, and expand the size of the infested area. Collect, bag, and dispose of or destroy flowers; seeds can mature and germinate if left. Tilling must be deeper than 6 inches to work. Prescribed fire applied before seed maturity, (late spring or early summer), may kill seeds; the trick is to get green cheatgrass and litter to carry fire and at a hot enough temperature to destroy seeds and seedlings. Always combine prescribed fire with cultural methods, timed appropriately, and base it on site conditions and other plants present. Monitoring and adaptive management are critical if prescribed fire is used as a tool for control.



© Helena Weed Control, Rocky Mountain Elk Foundation

CHEMICAL

Pseudomonas fluorescens D7 inhibits cheatgrass and is currently approved by EPA and Colorado. NOTE: Herbicide recommendations to control cheatgrass in pastures and rangeland are found at: <https://goo.gl/TvWnv9>. Rates are approximate and based on equipment with an output of 30 gal/acre. Follow the label for exact rates. Consult local turf and ornamental experts for residential settings. Always read, understand, and follow the label directions. The herbicide label is the LAW!

Cheatgrass

Bromus tectorum L.



Colorado Department of Agriculture - Conservation Services

305 Interlocken Parkway

Broomfield, CO 80021

(303) 869-9030

www.colorado.gov/ag/weeds



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 jurisdictions 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.

Convolvulus arvensis

**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.

Field bindweed

Hoary cress

Colorado Department of
Agriculture

305 Interlocken Pkwy
Broomfield, CO 80021

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



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.

Hoary cress Identification and Management

well on alkaline soils.



Identification and Impacts

Hoary cress (*Lepidium 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

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.



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

Lepidium draba

**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 available 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.

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
Chlorsulfuron* (Telar)	1 oz. product/acre + 0.25% v/v non-ionic surfactant	Apply at flowering. (Early spring to early summer)
Metsulfuron (Escort XP)	1 oz. product/acre + 0.25% v/v non-ionic surfactant	Apply at flowering. (Early spring to early summer)
Imazapic (Plateau, Panoramic)	12 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)

Note: *This herbicide has residual soil activity that will affect all broadleaf seedlings germinating after application has occurred.

Additional herbicide recommendations for other species can be found at:
www.colorado.gov/agconservation/CSUHerbicideRecommendations.pdf

Hoary cress

Hoary cress

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

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Hoary cress

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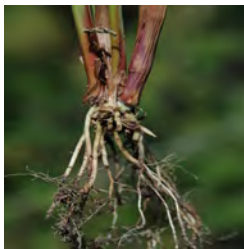
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Johnsongrass

Colorado Department of
Agriculture

305 Interlocken Pkwy
Broomfield, CO 80021

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



Key ID Points

Identification and Management



Identification and Impacts

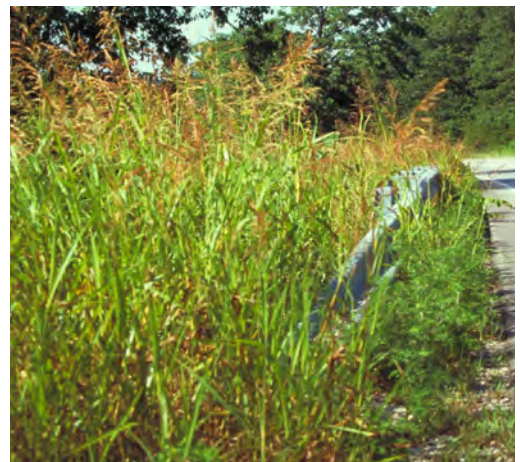
Johnsongrass (*Sorghum halpense*) is a perennial grass native to the Mediterranean region. The erect stems of this grass grows to be 2 to 8 feet tall and they are generally solid. At the base of the stalks they are reddish pink in color. Leaves of this grass range from 6 to 20 inches long and are 1/2 to 1 inch wide. The blades are flat with a very distinctive white midvein with maturity. The ligules of the plant are membranous and are surrounded with fine hairs. The inflorescence of Johnsongrass are a large open panicle, reddish to purple in color. The spikelets of the panicle are generally awn-tipped and shiny. Not all spikelets will contain awns, but the awns that are present can be bent and needle-like. Johnsongrass reproduces by seed and a thick fibrous rhizomes.

Habitats for Johnsongrass include; crop fields, hay fields, roadsides, fence rows, and waste areas. Originally introduced as a hay or forage crop, and thought to be a warm season grass, it has adapted in cooler climates. When found in areas that may frost or become moisture stressed, Johnsongrass becomes toxic

to livestock. It produces hydrocyanic acid, which can cause livestock's cells to lose the ability to utilize oxygen, similar to cyanide poisoning.

The key to effective control of Johnsongrass is the establishment and to minimize disturbance in areas susceptible to infestation. Using an integrated approach to control population of already established plant infestations can be an effective management tool. Depending on size of the infestation chemical, cultural and mechanical control options are useful. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

Johnsongrass 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 © (First 2) Chris Evans, River to River CWMA; Steve Dewey, Utah State University; Charles Bryson, USDA Agricultural Research Services; Bonnie Harper-Lore, Federal Highway Administrations; All Bugwood.org

Sorghum halpense

**CULTURAL**

Maintaining a healthy rangeland or pasture can help prevent the establishment of Johnsongrass. Planting native grasses and forbs to outcompete the grass can assist in control. For specific seed recommendations contact your local Natural Resources Conservation Services for seed mixes.

**BIOLOGICAL**

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

**MECHANICAL**

Hand pulling or hoeing when soil is moist, and infestations are small can be effective. When infestations are larger, mowing, tilling or plowing can assist with control when used in combination with herbicides. The key to effective control is to prevent seed production and/or spread through rhizomes.

Integrated Weed Management:

Preventing the establishment and maintaining healthy pastures by minimizing disturbance of the is most effective in controlling Johnsongrass. Using a combination of control methods can be effective if an infestation is already established. Cultural, chemical and mechanical treatments can be effective if used together.

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
Glyphosate + Isopropylamine (Glyphomax)	16 oz/acre	Apply in early growth stages before plant reaches 12 inches in height.
Glyphosate + Potassium	22 oz/acre	Apply in early growth stages before plant reaches 6 inches in height.
2,4-D + Glyphosate + Isopropylamine (Recoil)	1.25 -2.5 qts./acre	Apply in pre-seedhead stages of plant.

Johnsongrass





© WA State Noxious Weed Control Board

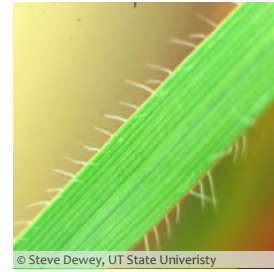
tains 1 to 3 viable seeds which develop quickly after pollination. Seeds germinate in fall and throughout cool months. Seeds remain viable for up to nine years. Often, spikelets will still be attached to the roots when plants are seedlings. In the seedling stage, Jointed goatgrass looks similar to winter wheat. The hairs on the jointed goatgrass will be the key diagnostic feature; winter wheat does not have these hairs.

Jointed goatgrass looks very similar to winter wheat in the younger stages of growth and hybridizes with winter wheat. The presence of the hairs on the leaf margin, sheath, ligules and auricles is key to identifying it apart from winter wheat. Mature hybrid spikelets closely resemble the zigzag structure of jointed goatgrass. A 2000 study found that hybrids do have a limited ability to produce viable seeds that can germinate and produce plants (Synder et al. 2006). The seeds of both species are also similar in terms of size and weight and so its assumed that hybrid seeds would be similar. It has a longer flowering season than winter wheat.

Jointed goatgrass is native to the temperate regions of central Asia, Russia and the Mediterranean. Long growing seasons, precipitation and cool weather favor jointed goatgrass. It invades a wide variety of sites, including grasslands, wheat fields, fence rows, waste places, roadsides, alfalfa fields, and pastures. Winter wheat fields infested with jointed goatgrass cause long-term economic loss

and wheat certification issues for the agricultural industry for years.

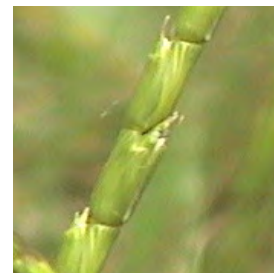
Jointed goatgrass is designated as a "List B" species on the Colorado Noxious Weed Act. It is required to be eradicated; some populations may be contained or suppressed depending on state regulations. For state regulations described for each county, refer to the most recent Rule, or visit www.colorado.gov/ag/weedcontacts for details.



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© Steve Dewey, UT State University



© Alejandro Perez Jones et al. 2010, Weed Science
Jointed goatgrass (left), hybrid (middle), winter wheat (right)

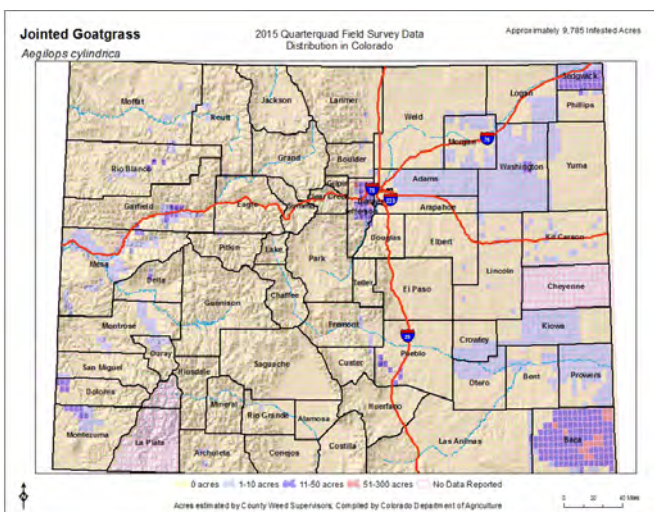
Jointed goatgrass

Aegilops cylindrica Host

Key ID Points

1. Stiff short hairs evenly spaced on the margins of leaf blades.
2. Evenly spaced hairs are on auricles, leaf sheath and ligules.
3. Spikelets fit in a zig-zag pattern in a cylindrical shape.

2015 Quarter Quad Survey



Acres estimated by County Weed Supervisors. Compiled by Colorado Department of Agriculture

Integrated Weed Management Recommendations

Effective integrated management means using a variety of eradication methods that also includes restoration, prevention of seed production and dispersal, and monitoring. Maintain robust healthy native landscapes and restore degraded sites. Avoid soil disturbance. As with most annuals, prevent seed production. Prevent seed from dispersing, such as on contaminated equipment. Rest sites until they are effectively restored. Control jointed goatgrass before March for the most effective results. Implementation and choice of method must consider the plant's life cycle.



CULTURAL CONTROL METHODS

Rotate crops for three seasons or longer before winter wheat is recultivated. Alternate crop selection is important: winter wheat/sunflower/fallow and winter wheat/corn/fallow decrease jointed goatgrass seed density. Early spring crops may not be effective as rotation crops. Band nitrogen fertilizer with desired species' seeds and irrigate; avoid broad nitrogen fertilizer applications. Select cultivars that result in early fall or spring growth, taller plants, and high till capacity to outcompete jointed goatgrass. Increase seed rates and reduce row space of crops and seeded sites. Isolate and harvest jointed goatgrass patches separately from other crops.



© Steve Dewey, UT State University

BIOLOGICAL CONTROL METHODS

The long awns and hard seeds make jointed goatgrass unpalatable to domestic livestock and can cause injury and may even be fatal. Grazing before flower production is believed to stimulate growth and plant density; properly timed grazing may increase the vigor of desired plants. Avoid high intensity-short duration and heavy grazing. There are no known biological control agents effective against jointed goatgrass authorized in Colorado. For more information about biological control agents, visit the Colorado Department of Agriculture's Palisade Insectary website at www.colorado.gov/ag/biocontrol.



© Kirby Brumfield

MECHANICAL CONTROL METHODS

Mowing and weed whacking should be done before flower production; these methods can induce more tiller and flower production and disperse seeds. Ensure that all methods do not cause spikelets to shatter and disperse seeds. Tilling may bring buried seeds back to the soil surface and could increase germination. Till "in the fall when primary dormancy is lost, but before secondary dormancy is imposed" (Fandrich and Mallory-Smith 2006). Mechanical methods have limited success. Prescribed fire can kill seeds if there is enough vegetation (> 7,000 lbs/acre) on the soil surface to carry fire and increase heat generated. Consecutive fire applications will be needed.

CHEMICAL CONTROL METHODS

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

HERBICIDE	RATE	APPLICATION TIMING
Glyphosate* (Roundup, and others)	16 oz./acre + 0.25% v/v non-ionic surfactant	Apply before first spikelets begin to emerge from the boot; usually weeds are < 6" in height. (Late winter to early spring). *These herbicide products are non-selective and will kill any vegetation contacted.
Imazapic + Glyphosate* (Journey)	6 oz./acre + 0.25% v/v non-ionic surfactant	Apply before first spikelets begin to emerge from the boot; usually weeds are < 6" in height. (Late winter to early spring). Note: *These herbicide products are non-selective and will kill any vegetation contacted.
Imazapic (Plateau, Panoramic)	6 oz./acre + 1% v/v methylated seed oil	Apply pre-emergence in late summer or fall, or early postemergence in late winter before tiller.
Aminocyclopyrachlor plus chlorsulfuron (Perspective)*	4.75-8 oz. product/acre + 0.25% v/v non-ionic surfactant	Apply from the seedling to the bolting stage. 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 for use on grazed or feed forage. *Product not permitted for use in the San Luis Valley.

Colorado Department of Agriculture - Conservation Services

305 Interlocken Parkway

Broomfield, CO 80021

(303) 869-9030

www.colorado.gov/ag/weeds



Leafy spurge

Colorado Department of
Agriculture

305 Interlocken Pkwy
Broomfield, CO 80021

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



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.

Leafy spurge Identification and Management



Identification and Impacts

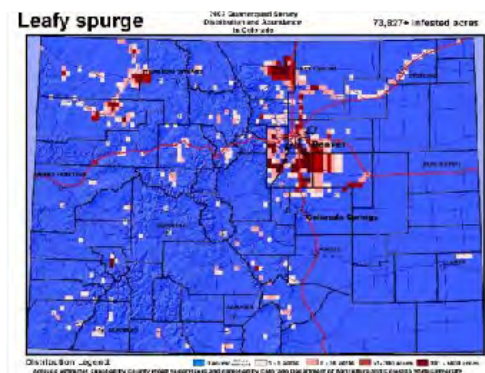
Leafy spurge (*Euphorbia esula*) is a non-native deep-rooted perennial that spreads by seed and extensive, creeping roots. The roots can extend as deep as 30 feet into the soil and are extremely wide-spreading. The roots are brown and contain numerous pink buds that generally produce new shoots or roots. 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.

Euphorbia esula

**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 *Aphthona nigricutis*, *A. lacertosa*, and *A. cyarissiae*, 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

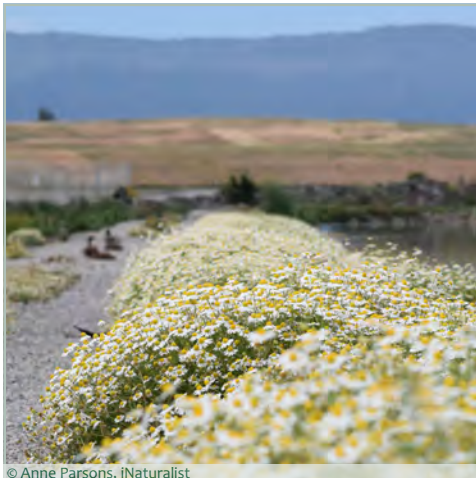
NOTE: The following are recommendations for herbicides that can be applied to range and pasturelands. Rates are approximate and based on equipment with an output of 30 gallons per acre. Please read label for exact rates. **Always read, understand, and follow the label directions. The herbicide label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

Herbicide	Rate	Application Timing
Aminocyclopyrachlor + chlorsulfuron (Perspective)* + Diflufenzopyr + dicamba (Overdrive, Distinct)	3-4 oz. Perspective/acre + 4 oz. Overdrive/acre + 1% v/v methylated seed oil	At flowering in the spring and/or fall.
Quinclorac (Paramount, Facel-L, Quinstar) + Diflufenzopyr + dicamba (Overdrive, Distinct)	12-24 oz. Quinstar/acre + 4 oz. Overdrive/acre + 1% v/v methylated seed oil	At flowering in the spring and/or fall.
Aminocyclopyrachlor + chlorsulfuron (Perspective)*	4.75-8 oz. product/acre + 1% v/v methylated seed oil	Post-emergence in spring until flowering, or to fall rosettes.

Note: *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. Perspective is not for use on grazed or feed forage.

Additional herbicide recommendations for this and other species can be found at: www.colorado.gov/agconservation/CSUHerbicideRecommendations.pdf

Leafy spurge



© Anne Parsons, iNaturalist

Mayweed chamomile (*Anthemis cotula* L.) is an annual forb in the Asteraceae family, also known as stinking chamomile, dog fennel, mayweed, and mayweed dogfennel. Distinguishing mayweed chamomile from similar looking species is difficult. Hybridization with scentless chamomile is reported (Kay 1971). It is believed to be phenotypically plastic, making visible traits inconsistent; traits overlap with other *Anthemis* species (Ali 2019, Kay 1971).

The most obvious diagnostic feature is its pungent odor. It may irritate skin of mammals upon contact (iNaturalist 2019). Mature plants range from 3 to 26 inches tall. Its leaves are alternate and deeply divided pinnately, each lobe is pinnately divided again two to three times (bi- to tripinnatifid), giving it a feather-like appearance. Each segment is short and narrow. Soft hairs are

on the leaf upper surface. Stems have many branches, sometimes stems have red hue, hairs or glands. It has a fibrous taproot. White ray flowers have shallow three-lobed margin. It has ten to 15 ray flowers. Once the yellow disc flowers are developed, they form a cone shape that causes the white ray flowers to subtend. When vertically sliced, the receptacle is diagnostically narrowly cone-shaped, solid in the center, and has chaff- a few long shaggy soft hairs restricted to the center, and sometimes glands, all are observable with a hand lens. The imbricate phyllaries are oval, in a series of two or more and have soft hairs. The achenes are wrinkled with ten ridges and small glands that give it a bumpy surface. It spreads only by seed and like other Asteraceae plants, it is a prolific seed producer. Seeds lack anatomical dispersal structures so they remain close to parent plants.

Other Asteraceae species are easily confused with this species from a distance. These include two other List B species, scentless chamomile (*Tripleurospermum inodorum*) and oxeye daisy (*Leucanthemum vulgare*), as well as German chamomile (*Matricaria chamomilla*), sea mayweed (*Tripleurospermum maritimum*), chamomile (*Chamaemelum nobile*), pineapple weed (*Matricaria discoidea*), native annual fleabane (*Erigeron annuus*) and whiplash daisy (*Erigeron flagellaris*) (iNaturalist 2018).

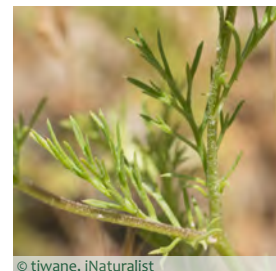
Mayweed chamomile is native to the arid Mediterranean and Middle Eastern areas and spread from there worldwide through trade and agriculture (Invasive Species Compendium 2019). Its status is unknown in Colorado; this species is likely both under-reported and incorrectly identified. Mayweed chamomile is ruderal, found mainly in Colorado's disturbed sites and the sides of impermeable surfaces, such as roads, sidewalks, trails, as well as gravelly or well-drained soils.



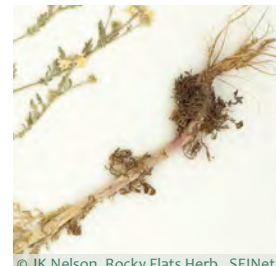
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© GC Carr, Burke Herbarium



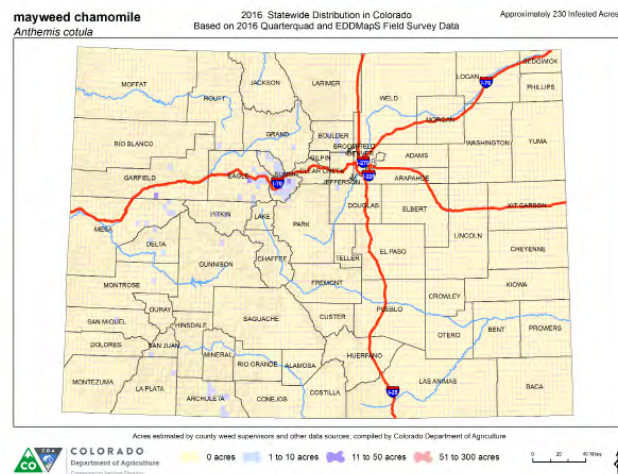
© tiwane, iNaturalist



© JK Nelson, Rocky Flats Herb., SEINet

mayweed chamomile

Anthemis cotula L.



Key ID Points

1. Three lobed ray flowers; pungent odor
2. Narrow cone-shaped receptacle with chaff- few long hairs; imbricate phyllaries with hairs
3. Alternate leaves are bi- to tripinnatifid
4. Fibrous taproot

Integrated Weed Management Recommendations

mayweed chamomile *Anthemis cotula* L.

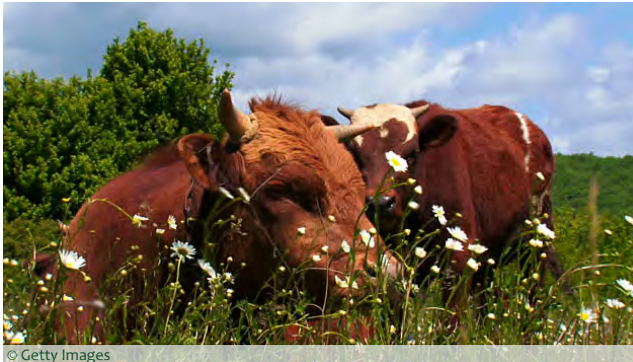
Effective integrated management means using a variety of eradication methods along with restoration, prevention of seed production and dispersal, and monitoring. Maintain robust healthy native landscapes. Restore degraded sites. Avoid soil disturbance. Prevent seed production and seeds from dispersing, e.g. on contaminated equipment. Rest sites until restored. Modify land use practices. Use methods appropriate for the site, other plants present and land uses.



© Colorado State University

CULTURAL

Since mayweed chamomile is not a strong competitor and is ruderal, minimizing soil disturbance and maintaining high native canopy cover of drought tolerant plants is key. It prefers moist soil, so implement modify water regimes where dense colonies exist. Since mayweed chamomile can modify its life history to take advantage of conditions, tilling during shoulder seasons, hot temperatures or before bolting, exposes the shallow roots to drying (Allaie et al. 2005). Till frequently and seed cover plants. Maintain or restore a competitive assemblage of shrubs, forbs, cool and warm season grasses, annuals and perennials. In restoration efforts, select locally adapted species, soil amendments, soil microbes and mycorrhizal fungi that are ecologically appropriate for the site to improve competitiveness of other species.



© Getty Images

BIOLOGICAL

Mayweed chamomile is not palatable to domestic livestock and irritates the skin of mammals (Woo et al. 1999, Kay 1971). Properly managed grazing can improve vigor of desired species and indirectly reduce infestations. At present, there are no biological control agents authorized in Colorado that would effectively control it. For more information about biological control agents, visit the Colorado Department of Agriculture's Palisade Insectary website at: www.colorado.gov/ag/biocontrol.



MECHANICAL

Mayweed chamomile has shallow roots, so mechanical methods can be effective in residential areas and moderate sized infestations. In loose soil, dig to remove the fibrous taproot. In spring, sever roots below the soil surface before the plant stores energy. Mowing, chopping and deadheading leaves roots behind, stimulates more flower production and are not recommended. Mowing, especially when timed near flowering or seeding phases, often disperses flowers and seeds, which expands the size of the infested area. Collect, bag, and dispose of or destroy flowers; seeds could mature and germinate if left on the ground. Prescribed fire may be an effective tool to control mayweed chamomile but since it prefers roadsides and developed sites, it may not be possible to generate the heat needed to damage the root, greens and seeds. Little information exists on fire effects on this plant.



© Mountain Spraying Company

CHEMICAL

NOTE: Herbicide recommendations to control mayweed chamomile in pastures and rangeland are found at: <https://goo.gl/TvWnv9>. Rates are approximate and based on equipment with an output of 30 gal/acre. Follow the label for exact rates. Consult local turf and ornamental experts for herbicides appropriate for residential settings. Always read, understand, and follow the label directions. The herbicide label is the LAW!



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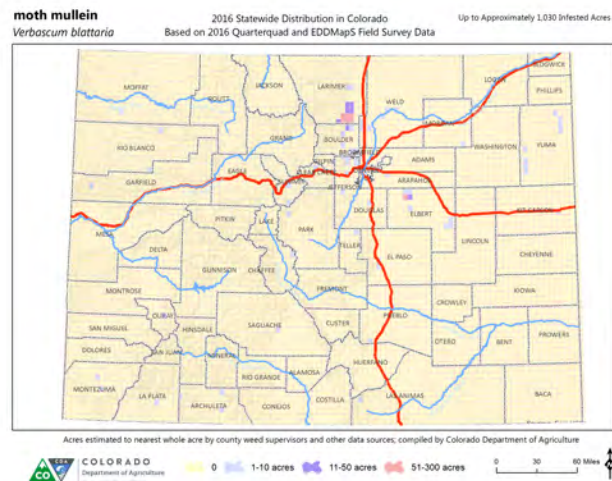
loosely arranged in a raceme. Sepals have glandular hairs. Lobed petals are 2 to 3 cm in diameter, ranging from off-white to yellow. Petals are slightly recurved, exposing faint guidelines towards the five stamens, which are densely lined with magenta knobby hairs, and single pistil that sits on a superior ovary with two chambers. Fruits are rounded bilobed capsules, about 8.5 mm in diameter and have conspicuous glandular hairs. Upon maturity, fruits split in two, revealing dark brown seeds whose surface has ridges and grooves. Seed is the primary reproductive method, but they lack dispersal anatomy so fall close to parent plants (Gros and Werner 1978). Viable seed longevity is at least 120 years (Telewski and Zeevaart 2002).

Moth mullein (*Verbascum blattaria* L.) is generally biennial, but in suitable sites it can be a short-lived perennial. Although recent genetic analyses split the family, this plant remains in the Scrophulariaceae family.

The stem is stiff, reaches up to 1.5 m tall and appears slender compared to common mullein. The upper stem, especially near the flowers, glistens in the sun from glandular-tipped hairs. Leaf shape varies. Initially they develop a basal rosette and are oval with slightly wavy margins. Leaves on mature plants alternate along the stem and are upright. Mature leaves are oblong in shape, have toothed margins but are not hairy, and are 8 to 45 cm long and 3 to 15 cm wide. The fibrous taproot is reportedly large (New Jersey Agricultural College Experimental Station 1892).

Solitary perfect flowers are five-parted,

Moth mullein is well adapted to upland semi arid or Mediterranean climates found in its Northern Africa and European origin (Bretzel et al. 2009, Plants of the World Online 2018). It is adapted to serpentine soils, including high levels of heavy metals such as lead, nickle, cobalt, chromium, and magnesium, but can also grow in fertile soils (Gross and Werner 1978, Shallari et al. 1998). As recently as 2009, moth mullein was recognized for its adaptations to infertile, nutrient poor and unproductive soils, attractiveness to pollinators, low maintenance, the quantity and duration of flowering, and promoted as an ornamental in its native Mediterranean range (Bretzel et al. 2009). It appears confined to elevations below 6500 feet in the USA and its native range (Ackerfield 2015, eFloras 2018).



Currently its distribution in Colorado is limited to the northern front range (EDD-MapS 2018). However, it is a prolific seeder and appears to be spreading south, so it is imperative to implement EDRR strategies before the infestation worsens. *V. blattaria* can hybridize with *V. thapus* (Flora of North America 2012, Gross and Werner 1978).



©Jesse Robinson iNaturalist



Key ID Points

1. Five-parted flowers (petal, sepal, stamen); magenta stamens densely lined with hairs
2. Oblong alternate leaves
3. Fibrous taproot
4. Conspicuous glandular hairs on stem and immature fruit

Moth mullein
Verbascum blattaria L.

Integrated Weed Management Recommendations

Effective integrated management means using a variety of eradication methods along with restoration, prevention of seed production and dispersal, and monitoring. Maintain robust healthy native landscapes. Restore degraded sites. Avoid soil disturbance. Prevent seed production and seeds from dispersing, e.g. on contaminated equipment. Rest sites until restored. Modify land use practices. Use methods appropriate for the site, other plants present and land uses.



© Colorado Natural Heritage Program



© The Nature Conservancy

CULTURAL

Very little information is available on cultural control methods effective against moth mullein; this remains a significant research gap. It does appear to prefer disturbed areas, so minimize soil disturbance especially near infested areas. In wildland settings, maintain or restore a competitive assemblage of shrubs, forbs, cool and warm season grasses, annuals and perennials. Use locally adapted species that are ecologically appropriate for the site to improve competitiveness. Incorporate soil amendments, soil microbes and mycorrhizal fungi to boost native species when appropriate. Aim to reduce above and below ground space and nutrients to make them unavailable to moth mullein.



© Cynthia Villa, NRCS

BIOLOGICAL

Moth mullein appears to be unpalatable to domestic livestock based on anecdotal reports. Properly managed grazing can improve vigor of desired species and indirectly reduce moth mullein. The biological control agent *Rhinusa tetra* attacks moth mullein, but its primary target is common mullein (Winston et al. 2014). Currently there are no biological control agents for moth mullein authorized in Colorado. For more biocontrol information, visit the Colorado Department of Agriculture's Palisade Insectary website at: www.colorado.gov/ag/biocontrol

MECHANICAL

Since moth mullein has a short life cycle, mechanical methods can be effective, especially in residential areas and small infestations. The key is to sever roots below the soil surface in the first year or early in the second season before the plant flowers. Mowing, chopping and deadheading is not effective; these methods leave roots behind, stimulate more flower production, disperse flowers and seeds, which expand the size of the infested area. Collect, bag, and dispose of all flowers and fruits; seeds will germinate if left on the ground. Since seed longevity is so long, consecutive years of treatment are necessary. Time prescribed fires before flowering to top kill above ground biomass. Low intensity prescribed fire would leave roots unaffected; spring burns increased cover by 0.2% so multiple entries are necessary (Denver Botanic Gardens 2002).



© Celestine Duncan, Techline Invasive Plant News

CHEMICAL

NOTE: Herbicide recommendations to control moth mullein in pastures and rangeland are found at: <https://goo.gl/TvWnv9>. Rates are approximate and based on equipment with an output of 30 gal/acre. Follow the label for exact rates. Consult local turf and ornamental experts for herbicides appropriate for residential settings. Always read, understand, and follow the label directions. The herbicide label is the LAW!

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Moth mullein
Verbascum blattaria L.



© Bruce Ackley, OH State University

plumose bristles that appear barbed under magnification. Musk thistle produces many flower heads. The tallest shoots flower first; lateral shoots develop in leaf axils. A robust plant may produce 100 or more flowering heads. Reproduction is usually via out-crossing through insect pollination, but self-pollination also occurs. Flowers emerge in May through September. Seeds develop shortly after flowers emerge. Flower buds can contain viable seeds from self-pollination. Seeds can mature on severed bud and flower-heads. Seeds remain viable in the soil for up to about 14 years. Seeds can germinate and emerge from spring through fall.

Musk thistle *Carduus nutans* L. is a non-native biennial forb that reproduces solely by seed. During the first year of growth, a rosette forms 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 can grow up to 6 feet tall. The leaves have spines, are waxy, and dark green in color with a prominent light green to white midrib that can be seen from a distance. Leaves are dentately lobed; leaf bases sometimes extend down below the point of attachment. The terminal flower heads are purple, large in size (1.5 to 3 inches in diameter) and bend over as if nodding. These flower heads are made up of only disk flowers. They are surrounded by numerous, wide and stout lance-shaped, spine-tipped bracts that resemble an open pineapple. The pappus has

Musk thistle habitat is found in a variety of environments extending from shortgrass prairie to alpine. It is strongly associated with heavily disturbed sites, where over-use occurs or where site conditions are poor due to land management practices. This includes over-grazed areas, large fires, trails, ditches and roadsides. Infested livestock pastures suffer from significantly decreased carrying capacity.

Because musk thistle reproduces solely from seed, the key for successful management is to prevent seed production. Once flowers emerge and start to produce seed, effective management options will become limited. Once sites are infested, musk thistle can form dense stands. Prevention, adjusting land management practices, a robust integrated treatment plan and restoration are critical to eliminating this species.



© Chris Evans, University of IL



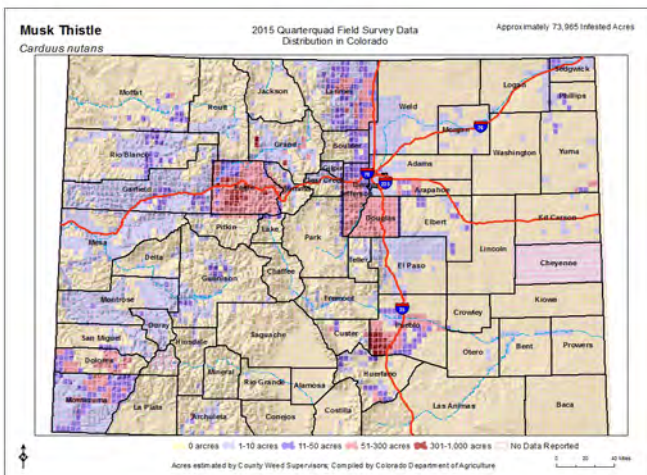
© Les Mehrhoff, DiscoverLife.org



Musk thistle

Carduus nutans L.

2015 Quarter Quad Survey



management practices, a robust integrated treatment plan and restoration are critical to eliminating this species.

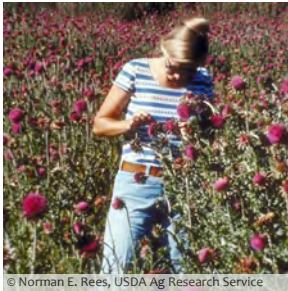
Musk thistle is designated as a "List B" species in the Colorado Noxious Weed Act. It is required to be eradicated; some populations may be contained or suppressed depending on state regulations. For management directions for each county, refer to the most recent Rule, or visit www.colorado.gov/ag/weedcontacts for details.

Key ID Points

1. Leaf with white midrib and leaf margins with spines.
2. Pappus with plumose barbed bristles.
3. Wide, stout lance-shaped bracts with spiny tips.

Integrated Weed Management Recommendations

Effective integrated management means using a variety of eradication methods that also includes restoration, prevention of seed production and dispersal, and monitoring. Maintain robust healthy native landscapes and restore degraded sites. Avoid soil disturbance. As with most biennials, prevent seed production in the first and second year of musk thistle growth. Prevent seed from dispersing, such as on contaminated equipment. Rest sites until they are effectively restored. Change land use practices. Use methods appropriate for the site.



© Norman E. Rees, USDA Ag Research Service

CULTURAL CONTROL METHODS

Musk thistle is not tolerant of competition and needs light to germinate seeds. Cultural methods should aim to maintain or restore a competitive assemblage of forbs, cool and warm season grasses. Implement whole site restoration of soils, plants and water regimes where stands of musk thistle exist where needed. Use locally adapted species that are ecologically appropriate for the site to improve competitiveness. Include annual as well as perennial species. Incorporate soil amendments, soil microbes and mycorrhizal fungi in restoration and land management efforts. Minimize soil compaction and disturbance, especially in wetlands and moist soil. Irrigation can increase competitive species.



© Eric Coombs, OR Dept of Agriculture

BIOLOGICAL CONTROL METHODS

Although horses, cattle, goats and sheep may eat flower heads on a few plants, seeds pass through their digestive tracks unaltered and spread. The leaf and stalk spines can cause domestic livestock to avoid mature musk thistle. Thus, musk thistle can become an "increaser" in over-grazed systems. Properly managed grazing can improve vigor of desired species and indirectly reduce musk thistle. *Trichosirocalus horridus* is the only biological control agent available for musk thistle in Colorado. The other species, *Rhinocyllus conicus*, is not host specific and will damage native thistles, and therefore cannot be released as an agent in Colorado. For more information, visit the Colorado Department of Agriculture's Palisade Insectary website at www.colorado.gov/ag/biocontrol.



© Friends of NV Wilderness Stewardship Team

MECHANICAL CONTROL METHODS

Methods, such as tilling, hoeing and digging, are best for infestations smaller than 0.5 acres; weigh this against other plants present, ecology and site condition. Sever roots below the soil surface during the first year before the plant stores energy, and in the second year before flower production. Mowing, chopping and deadheading stimulates more flower production; these methods require consecutive years of season-long treatments. All flowerbuds and heads must be collected, bagged, and disposed of or destroyed; seeds will mature and germinate if left on the ground. Prescribed fire that results in high soil burn severity damage roots and above ground biomass, but is not recommended due to impacts on desired plants. Fire generally favors musk thistle germination.

CHEMICAL

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

HERBICIDE	RATE	APPLICATION TIMING
Aminopyralid* (Milestone)	6 oz./acre + 0.25% v/v non-ionic surfactant	Apply in spring rosette to early bolting growth stages or in fall to rosettes. *Product not permitted for use in the San Luis Valley.
Chlorsulfuron** (Telar)	1-2.6 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.) **This herbicide has residual soil activity that will affect all broadleaf seedlings germinating after application has occurred.
Clopyralid (Transline)	0.67-1.33 pints product/acre + 0.25% v/v non-ionic surfactant	Apply to rosettes through flower bud stage in spring, or to fall rosettes.

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Musk thistle
Carduus nutans L.



when necessary. Ornamental Shasta daisy (*Leucanthemum x superbum*) is not an aggressive invader and looks similar to oxeye daisy, but it is 6 to 12 inches taller and has larger flowers.

Oxeye daisy is a strong competitor. It forms dense stands that reduce native plant diversity. It degrades pastures and natural areas because cattle and wildlife avoid feeding on oxeye daisy. Heavy infestations may reduce nutrient cycling due to a shallow root system and create areas of bare soil, thus increasing soil erosion.

Habitats for oxeye daisy included mountain meadows, grasslands, pastures, streams, gardens, waste grounds, railway, and roadsides. Oxeye daisy typically grows in high elevations, up to 11,000 feet in Colorado.

The key to effective control of oxeye daisy is education and prevention. Oxeye daisy has been included in many different seed mixes, thus consumers should carefully read the label prior to planting so-called “native wildflower” mixes. Homeowners and land managers often overlook the impacts and the need to manage this weed because of the plant’s attractiveness. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

Oxeye daisy (*Leucanthemum vulgare*) was introduced from Europe as a seed contaminant and as an ornamental. It is a rhizomatous, creeping, short-lived perennial that grows 10 inches to 2 feet tall. The basal and lower leaves are spoon-shaped, toothed, and with long petioles (leaf stem). The upper leaves are narrow, toothed, and clasp the stem. Flowers bloom between June and August. The flowers are 1 to 3 inches in diameter, with 15 to 30 white ray flowers, and mostly solitary. The phyllaries beneath the flower head are green with a dark brown margin. One flower head can produce up to 200 seeds. Oxeye daisy spread vegetatively from roots, root fragments, or by seed. Seeds may be viable up to 38 years or more. Infestation sites needs to be monitored for at least 10 years after the last flowering plant has been eliminated and treatments repeated



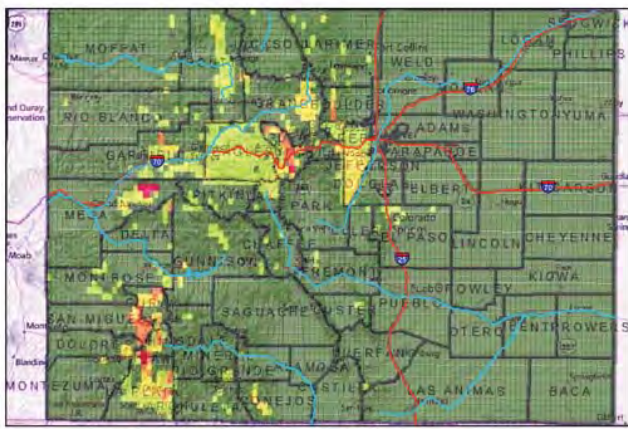
Oxeye daisy
Leucanthemum vulgare

2013 Quarter Quad Survey

Oxeye Daisy
Chrysanthemum leucanthemum

2013 Quarterquad Survey
Distribution and Abundance
in Colorado

16,506+ Infested Acres



Acres estimates supplied by County Weed Coordinators and compiled by the Colorado Department of Agriculture.

Oxeye daisy 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 Management Program. Or call the State Weed Coordinator at the Colorado Department of Agriculture, Conservation Services Division, (303) 869-9030.

Key ID Points

1. 15-30 white ray flowers on flowerheads that are 1-3 inches in diameter.
2. Rosette and lower leaves are spoon-shaped and toothed.
3. Upper leaves on the stem are narrow, toothed, and clasp the stem.

Integrated Weed Management Recommendations

Oxeye daisy has been included in many different seed mixes, thus consumers should carefully read the label prior to planting so-called “native wildflower” mixes. Repeated hand pulling can eliminate small infestations. Mowing or grazing by sheep or goats can be effective, in addition with a chemical approach.



CULTURAL

Generate awareness for this noxious weed. Carefully inspect “wildflower” seed mixes; do not plant mixes that include *Leucanthemum vulgare*. Avoid overgrazing, disturbance, and seed dispersal. Bare ground is prime habitat for weed invasions. Tall perennial grasses that shade oxeye daisy are good competitors.

BIOLOGICAL

Goats or sheep can be effective in the control of oxeye daisy. There are no insect biological controls available for oxeye daisy. For more information on biocontrols, contact the Colorado Department of Agriculture-Palisade Insectary at 970-464-7916.

MECHANICAL

Repeated hand pulling or digging when soil is moist and infestations are small. Oxeye daisy is fairly shallow rooted; pull up as much of the root as possible. If removed during or after flowering, bag specimens carefully so as to not scatter seeds. Mowing before flowering or when flower buds are present can limit dispersal; do not mow during or after flowering. Tilling at 6 inches or deeper, and repeated shallowly as necessary, can control patches.

CHEMICAL

The table below includes recommendations for herbicides that can be applied to rangeland and pastures. 0.25% v/v non-ionic surfactant is equivalent to 0.32 oz/gal of water or 1 pt/100 gal of water. Always read, understand, and follow the label directions. The herbicide label is the LAW!

Herbicide	Rate	Application Timing
Aminopyralid (Milestone)	4-6 oz./acre + 0.25% v/v non-ionic surfactant	Optimum control when applied <u>at the pre-flower bud growth stage</u> .
Metsulfuron (Escort XP)	1 oz. product/acre + 0.25% v/v non-ionic surfactant	Surfactant is absolutely necessary. Optimum control when applied <u>at flowering</u> growth stage. 1 oz. product is the minimum eradication rate based on best treatment observed in several CSU

Additional herbicide recommendations for this and other species can be found at:
www.colorado.gov/agconservation/CSUHerbicideRecommendations.pdf

Oxeye daisy

Leucanthemum vulgare

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.

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

**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 recommended, 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 revegetation 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/acre + 0.25 v/v non-ionic surfactant	Apply when plant is in the early flower to flowering growth stages. (Early spring to early summer)
Metsulfuron (Escort XP)	1 oz. product/acre + 0.25 v/v non-ionic surfactant	Apply when plant is in the early flower to flowering growth stages. (Early spring to early summer)
Imazapic (Plateau, Panoramic)	12 oz./acre + 2 pints/acre methylated seed oil or crop oil concentrate	Apply when plant is in the early flower to flowering growth stages. (Early spring to early summer)
Note: *This herbicide has residual soil activity that will affect all broadleaf seedlings germinating after application has occurred.		
Additional herbicide recommendations for other species can be found at: www.colorado.gov/agconservation/CSUHerbicideRecommendations.pdf		

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.

Perennial pepperweed



Perennial sowthistle

Colorado Department of Agriculture

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Identification and Management



Perennial sowthistle produces by seeds and the rhizomatous 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.

Identification and Impacts

Perennial sowthistle (*Sonchus arvensis*) is a perennial for 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 produced 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.

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.



Key ID Points

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



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

**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:

Combining 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.

Perennial sowthistle

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 bolting 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

Plumeless thistle

Colorado Department of
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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.

Plumeless thistle Identification and Management



Identification and Impacts

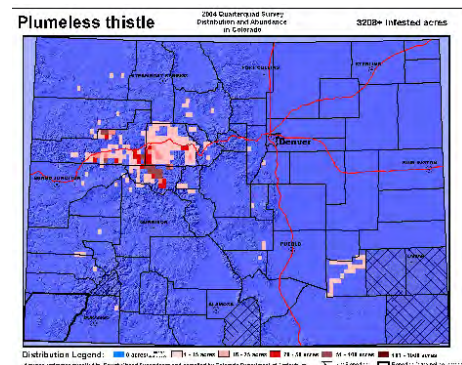
Plumeless thistle (*Carduus acanthoides*) is a winter annual or biennial that is native to Europe and Asia. Plumeless thistle rosettes have wavy leaves with yellow spines along the white-colored leaf margins. The stems are covered with leaf-like, winged spines that extend up to the flowering heads. The 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.

Carduus acanthoides

**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.

Plumeless 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
Aminopyralid* (Milestone)	5 oz. product/acre + 0.25% v/v non-ionic surfactant	Apply in spring rosette to early bolting growth stages or in fall to rosettes.
Chlorsulfuron** (Telar)	1-2.6 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
Clopyralid (Transline)	0.67-1.33 pints product/acre + 0.25% v/v non-ionic surfactant	Apply to rosettes through flower bud stage in spring, or to fall rosettes.

Note: *Product not permitted for use in the San Luis Valley. **This herbicide has residual soil activity that will affect all broadleaf seedlings germinating after application has occurred.

Additional herbicide recommendations for this and other species can be found at: www.colorado.gov/agconservation/CSUHerbicideRecommendations.pdf

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.

Puncturevine

Colorado Department of
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Key ID Points

Identification and Management



Identification and Impacts

Puncturevine (*Tribulus terrestris*) is a summer annual forb, and is native to Europe. The plant is prostrate or ascending, spreading into mat forming cover. The stems are trailing and can grow to 1 1/2 to 5 feet long. Leaves are formed into leaflets, with each leaflet containing 5 to 8 oval leaves. The leaves are hairy and opposite. The flowers appear in July through October. They have five petals and are yellow in color. Each flower node will produce a fruit, at maturity the fruit will break into 5 seed capsules. Each seed capsule will produce 2-4 seeds. Each capsule is hard and contains many spines, almost tack like. The shape of the seed capsule has been referred to as a "goathead." The seeds will propagate after the first moisture of the spring and then any wet period following. Seeds can stay viable for 4 to 5 years.

Habitats for Puncturevine include, but are not limited to roadsides, pastures, waste areas, cultivated fields, yards, and disturbed sites. The seed capsules can cause injury to humans, animals, and tires. Seeds can be found in hay, which may cause injury to animals. The capsules

can also become entangled in wool, and decrease the quality. Due to the spiny nature of the plant, spreading seed over large areas is fairly easy.

The key to effective control of Puncturevine is preventing the plants to produce seed. Puncturevine can easily be dug up, making sure to get all the roots and to bag any flowering parts. Chemical and biological controls can also be effective as treatment options. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

Puncturevine 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 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.



Photos © From Bottom left; Steve Dewey, Utah State University, Bugwood.org; All other Kelly Uhing, Colorado Department of Agriculture

Tribulus terrestris

**CULTURAL**

Cultural control for Puncturevine is a difficult task, since seed reserves can stay viable for 4 to 5 years. Preventing the plants from establishing, by eliminating bareground can assist in the process. For specific seed recommendations contact your local Natural Resources Conservation Services for seed mixes.

**BIOLOGICAL**

There are two biological controls available for control of Puncturevine; *Microlarinus lareynii*, a seed feeding weevil, and *Microlarinus lypriformis*, a stem boring weevil. Contact the Palisade Insectary of the Colorado Department of Agriculture at 970-464-7916 for more information.

**MECHANICAL**

Hand pull or dig when soil is moist, but make sure to wear gloves. Bag specimens carefully so as not to scatter seeds. This is helpful unless infestations are too large. The key to effective control is to prevent seed production and/or spread.

Integrated Weed Management:

Using a combination of control options can be effective in the control of Puncturevine. The plants are hard to eradicate, due to the seed viability of 4 to 5 years in the soil. Constant monitoring and management can be helpful.

Puncturevine

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
Glyphosate (Roundup) *Non-selective herbicide*	1.6% solution or 2 oz./gal water	Apply early plant growth stages, emergence and rosettes.
2,4 D and Dicamba (Outlaw)	1-2 pints/Acre or 0.5-1.0 oz/gal water	Spring at emergence of seedlings continue through growing season. Add non-ionic surfactant 0.32 oz./gal water or 1 qt./100 gal water.
Chlorusulfuron (Telar)	1-3 oz./Acre	Apply pre-emergence or early post-emergence.
Pendimethalin (Pendulum)	2.1-4.2 qts/Acre	A pre-emergence spray.

Photos © Top to Bottom; (middle) Neal Spencer, USDA Agricultural Research Service European Laboratory, Bugwood.org; (other 2) Kelly Uhing, Colorado Department of Agriculture

Quackgrass

Colorado Department
of Agriculture
Conservation Services

305 Interlocken Pkwy
Broomfield, CO 80021
303-869-9030



Key ID Points

1. The yellowish-white rhizomes (root systems).
2. The leaves ear-like appedages at the sheath node.

Quackgrass Identification and Management



Identification and Impacts

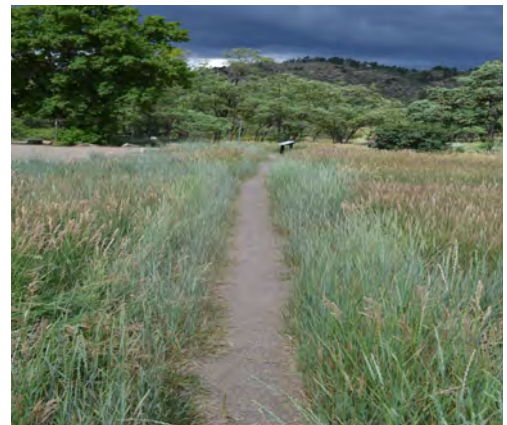
Quackgrass (*Elymus repens*) is a perennial grass that is native to Europe. It grows from underground rhizomes to an unmowed height of 1 to 4 feet with erect stems. The rhizomes are yellowish-white, sharp pointed and somewhat fleshy. Both the leaf sheath and blade are hairless or sparsely hairy. The seeds germinate in the fall and spring and plants can produce seeds more than 1 time per season. Spikelets are in 2 long rows and borne flatwise to the stem. The florets have short, straight awns or are awnless. The leaves of Quackgrass are constricted near the tips. Leave blades are 0.25 to 0.5 inches wide, flat, pointed, with small ear-like appendages at the junction of the blade and the sheath. Quackgrass's flowers appear from June through August and resemble wheat head in a slender spike. Each Quackgrass plant produces about 25 seeds. These seeds remain viable for 3 to 5 years in the soil.

The habitat of Quackgrass includes: crops, pasture, rangeland, roadsides, ditches, gardens, yards, and any disturbed moist area. It is a rapid invader that does stabilize eroding soils, but take over good areas for other plants. Since it adapts to moist soils the

optimal growth temperature is 68-77 degrees Fahrenheit. Quackgrass only moderately tolerates shade.

The key to effective control of Quackgrass is preventing the establishment of dense stands, once it becomes established it is hard to control. Using an integrated weed management approach proves to be the best control. Using a combination of cultural, mechanical and chemical controls can have an effect, with Quackgrass. Herbicide treatments are an option if used when plants are young, generally in the spring. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

Quackgrass is designated as a "List C" species in 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, 303-869-9030.



Photos © (Clockwise from lower left): Ohio State Weed Lab, Ohio State University; (Unknown) weeds.hotmeal.net; (Unknown) Shawnee County Kansas; (Next two) Steven Dewey,

Elymus repens

**CULTURAL**

Cultural methods for Quackgrass include outcompeting when in crop fields, but preventing the establishment of new infestations by minimizing disturbance, and maintaining healthy native communities proves to be successful. Contact your local Natural Resources Conservation Service for seed mix recommendations.

**BIOLOGICAL**

Currently, there are no biocontrol agents available for Quackgrass. Biocontrol takes many years of research and development. For more information, contact the Colorado Department of Agriculture's Insectary in Palisade, Colorado at 970-464-7916.

**MECHANICAL**

Mechanical treatments are tricky when dealing with Quackgrass. Tilling proves to be the best method, but it can also aid in the spread of the rhizomatous nature of the plant. If tilling is the only option till towards the center of the infestation, so spreading doesn't occur outward and till when the roots can be exposed to high or freezing temperatures. This will kill the roots and minimize regrowth.

Integrated Weed Management:

Using a combination of control methods proves to be the most effective method when dealing with Quackgrass. Using a mechanical and chemical approach seems to be most effective. Always revegetate with desirable grasses and forbs after treatments. Once infestations of Quackgrass become established control and containment become more difficult.

Quackgrass

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. Always read, understand, and follow the label directions. The herbicide label is the LAW!*

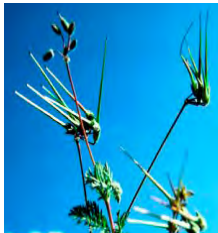
HERBICIDE	RATE	APPLICATION TIMING
Glyphosate (Roundup)	2 to 3 qt/acre or a 2% solution	Apply when grass is 8 or more inches tall.
Clethodim (Select 2EC)	8 to 16 fl. oz. of product /acre + 1% v/v crop oil concentrate	Apply when grass is 4 to 12 inches tall and repeat, if necessary, when 4 to 12 inches tall. *Select can be used in many crops, including alfalfa, and in non-crop areas.

Redstem filaree

Colorado Department of
Agriculture

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Key ID Points

1. The hairy red colored stems.
2. The opposite leaf pattern in the rosette stage.
3. The long-beak like fruit and seed.

Updated on:
08/09

Redstem filaree Identification and Management



Identification and Impacts

Redstem filaree (*Erodium cicutarium*) is a winter annual or biennial forb that has a spreading or erect profile and is native to the Mediterranean or Asia. Part of the Geranium family, Redstem filaree grows generally from a rosette stage, and can grow from the 3 inches to 2 feet tall. The stems are hairy and red in color. The leaves are opposite and finely divided with toothed or lobed margins. They are pubescent, grow on short stems and have a reddish tint. The root system is a shallow taproot with fibrous secondary roots. The five petaled flowers are a purplish-pink in color and are in clusters of 2 or more. Each flower will produce five long lobed fruits. Each fruit will have an awn like tail which will dry and split with maturity. Redstem filaree primarily reproduces by seed and generally germinates in early spring.

Habitats for Redstem filaree include: dry pasturelands, landscapes, turfgrass and it prefers sandy soils. It can easily outcompete desirable vegetation once established. Redstem filaree is drought tolerant and can withstand a heavy stocking rate. The plant is

grazed by many different animals especially sheep.

The key to effective control of Redstem filaree is preventing establishment of the plant and seed production. There are many options for control of Redstem filaree depending on site ecology. Both chemical and mechanical control options are effective. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

Redstem filaree is designated as a "List C" 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.



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Erodium cicutarium



CULTURAL
Prevent the establishment of Redstem filaree, in rangeland or pastureland by planting native grasses and forbs. Contact your local Natural Resources Conservation Service for seed mix recommendations that may help. Bareground is prime habitat for weed invasions.



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



MECHANICAL
Hand pulling or digging when soil is moist, making sure to get the roots to prevent resprouting is effective. Removing flowers before the plant sets seed will also be effective. Be sure to bag specimens carefully so as not to spread seeds. Any kind of tillage to the area can also be effective.

Integrated Weed Management:

Locate and remove plants immediately before plants set seed to prevent the spread of Redstem filaree. Since the plant reproduces solely by seed, an integrated management effort must include the elimination of seed production and depletion of seed bank. Combing herbicide and mechanical can be effective.

Redstem filaree

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. Always read, understand, and follow the label directions. The herbicide label is the LAW!*

HERBICIDE	RATE	APPLICATION TIMING
Metsulfuron (Escort XP)	.33 oz of product /acre +.025% v/v non-ionic surfactant	Apply rosette stage through early flower stage.
2,4-D + dicamba (Rangestar)	2 pt. + 1 pt. product / acre	Apply rosette stage of growth.



Above photos © (Top): Richard Old, XID Services Inc., Bugwood.org; (Middle) Whitney Cranshaw, Colorado State University, Bugwood.org; (Bottom) Kelly Uhing, Colorado Department of Agriculture



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.



© Steve Dewey USU



Black, scaly root



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,

Russian knapweed

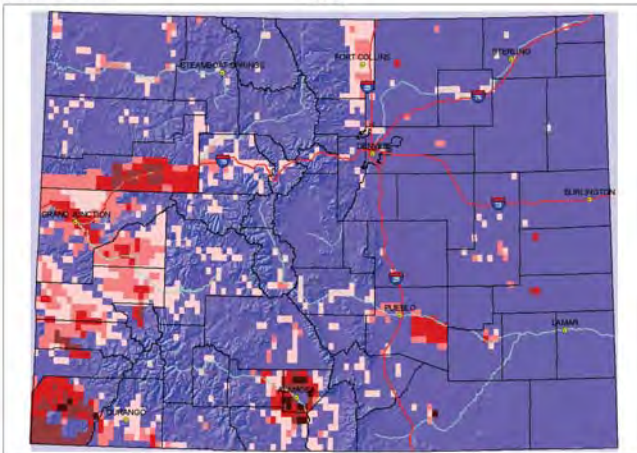
Acroptilon repens

2008 Quarter Quad Survey

Russian knapweed
Acroptilon repens

2008 Quarterquad Survey
Distribution and Abundance
in Colorado

132,466+ Infested Acres



Distribution Legend: 0 ACRES/0Q 1-5 6-50 51-300 301-1000 1001-5000
Acreage estimates supplied by county weed supervisors and compiled by the Colorado Department of Agriculture

Russian knapweed is redesignated 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.

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.

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.



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 foot) 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)	7 oz. product/acre + 0.25% v/v non-ionic surfactant	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 or in the spring during early bolt before flower buds form.
Aminocyclopyrachlor + Chlorsulfuron (Perspective)*	4-5 oz. product/acre + 1% v/v methylated seed oil	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 or in the spring during early bolt before flower buds form. 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 for use on grazed or feed forage. Not for use on grazed or feed forage.

Note: *Product not permitted for use in the San Luis Valley. **This herbicide has residual soil activity that will affect all broadleaf seedlings germinating after application has occurred.

Additional herbicide recommendations for this and other species can be found at:

www.colorado.gov/agconservation/CSUHerbicideRecommendations.pdf

Russian knapweed

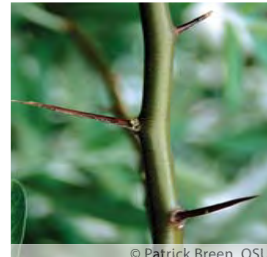
Acroptilon repens



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 (*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,

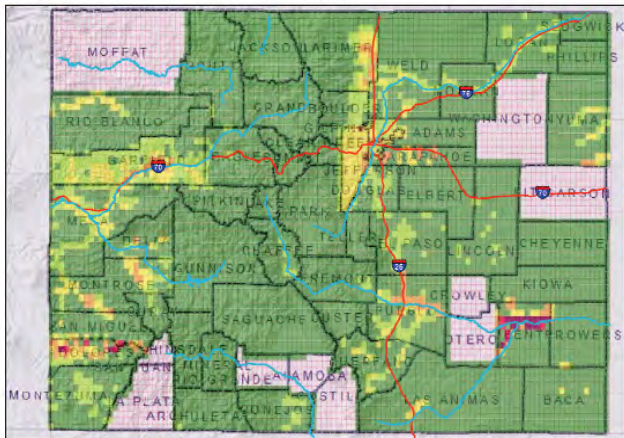
Russian Olive

Elaeagnus angustifolia

Russian Olive
Elaeagnus angustifolia

2013 Quarterquad Survey
Distribution and Abundance
In Colorado

64,150+ Infested Acres



Distribution Legend: 0 acres 1-10 acres 11-50 acres 51-300 acres 301-999 acres >1000 acres Not Reported
Acreage estimates supplied by County Weed Coordinators and compiled by the Colorado Department of Agriculture.

Russian olive is redesignated 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.

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.

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.



© John Randall, TNC



© James Miller, USFS



© Chris Ness, Adams County



© Scott Peterson, USDA

Russian olive

Elaeagnus angustifolia

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)	20-30% solution in basal bark oil. The herbicide Pathfinder and does not require dilution.	Cut-Stump Treatment: Apply to the cambial layer of the tree immediately after the cut-stump treatment and to roots above soil surface. (Summer to fall; fall treatments showed fewer re-growth) Basal Bark Treatment: Spray till wet but not dripping; the roots above soil surface, root collar, and lower trunk to a height of 12-15 inches above ground (Late summer to fall)
Glyphosate* (Rodeo - approved aquatic label)	Undiluted (100% solution) or 50% solution in basal bark oil	Cut-Stump Treatment: Apply to the cambial layer of the tree immediately after the cut-stump treatment and to roots above soil surface. Diluted solutions requires regular agitation. Treat summer to fall; fall treatments showed fewer re-growth.

Note: *These products are non-selective and will kill any vegetation contacted.

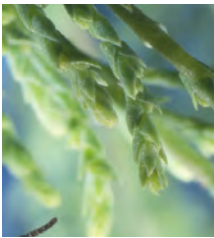
Additional herbicide recommendations for this and other species can be found at:
www.colorado.gov/agconservation/CSUHerbicideRecommendations.pdf

Saltcedar

Colorado Department of
Agriculture

305 Interlocken Pkwy
Broomfield, CO 80021

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



Key ID Points

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

Saltcedar Identification and Management



Identification and Impacts

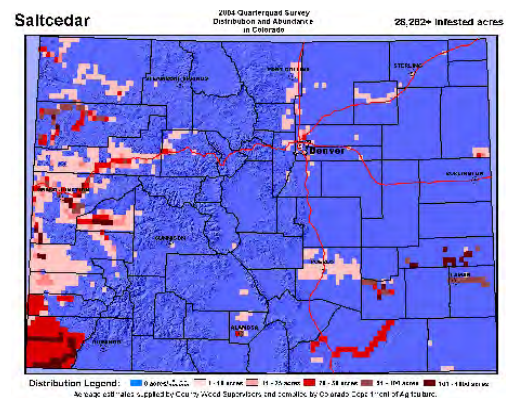
Saltcedar, or tamarisk (*Tamarix spp.*), is a non-native deciduous evergreen shrub or small tree that grows from 5 to 20 feet tall. The bark on saplings and stems is reddish-brown. The leaves are small, scale-like and bluish-green in color. Tiny pink to white flowers have five petals and grow on slender 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

Tamarix spp.

**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, Remedy)	20-30% solution in basal bark oil. The herbicide Pathfinder comes pre-mixed in oil and does not require dilution.	Cut-Stump Treatment: Apply to the cambial layer of the tree immediately after the cut-stump treatment and to roots above soil surface. (Summer to fall) Basal Bark Treatment: Spray till wet but not dripping; the roots above soil surface, root collar, and lower trunk to a height of 12-15 inches above ground (Summer to fall)
Glyphosate* (Rodeo - approved aquatic label)	Undiluted (100% solution) or 50% solution in basal bark oil	Cut-Stump Treatment: Apply to the cambial layer of the tree immediately after the cut-stump treatment and to roots above soil surface. Diluted solutions requires regular agitation. (Summer to fall)
Triclopyr (Garlon 4, Remedy) + Aminopyralid (Milestone)	3 qts. Garlon 4/acre + 7 oz. Milestone/acre + 0.25% v/v non-ionic surfactant	Broadcast foliar treatment: Apply when plants are growing rapidly. (May to September)
Note: *These products are non-selective and will kill any vegetation contacted.		
Additional herbicide recommendations for other species can be found at: www.colorado.gov/agconservation/CSUHerbicideRecommendations.pdf		



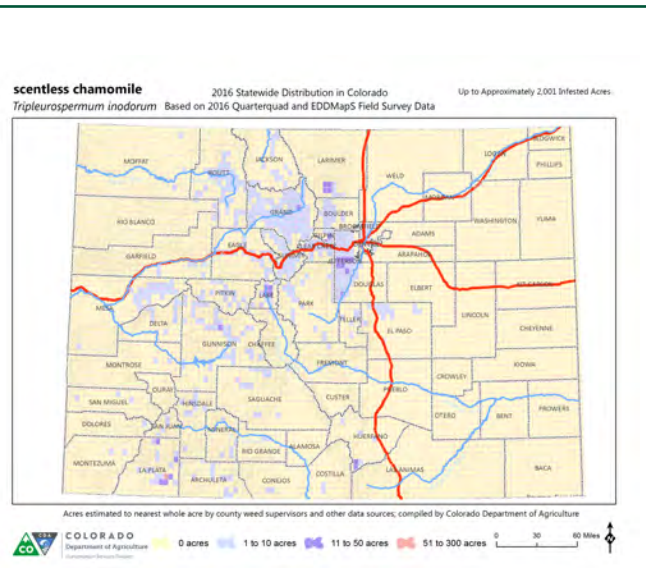
to subtend. When vertically sliced, the receptacle is diagnostically cone-shaped, solid in the center, and lacks chaff. The phyllaries are oblong, in a series of two to five, are green in the middle, dried and thin on margins. The achenes diagnostically have three deep ribs that are well-separated, rounded oil-glands. It spreads only by seed; like other Asteraceae, it is a prolific seed producer. Seeds lack anatomical dispersal structures so remain close to parent plants.

Identification of this species is difficult and underwent numerous past taxonomic changes. There are several Asteraceae species that are easily confused with scentless chamomile from a distance. These include two other List B species, stinking chamomile (*Anthemis cotula*) and oxeye daisy (*Leucanthemum vulgare*), as well as German chamomile, sea mayweed (*Tripleurospermum maritimum*), chamomile (*Chamaemelum nobile*), pineapple weed (*Matricaria discoidea*), native annual fleabane (*Erigeron annuus*) and whiplash daisy (*Erigeron flagellaris*) (iNaturalist 2018).

It is native to mountains and river valleys in the Caucus region, Russia, Uzbekistan, Kazakstan, parts of China (eFloras 2019,). It was introduced into European prairies and spread through agriculture (Kay 1969, Woo et al. 1999). Diploid plants (two chromosome sets), which are more common, come from western Europe; tetraploid plants (four chromosome sets) come from marginal edges of its range in eastern and central Europe.

Scentless chamomile (*Tripleurospermum inodorum* L.) is an annual forb in the Asteraceae family, also known as scentless false mayweed, scentless mayweed, and false chamomile, not to be confused with the tea producing German chamomile (*Matricaria chamomilla*).

Distinguishing scentless chamomile from similar looking species is difficult. The lack of odor is one clue; lack of hairs is another. Mature plants are about 1 to 1.5 feet tall. Its alternate leaves are 2 to 8 cm long, divided pinnately, and each lobe is pinnately divided again (bipinnatifid), giving a fern-like appearance. It has more than two stem leaves. Its roots are shallow and fibrous. White ray flowers have shallow five-lobed margin, which sometimes are asymmetrical. It has ten to 24 ray flowers. Fully developed yellow disc flowers form a dome shape that causes the white ray flowers



Tetraploidy may indicate sympatric speciation, hybridization, genetic modifications, climatic changes or different introduction pathways (Kay 1969).

Scentless chamomile is ruderal, found mainly in Colorado's disturbed sites in upper montane and subalpine, where soil water content is slightly higher. This is usually on the sides of impermeable surfaces, such as roads, sidewalks, trails, and gravelly areas.



- Key ID Points**
1. Receptacle is solid in the center, cone-shaped & naked
 2. Phyllaries are oblong, green in center & dried on margins
 3. Alternate leaves are bipinnatifid into filiform segments
 4. Fibrous roots

Scentless chamomile

Tripleurospermum inodorum L.

Integrated Weed Management Recommendations

Effective integrated management means using a variety of eradication methods along with restoration, prevention of seed production and dispersal, and monitoring. Maintain robust healthy native landscapes. Restore degraded sites. Avoid soil disturbance. Prevent seed production and seeds from dispersing, e.g. on contaminated equipment. Rest sites until restored. Modify land use practices. Use methods appropriate for the site, other plants present and land uses.



© Glassdoor

CULTURAL

Since scentless chamomile is ruderal, and sensitive to drought, minimizing soil disturbance and maintaining high native canopy cover of drought tolerant plants is key. It prefers moist soil, so modify drainage where dense colonies of scentless chamomile exist. Tilling during shoulder seasons or hot temperatures, exposes the shallow roots to drying. Since seed viability is more than 6 years, till frequently and seed cover plants. Maintain or restore a competitive assemblage of shrubs, forbs, cool and warm season grasses, annuals and perennials. In restoration efforts, select locally adapted species, soil amendments, soil microbes and mycorrhizal fungi that are ecologically appropriate for the site to improve competitiveness of other species.



MECHANICAL

Since scentless chamomile has shallow roots, mechanical methods can be effective in residential areas and moderate sized infestations. In loose soil, dig to remove the fibrous roots, especially the caudex. Mowing, chopping and deadheading leaves roots behind, stimulates more flower production and are not recommended. Mowing, especially when timed near flowering or seeding phases, often disperses flowers and seeds, which expands the size of the infested area. Collect, bag, and dispose of or destroy flowers; seeds could mature and germinate if left on the ground. Prescribed fire may be an effective tool to control scentless chamomile, but since it prefers roadsides and developed sites it may not be possible to generate the heat needed to damage the caudex and seeds. Little information exists on fire effects to this plant.

Scentless chamomile

Tripleurospermum inodorum L.



© Getty Images

BIOLOGICAL

Scentless chamomile is not palatable to domestic livestock (Woo et al. 1999). Properly managed grazing can improve vigor of desired species and indirectly reduce infestations. In Canada, two biological control agents were released; only one established (Winston et al. 2014). At present, there are no biological control agents authorized in Colorado that would effectively control it. For more information about biological control agents, visit the Colorado Department of Agriculture's Palisade Insectary website at: www.colorado.gov/ag/biocontrol.



© Mountain Spraying Company

CHEMICAL

NOTE: Herbicide recommendations to control scentless chamomile in pastures and rangeland are found at: <https://goo.gl/TvWnv9>. Rates are approximate and based on equipment with an output of 30 gal/acre. Follow the label for exact rates. Consult local turf and ornamental experts for herbicides appropriate for residential settings. Always read, understand, and follow the label directions. The herbicide label is the LAW!



Colorado Department of Agriculture - Conservation Services

305 Interlocken Parkway

Broomfield, CO 80021

(303) 869-9030

www.colorado.gov/ag/weeds

Colorado
State
University



spine-tipped bracts curve away from the flowering head. The flower receptacle is fleshy and has pits to hold seeds. The plants flower from mid-June to September. Scotch thistle seeds have the ability to mature in flower buds and heads that have been removed from the stalk. Both species can produce up to 14,000 seeds per plant. Seeds remain viable for up to 30 years but germinate readily with moisture in spring and fall.

Scotch thistle includes two species, *Onopordum acanthium* L. and *O. tauricum* Willd. Both are non-native biennial forbs. During the first year of growth, both species appear as a rosette in spring or fall. During the second year in mid to late spring the stems bolt, the plants flower, set seed, and the plants die. Both Scotch thistle species can grow up to 12 feet tall and basal rosettes can be up to 2 feet in diameter. Stems are numerous and branched. Characteristically, the entire length of stems from both species have broad wings with spiny tips. *O. acanthium* leaves have an overall gray color from dense woolly hairs. *O. tauricum* leaves are glandular and not as hairy as *O. acanthium*. For both, leaves are spiny. Both species have a distinct mid-rib. Flower heads are terminal, violet to reddish in color, 1 to 3 inches in diameter, and arranged in a raceme. One plant can produce up to 100 flower heads. The

Scotch thistle invades rangeland, overgrazed pastures, roadsides, and irrigation ditches. Both species prefer moist soil, such as areas adjacent to creeks and rivers. Roadsides appear to be especially vulnerable to invasion likely due to the water runoff from the shoulders. Maintaining healthy pastures and native plants, minimizing soil disturbance, changing land use practices to prevent overuse, and using seed-free equipment are critical measures to preventing infestations. As with most biennials, once established, limiting seed production is critical to effective control. 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 and unpalatable to cattle.

To control seed production, plants with buds or flowers should be collected, bagged and immediately disposed of or destroyed. Chemical control is most effective when plants are in rosette stage, spring or early fall. Mechanical controls

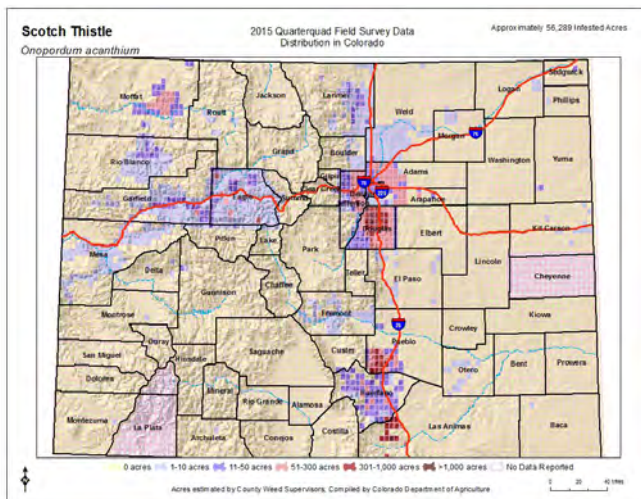
can be used to eliminate small patches or plants in a later growth stage.

Scotch thistle is designated as a "List B" species in the Colorado Noxious Weed Act. It is required to be eradicated; some populations may be contained or suppressed depending on state regulations. For state regulations described for each county, refer to the most recent Rule, or visit www.colorado.gov/ag/weedcontacts for details.



Scotch thistle
Onopordum acanthium L. and *O. tauricum* Willd.

2015 Quarter Quad Survey



- Key ID Points
1. Pitted fleshy flower receptacle.
 2. Prominent mid-rib.
 3. Wide lobed leaves with distinct mid-rib.
 4. Wide spiny wings extend the length of the stem.

Integrated Weed Management Recommendations

Effective integrated management means using a variety of eradication methods along with restoration, prevention of seed production and dispersal, and monitoring. Maintain robust healthy native landscapes. Restore degraded sites. Avoid soil disturbance. As with most biennials, prevent seed production in the first and second year of growth. Prevent seed from dispersing, such as on contaminated equipment. Rest sites until they are effectively restored. Change land use practices. Use methods appropriate for the site.



CULTURAL CONTROL METHODS

Effectiveness begins with maintaining or restoring a competitive native forb and forb assemblage. Continue restoration efforts until native plants are robust and abundant. Use locally adapted native seeds whenever possible to improve competitiveness. Include cool season and warm season, as well as perennial and annual grasses in revegetation efforts. Soil may need to be restored by adding soil amendments, soil microbes, mycorrhizal fungi and nitrogen fixing plants such as legumes. Manage land uses so they do not create bare mineral soil or compact soil. Annual crop cultivation appears to be an effective control measure.



© Jacqui Turner, The Timaru Herald

BIOLOGICAL CONTROL METHODS

Domestic livestock are likely to avoid this plant due the large number of spines all over the plant. Goats and sheep may eat flower heads if plants are small. Since most livestock and herbivores avoid the leaves and stems, Scotch thistle can become an “increaser” in over-grazed systems. Properly managed grazing systems can increase desirable plant vigor and indirectly reduce Scotch thistle. There are no known biological control agents effective against scotch thistle or authorized in Colorado. For more information about biological control agents, visit the Colorado Department of Agriculture’s Palisade Insectary website at www.colorado.gov/ag/biocontrol.



© Bugwood

MECHANICAL CONTROL METHODS

Methods, such as tilling, hoeing and digging, are best for infestations smaller than 0.5 acres; weigh this against other plants present, ecology and site condition. Sever roots below the soil surface during the first year before the plant stores energy and in the second year before seed production. Mowing, chopping and deadheading stimulates more flower production; these methods require consecutive years of season-long treatments. Flower heads must be collected, bagged, and disposed of or destroyed; seeds will mature and germinate if left on the ground. Fire gives Scotch thistle a competitive advantage. Large fleshy stems and leaves would not be consumed in a low severity fire and seeds would remain unaffected. High severity fires would likely damage native plants, which favors Scotch thistle if seeds are not killed and this is not recommended.

CHEMICAL

NOTE: The following are recommendations for herbicides that can be applied to pastures and rangeland. Rates are approximate and based on equipment with an output of 30 gal/acre. Follow the 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 + 0.25-0.5% v/v non-ionic surfactant	Apply in spring rosette to early bolting growth stages or in fall to rosettes. *Product not permitted for use in the San Luis Valley.
Chlorsulfuron** (Telar)	1-2.6 oz. product/acre (0.75 oz. active ingredient/acre)+ 0.25% v/v non-ionic surfactant	Spring from bolting to flower bud stages. **This herbicide has residual soil activity that will affect all broadleaf seedlings germinating after application has occurred.
Metsulfuron + Chlorsulfuron (Cimarron X-tra)	2 oz. product/acre + 0.25-0.5% v/v non-ionic surfactant	Apply during rosette to flower bud stages.
Clopyralid (Transline)	0.67-1.33 pints product/acre + 0.25% v/v non-ionic surfactant	Apply to rosettes in spring or fall.
Aminocyclopyrachlor + chlorsulfuron (Perspective)*	4.75-8 oz. product/acre + 0.25% v/v non-ionic surfactant	Apply from the seedling to the bolting stage. 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 for use on grazed or feed forage.

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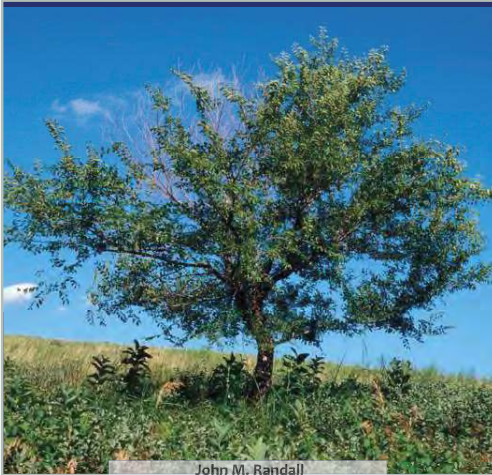
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www.colorado.gov/ag/weeds



Scotch thistle
Onopordum acanthium L. and O. tauricum Willd.



John M. Randall

can also be self-fertilizing. Small clusters of 3-15 perfect flowers are produced at intervals along the preceding year's branches. Individual flowers are 1/8" across, consisting of a green calyx with 4-5 lobes, 4-8 exerted stamens, and a flattened pistil with a divided style. The blooming period occurs from early to mid-spring before the leaves develop, lasting about one week. Seeds develop in a light green, oval-shaped, and flattened wing-like fruit known as a samara. Under damp conditions, the seeds have the capacity to germinate within a week or two, and can persist in the seed bank for up to eight years.

Siberian elm (*Ulmus pumila*) is a hardy fast growing, mid-sized, deciduous tree or shrub. It is also known by the names dwarf elm, and little leaf elm. Siberian elm can get up to 70 feet tall and has an open crown with upward-growing branches and many flexible, brittle branchlets that easily break off. There is usually a large accumulation of leaves and woody litter that builds up in the understory beneath Siberian elm. Leaves grow alternately on branches, are heart-shaped at the base and taper to a long point, with small teeth along the entire margin. Siberian elm is commonly confused with other elms in the *Ulmaceae* family.

Siberian elm is native to northern China, eastern Siberia, Manchuria, and Korea and was likely introduced in the late 1860s through the ornamental trade. It was used in the Midwest as a windbreak. It commonly grows on disturbed grounds, moist stream banks, in pastures and rangelands, and along road and railroad rights-of-way. Siberian elm does not tolerate flooding and seldom invades mature forest because of its high requirement for sunlight. Siberian elm can dominate new locations in just a few years due to its adaptability, high rate of germination, and rapid growth.

Reproduction is by seed, primarily dispersed by wind, but also by water, animals, and in the undercarriages of equipment and vehicles. Flowers are cross-pollinated by the wind, and trees

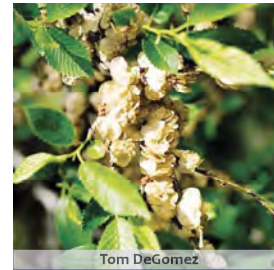
The key to effective control of Siberian elm is to prevent establishment through proper land management. Maintain healthy riparian corridors, wetlands and rights-of-way, and continually monitor your property for new infestations. Siberian elm is a designated "List C" species in the Colorado Noxious Weed Act. For List C species, the goal is to provide additional education, research, and biological control resources to jurisdictions that choose to require management of the List C species. The following page provides management recommendations. For more information please visit: www.colorado.gov/ag/weeds or call the CDA at 303-869-9000, and ask to speak with staff in the Noxious Weed Program.



Patrick Breen



John M. Randall



Tom DeGomez



Robert Videki



Steve Hurst

Key Leaf ID Points:

1. Alternate, simple, 1"-2" long, dark green with conspicuous, grooved veins in a fishbone pattern,
2. Slightly hairy underneath when young; yellow in fall,
3. On short stalks, which are sometimes tinged dark red.

Integrated Weed Management Recommendations

Effective integrated management means using a variety of eradication methods in the same site along with restoration, prevention of seed production and dispersal, and monitoring. Maintain robust healthy native landscapes. Restore degraded sites. Avoid soil disturbance. Prevent seed production and seed dispersal, e.g. on contaminated equipment. Rest sites until restored. Modify land use practices. Use methods appropriate for the site, including land use practices.



Whitney Cranshaw

CULTURAL

Maintain healthy plant communities to prevent or limit Siberian elm infestations, and limit disturbance. Promptly re-vegetate disturbed areas, and prevent establishment of new trees by removing seedlings and saplings before they mature. Replace existing Siberian elms with native trees. Contact your local Natural Resources Conservation Service for recommendations of alternative trees or shrubs.



BIOLOGICAL

There are currently no known biological control agents effective against Siberian elm or authorized in Colorado. For more information on the use of biocontrol agents to control weeds in Colorado, please contact the Palisade Insectary of the Colorado Department of Agriculture at 970-464-7916.



Northern Arizona Invasive Plants

MECHANICAL

Very young seedlings can be pulled fairly easily by hand or with a weed-wrench, especially in moist soil conditions. Cutting trees without chemical application often leads to significant basal and root sprouting. Mechanical methods alone are not recommended for older trees. Treating cut-stumps with herbicide is more effective than cutting alone and can eliminate sprouting.



Rutgers Plant and Pest Advisory/Cooperative

CHEMICAL

Methods include foliar application, basal bark spray, cut stump, and success is influenced by factors like time of year, the growth form (low growing, multi-stemmed shrub vs mid-sized, single stem tree), etc. The following are recommendations for herbicides that can treat Siberian elm; follow-up applications will be necessary. Please reference the label for exact rates. Always read, understand, and follow the label directions. The herbicide label is the LAW!

HERBICIDE	RATE	APPLICATION TIMING
Triclopyr (Garlon 3A, Garlon 4 Ultra, Pathfinder II)	Foliar treatment: 1-1.5% v/v solution plus 0.5% v/v non-ionic surfactant	Summer/early fall when actively growing and fully leafed but before fall color begins.
Glyphosate (Roundup, Accord XRT II, etc.)	Cut stump/girdling: 20-30% solution in oil or water carrier, depending on chemical	
Imazapyr (Arsenal, Habitat, Chopper, Stalker, etc.)	Foliar treatment: 1-5% v/v solution plus 0.5% v/v non-ionic surfactant	



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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.

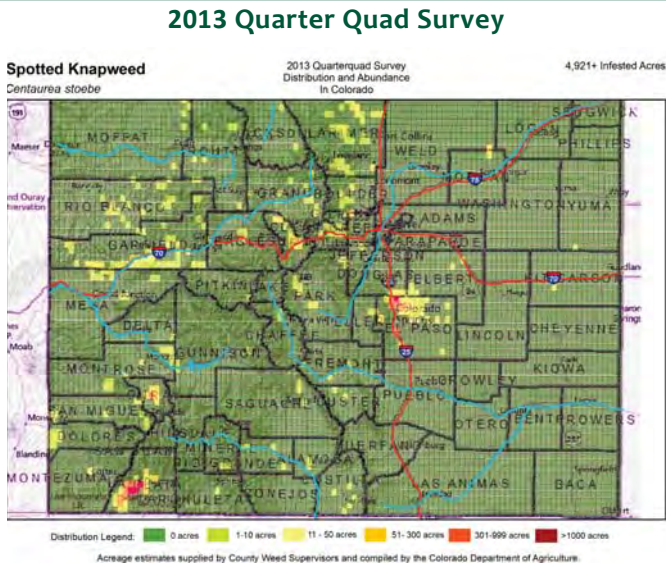


© Rob Routledge, bugwood.org



Spotted Knapweed

Centaurea stoebe



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.

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.



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
Aminocyclopyrachlor + chlorsulfuron (Perspective)*	4.75-8 oz. product/acre + 0.25% non-ionic surfactant	Pre-emergence or from seedling to mid-rosette stage. 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 for use on grazed or feed forage.
Aminopyralid* (Milestone)	5-7 oz./acre + 0.25% non-ionic surfactant	Spring at rosette to early bolt stage and/or in the fall to rosettes. Add 1 qt./acre 2,4-D or 3 oz. Perspective when treating in the bolting to flowering growth stages.
Clopyralid (Transline)	0.67-1.33 pints/acre + 0.25% non-ionic surfactant	Apply to spring/fall rosettes before flowering stalk lengthens. Add 1 qt./acre 2,4-D when treating in the bolting to flowering growth stages.

Note: *Product not permitted for use in the San Luis Valley.

Additional herbicide recommendations for this and other species can be found at:

www.colorado.gov/agconservation/CSUHerbicideRecommendations.pdf

Spotted knapweed

Centaurea stoebe



loose cyme. Each flower has pale yellow petals and notched margins; flower color is not diagnostic. Like many *Potentilla* species, it has five bracts that subtend flowers, five petals, 25 or 30 stamens, numerous pistils, superior ovary and hypanthium. The style is not plumose or hooked at the top. The achene fruit is slightly winged with a heavily network-like veined surface, holding seeds. It is a prolific seeder (Zouhar 2003). Most seeds fall close to the parent plant. Seed longevity is at least four years (Zouhar 2003). It reproduces mainly vegetatively from the woody base where new shoots sprout as older portions die back, eventually forming new independent plants (Zouhar 2003). The woody taproot and lateral roots grow annual rings that can be used to age the plant up to 6 years (Dietz et al. 2002).

Sulfur cinquefoil (*Potentilla recta* L.) is a perennial forb in the Ranunculaceae family, also known as roughfruit or erect cinquefoil. There are 32 *Potentilla* species in Colorado, 32 have compound leaves, 26 of them are hairy, four are introduced, one is a rare endemic, and they hybridize within the Genus. Thus, correct identification is imperative.

The plant overall has a ring-like form, growing from the center outward and its stiff stems give it an upright growth form, up to three feet tall. The stem, petioles, calyx and underside of leaves are hirsute with long perpendicular hairs, sparse hairs on upper leaf surface. The palmate compound leaves with serrate margins and narrow oblanceolate and generally has five leaflets. The underside of its leaves are green. Leaves are basal, alternate on stem and stipulate.

The perfect flowers are arranged in a

The native slender cinquefoil (*Potentilla gracilis*) is often confused with sulfur cinquefoil. It has palmate compound leaves that are shallowly toothed, broad oblong-elliptical shape, has five leaflets, and the leaf underside is green. It can be sparsely to densely hairy, but the hairs on the stem are appressed; small hair tufts are on leaflet tips. Long yellow petals exceed the length of its sepals. It grows to three feet tall.

Beautiful potentilla (*Potentilla pulcherrima*) is another hirsute native that has many appressed stem hairs. However the underside of the leaves are gray and hairy. Its leaves are shallowly and obtusely serrate and each leaflet is rounded at the tip.

sulfur cinquefoil
Potentilla recta
2016 Statewide Distribution in Colorado
Based on 2016 Quarterquad and EDDMapS Field Survey Data
Up to Approximately 732 Infested Acres



Acres estimated to nearest whole acre by county weed supervisors and other data sources; compiled by Colorado Department of Agriculture
 COLORADO Department of Agriculture
 0 acres 1 to 10 acres 11 to 50 acres
 0 30 60 Miles

In Colorado, sulfur cinquefoil is robust in partial to full sun and moist soil found in wet meadows, swales, seeps, ditches, wetlands, riparian areas, and roadsides. However, it can also tolerate slopes and dry sites. Seedlings can be susceptible to drought when faced with interspecific competition (Zouhar 2003).



P. recta *P. pulcherrima*



P. recta *P. pulcherrima*



Key ID Points

1. Hirsute calyx with perpendicular hairs
2. Leaf underside is green
3. Hirsute stem, petioles & leaves with perpendicular hairs
4. Caudex & woody taproot with annual rings

Integrated Weed Management Recommendations

Effective integrated management means using a variety of eradication methods along with restoration, prevention of seed production and dispersal, and monitoring. Maintain robust healthy native landscapes. Restore degraded sites. Avoid soil disturbance. Prevent seed production and seeds from dispersing, e.g. on contaminated equipment. Rest sites until restored. Modify land use practices. Use methods appropriate for the site, other plants present and land uses.



© Douglas County



© Arizona Native Plant Society

CULTURAL

Since sulfur cinquefoil is shade-intolerant and seedlings are susceptible to drought, promote species that provide dense shade, high ground cover, or remain robust during drought, providing appropriate site conditions (Zouhar 2003). In cultivated sites, plowing, discing and reseeding to contiguous crop cover, such as grass may be effective as long as the entire root crown is killed (Zouhar 2003). In wildland settings, maintain or restore a competitive assemblage of shrubs, forbs, cool and warm season grasses, annuals and perennials. Use locally adapted species and mycorrhizal fungi that are ecologically appropriate for the site to improve competitiveness. Implement whole site restoration of soils, plants and water regimes where dense colonies of sulfur cinquefoil exist. Minimize soil compaction and disturbance, especially in moist soil.



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BIOLOGICAL

Sulfur cinquefoil is not palatable to cattle, sheep or horses likely due to tannins, but may be palatable to goats; when eaten, only buds and flowers are selected (Zouhar 2003). Properly managed grazing can improve vigor of desired species and indirectly reduce sulfur cinquefoil. There are no biological control agents for sulfur cinquefoil authorized in Colorado that would effectively control it. For more information about biological control agents, visit the Colorado Department of Agriculture's Palisade Insectary website at: www.colorado.gov/ag/biocontrol.

MECHANICAL

Since sulfur cinquefoil grows new shoots readily at the caudex, mechanical methods that fragment roots, such as tilling, hand-pulling and mowing are not recommended. Mowing, chopping and deadheading leaves roots behind, stimulates shoot and flower production and disperses flowers and seeds, which expands the infestation. Be sure to remove the entire upper root crown if digging in small infestations. Collect, bag, and dispose of or destroy flowers; seeds could mature and germinate if left. Low severity prescribed fires would leave root caudex unaffected and cause resprouting. Piling slash on infestations can increase temperature transferred to roots during prescribed fire, but resulting high severity effects can damage soils. Spring burns are more effective than fall burns for mature plants; fall burns are best for seedlings (Zouhar 2003).



© Techline Invasive Plant News

CHEMICAL

NOTE: Herbicide recommendations to control sulfur cinquefoil in pastures and rangeland are found at: <https://goo.gl/TvWnv9>. Rates are approximate and based on equipment with an output of 30 gal/acre. Follow the label for exact rates. Consult local turf and ornamental experts for herbicides appropriate for residential settings. Always read, understand, and follow the label directions. The herbicide label is the LAW!

Sulfur cinquefoil

Potentilla recta L.



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Richard Gardner

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like burnt peanuts. One female tree can produce 325,000 seeds or more annually, a large portion of which are viable, but not long lived, as seeds do not typically persist for more than two years. Leaves are pinnate-compound with dark green, broadly lanceolate leaflets, margins entirely with teeth or lobes at the base; light green veins and whitish green underneath with glandular red dots near their lobes. Bark is light brown to pale gray, rough with fissures on trunk, and fast-growing, as young sprouts grow as much as 10 to 15 feet in a year.

Tree of heaven (*Ailanthus altissima*), is a perennial, relatively short-lived deciduous tree, also known by the names stinking sumac, Chinese sumac, varnish tree, and stink tree. The tree grows up to 70' tall with up to 80' in crown width and 6' in trunk diameter. It is highly adaptable and can grow under limiting or harsh conditions, including soils that are saline, nutrient poor or highly compacted. It will also grow in areas affected by heat, drought, or pollution and has been troublesome in urban landscapes and woodlands. Tree of heaven is in the *Simaroubaceae* family.

Reproduction is mostly sexual by seed, but new plants are also produced asexually from root sprouts. The species is dioecious with female trees producing clusters of persistent, one-seeded, winged fruit and male trees producing groups of flowers that smell



Annemarie Smith

Tree of heaven is native to China, and was likely introduced in the late 1700s through the ornamental trade. The plant grows along roadsides, railways, fence rows, woodland edges, forest openings, or in riparian zones. It is most often found in waste areas or disturbed sites such as old fields and abandoned areas but can also grow on cliffs, or in crevices and paved areas. Its aggressive root system can impact pavement and foundations, the wood is weak and breaks easily, and infestations crowd out native species. The plant has also helped advance the spread of the spotted lanternfly, an invasive insect also originally from China.

The key to effective control of the tree of heaven, is to prevent establishment through proper land management. Maintain healthy riparian corridors, rights-of-way, and continually monitor your property for new infestations. Tree of heaven is a designated "List C" species in the Colorado Noxious Weed Act. For List C species, the goal is to provide additional education, research, and biological control resources to jurisdictions that choose to require management of the List C species. The following page provides management recommendations. For more information please visit: www.colorado.gov/ag/weeds or call the CDA at 303-869-9000, and ask to speak with staff in the Noxious Weed Program.



Ian Trueman



Richard Gardner



Annemarie Smith



Annemarie Smith

Key ID Points

1. Leaf is pinnately compound (1'-4' long) with 10 to 41 leaflets (2"-7" long).
2. Produces clusters of small, yellow-green flowers.
3. When crushed, the leaves and all plant parts give off a strong, offensive smell

Integrated Weed Management Recommendations

Effective integrated management means using a variety of eradication methods in the same site along with restoration, prevention of seed production and dispersal, and monitoring. Maintain robust healthy native landscapes. Restore degraded sites. Avoid soil disturbance. Prevent seed production and seed dispersal, e.g. on contaminated equipment. Rest sites until restored. Modify land use practices. Use methods appropriate for the site, including land use practices.



Jan Samanek

CULTURAL

Replace tree of heavens 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 alternative trees or shrubs.



BIOLOGICAL

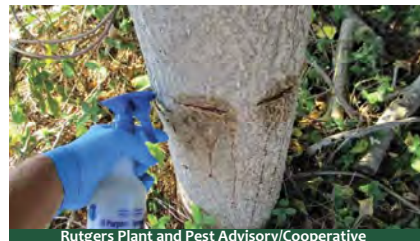
There is not yet a biocontrol agent approved for tree of heaven, although the eriophyid mite, *Aculus taihangensis*, is being researched and shows promise. It is possible in some situations to utilize goat grazing, especially in combination with chemical application. For more information on the use of biocontrol agents to control weeds in Colorado, please contact the Palisade Insectary of the Colorado Department of Agriculture at 970-464-7916.



Richard Gardner

MECHANICAL

Very young seedlings can be pulled fairly easily by hand or with a weed-wrench, especially in moist soil conditions. Seedlings are distinguished from root sprouts by their more slender stems, trifoliate leaflets, and cotyledons. Cutting trees without chemical application often leads to significant basal and root sprouting. Mechanical methods alone are not recommended for older trees. Treating cut-stumps with herbicide is more effective than cutting alone and can eliminate sprouting.



Rutgers Plant and Pest Advisory/Cooperative

CHEMICAL

Methods include foliar application, basal bark spray, cut stump, and stem injection. For mature trees, apply undiluted herbicide into cuts made in bark by a girdling or drilling method. Make cuts all around the trunk, through the cambium layer into nonliving layers. Girdle or drill in June and early July. Always read, understand, and follow the label directions, and use herbicides approved for the site and species. The herbicide label is the law.

Tree of Heaven

Ailanthus altissima

HERBICIDE	RATE	APPLICATION TIMING
Triclopyr (Garlon 3A, Garlon 4 Ultra, Pathfinder II)	Foliar spot treatment: 1-2% v/v solution in water plus 0.5% v/v non-ionic surfactant	Best when leaves are fully expanded
	Cut stump/girdling: 20-30% solution in oil or water carrier, depending on chemical	Can be used anytime but best in late summer or early fall
Glyphosate (Roundup, Accord XRT II, etc.)	Foliar spot treatment: 2-4% v/v solution in water, plus 0.5% v/v non-ionic surfactant	Best when leaves are fully expanded; thoroughly wet leaves
	Stem injection: 1 cut per 3" diameter; 1ml undiluted herbicide to each cut	Best when applied mid-June to mid-September (fall color)



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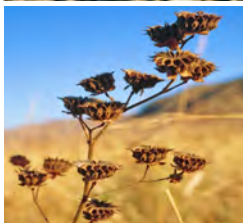


Velvetleaf

Colorado Department of
Agriculture

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weeds@state.co.us



Key ID Points

Identification and Management



Identification and Impacts

Velvetleaf (*Abutilon theophrasti*) is an annual forb native to Asia. This summer annual's seedling is formed with one heart-shaped and one round cotyledon. These cotyledons are hairy on both the upper and lower surface. As the plant grows, the stems become erect and can range in heights of 2 to 7 feet tall. Fine and soft hairs are present along the unbranched stem. Leaves form alternate from one and another. They range in size from 2 inches to 6 inches in width and length. Both surfaces of the leaves are densely covered in soft, "velvet" hairs. Leaves are heart-shaped with toothed margins and taper to a point. Single flowers are born on individual stalks at the leaf axils. They are yellow-orange in color, and are 1/2 to 1 inch in size. The flowers have 5 petals and the stamens of the flower form a tube. Flowering occurs in late June to October. The seed capsule is round in shape about 1 inch in diameter. The seed capsule has 9 to 15 prickly seed pockets, arranged in a disk. Each seed pocket contains 3 to 9 egg-shaped seeds. Seed viability can last up to 50 years in the soil. The plant has a fibrous taproot.

Habitats for Velvetleaf are cultivated fields, roadsides, gardens, fencerows, and waste areas.

Velvetleaf thrives in nutrient rich soils. Velvetleaf is detrimental in croplands, outcompeting the strongest row crops for nutrients and water. It will appear generally after the last cultivation, growing quickly and vigorously.

The key to effective control of Velvetleaf is preventing the establishment of plants by keeping seed production in check. Mechanical, chemical, and cultural control options are effective if used in an integrated weed management approach. Hand pulling is most effective when plants are young, prior to flower production. Once established, control options diminish due to seed longevity. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

Velvetleaf 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; (First 2) Steve Dewey, Utah State University; Charles Bryson, USDA Agricultural Research Service; Dan Tengalia, missouriplants.com; Jan Samanek, State Phytosanitary Administration; All Bugwood.org

Abutilon theophrasti

**CULTURAL**

Since Velvetleaf is generally found in cultivated fields, utilizing a proper crop rotation regiment can prove to be effective. Planting competitive grasses and forbs in native pastures can assist in slowing establishment of Velvetleaf. For specific seed recommendations contact your local Natural Resources Conservation Services for seed mixes.

**BIOLOGICAL**

There is studies being conducted on proper biological control for Velvetleaf. Currently though there has not been any approved for use in Colorado. For more information please contact the Palisade Insectary of the Colorado Department of Agriculture at 970-464-7916.

**MECHANICAL**

Hand pull or dig when soil is moist, and before plants flower and go to seed. Bag specimens carefully so as not to scatter seeds. Mowing very close to the ground can also be effective. The key to effective control is to prevent seed production and/or spread.

Integrated Weed Management:

Preventing the establishment of plant populations is the key to effective control of Velvetleaf. If plants are present preventing flower and seed production is the best option for control. Cultural, mechanical and chemical options are effective methods in controlling plant populations. Velvetleaf is hard to eradicate due to seed viability of 50 years once populations become established.

Velvetleaf

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 (Banvel+2,4-D)	1 to 2 pts/acre	Apply to early growth stages. Add non-ionic surfactant @ 0.32 oz/gal of water or 1 pt/100 gal of water.
Glyphosate (Roundup) *Non-Selective herbicide*	22 oz/acre if < 6" in height - 1 to 2.7 qt/acre in > 6" in height	Apply to early growth stages.
Quinclorac (Paramount)	5.3 to 8 oz/acre	Apply to early growth stages.
Pendimethalin (Pendulum)	2.4 to 4.8 qts/acre	Apply pre-emergence of weed species.

Photos©Top to Bottom; Jan Samanek, State Phytosanitary Administration, Bugwood.org; Whitney Cranshaw, Colorado State University, Bugwood.org; Kelly Uhing, Colorado Department of Agriculture



© Irene Shonle, Colorado State University Extension

involucre or bractlets in the involucre, or they are tiny. Flowers are usually white to pale pink, and when viewed up close, are very distinct. Each flower is made up of five petals that are obcordate with the center cupped inward forming a hook. Five stamens surround two stylopodia. The fruits are oblong, compressed laterally and prominently ribbed evenly. Their size ranges from 3 to 4.5 mm long and are about half as wide. Even with a slight movement, mature seeds shatter and disperse. In Colorado, wild caraway flowers from May through July, sets fruit through September.

Wild caraway (*Carum carvi* L.) is a biennial to perennial forb in the Apiaceae family, also known as caraway, not to be confused with cumin (*Cuminum cyminum*). It grows up to 70 cm tall.

Leaves are primarily basal, however stem leaves are also present in fewer numbers and smaller in size comparatively. The overall shape of the basal leaves is ovate with a tripinnate form. Stem leaves are fine and filliform; each leaflet is less than 1 mm wide. Stem leaves are opposite. Stems and leaves are glabrous. Tap roots are fusiform, similar to a carrot, and up to 25 cm long. Like other plants in the carrot family, the inflorescence is a compound umbel. Peduncles range from 5 to 13 cm long. On each umbel, there can be 7 to 14 rays, usually an unequal number, each measuring about 2 to 4 cm long in an upright position. The pedicel holding each umbellet is about 1 to 12 mm wide. Usually there are no bracts in the

Its origin is distributed from Europe, North Africa, Middle East, Central Asia, Himalayas in India and West Pakistan (eFloras 2018). It is very common in its native range. Worldwide its fruits are used as a culinary spice and explored for medicinal properties due to its aromatic essential oils, carvone and limonene (Solberg et al. 2016).

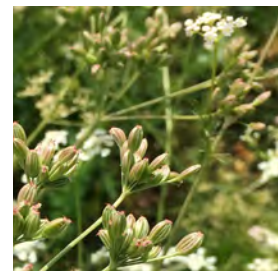
In 1893, James H. Cowen collected the first Colorado wild caraway specimen from a street in Fort Collins (SEINet 2018). In Utah, wild caraway was likely introduced by Mormon settlers (Pammel 1910). Currently in Colorado, it is found in mountain valleys, and occasionally in the eastern plains. It prefers moist soil, such as irrigated fields and pastures, ditches, riparian corridors, wetlands, wet meadows, swales and roadsides. It can tolerate dry soils, such as montane grasslands, abandoned lands, montane woodlands, subalpine forests and stony fields.

Elevation ranges from 1500 to 4300 meters.

From a distance, wild caraway can be confused with Queen Anne's lace (*Daucus carota*) or common yarrow (*Achillea millefolium*). Queen Anne's lace has distinct three-pronged linear bracts subtending the inflorescence and the rays of the inflorescence form a nest-like structure as they curve inward.



© Botanic Gardens in the Netherlands



Wild Caraway
Carum carvi L.

wild caraway
Carum carvi
2016 Statewide Distribution in Colorado
Based on 2016 Quarterquad and EDDMapS Field Survey Data
Up to Approximately 1,695 Infested Acres



Acres estimated to nearest whole acre by county weed supervisors and other data sources; compiled by Colorado Department of Agriculture
0 30 60 Miles

- Key ID Points**
1. Flowers compound umbel, 5 white obcordate petals cupped inward, 5 stamens, & 2 stylopodia
 2. Tripinnate stem leaves
 3. Evenly ribbed seeds 3 mm long
 4. Carrot-like brown taproot

Integrated Weed Management Recommendations

Effective integrated management means using a variety of eradication methods along with restoration, prevention of seed production and dispersal, and monitoring. Maintain robust healthy native landscapes. Restore degraded sites. Avoid soil disturbance. Prevent seed production and seeds from dispersing, e.g. on contaminated equipment. Rest sites until restored. Modify land use practices. Use methods appropriate for the site, other plants present and land uses.



© Brian Randall, Sage-grouse Initiative

CULTURAL

Since wild caraway prefers moist soil, modify irrigation or water regimes if possible to make sites less hospitable. In irrigated fields, switch to grass/monocots until control is established. In wildland settings, maintain or restore a competitive assemblage of shrubs, forbs, cool and warm season grasses, annuals and perennials. Use locally adapted species that are ecologically appropriate for the site to improve competitiveness. Incorporate soil amendments, soil microbes and mycorrhizal fungi to boost desired species when appropriate. Aim to reduce above and below ground space and nutrients to make them unavailable to wild caraway. Minimize soil compaction and disturbance, especially in wetlands and moist soil. Acquire permits for wetland restoration, if required.



© Harris and Ewing, Library of Congress

BIOLOGICAL

Wild caraway is toxic to horses but is highly palatable to other livestock in spring before bolting. Its reported as a possible dewormer and source of minerals (Schmit et al. 2012, Walter et al. 2001). Properly managed grazing can improve vigor of desired species and directly reduce wild caraway. Currently there are no biological control agents for wild caraway authorized in Colorado. For more biocontrol information, visit the Colorado Department of Agriculture's Palisade Insectary website at: www.colorado.gov/ag/biocontrol



MECHANICAL

Mechanical methods are best for residential areas and small infestations. Sever roots below the soil surface early in the season before the plant stores energy, and before seed production. Mowing, chopping and deadheading leaves roots behind, stimulates more flower production; these methods require consecutive years of season-long treatments. Mowing, especially when timed near flowering or seeding phases, often disperses flowers and seeds, which expands the size of the infested area. Collect, bag, and dispose of or destroy flowers; seeds could mature and germinate if left on the ground. Prescribed fire temperatures would need to be very hot to carry in moist soil conditions; this type of fire would smolder for long durations and kill microbes and native plant roots and may leave wild caraway roots moderately damaged.



© Wyoming Bureau of Land Management

CHEMICAL

NOTE: Herbicide recommendations to control wild caraway in pastures and rangeland are found at: <https://goo.gl/TvWnv9>. Rates are approximate and based on equipment with an output of 30 gal/acre. Follow the label for exact rates. Consult local turf and ornamental experts for herbicides appropriate for residential settings. Always read, understand, and follow the label directions. The herbicide label is the LAW!

Colorado Department of Agriculture - Conservation Services

305 Interlocken Parkway

Broomfield, CO 80021

(303) 869-9030

www.colorado.gov/ag/weeds



Colorado
State
University

Wild caraway
Carum carvi L.

Wild proso millet

Colorado Department of
Agriculture

305 Interlocken Pkwy
Broomfield, CO 80021

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



Key ID Points

Identification and Management



Identification and Impacts

Wild proso millet (*Panicum miliaceum*) is an annual grass that is native to Asia or middle Europe. This grass grows an erect stem, that branches near the base. It can grow 2 to 6 feet tall. Leaf blades are 1/2 to 3/4 inches wide, with stiff hairs on both the upper and lower surfaces of the blade. Leaf sheaths contain and open with long spreading hairs. Fused at the base of the leaf, are the ligules that are a fringe of 1/16 of an inch long dense hairs. The inflorescence grows to be a 4 to 12 inches long spreading panicle that is nodding or erect when mature. The panicle is usually not fully extended from the leaf sheath. Spikelets on the panicle are 1/4 inch to 1/2 inch long and are two-flowered. The upper flower of the spikelet is fertile and the lower spikelet is sterile. The glumes are pointed at the tip, ovate and strongly nerved. At the plants maturity the seeds shed. The seeds are brown to black in color, shiny, and smooth. Plants can be easily identified by the seed coat that stays attached to the fibrous root system.

Habitats for Wild proso millet are cultivated fields, waste places,

roadsides, and disturbed sites. Wild proso millet is easily spread through its prolific seed production. Seeds can be spread by harvesting equipment, birds, manure, irrigation water, and small animals.

The key to effective control of Wild proso millet preventing the establishment of plant populations and limiting seed production. Since Wild proso millet likes to grow in cultivated fields, identifying the plant in early growth stages is imperative. Control options include, mechanical, cultural and chemical. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

Wild proso millet 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; All photos, Steve Dewey, Utah State University, Bugwood.org

Panicum miliaceum

**CULTURAL**

Within cultivated fields Wild proso millet can be effectively controlled using a rotational crops system. Minimizing disturbance in native pastures can assist in preventing establishment, and planting native grasses and forbs. For specific seed recommendations contact your local Natural Resources Conservation Services for seed mixes.

**BIOLOGICAL**

Currently there is not any biocontrol available for Wild proso millet. 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**

Hand pull or dig when soil is moist, can be an effective control method. Bag specimens carefully so as not to scatter seeds. Mowing and tilling can contribute to the spread of seeds. The key to effective control is to prevent seed production and/or spread.

Integrated Weed Management:

Preventing the establishment and seed production is the key to effectively controlling Wild proso millet. Once the plant is established and depending on site features, an integrated weed management approach 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
Glyphosate (Roundup Promax)	16 - 32 oz/acre	Apply to early growth stages to plant bolting stages.
2,4-D + Glyphosate (Recoil)	1.2 to 1.8 qts/acre	Apply to early growth stages to plant bolting stages. Add non-ionic surfactant @ 0.32 oz/gal of water or 1 pt/100 gal of water.
Pendimethalin (Prowl)	Up to 4.8 pts/acre	Apply to early growth stages. Add non-ionic surfactant @ 0.32 oz/gal of water or 1 pt/100 gal of water.

Wild proso millet





© John Cardina, OSU

beans, and corn. It reduces crop yield and quality by competing for light, water, and nutrients. Yellow nutsedge is a serious invader because it cannot be controlled by common grass herbicides and is extremely difficult to eliminate from cropland sites once it invades. Yellow nutsedge favors moist areas, irrigated croplands, and forms dense colonies. It can also be found on disturbed sites within: pastures, floodplains, dams, ditches, streambanks, roadsides, wet fields, wet prairies, turf, landscaped areas, and around lakes and ponds. It has been sighted in elevations up to 8,200 feet. Once yellow nutsedge establishes, it is drought tolerant.

The key to effective control of yellow nutsedge is prevention. It is especially important to clean dirt and tubers from potentially contaminated farm and construction equipment. It can also be introduced with nursery activities and contaminated transplants. New infestations must be treated early, before tubers form and the plant becomes established.. Hand pulling plants, when they first appear and have less than 6 leaves, help deplete carbohydrates that supply the tubers growth. In the spring, when plants are young, herbicide treatments are an option. Details on the back of this sheet can help you create a management plan compatible with your site ecology.

It is illegal to plant any variety of yellow nutsedge in Colorado, including chufa (*Cyperus esculentus* var. *sativus*) which is sometimes used to attract wildlife, such as turkeys.

Yellow nutsedge (*Cyperus esculentus*) is a warm season, perennial species that is native to Europe. Plants range from 6 to 30 inches tall. Leaves originate from the base of each stem and are grass-like, smooth, glossy, and folded lengthwise. The stems are pithy and triangular in cross-section. The flower inflorescence is umbrella-shaped, has up to 40 florets per flattened spikelet, and subtended by 3 to 9, long, leaf-like bracts. Flowers are yellowish-brown in color and appear from June to October. The root system on each plant can produce hundreds to thousands of hard, round, brown-black tubers in a season; the tubers can survive 3 to 4 years. Yellow nutsedge is particularly noticeable in July and August when it grows more quickly than native species and stands out visually.

Yellow nutsedge is very damaging to crops like onions, potatoes,



© Lynn Sosnoskie, Univ. of Georgia



© Richard Old, XID Services



© 2007 The Regents of Univ. of Cal

Yellow nutsedge

Cyperus esculentus

Key ID Points

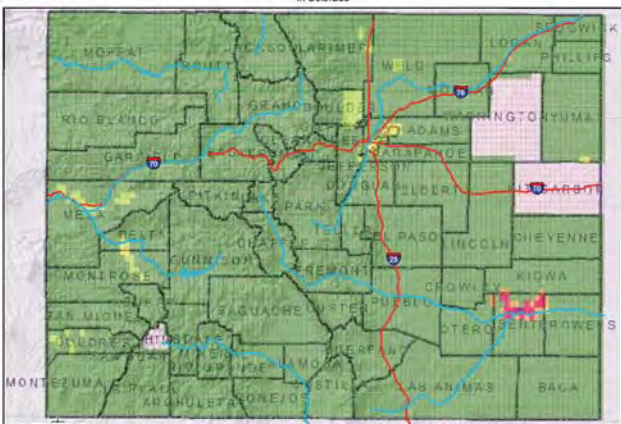
1. Stout triangular stem with grass-like leaves.
2. Brown to black, round tubers at the ends of slender rhizomes.
3. Yellowish, triangular, flattened, and oblong seeds.
4. Leave-like bracts under the inflorescence.

2013 Quarter Quad Survey

Yellow Nutsedge
Cyperus esculentus

2013 Quarterquad Survey
Distribution and Abundance
in Colorado

15,049+ Infested Acres



Distribution Legend: 0 acres, 1-10 acres, 11 - 50 acres, 51- 300 acres, 301-999 acres, >1000 acres, Not Reported

Areage estimates supplied by County Weed Coordinators and compiled by the Colorado Department of Agriculture.

Yellow nutsedge 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 or call the State Weed Coordinator at the Colorado Department of Agriculture, Conservation Services Division, (303) 869-9030.

Integrated Weed Management Recommendations

Prevention is the best control for yellow nutsedge. Avoid soil disturbances and introduction from contaminated equipment or nursery material. Once established, it is difficult to eliminate because herbicides don't effectively kill the plant or tubers. Young plants can be hand pulled before they form tubers and pulling can deplete energy stored in the roots.



© John D. Byrd, MSU



CULTURAL

The best control method is preventing the establishment of new infestations by minimizing disturbance, preventing tuber and seed dispersal by cleaning equipment, carefully inspecting plantings from nurseries, eliminating seed production, and maintaining healthy native communities. Yellow nutsedge can penetrate and grow through black polyethylene plastic.

BIOLOGICAL

In cultivated field, pigs and chickens can effectively grub and feed on tubers. However, there are no other biocontrol agents available for yellow nutsedge. Biocontrol takes many years of research and development. For more information on biocontrols, contact the Colorado Department of Agriculture's Insectary in Palisade, Colorado at 970-464-7916.

MECHANICAL

Hand pull small nutsedge plants when they have less than 6 leaves, which is before tubers form. This is approximately every 2 to 3 weeks during the growing season; over time, this will deplete energy reserves in the roots. Tilling can potentially spread tubers.

CHEMICAL

Not many herbicides are effective at controlling yellow nutsedge because they lack selectivity or uptake, and most are not effective on tubers. The table below includes recommendations for herbicides that can be applied to turf, range, and pastures. Always read, understand, and follow the label directions. The herbicide label is the LAW!

Herbicide	Rate	Application Timing
Aminocyclopyrachlor + Chlorsulfuron (Perspective)	4.75-8 oz. product/acre + 0.25% non-ionic surfactant	Apply at bolting to bud growth stages. (Spring to early summer) 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. Not for use on grazed or feed forage.
Aminopyralid + Metsulfuron (Opensight)	2.5-3 oz. product/acre + 0.25% non-ionic surfactant	Apply at bolting to bud growth stages. (Spring to early summer) Not permitted for use in the San Luis Valley. See label regarding grazed or feed forage.
Metsulfuron (Escort XP) + 2,4-D	1 oz. product/acre + 1 qt. 2,4-D/acre + 0.25 % v/v non-ionic surfactant	Apply at bolting to bud growth stages. (Spring to early summer) May stunt grass growth.

Additional herbicide recommendations for this and other species can be found at:
www.colorado.gov/agconservation/CSUHerbicideRecommendations.pdf

Yellow nutsedge

Cyperus esculentus

Yellow toadflax

Colorado Department of
Agriculture

305 Interlocken Pkwy
Broomfield, CO 80021

(303) 869-9030
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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:
07/2015

Yellow toadflax Identification and Management



Identification and Impacts

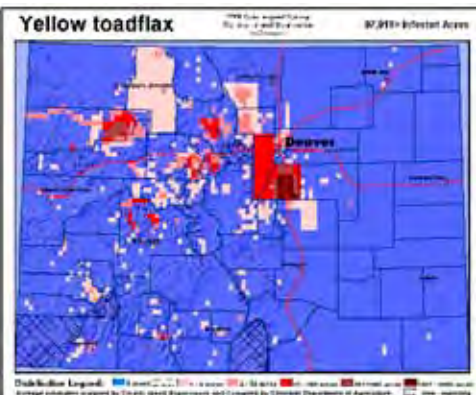
Yellow toadflax (*Linaria vulgaris*) is a perennial escaped ornamental plant that is native to the Mediterranean region. The leaves are narrow, linear, and 1 to 2 inches long. The stems are woody at the base and smooth toward the top. Sparingly branched and 1 to 3 feet tall. The showy snapdragon-like 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, University of Wisconsin, Stevens Point.

Linaria vulgaris

**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.

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. Always read, understand, and follow the label directions. The herbicide label is the LAW!

Herbicide	Rate	Application Timing
Aminocyclopyrachlor + Chlorsulfuron (Perspective)*	4 oz. product/acre + 0.5% v/v methylated seed oil	Apply <u>at flowering through fall post-flower into senescence</u> . 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 for use on grazed or feed forage.
Picloram* (Tordon/Picloram 22K - Restricted use pesticide) + Chlorsulfuron (Telar)	1 qt./acre Tordon + 1.25 oz./acre Telar + 0.25% v/v non-ionic surfactant	Apply <u>at flowering through fall post-flower into senescence</u> . Typically late August through September application timing has shown best results. Re-treatment may be necessary. Refer to label for grazing restrictions on Telar. DO NOT use near trees, desirable shrubs, water, or high water table.

Note: *Product not permitted for use in the San Luis Valley.

Additional herbicide recommendations for this and other species can be found at:
www.colorado.gov/agconservation/CSUHerbicideRecommendations.pdf

Yellow toadflax



Appendix B – Lincoln County Noxious Weed Enforcement Plan

Resolution No. _____

ARTICLE I

Chapter 1

Vegetation

Noxious Weed Management Enforcement Plan

Sec. 1-1-10. Title

This policy shall be known as and be referred to as the “Lincoln County Noxious Weed Enforcement Plan” and shall be effective throughout the unincorporated areas of Lincoln County.

Sec. 1-1-20. Purpose of Plan

The Colorado Noxious Weed Act, Section 35-5.5-101, et seq., C.R.S. (hereinafter “the Act”) states that certain noxious weeds pose a threat to the continued economic and environmental value of the land in Colorado and that they must be managed by all landowners of the State. The Act states that local governments (cities and counties) are directed to take the necessary steps to manage the noxious weeds in their respective jurisdictions. As a result, Lincoln County established a Noxious Weed Management Advisory Board and this Lincoln County Noxious Weed Enforcement Plan.

Sec. 1-1-30. Definitions.

For the purposes of the Chapter, the following words and phrases shall be the meanings stated in this Section:

Act: The Colorado Noxious Weed Act.

Authorized agent: Any agent, delegate, or employee designated by the Board of County Commissioners to carry out the Noxious Weed Management Plan for Lincoln County.

Inspector: An authorized agent of Lincoln County.

Integrated weed management: The planning and implementation of a coordinated program utilizing a variety of methods for managing noxious weeds, the purpose of which is to achieve desirable plant communities. Such

methods may include but are not limited, to education, preventive measures, good stewardship, and the following techniques:

- (a) Biological management: the use of an organism to disrupt the growth of noxious weeds.
- (b) Chemical management: the use of herbicides or plant growth regulators to disrupt the growth of noxious weeds.
- (c) Cultural management: methodologies or management practices that favor the growth of desirable plants over noxious weeds, including maintaining an optimum fertility and plant moisture status in an area, planting at optimum density and spatial arrangement in an area, and planting species most suited to an area.
- (d) Mechanical management: methodologies or management practices that physically disrupt plant growth, including tilling, mowing, burning, flooding, mulching, hand-pulling, hoeing, and grazing.

Landowner: Any owner of record of federal, state, county, municipal, or private land.

Local advisory board: The Lincoln County Noxious Weed Management Advisory Board and those individuals appointed by the Lincoln County Board of County Commissioners to advise on matters of noxious weed management.

Local governing body: The Lincoln County Board of County Commissioners.

Management: Any activity that prevents a plant from establishing, reproducing, or dispersing itself.

Management objective: The specific, desired result of integrated management efforts includes:

- (a) Eradication: Reducing the reproductive success of a noxious weed species or specified noxious weed population in largely uninfested regions to zero and permanently eliminating the species or population within a specified period of time. Once all specified weed populations are eliminated or prevented from reproducing, intensive efforts continue until the existing seed bank is exhausted.

- (b) Containment: Maintaining an intensively managed buffer zone that separates infested regions, where suppression activities prevail, from largely un-infested regions, where eradication activities prevail.
- (c) Suppression: Reducing the vigor of noxious weed populations within an infested region, decreasing the propensity of noxious weeds to spread to surrounding lands, and mitigating the negative effects of noxious weed populations on infested lands. Suppression efforts may employ a wide variety of integrated management techniques.
- (d) Restoration: The removal of noxious weed species and reestablishment of desirable plant communities on lands of significant environmental or agricultural value in order to help restore or maintain value.

Management plan: The noxious weed management plan developed by any person or the local advisory board using integrated management.

Noxious weeds: Those plants designated in Section 1-1-40 of this Code.

Person or occupant: An individual, partnership, corporation, association, or federal, state, or local government or agency thereof owning, occupying, or controlling any land, easement, or right-of-way, including any city, county, state, or federally owned and controlled highway, drainage or irrigation ditch, spoil bank, borrow pit, gas and oil pipeline, high voltage electrical transmission line, or right-of-way for a canal or lateral.

Sec. 1-1-40. Noxious weeds.

- A. The Rules Pertaining to the Administration and Enforcement of the Act (8 CCR 1203-19, Part 3), identify 18 noxious weed species designated for eradication in Colorado and consequently Lincoln County (known therein as "List A – Noxious Weed Species"). The State Noxious Weed Management Plans for List "A" Noxious Weed Species can be found in C.R.S. The species include:

African rue (*Peganum harmala*)

Camelthorn (*aihagi pseudaihagi*)

Common crupina (*Crupina vulgaris*)

Cypress spurge (*Euphorbia cyparissias*)

Dyer's woad (*Isatis tinctoria*)

Giant salvinia (*Salvinia molesta*)

Hydrilla (*Hydrilla verticillata*)

Meadow knapweed (*Centaurea pratensis*)

Mediterranean sage (*Salvia aethiopsis*)

Medusahead (*Taeniatherum caput-medusae*)

Myrtle spurge (*Euphorbia myrsinites*)

Orange hawkweed (*Hieracium aurantiacum*)

Purple loosestrife (*Lythrum salicaria*)

Rush skeletonweed (*Chondrilla juncea*)

Sericea lespedeza (*Lepedeza cuneata*)

Squarrose knapweed (*Centaurea virgata*)

Tansy ragwort (*Senecio jacobaea*)

Yellow starthistle (*Centaurea solstitialis*)

- B. The noxious weed species designated for management in Lincoln County are as follows:

Absinth wormwood (*Artemisia absinthium*)

Canada thistle (*Cirsium arvense*)

Chinese clematis (*Clematis orientalis*)

Dalmatian toadflax, broad-leaved (*Linaria dalmatica*)

Diffuse knapweed (*Centaurea diffusa*)

Field bindweed (*Convolvulus arvensis*)

Leafy spurge (*Euphorbia esula*)

Musk thistle (*Carduus natans*)

Plumeless thistle (*Onopordum acanthium*)

Russian knapweed (*Acroptilon repens*)

Scotch thistle (*Onopordum acanthium*)

Spotted knapweed (*Centaurea maculosa*)

Tamarisk (*Tamarix ramosissima*)

Lincoln County will add to this list “the remaining “B” weed species listed in the Rules 8 (CCR 1203-19, Part 4) as the integrated management plans designed to stop the continued spread of these species are developed by the State of Colorado, Department of Agriculture.

The remaining “B” weed species listed in the Rule can be found in Appendix A.

ARTICLE II

Enforcement of Plan

Sec. 1-2-10 Noxious weeds deemed a public nuisance.

The noxious weeds listed in Section 1-1-40 of this Code, at any and all stages, their carriers, and any and all premises, and things infested or exposed to infestation therewith in Lincoln County are declared to be a public nuisance and, in addition to the remedies contained in Article II, chapter 15 of this Code, are subject to all of the laws and remedies relating to the prevention and abatement of nuisances, including, but not limited to, those set forth in Section 35-5.5-113, C.R.S.

Sec. 1-2-20. Authorized agent for enforcement.

Pursuant to Section 35-5.5-105(2), C.R.S., The Lincoln County Commissioners are hereby designated "authorized agents" to enforce the Noxious Weed Management Enforcement Policy in the unincorporated areas of the County, by utilizing those procedures set forth in Sections 35-5-108, 35-5-109 and 35-5.5-108, C.R.S., and any other applicable state and federal statutes, rules, regulations and ordinances, including the remaining provisions of this Chapter.

Sec. 1-2-30. Methods of identification and inspection.

- A. An authorized agent shall have the right to enter upon any premises, lands, or places, whether public or private, during reasonable business hours, for the purpose of inspecting for the existence of noxious weed infestations, when at least one of the following events has occurred:
 1. The landowner or occupant has requested an inspection.
 2. A neighboring landowner or occupant has reported in writing a suspected noxious weed infestation and requested an inspection.
 3. The authorized agent has made a visual inspection from the public right-of-way or area and has reason to believe that a noxious weed infestation exists.
- B. If verbal permission to inspect the property is not obtained from the landowner or occupant, and after notification by certified mail the landowner or occupant denies access to the authorized agent, the authorized agent may seek an inspection warrant issued by a municipal, county, or district court having jurisdiction over the land, utilizing the procedures set forth in Section 35-5.5-109(4)(b), C.R.S.

Sec. 1-2-40. Notice to control identified noxious weeds.

- A. The authorized agent has the authority to notify a landowner or occupant of such lands of the presence of noxious weeds (“*Notice to Control Identified Noxious Weeds*”). Such notice shall be by certified mail, and shall include the following:
1. The name(s) and address(es) of the landowner or occupant;
 2. The property’s Assessor’s office parcel # and legal description;
 3. The noxious weeds to be managed;
 4. Advisement to the landowner or occupant to manage the noxious weeds within ten (10) days of mailing of the notice;
 5. The best available control methods of integrated management;
 6. The options of notice compliance;
 7. The consequences for non-compliance; and
 8. A statement that the authorized agent will seek a “right-of-entry” from the Board of County Commissioners to enter the property and manage identified noxious weeds unless the landowner/occupant complies with the notice, or submits a written weed management plan with an acceptable completion date, or requests an arbitration panel develop a weed management plan pursuant to Section 25-5.5-109(4)(a)(III) and (4)(b).
- B. The authorized agent may give a *Notice to Control Identified Noxious Weeds* to any State board, department or agency that administers or supervises State land within the County’s jurisdiction, to manage or control noxious weeds on such lands.
1. Such notice shall specify the best available method(s) of integrated management and will include the same information as itemized in Section 1-2-30 A. of this Code.
 2. Wherever possible, the authorized agent will consult with the affected State board, department or agency in the development of a plan for the management or control of noxious weeds on the lands.

Sec. 1-2-50. Right of Entry

Prior to entering private or state lands for the purposes of enforcing the notice, the authorized agent shall first obtain a "right-of-entry" from the Board of County Commissioners, no less than ten (10) days after a *Notice to Control Identified Noxious Weeds* has been sent to the owner or occupant of the private lands and said owner or occupant has failed to comply with said notice.

Sec. 1-2-60. Right to assess whole cost of management.

The authorized agent shall assess the whole cost of such enforcement, including up to twenty percent (20%) for inspection and other incidental costs in connections therewith upon the tract of land where the noxious weeds are located. Notice of such assessment shall be mailed to the landowner or occupant by certified mail. Failure to receive notice of control shall not act as a defense to such assessment.

Sec. 1-2-70. Failure to pay assessment.

Any assessment that is not paid within thirty-three (33) days after the date of mailing by certified mail to the landowner or occupant of private lands upon which the authorized Agent has performed enforcement work, shall constitute a lien against each lot or tract of land until paid and may be certified by resolution of the Board of County Commissioners to the County Treasurer to be collected in the same manner as provided for collection of taxes upon private lands in accordance with Section 35-5.5-109(5)(a), C.R.S.

Sec. 1-2-80. Liability.

This Chapter shall not be intended to create a civil cause of action against the Board of County Commissioners of Lincoln County, or any other person that may administer this Chapter in any manner.

APPENDIX A

Black henbane (*Hyoscyamus niger*)
Bouncingbet (*Saponaria officinalis*)
Bull thistle (*Cirsium Vulgare*)
Common tansy (*Tanacetum vulgare*)
Common teasel (*Dipsacus fullonum*)
Corn chamomile (*Anthemis arvensis*)
Cutleaf teasel (*Dipsacus laciniatus*)
Dalmatian toadflax, narrow-leaved (*Linaria genistifolia*)
Dame's rocket (*Hesperis matronalis*)
Eurasian watermilfoil (*Myriophyllum spicatum*)
Hoary cress (*Cardaia draba*)
Houndstongue (*Cynoglossum officinate*)
Mayweed chamomile (*Anthemis cotula*)
Moth mullein (*verbascum blattaria*)
Oxeye daisy (*Chrysanthemum leucanthemum*)
Perennial pepperweed (*Lepidium latifolium*)
Plumeless thistle (*Carduus acanthoides*)
Quackgrass (*Elytrigia repens*)
Redstem filaree (*Erodium cicutarium*)
Russian-olive (*Elaeagnus angustifolia*)

Scentless chamomile (*Matricaria perforata*)

Scotch thistle (*onopordum tauricum*)

Spurred anoda (*Anoda cristata*)

Sulfur cinquefoil (*Potentilla recta*)

Venice mallow (*Hibiscus trionum*)

Wild caraway (*Carum carvi*)

Yellow nutsedge (*Cyperus esculentus*)

Yellow toadflax (*Linaria vulgaris*)