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INTEGRATED NOXIOUS WEED MANAGEMENT PLAN TWO RIVERS PIT, PUEBLO COUNTY, COLORADO

The Colorado Department of Agriculture (CDA), Colorado Division of Reclamation Mining and Safety (DRMS) and Pueblo County require all landowners to prevent the spread of State Listed Noxious Weeds. Kirkland Construction, as the permittee and operator of the Two Rivers sand and gravel operation (M-1998-038) is updating the Two Rivers Integrated Noxious Weed Management Plan in consultation with Turkey Creek Conservation District, Pueblo County Noxious Weed Control program.

EVALUTATION AND CONSULTATION:
PUEBLO COUNTY NOXIOUS WEED CONTROL PROGRAM: Turkey Creek Conservation District - Beth Campbell; 200 S. Santa Fe Ave., Pueblo, CO 81003; (719) 543-8386 ext. 116; www.puebloweeds.com

PROPERTY INFORMATION – The Two Rivers Sand and Gravel operation is permitted and operated by Kirkland Construction. Two Rivers is located in Pueblo County approximately 5.75 miles east of Avondale, and just east of Highway 50; on the south side of the confluence of the Huerfano and Arkansas rivers. Two Rivers has 112 mined land reclamation permit issued by the Colorado Division of Reclamation, Mining and Safety. This pit is only mined when Kirkland Construction has a project in close proximity to the pit. The current disturbed area is approximately 40 Acres.

Operation: Two Rivers Sand & Gravel Operation: 112 Reclamation Permit Number M1998-038

Permitted acreage: 154 acres with ±40 acres of currently disturbed land within the permit boundary.

Location: Portions of Section 8, 17 and 18, Township 21 South, Range 61 West, 6thPM, Pueblo County, Colorado

Latitude / Longitude: 38°13'24"N / 104°14'56"W **Elevation:** ±4,485 ft.

Terrain Type: Grazing land with native vegetation consisting mainly of plains grasses. The gravel pit is located near the confluence of the Huerfano and Arkansas Rivers. The soil types consist of Gilcrest – gravelly sandy loam and Otero D gravelly sandy loam. Soils in this area exhibit rapid permeability, low water holding capacity and the soils are mildly alkaline.

Integrated Noxious Weed Control Plan: The development of this plan is accordance with Section 3.1.10 (6) of the Mineral Rule and Regulations of the Colorado Mined Land Reclamation Board for the Extraction of Construction Materials, which states: **Methods of weed control shall be employed for all prohibited noxious weed species, and whenever invasion of a reclaimed area by other weed species seriously threatens the continued development of the desired vegetation. Weed control methods shall also be used whenever the inhabitation of the reclaimed area by weeds threaten to further spread of serious weed pests to nearby areas.**

This Integrated Noxious Weed Management Plan is for the control of noxious weed species within the Two Rivers gravel permit boundary. The plan identifies existing noxious weed on the property and potential weeds in the vicinity of the pit that may invade the site. Appropriate weed control actions shall be implemented whenever noxious weed species are observed on the property per the attached noxious weed fact sheets.

1. Weed control must be applied and evaluated over an extended period of time to be successful.
2. The basic steps of Weed Control include identification of weed species, locating the weed problem, development of control and prevention strategies, implementation of those strategies, and ongoing monitoring to assess the effectiveness of the efforts.
3. To prevent or minimize the infestation and spread of noxious weeds, bi-annual inspections of the pit area will evaluate presence or absence, degree of invasion, and the response to previous treatments in the spring and fall of each year.
4. Specific treatment methods and time tables are identified in the attached weed summaries. Plans may be modified based in new invasions of weed based on the species of concern, location and extent of the infestation, and other pertinent factors.

WEED MANAGEMENT GOALS AND PRIORITIES: This management plan focuses on the control of targeted noxious weed species listed below.
The goal is to implement this weed control plan. The best management practice for this site is to contain the current infestations of salt cedar / tamarisk and work towards its elimination.
Following is a general description of the basic types of weed management. Also refer to the specific noxious weed guidelines provided by the Turkey Creek Conservation District and Colorado Department of Agriculture in the attached noxious weed fact sheets. It is very important to get control of these invasive species on a local level.

- Elimination or eradication is the complete removal of a weed infestation. It is the implementation of a short-term but intensive control effort to completely purge a targeted weed infestation permanently from an area (unless reintroduced). Elimination is desirable and possible for small weed patches, but not always for larger ones. (Important note: if eradication creates an open environment, a weed problem may be cured simply to create another one; therefore, it is essential to revegetate the ground to prevent another infestation.)
- Containment prevents weed encroachment onto non-infested areas. It is the creation of confining perimeters around the infestation. This is achieved by eradicating plants on the exterior of the infestation's designated perimeter and those along roads, streams and trails that may help spread the infestation beyond the perimeter.
- Suppression reduces weed density and area. It is the use of a wide variety of weed management techniques that reduce the density and severity of infestations within the boundaries of containment perimeters. This is done to mitigate harm to agriculture, environment and other valuable land caused by widespread populations of noxious weeds.

OVERVIEW OF TARGETED WEED SPECIES AND POTENTIAL INVASIVE WEED SPECIES: (SEE THE ENCLOSED NOXISOUS WEED FACT SHEETS) the following bulleted paragraphs provide general descriptions and information about the noxious weeds that are identified on the property during the evaluation process as the primary targets for management. For information purposes at this time descriptions of potential invasive weed species have been included that have been identified in Pueblo County, Colorado and the general area. Turkey Creek Conservation District, Noxious Weed Control Program www.puebloweeds.com can provide guidance and assistance for the control of these and other noxious weeds currently found in Pueblo County.

TARGET WEED SPECIES:

- **Identified Weed Species within the permitted mine boundary.**
  - **Tamarisk / Salt Cedar** are a perennial non-native deciduous evergreen shrub or small tree that grows from 5 to 2o feet tall. A mature plant can produce up to 600,000 seeds per year. Seeds are viable for up to 45 days under ideal conditions. Ideal conditions for salt cedar 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. See following effective treatments chart and the Tamarisk / Salt Cedar fact sheet.

POTENTIAL INVASIVE WEED SPECIES:

- **Potential Invasive Weed Species in Pueblo County and the general area outside of the permitted area.**
  - **Musk Thistle** is a biennial forb plant that produces solely by seed. Its life cycle is completed in two growing seasons. In its first year, it is a cluster of leaves at ground level called a rosette. During its second year it bolts, forming an elongated flowering stem. Musk thistle only spreads by seed so it is very important to stop seed formation. Seeds are spread mainly by wind and animals. Each plant can produce up to 100,000 seeds. On average, plants produce about 10,000 seeds. Seed viability in the soil is approximately 10 years. Musk thistle seed head weevils are established throughout the state as a biological control method. See the following effective treatments chart and the Musk Thistle fact sheet.
  - **Canada thistle** is a deep rooted perennial plant that spreads by seeds and aggressive creeping, horizontal roots called rhizomes. These plants are long-lived and will grow and spread year after year. On average, a mature female plant will produce 1,500 seeds per season with seed viability at approximately 3 years. Seeds are spread mainly by wind. However, Canada thistle spreads mainly through its extensive creeping root system and will form dense colonies. New shoots will emerge from any root fragmentation. While it is important to stop seed formation, with this plant, it is most important to stop its vegetative spread. See the following effective treatments chart and the Canada thistle fact sheet.
  - **Common Teasel** is a biennial forb. Mature plants can grow up to over six feet tall and have a taproot. This species reproduces by seed. 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 for from the parent plant. See the following effective treatments chart and the Common Teasel fact sheet.
  - **Hoary Cress** commonly known as whitetop is a creeping perennial that is a member of the mustard family. The stems and rosette state may grow up to two feet in height. One plant can produce from 1,200 to 4,800 seeds. The plants emerge in the early spring and set seed by mid-summer. See following effective treatments chart and the Hoary Cress fact sheet.

- **Perennial Pepperweed** is an extremely invasive perennial forb. Pepperweed reproduces both by seed and by vegetative roots and shoots. Root fragments as small as 0.5 inches 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 soil surface. See the following effective treatments chart and the Pepperweed fact sheet.
- **Russian Knapweed** is a deep root perennial that spreads by aggressive creeping, horizontal roots or rhizomes and seed. Russian knapweed can grow up to 3 feet in height. 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 knap weed reproduces primarily from its root system. See the following effective treatments chart and the Russian Knapweed fact sheet.
- **Russian olive** is a perennial tree or shrub. The plant has olive shaped fruits. Russian olives 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. Russian olive can grow in a variety of soil conditions, but prefers open, moist riparian zones. It is shade tolerant and can be found along streams, floodplains, fields and open areas up to ±8,000 feet in elevation. Russian olive can outcompete native plants, interfere with natural plant succession and nutrient cycling and tax water reserves. See the following effective treatments chart and the Common Teasel fact sheet.

EFFECTIVE NOXIOUS WEED TREATMENTS FOR TWO RIVERS:

These noxious weed control practices are tailored to particular weed problems discovered during the evaluation process and listed in the following table. In coordination with the Turkey Creek Conservation District, this plan is designed to be user friendly; however in the event of questions; Turkey Creek Conservation District at 719-543-8386 ext. 116 will be contacted to address control measures.

CONTROL METHODS FOR TARGETED WEED SPECIES: Tamarisk / Salt Cedar is currently identified as the only noxious weed identified within the permitted mine boundary. The most effective method for control of noxious weeds is to prevent its establishment through proper land management. Maintain healthy pastures and rangeland and continually monitor the site for new infestations. New infestations are much more easily controlled than established infestations. Please refer to the chemical and mechanical controls in the Effective treatment table and timeline. Also refer to the Cultural, Biological, Mechanical and Herbicides controls in the attached Salt Cedar and Tamarisk fact sheet.

EFFECTIVE TREATMENTS FOR SELECTED NOXIOUS WEED SPECIES IN VICINITY OF THE TWO RIVERS SAND & GRAVEL PERMIT BOUNDARY			Chemical & Mechanical Controls - PLEASE REFER TO, READ AND COMPLY WITH THE APPROPRIATE HERBICIDE LABEL AND THE ATTACHED SPECIFIC NOXIOUS WEED FACT SHEET						
B-List Species	**Duration**	**Project Occurrence**	**May**	**June**	**July**	**August**	**September**	**October**	**Biologic Control Method**
IDENTIFIED WEED SPECIES WITHIN THE PERMITTED SAND & GRAVEL BOUNDARY									
Tamarisk / Salt Cedar	Perennial	Known	na		Cut Stump Treatment - Treat cambial layer of the tree with appropriate herbcides immediately cutting stump to roots above soil.				Saltcedar leaf beetle
Tamarisk / Salt Cedar	Perennial	Known	Broadcast foliar treatment: apply appropriate herbicide when the plants are growing					na	
POTENTIAL INVASIVE WEED SPECIES									
Musk Thistle	Biennial	In Region	Spot treat with appropriate herbicides from rosette to early bloom stage or dig to below ground surface.		Inspect site and treat late emerging plants, or remove flowering plants to prevent seed production.		Spot treat fall rosettes with appropriate herbicides or dig to below ground surface.		Musk thistle seed head weevils.
Canada Thistle	Perennial	In Region	Spot treat with appropriate herbicides from rosette to bud stage.				Spot treat fall rosettes with appropriate herbicides		Goats, Cattle and Sheep will graze young
Common Teasel	Biennial	In Region	Spot treat with appropriate herbicides from rosette to bolting stage.						No biologic control.
Hoary Cress	Perennial	In Region	Spot treat with appropriate herbicides from rosette to early bloom stage or dig to below ground surface.						No biologic control.
Perennial Pepperweed	Perennial	In Region	Spot treat with appropriate herbicides from the early flower bud to flowering growth stage is extremely effective to control pepperweed.						Biologic control is not a viable option.
Russian Knapweed	Perennial	In Region	Spot treat with appropriate herbicides from rosette to bud stage.				Treat during root bud development		Gall Midge
Russian Olive	Perennial	In Region	na		Cut Stump Treatment - Treat cambial layer of the tree with appropriate herbcides immediately cutting stump to roots above soil. Basal Bark treatment - spray until wet but not dripping with appropriate herbicides to the roots above soil surface, root collar and lower trunk to a height 12 to 15 inches above ground.				Tubercularia canker is an un-approved biocontrol.

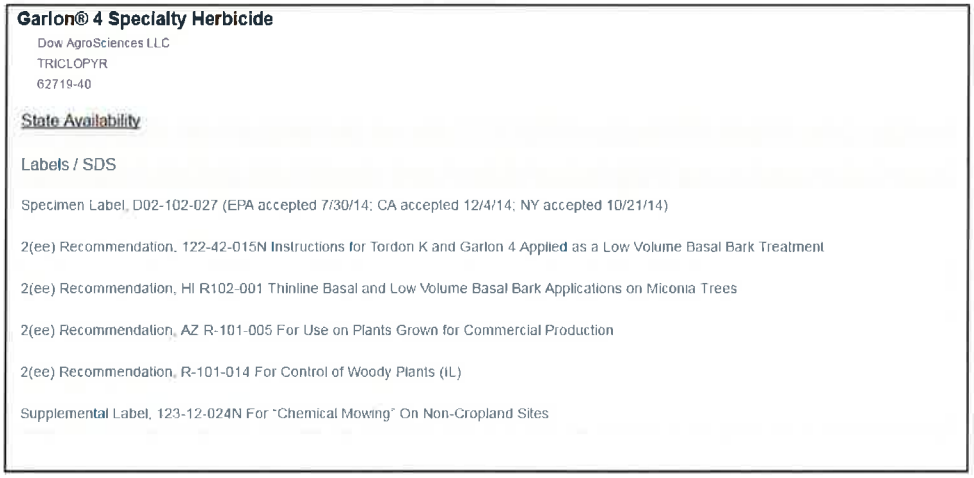
Always read, understand and follow label directions.
The herbicide label is the LAW!

BASIC WEED MANAGEMENT GUIDELINES: Integrated management is a program of noxious weed control that properly implements a variety of coordinated control methods. There are no cure-alls for noxious weeds – no single tool will work every time in every situation. The solution is integrated management, which combines, or integrates, different tools to provide more effective weed control than any single tool could produce. Types of control methods include mechanical, cultural, chemical, and biological. Please refer to the attached noxious weed fact sheets.

Noxious weed management is not a one-time effort and the operator will need to perform control measures several times per during the operations life time. Work will include observation, control application, observation of controls effectiveness and eradication of the weed population. Work will be initiated on small infestations and the perimeters of larger infestations first. This will help keep infestations from spreading outward and will help to control new outbreaks. By confining the weeds into areas, they will be more manageable. Records should be kept of the controls applied on site and the

results. This will provide analysis of the weed control progress and make any needed modifications to the specific weed control program.

HERBICIDE OPTIONS FOR TARGETED WEED SPECIES: For reference concerning a particular herbicide, refer to Crop Data Management Systems, Inc. (CDMS) (http://www.cdms.net/Label-Database) provides labels for specific herbicides. The herbicides recommended on the noxious weed fact sheets will be used to for chemical control. The herbicide labels will be read before using the product and all directions and precautions will be followed regarding the application and use of the herbicide. Following is an example of the CDMS data base index for a salt cedar herbicide and specimen label D02-102-027.



Garlon® 4 Specialty Herbicide

Dow AgroSciences LLC
TRICLOPYR
62719-40

State Availability

Labels / SDS

Specimen Label, D02-102-027 (EPA accepted 7/30/14; CA accepted 12/4/14; NY accepted 10/21/14)

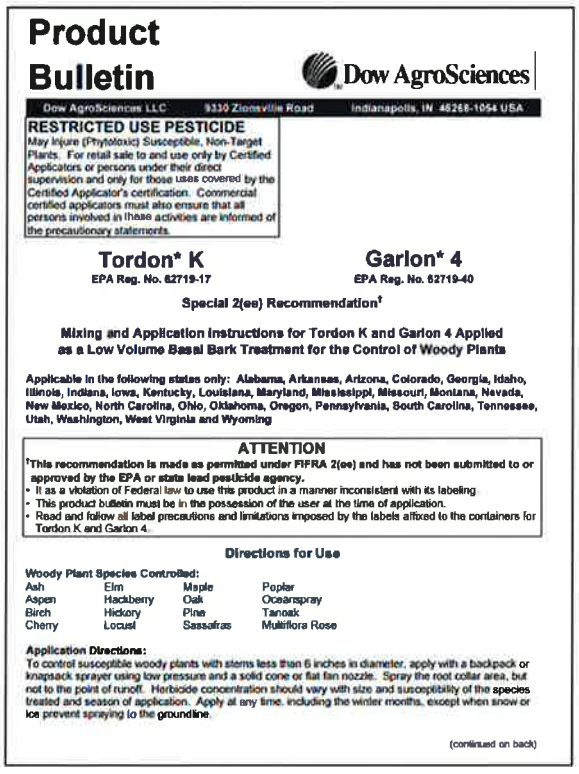
2(ee) Recommendation, 122-42-015N Instructions for Tordon K and Garlon 4 Applied as a Low Volume Basal Bark Treatment

2(ee) Recommendation, HI R102-001 Thinline Basal and Low Volume Basal Bark Applications on Miconia Trees

2(ee) Recommendation, AZ R-101-005 For Use on Plants Grown for Commercial Production

2(ee) Recommendation, R-101-014 For Control of Woody Plants (IL)

Supplemental Label, 123-12-024N For "Chemical Mowing" On Non-Cropland Sites



Product Bulletin

Dow AgroSciences

Dow AgroSciences LLC 9330 Zionsville Road Indianapolis, IN 46268-1054 USA

RESTRICTED USE PESTICIDE
May Injure (Phytotoxic) Susceptible, Non-Target Plants. For retail sale to and use only by Certified Applicators or persons under their direct supervision and only for those uses covered by the Certified Applicator's certification. Commercial certified applicators must also ensure that all persons involved in these activities are informed of the precautionary statements.

Tordon® K
EPA Reg. No. 62719-17

Garlon® 4
EPA Reg. No. 62719-40

Special 2(ee) Recommendation†

Mixing and Application Instructions for Tordon K and Garlon 4 Applied as a Low Volume Basal Bark Treatment for the Control of Woody Plants

Applicable in the following states only: Alabama, Arkansas, Arizona, Colorado, Georgia, Idaho, Illinois, Indiana, Iowa, Kentucky, Louisiana, Maryland, Mississippi, Missouri, Montana, Nevada, New Mexico, North Carolina, Ohio, Oklahoma, Oregon, Pennsylvania, South Carolina, Tennessee, Utah, Washington, West Virginia and Wyoming

ATTENTION

†This recommendation is made as permitted under FIFRA 2(ee) and has not been submitted to or approved by the EPA or state lead pesticide agency.

- It as a violation of Federal law to use this product in a manner inconsistent with its labeling.
- This product bulletin must be in the possession of the user at the time of application.
- Read and follow all label precautions and limitations imposed by the labels affixed to the containers for Tordon K and Garlon 4.

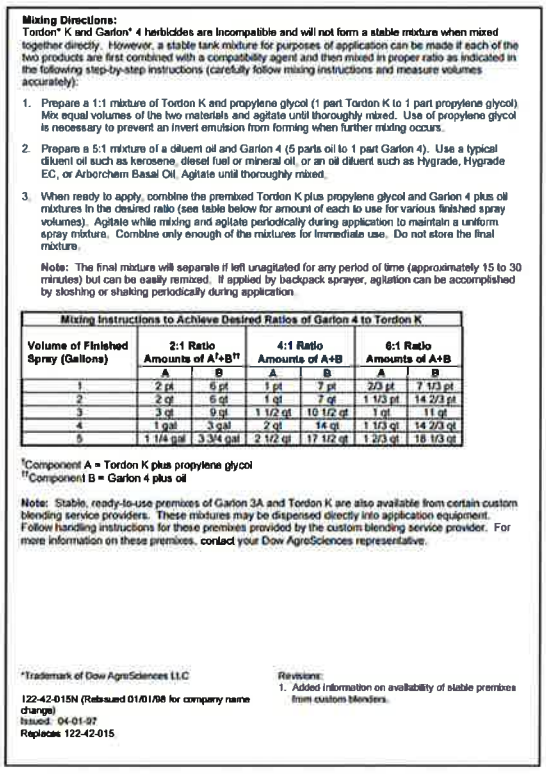
Directions for Use

Woody Plant Species Controlled:

Ash	Elm	Maple	Poplar
Aspen	Hackberry	Oak	Oceanspray
Birch	Hickory	Pine	Tanoak
Cherry	Locust	Sassafras	Multiflora Rose

Application Directions:
To control susceptible woody plants with stems less than 6 inches in diameter, apply with a backpack or knapsack sprayer using low pressure and a solid cone or flat fan nozzle. Spray the root collar area, but not to the point of runoff. Herbicide concentration should vary with size and susceptibility of the species treated and season of application. Apply at any time, including the winter months, except when snow or ice prevent spraying to the groundline.

(continued on back)



Mixing Directions:
Tordon® K and Garlon® 4 herbicides are incompatible and will not form a stable mixture when mixed together directly. However, a stable tank mixture for purposes of application can be made if each of the two products are first combined with a compatibility agent and then mixed in proper ratio as indicated in the following step-by-step instructions (carefully follow mixing instructions and measure volumes accurately):

1. Prepare a 1:1 mixture of Tordon K and propylene glycol (1 part Tordon K to 1 part propylene glycol). Mix equal volumes of the two materials and agitate until thoroughly mixed. Use of propylene glycol is necessary to prevent an invert emulsion from forming when further mixing occurs.
2. Prepare a 5:1 mixture of a diluent oil and Garlon 4 (5 parts oil to 1 part Garlon 4). Use a typical diluent oil such as kerosene, diesel fuel or mineral oil, or an oil diluent such as Hygrade, Hygrade EC, or Arborchem Basal Oil. Agitate until thoroughly mixed.
3. When ready to apply, combine the premixed Tordon K plus propylene glycol and Garlon 4 plus oil mixtures in the desired ratio (see table below for amount of each to use for various finished spray volumes). Agitate while mixing and agitate periodically during application to maintain a uniform spray mixture. Combine only enough of the mixtures for immediate use. Do not store the final mixture.

Note: The final mixture will separate if left unagitated for any period of time (approximately 15 to 30 minutes) but can be easily remixed. If applied by backpack sprayer, agitation can be accomplished by sloshing or shaking periodically during application.

Mixing Instructions to Achieve Desired Ratios of Garlon 4 to Tordon K

Volume of Finished Spray (Gallons)	2:1 Ratio Amounts of A†+B††		4:1 Ratio Amounts of A+B		6:1 Ratio Amounts of A+B	
	A	B	A	B	A	B
1	2 pt	6 pt	1 pt	7 pt	2/3 pt	7 1/3 pt
2	2 qt	6 qt	1 qt	7 qt	1 1/3 pt	14 2/3 pt
3	3 qt	9 qt	1 1/2 qt	10 1/2 qt	1 qt	11 qt
4	1 gal	3 gal	2 qt	14 qt	1 1/3 qt	14 2/3 qt
5	1 1/4 gal	3 3/4 gal	2 1/2 qt	17 1/2 qt	1 2/3 qt	18 1/3 qt

†Component A = Tordon K plus propylene glycol
††Component B = Garlon 4 plus oil

Note: Stable, ready-to-use premixes of Garlon 3A and Tordon K are also available from certain custom blending service providers. These mixtures may be dispensed directly into application equipment. Follow handling instructions for these premixes provided by the custom blending service provider. For more information on these premixes, contact your Dow AgroSciences representative.

*Trademark of Dow AgroSciences LLC

122-42-015N (Reissued 01/01/98 for company name change)
Issued: 04-01-97
Replaces 122-42-015

Revisions:
1. Added information on availability of stable premixes from custom blenders.

BASIC CHEMICAL CONTROL GUIDELINES: The first rule of herbicide use is to read the label before using the product and follow all directions and precautions. The label is the law. Seek assistance before purchasing or using an herbicide if not absolutely sure of the use or purpose of the product. Chemicals are powerful tools that should be used judiciously. Follow all instructions (application rates, proper safety equipment, appropriate weather conditions, etc.) as directed on the herbicide's label. Safety precaution may include safety glasses, rubber gloves, long-sleeved shirts, long pants, high-top shoes, and socks are common sense precautions. An additional precaution includes the use a respirator to protect sensitive mucus membranes in nose and throat. Follow proper clean-up and disposal procedures for the equipment and containers.

Care must be taken to avoid spraying herbicides near water unless they are specifically labeled for aquatic use. An aquatic-approved herbicide is required when applications will be made over water or come in contact with surface water. An aquatic-safe herbicide is a great quality to have in an herbicide when applying near any kind of stream or river (riparian areas) or drainages. Broadleaf selective herbicides can either be applied by spot spraying individual plants or by a continuous spray over an entire area. A non-selective herbicide (such as glyphosate) should only be used if spot spraying. Avoid using soil-active herbicides (such as dicamba) near windbreak plants or other desirable woody vegetation. Plant injury or death can occur. Also, do not allow any herbicide to drift onto desirable vegetation for the same reasons. From time to time, if possible, alternate the herbicide (active ingredient) applied to the noxious weed infestation. This will help to prevent the weeds from developing chemical resistance.

When using a foliar spray, be sure to get good spray coverage of the plants. All of the leaves should have herbicide contact. The sprayed plants should be obviously wet, but not dripping with herbicide. If a surfactant is indicated the herbicide label, it should be mixed as directed with the herbicide. Surfactants help herbicides do their job by reducing the surface tension of liquids between two liquids or a solid leaf. Calibrate the sprayer to the recommended application rate.

Chemical sources in the Pueblo area include agriculture coops and agriculture retailers such as Big R and American Fertilizer Company in Pueblo. Herbicide spraying subcontractors in the area include Chem-Way and Colorado Vegetation Management.

BASIC MECHANICAL CONTROL GUIDELINES: Clean the mowing equipment to remove seeds and vegetative plant parts with a pressure washer before and after mowing operations. This is especially important when mowing flowering plants. To limit any spreading of weeds, do not clean equipment in un-infested areas or near roadways or streams.

Some flowering plants and their cut-off flower heads can still develop viable seeds. If the plants have already bloomed when you cut or pull them, it is important to properly dispose of them. Put them in a garbage bag, make sure bags are securely closed, and send them to a landfill. Generally, it is okay to mow one week after spraying. Mowing should not be done immediately following applications to allow the sprayed plants time to absorb the herbicide into their systems

BIOLOGICAL CONTROL GUIDELINES: Biological controls or insects are a good option for larger infestations. Once established, insects tend to persist and provide control for many years. Biocontrol agents are affected by the environment and climatic/cultural conditions. Information

is available at the Palisade Insectary, Colorado Department of Agriculture (phone 970-464-7916).

REVEGETATION GUIDELINES: Disturbed soil and bare ground are prime habitats for weed invasions. A healthy native plant community will help keep noxious weeds under control by providing competition. Grass seeding takes place in the fall with follow up over seeding the spring as required to establish a healthy stand of vegetation. Seed will be planted by broadcast seeding, native grass seed drill or hydro seeding depending on the area. The operator will use DRMS approved reclamation seed mixture per the reclamation plan and permit.

MINING PLAN

EXHIBIT C

(1) 6' Top Soil
6' Rock
6' Sand Part

(2) 4' Top Soil
17" Small Rock - Sand

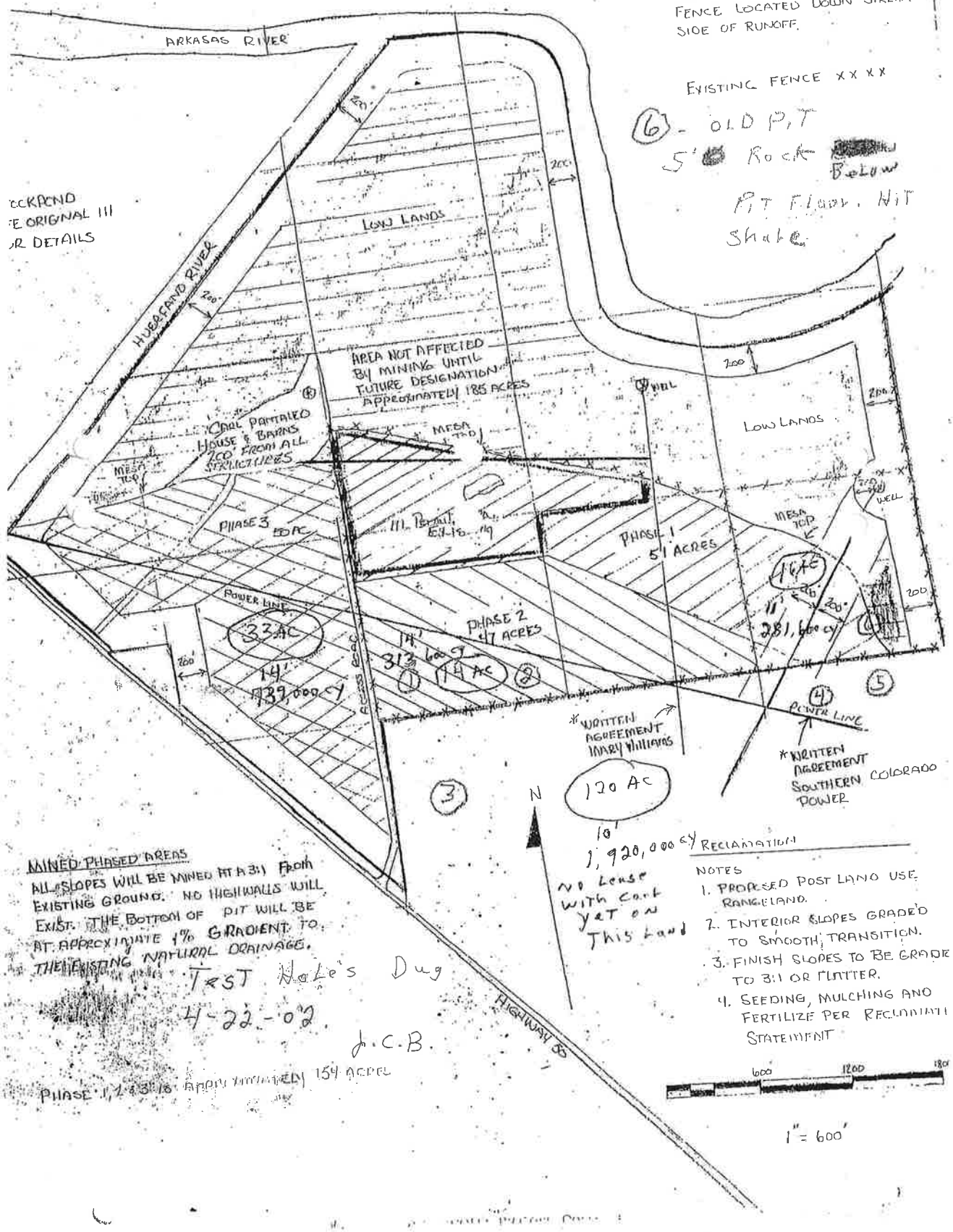
(3) 11' Sand - Some Rock

(4) 5' Top Soil
12' Sand - Small Rock

(5) 1' Top Soil
13' Sand - Rock

EROSION CONTROL

SEDIMENT BASINS WILL BE CONSTRUCTED IN ALL NATURAL DRAINING LOCATIONS WATER WILL BE ALLOWED TO FLOW OVER BASINS AND INTO SILT FENCE LOCATED DOWN STREAM SIDE OF RUNOFF.



No Lease with Coal yet on This Land

MINED PHASED AREAS

ALL SLOPES WILL BE MINED AT A 3:1 FROM EXISTING GROUND. NO HIGHWALLS WILL EXIST. THE BOTTOM OF PIT WILL BE AT APPROXIMATE 1% GRADIENT TO THE EXISTING NATURAL DRAINAGE.

TEST Holes Dug

4-22-02

J.C.B.

PHASE 1, 2 & 3 IS APPROXIMATELY 154 ACRES

RECLAMATION

NOTES

1. PROPOSED POST LAND USE RANGELAND.
2. INTERIOR SLOPES GRADED TO SMOOTH TRANSITION.
3. FINISH SLOPES TO BE GRADE TO 3:1 OR FLATTER.
4. SEEDING, MULCHING AND FERTILIZE PER RECLAMATION STATEMENT

600 1200 1800

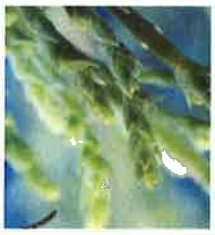
1" = 600'

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 racimes.
2. Leaves are small and scaly.

Updated on:
07/2015

Saltcedar Identification and Management

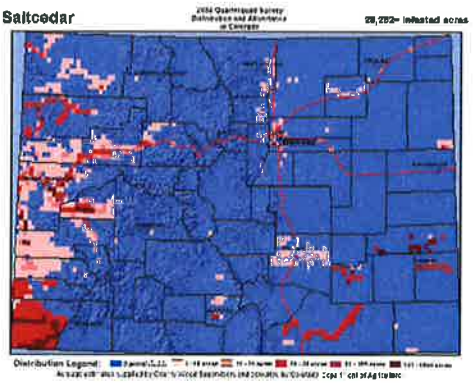
Identification and Impacts

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.

Management Recomendations

http://www.colorado.gov/ag/csd

Saltcedar

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.

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 basil 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		

Colorado State University

CDA CO

Musk Thistle Identification and Management

List B

© Bruce Ackley, OH State University

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.

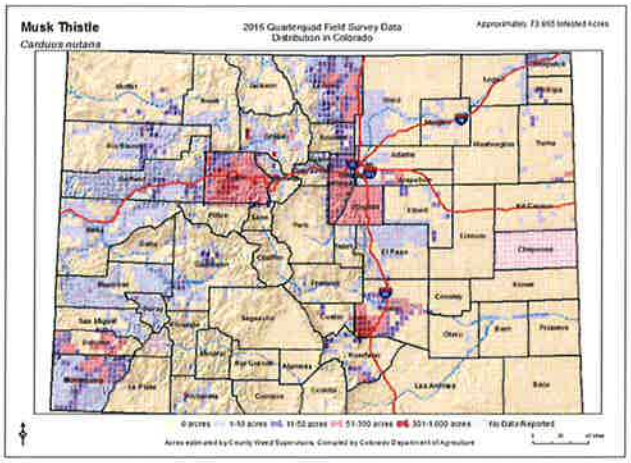
Musk thistle can grow up to 6 feet tall. The leaves have spines, are waxy, and dark green in color with a prominent light green to white midrib that can be seen from a distance. Leaves are dentately lobed; leaf bases sometimes extend down below the point of attachment. The terminal flower heads are purple, 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 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 flowerheads. Seeds remain viable in the soil for up to about 14 years. Seeds can germinate and emerge from spring through fall.

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 pasturs 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.

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/co-weedcontacts for details.

2015 Quarter Quad Survey



© Chris Evans, University of IL

© Les Mehrhoff, DiscoverLife.org

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.

Musk thistle

Carduus nutans L.

List B

Integrated Weed Management Recommendations

Musk thistle
Carduus nutans L.

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 indireclty 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.

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

Rev. 11/16

Canada Thistle Identification and Management

List B

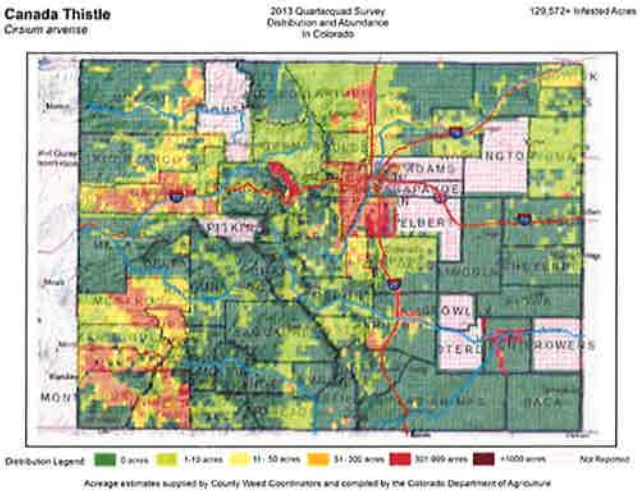
Canada thistle (*Cirsium arvense*) is a non-native, deep-rooted perennial that spreads by seeds and aggressive creeping, horizontal roots called rhizomes. Canada thistle can grow 2 to 4 feet in height. The leaves are oblong, spiny, bright green, and slightly hairy on the undersurface. Unlike other noxious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

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

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

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

2013 Quarter Quad Survey



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.

Canada thistle

Cirsium arvense

List B

Canada thistle

Cirsium arvense

Integrated Weed Management Recommendations

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

CULTURAL

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

BIOLOGICAL

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

MECHANICAL

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

CHEMICAL

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

Herbicide	Rate	Application Timing
Aminopyralid* (Milestone)	5-7 oz. 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		

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305 Interlocken Parkway
Broomfield, CO 80021
(303) 869-9030
www.colorado.gov/ag/weeds

Updated:
07/2015

Common Teasel Identification and Management

List B

© 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.

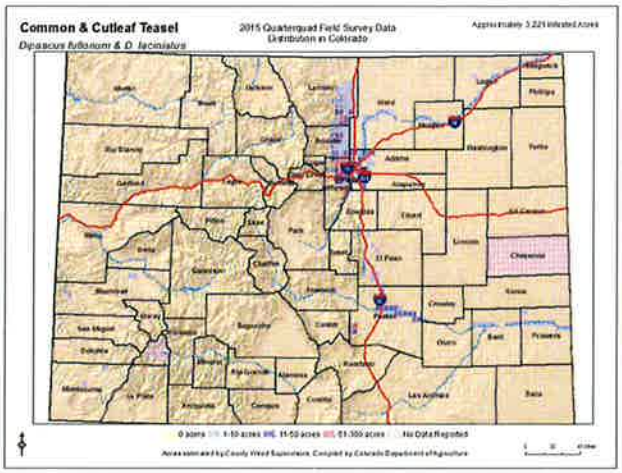
Flowers are range from white to violet. The flower head is generally egg-shaped, with a square base. The long thin stiff floral bracts at the base of the inflorescence are generally longer than the flower head; these also have prickles. It flowers from April to September. This species reproduces by seed.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

2015 Quarter Quad Survey



© Steve Dewey, UT State University, Bugwood

© Chris Evans, IL Wildlife Action Plan

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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.

Common teasel

Dipsacus fullonum L.

List B

Integrated Weed Management Recommendations

Common teasel

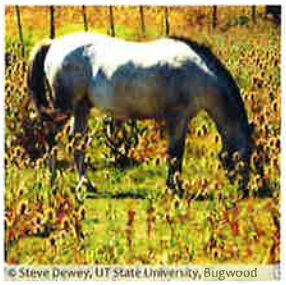
Dipsacus fullonum L.

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 indirecIty 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
Broomfield, CO 80021
(303) 869-9030
www.colorado.gov/ag/weeds

Rev. 11/16

Hoary cress

Colorado Department of Agriculture

305 Interlocken Pkwy
Broomfield, CO 80021

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

Hoary cress
Identification and Management

Identification and Impacts

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

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

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.

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,

Updated on: 07/2015

Cardaria draba

Hoary cress

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

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

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

Integrated Weed Management:

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

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		

Top to bottom photos, © R. Old, XID Servisces; A. Sparks Jr., University of Georgia; and Kelly Uhing

Colorado State University

CDA CO

Perennial pepperweed

Colorado Department of Agriculture

305 Interlocken Pkwy
Broomfield, CO 80021

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

Key ID Points

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

Updated on: 07/2015

Perennial pepperweed Identification and Management

Identification and Impacts

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

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

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

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

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

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

Photos courtesy of Kelly Uhing, Colorado Department of Agriculture.

Lepidium latifolium

Perennial pepperweed

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

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

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

Integrated Weed Management:

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

HERBICIDES

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

Herbicide	Rate	Application Timing
Chlorsulfuron* (Telar)	1 oz. product/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.

Russian Knapweed Identification and Management

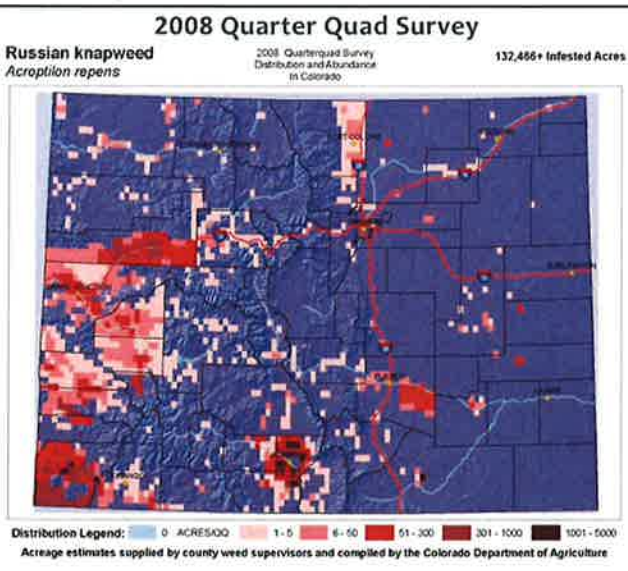
List B

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

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

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

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



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


Black, scaly root

Key ID Points

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

Russian knapweed

Acroptilon repens

List B

Integrated Weed Management Recommendations

Russian knapweed

Acroptilon repens

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 feet) over 3 years can kill much of the root system.

CHEMICAL

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

Herbicide	Rate	Application Timing
Aminopyralid* (Milestone)	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		

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

Updated:
07/2015

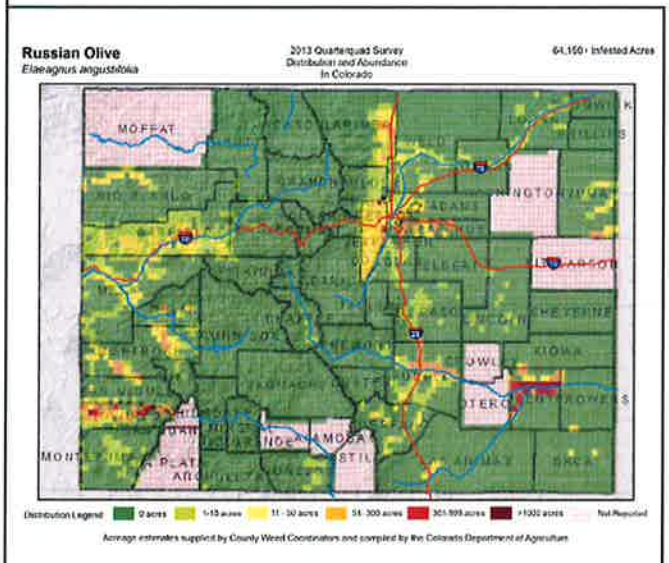
Russian Olive Identification and Management

List B

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

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

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



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

© Patrick Breen, OSU

© Patrick Breen, OSU

Key ID Points

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

Russian olive

Elaeagnus angustifolia

List B

Integrated Weed Management Recommendations

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

Russian olive
Elaeagnus angustifolia


© John Randall, TNC

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.


© James Miller, USFS

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.


© Chris Ness, Adams County

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.


© Scott Peterson, USDA

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 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; 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 basil 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		

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