



Taos Land Trust

Invasive Species Management Plans

This document is a guide to the invasive plants and trees present on the Rio Fernando Park property. It has information regarding the identification of each species and the impact that each species has on surrounding ecosystems. Then, there are feasible treatment plans listed for each species. This is not an exhaustive list of all of the possible eradication methods for each species, but it is robust enough to guide the Taos Land Trust staff and other community members in their management efforts. This document cites all resources used and all image sources.

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August 2018**

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Common Burdock (*Arctium minus*)

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Characteristics:

Common burdock is a biennial, so it completes its lifecycle in two years. The second-year burdock plants begin to bloom sometime between June and September, and the seeds germinate in early spring. Common burdock is easy to identify. Common burdock has a crown stem close to the ground and a dense basal rosette the first year, and a branched, hairy, and grooved stem that reaches between two and six feet tall the second year. The flower heads are 1.5-3 centimeters in

diameter with small and red-violet colored flowers. The flowers are surrounded by hooked bracts that later form brown burs about 1.4 centimeters in diameter.

Impact:

Common burdock is not considered a noxious weed in the state of New Mexico. However, as more farmers have adopted no-till farming, this plant is becoming more important and can cause economic yield losses if not controlled. The value of wool is reduced when the dry heads of the plant cling to the coats of animals, and if cows eat large quantities of it, the plant gives a bitter taste to the milk. The plants also cause powdery mildew and root rot. The bristles of the plant may cause localized allergic reactions for some individuals.

Treatment Plan:

Burdocks are biennial, so you must remove them in their first year so that they cannot go to seed and spread farther. Start your efforts in early spring, when the plants are still small.

1. Physical Control

a. Manual Methods

- i. Use hand pulling, plowing, and digging to remove the plants in their early stages.
- ii. Removal method: Grasp the stalk of the burdock near the soil level and pull slowly and evenly to remove the long root from soil. If the root breaks, use a shovel or spade to dig down to the bottom of the root and remove it. The root often pulls free of the soil easily when the soil is wet. For small plants a dandelion digging tool will be effective; other tools intended to remove garden and lawn weeds will also work on young



The second-year rosette getting ready to send up a stock.



The burs that form after the flowering cycle has ended. These burs are how the burdock plants spread their seeds.

burdocks. For larger individuals try a sharpened shovel or Parsnip Predator.

- iii. Tip: Burdock roots may reach 1 to 2 feet long, so make sure you get the whole root.

b. Mechanical Methods

i. Mowing

1. Mow or cut the burdock plants to the soil level frequently.
 - a. Cut or mow after the plants have bolted, but before the flowers are fully open.
 - b. This reduces the number and size of leaves on burdock plants.
2. Only mow the first-year plants
 - a. Mowing the plants that have gone to seed will just spread the seeds and result in new growth.

ii. Tillage/ Cultivation

1. Tilling is not an effective method for controlling common burdock, but thorough cultivation should kill most burdock plants.
 - a. Why? Because cultivation is loosening the top few inches of soil to optimize the retention and penetration of air, water, and nutrients. While tilling is basically deeper cultivation, which causes more disturbance to the soil and allows the burdock seeds to germinate (Mantis).
 - b. Read more at: <https://mantis.com/cultivating-the-soil-why-its-important-and-how-it-differs-from-tilling/>
- iii. For plants that have already gone to seed, clip the seed heads off and remove them from the site to reduce the establishment of new plants.
 1. Collect the seeds in a bag or box, then burn the seeds to prevent the spread

c. Prescribed Fire

- i. Prescribed burning is not an effective method for controlling common burdock, because it will only cause damage to the landscape and will not kill the undesired plants.

d. Flooding

- i. Flooding is not an effective method for controlling common burdock, because it will only cause damage to the landscape and will not kill the undesired plants.

2. Cultural Control

a. Prevention

- i. Prevent the establishment of other weeds after removing burdock by establishing a diverse mix of native species by seeds or plugs.
 1. Suggested: wild geranium (*Geranium maculatum*), wild columbine (*Aquilegia canadensis*), Jacob's ladder (*Polemonium reptans*), solomon's seal (*Polygonatum biflorum*), starry false solmon's seal

(*Smilacina stellata*) and golden alexanders (*Zizia aurea*) can be planted in shade or sun to replace burdock wherever it is found.

- ii. Make sure to clean off machines, clothes, and animals to avoid spreading the seeds.

3. Biological Control

a. Grazing

- i. Grazing is not an effective method for controlling common burdock, because burdock is notorious for causing problems with livestock.

b. Classic Biological Control Methods

- i. There are thirteen insect species which attack the common burdock plant. However, Burdock moth (*Metzneria lappella*) is the only one that has been reported in North America.

4. Chemical Control

a. Suggested herbicides:

- i. 2,4-D, MCPA, 2,4-DB, dicamba, and Glyphosate.

b. Spray the first-year rosettes of foliage with a ready-to-use herbicide containing 2,4-D in spring when the plants are young.

i. Tips:

1. Use a broadleaf herbicide that can move down into the root. Don't use too much herbicide, because it will just kill the leaves and won't spread down to the roots.
2. Watch for new growth and repeat the application, if necessary. New growth may appear from the roots, but repeated applications of herbicides are effective against burdock.

c. For more information on suggested herbicides, application methods, and restrictions, go to:

- i. <https://fyi.uwex.edu/weedsci/1997/11/02/common-burdock/>
- ii. <http://goodoak.com/info/weeds/burdock.pdf>
- iii. <https://www.canadiancattlemen.ca/2016/12/06/beating-back-burdock/>
- iv. <http://homeguides.sfgate.com/eradicate-burdock-arctium-minus-22029.html>

Field Bindweed (*Convolvulus arvensis*)

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Characteristics:

Field bindweed is a perennial herb, which flowers from April through October. Field bindweed spreads by both the root system and seeds. The first true leaves on a bindweed seedling are arrowhead shaped and have petioles (leaf stems) that are flattened and grooved on the upper surface. Mature field bindweed plants have arrowhead-shaped leaves that can be 0.5 to 2 inches long. The flowers are trumpet shaped, white to pink, and 1 to 1.5 inches wide. Field bindweed is often found climbing another object for support, but mostly grows along the ground.



A close-up of field bindweed showing the flowers and leaves.

Impact:

Field bindweed is considered a Class C noxious weed in the state of New Mexico, and it is one of the most persistent and difficult-to-control weeds in landscapes and agricultural crops. It has a vigorous root and rhizome system that makes it almost impossible to control with cultivation between desirable plants or broad scale tillage alone; in fact, it often spreads the infestation. Its seed has a long dormancy and can last in soil for up to 50 years. It has a climbing habit that allows the plant to grow up. In addition, rhizomes can penetrate through fabric, plastic, and other barriers. Field bindweed also is very drought tolerant and once established is difficult to control even with herbicides. If field bindweed is present, land is devalued and the weed precludes planting of many vegetable crops.



A small patch of field bindweed.

Treatment Plan:

Effective control of field bindweed requires prevention of seed production, reduction of stored carbohydrates by deep tillage of the root system, competition for light from other plants, and constant vigilance in removing top growth. Controlling field bindweed requires attention all year round, but certain methods work better at certain times of the year. To manage field bindweed, use a combination of the following methods:

1. Physical Control
 - a. Manual Methods
 - i. Repeated hand pulling or grubbing prior to seed-set.
 - b. Mechanical Methods
 - i. Mowing
 1. In turf grass areas, mowing can be used to reduce the vigor of field bindweed, but not to eradicate it completely. Mowing misses stems lying flat as well as low leaves and flowers, and the plants

can reproduce. Mowing is effective only when combined with other control methods such as herbicide treatment.

ii. Tillage/ Cultivation

1. Field bindweed control by tillage requires 3 to 5 years of consistent, frequent tillage.
2. Suggested method: After harvest, plow 6 inches deep, then 12 days after the plants re-emerge, perform a tillage operation with an implement that cuts off all the plants such as a rod weeder or a sharp, duckfoot-type field cultivator. Make an adequate overlap of the sweeps every 14 days until the bindweed shoots are killed by freezing. Cultivate no deeper than necessary to completely cut off all the shoots, usually 2 to 4 inches. Resume tillage in the spring 12 days after the bindweed emerges. Repeat this tillage operation every 14 days until bindweed no longer appears.

iii. Landscape fabrics

1. Use landscape fabrics – such as polypropylene and polyester and other mulches such as black plastic or cardboard – to block sunlight from the field bindweed and prevent growth. Complete death of the plant under the mulch makes 3 to 5 years, and there must be no access to light from holes in the fabric, or else the plants will continue to grow.

c. Prescribed Fire

- i. Removal of all field bindweed top growth by burning can eliminate all but the weed seed if repeated at least every 14 days over 3 to 5 years. Burning is most effective in the summer.

d. Flooding

- i. Flooding is not an effective method against field bindweed. In fact, withholding water to dry the site might help to reduce the perennial population in a summer season, assuming the roots have not tapped into deep moisture.

2. Cultural Control

- a. Implement and maintain healthy stands of native vegetation as a competitor for field bindweed.
 - i. Use native vegetation to create shade to reduce field bindweed growth. Alfalfa, cereal grains, sorghums, and corn, along with shade from shrubs and trees significantly reduce field bindweed growth.
- b. Take preventative measures to reduce the spread of field bindweed.
 - i. Purchase and plant clean seed and ornamental stock, remove any seedlings before they become perennial plants, and prevent any plants from producing seed.

3. Biological Control

- a. Grazing

- i. Grazing is not a successful method for managing field bindweed. Field bindweed provides very little green summer forage, as sheep and cattle generally avoid it.
 - b. Classic Biological Control Methods
 - i. Bindweed gall mite
- 4. Chemical Control
 - a. Suggested Herbicides
 - i. 2,4-D, Chlorsulfuron, Dicamba, Fluroxypyr, Glyphosate, Imazapyr, Isoxaben, Metsulfuron methyl, and Triclopyr
 - ii. For more information on the use of herbicides on field bindweed in specific land areas, go to:
<http://ipm.ucanr.edu/PMG/PESTNOTES/pn7462.html#ipmpagetop>
- 5. Even after the visible infestations are managed, make sure to watch for new infestations from remaining seeds, which can survive up to fifty years in the soil.

Cheatgrass (*Bromus tectorum* L.)

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Characteristics:

Cheatgrass is an annual or winter annual (biennial) weed that germinates in late fall or early spring. As a seedling or young plant, cheatgrass is bright green with hairy blades and a dense, drooping seed head. Maturing foliage and seed heads are purplish in color that later change to brown and tan colors when dried out. The seed stocks grown between four and thirty inches tall, and the grass has twisting leaf blades covered with rough hairs.



Cheatgrass seed heads in the immature stage.

Impact:

Cheatgrass is considered a Class C noxious weed in the state of New Mexico. The grass is an aggressive invader of sagebrush, pinyon-juniper, ponderosa pine, mountain brush, and other rangeland and forest communities. Its ability to rapidly grow and reproduce before most native grasses makes it especially troublesome on rangelands, croplands, and pastures. Cheatgrass can alter the normal fire pattern in vegetated areas when its populations become dense and dominant. After wildfire, cheatgrass thrives and can out-compete native herbaceous and shrubby seedlings such as antelope bitterbrush. The presence of cheatgrass with its fawned seed can diminish recreational opportunities, reduce available forage, degrade wildlife diversity and habitat, and decrease land values.



Cheatgrass seed heads as they mature. The seed heads mature right to left, with the leftmost seed head being the oldest and most mature.

Treatment Plan:

Before beginning the eradication process, examine infestation sites and determine if native grasses will return naturally after the removal of cheatgrass, or if reseeding is necessary. Management efforts should be focused in the early spring and fall, since the seeds germinate in early spring/ late winter, and the roots grow rapidly throughout the winter. Use an adaptive approach that allows for adjustments to be made, and use a combination of the following methods:

1. Physical Control
 - a. Manual Methods
 - i. Hand pull, cut, or dig the grass out
 1. Before seeds are produced; about one week after flowering
 2. Extract as much of the root as possible
 3. Repeat for several years to reduce seed bank reserves
 - b. Mechanical Methods

- i. Mowing
 - 1. Repeated mowing every 2 to 3 weeks in the spring and summer may be effective
 - ii. Tillage/ Cultivation
 - 1. Tilling/ cultivation is not an effective method for controlling cheatgrass, therefore it is not suggested.
 - 2. However, when repeatedly done, disking or tillage operations may be effective if cheatgrass seed is buried 4 to 6 inches deep.
- c. Prescribed Fire
 - i. Prescribed burning is not an effective method for controlling cheatgrass, because fire often leads to a displacement of native desirable plants and an increase in cheatgrass density and dominance.
 - ii. However, prescribed burning can be used in certain areas with mixed shrub and grasses during late spring to early summer.
 - 1. If prescribed burning is used, combine it with chemical control or reseeding.
- d. Flooding
 - i. Flooding is not an effective method for controlling cheatgrass, as it will just cause damage to the landscape without killing the undesired plants.
- 2. Cultural Control
 - a. Educate land managers, local public, and road crews on how to identify cheatgrass, and discourage humans, vehicles, and animals from travelling through infested areas.
 - b. In cultivated fields, crop rotation is widely used as a means of reducing cheatgrass. In some cases, reseeding with desirable native perennials may be necessary after cheatgrass control.
- 3. Biological Control
 - a. Grazing
 - i. Graze while the cheatgrass is green during the spring and again in the fall by using a high intensity, short duration approach.
 - 1. A reduction in seed production is possible if grazing is practiced twice per year for 2 consecutive years
 - 2. Cheatgrass provides good quality forage for about 6 to 8 weeks early in the season, which is also the optimal time to graze.
 - ii. Do not have animals graze in late spring and summer, because it can have negative effects on livestock.
 - b. Classic Biological Control Methods
 - i. There are currently no biological control agents that have been approved by USDA for use on cheatgrass.
- 4. Chemical Control
 - a. Herbicides approved for use on cheatgrass are usually best applied in fall or early winter before soils are frozen.
 - i. In the fall, apply between the first light frost and the first heavy frost.
 - ii. Stop application after the first heavy frost.

- iii. Herbicide treatments are less efficient in the spring.
- b. Suggested:
 - i. All options either cannot be used along streams and rivers, kills desirable vegetation, cannot be used on rangelands, cannot be used in crop areas, will kill native plants, or have grazing restrictions.
 - c. For more information on suggested herbicides and application methods, go to:
https://www.riversedgewest.org/sites/default/files/resource-center-documents/Field_Guide_Mgmt_Cheatgrass.pdf
- 5. Make sure to clean off machines, clothes, and animals to avoid spreading the seeds.
- 6. Repeat treatments for at least 3 years to deplete the seed bank.

Hoary Cress (*Cardaria draba*)

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Characteristics:

Hoary cress is a perennial weed that begins its life cycle in the fall with seed germination and seedling establishment. Seedlings overwinter as rosettes, then the plant blooms in late April and usually grows from 10 to 24 inches tall. It has both basal and stem leaves that are grayish to bluish green, arrowhead shaped, with smooth and sometimes finely toothed edges, and a covering of soft white hairs. The flowers are white and have four petals and six stamens. The root system consists of a vertical taproot with a mesh of lateral roots, and the seeds that the plant reproduces by are viable in the soil for up to three years.

Impact:

Hoary cress (aka “whitetop”) is considered a Class A noxious weed in the state of New Mexico. Whitetop produces low quality forage, and dense infestations can crowd out desirable plants and reduce animal diversity. The foliage contains glucosinolates, which are toxic to cattle and decompose into allelopathic compounds that can impede germination and growth of desirable plants.

Treatment Plan:

Whitetop management will likely require several consecutive years of treatment with an integrated approach to reduce its impact to the plant community. Before starting any treatment, consider that more than one control method may be needed for a site.

1. Physical Control

a. Manual Methods

i. Hand pulling and digging can be done on small infestations.

1. Completely remove the plants within the first ten days of weed emergence throughout the growing season. Repeat for 2 to 4 years.
2. Growing season: Whitetop begins its life cycle in the fall with seed germination and seedling establishment, and the weed blooms by late April. However, if conditions are right, it will flower and produce a second crop of seeds later in the summer.



Hoary Cress full plant.



Close-up of hoary cress stem and flower structure.

- ii. Dig out the entire root system before seeds form. Then, dispose of the plant debris by burning or bagging and throwing out.
 - b. Mechanical Methods
 - i. Mowing
 - 1. By itself, mowing is not recommended as it can contribute to further spread and increased densities of whitetop
 - 2. Combine mowing with the application of herbicides.
 - a. Mow whitetop early in the growing season when it is at flower bud stage. Allow the shoots to re-sprout and then apply herbicide when plants again reach flower bud stage.
 - ii. Tillage/ Cultivation
 - 1. For plants:
 - a. Till plants below the depth of lateral and vertical roots, and plan to repeat cultivation shortly after new shoots emerge.
 - b. Till every 10 to 15 days for 6 to 8 weeks during the growing season, then follow by less frequent tillage.
 - c. Repeat for at least 2 consecutive years.
 - 2. For seedlings:
 - a. Use initial deep cultivation followed by repeat cultivation at a 4 to 6-inch depth every 5 to 10 days during the growing season.
 - b. Repeat for 2 to 4 consecutive years.
 - c. Prescribed Fire
 - i. Prescribed burning is not an effective method for controlling hoary cress.
 - 1. 75 percent of whitetop's total biomass is below ground, so populations rebound rapidly following fire.
 - ii. However, burning is an acceptable means to dispose of plant debris.
 - d. Flooding
 - i. When feasible, flooding an area with 6 to 8 inches of water for 2 months can be an effective control method.
2. Cultural Control
- a. Reseed with competitive, desirable plants.
 - i. Ex: alfalfa
 - b. Containment/Prevention
 - i. Use containment to prevent spread.
 - 1. Give priority to small infestations on otherwise healthy sites.
 - 2. Give second priority to infestations in corridors with a high likelihood for spread, such as waterways and irrigation structures.
 - 3. Focus on well-establish or large infestations last.
 - ii. Refrain from driving vehicles and machinery through infested areas during seeding, wash the undercarriages of vehicles and machinery, animals, and clothes before leaving infested areas, **keep livestock from**

grazing during flowering and seed set, and avoid whitetop patches during cultivation.

3. Biological Control

a. Grazing

- i. Although palatability is low, goats and sheep will graze whitetop from rosette until the early flowering stage.
- ii. Whitetop reportedly is toxic to cattle if consumed in great enough quantity, but livestock generally make very little use of this weed.

b. Classic Biological Control Methods

- i. There are currently no classical biological control agents approved by USDA for management of whitetop.

4. Chemical Control

a. Spray when the plant is still a rosette

- i. Early spring and late fall

b. Suggested herbicides:

- i. Milestone, 2,4-D, Escort, Telar, Tordon, or Weedmaster
- ii. For more information on herbicide recommendations, restrictions, and specific applications, go to:

- 1. https://www.riversedgewest.org/sites/default/files/resource-center-documents/Field_Guide_Mgmt_White_Top.pdf
- 2. https://www.nwcb.wa.gov/images/weeds/hoarycresswhitetop_Lincoln.pdf

c. The use of a good, penetrating MSO or silicone surfactant is essential since the leaves are covered with soft, white hairs.

d. For extensive and dense infestations, use ground or aerial broadcast spraying. For sparse infestations, use backpack or hand-held sprayer.

Hound's Tongue (*Cynoglossum officinale* L.)

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Characteristics:

Hound's tongue is a biennial plant. Its seedlings emerge in both the spring and autumn and the rosettes bolt in the second year. The reddish-purple flowers bloom May through July, have five petals, and hang in small clusters from panicles. Each flower produces four barbed nutlets about 7 millimeters long. Hound's tongue produces a woody taproot, but it only reproduces by seed. All parts of the plant are covered with bristly hairs. Its stems are erect, usually branched in the upper portion, and grow up to 1.5 meters tall. Its leaves have distinct veins, smooth margins, pointed tips, can be up to 30 centimeters long. Rosette leaves are broader than stems, but become smaller, lance-shaped, alternate, and clasp the stem on bolting plants.

Impact:

Hound's Tongue is not considered a noxious weed in the state of New Mexico. However, hound's tongue is a common weed of rangeland and spreads locally attached to the fur of livestock. It can rapidly establish, forming dense populations that displace native plant species and hinder the re-establishment of valuable range species, thereby decreasing availability of forage to wildlife and livestock, and it is poisonous to livestock if ingested. Once the seeds cling to animals, they are very hard to remove which can lower the value of wool and can cause irritation and behavioral problems in cattle.

Treatment Plan:

Hound's tongue, like burdock, is biennial so it is important to remove plants in the first year before they go to seed. The best method for controlling hound's tongue is a combination of the following methods:

1. Physical Control
 - a. Manual Methods
 - i. Hand-pull the plant out
 1. Hand-pulling is very effective but in harder soils the root will break off, resulting in re-sprouting. Instead, the root can be severed below ground level with a knife or shovel and re-sprouting should not occur.
 2. Do this before the plants go to seed, to prevent spreading.



Second-year hound's tongue rosette.



Close-up of hound's tongue flowers. Notice the hairy appearance of the leaves; this is a good way to identify hound's tongue.

- ii. Cut the young rosettes below the crown in autumn or early spring
 - 1. This will reduce seed production and flowering
 - iii. Mow or clip the second-year plants before seeds are formed to reduce seed production.
 - 1. Burn the seeds if possible to prevent spread.
 - iv. Since hound's tongue seeds last 2-3 years on the surface after leaving the plant, composting the already flowered plants is not suggested.
 - b. Mechanical Methods
 - i. Mowing
 - 1. Mow the plants before flowering to prevent them from growing taller and to prevent seed production.
 - a. Mow flowering stems close to the ground
 - b. Do not mow after they flower, or the seeds will spread
 - ii. Tillage/ Cultivation
 - 1. Tillage and cultivation, along with other physical methods such as hand pulling, can be effective if done cautiously.
 - 2. Cultivation is more effective, since less of the soil is disturbed than while tilling.
 - a. Cultivation of young rosettes in the autumn or early spring gives effective control.
 - c. Prescribed Fire
 - i. Prescribed burning is not an effective method for controlling hound's tongue, as it will just cause damage to the landscape without killing the undesired plants.
 - d. Flooding
 - i. Flooding is not an effective method for controlling hound's tongue, as it will just cause damage to the landscape without killing the undesired plants.
- 2. Cultural Control
 - a. Prevention
 - i. Make sure to clean off machines, clothes, and animals to avoid spreading the seeds.
 - ii. Maintain you land in a healthy, vigorous condition to ensure a productive plant community; competitive perennial grasses and forbs utilize water and nutrients that would otherwise be readily available to hound's-tongue.
- 3. Biological Control
 - a. Grazing
 - i. Grazing is not an effective method to control hound's tongue.
 - 1. Hound's tongue is poisonous to livestock.
 - b. Classic Biological Control Methods

- i. Suggested:
 - 1. *Erysiphe cynoglossi*
 - 2. A weevil – *Mogulones cruciger*
 - 3. A beetle – *Longitarsus quadriguttatus*
 - 4. *Phoma pomorum*
 - ii. For more information on classic biological control methods, go to:
 - 1. <https://extension.wsu.edu/whitman/2013/11/houndstongue/>
- 4. Chemical Control
 - a. Use herbicides when the plants are about 28 cm tall.
 - b. Suggested:
 - i. Picloram
 - ii. Dicamba
 - iii. Chlorsulfuron
 - iv. 2,4-D amine
 - c. For more information on herbicide suggestions and applications, go to:
 - i. <https://extension.wsu.edu/whitman/2013/11/houndstongue/>
 - d. Note: Some viable seed can still develop from a flowering plant sprayed with herbicide. Herbicide treatment should be restricted to rosettes and bolting plants be pulled and disposed of.

Knapweed, Russian (*Rhaponticum repens* L.)

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Characteristics:

Russian knapweed is a creeping perennial that flowers from June to September. The flowers are terminal, urn-shaped, 0.25-0.5 inches in diameter, and a pink to lavender color. Grayish-green rosettes emerge in early spring and grow into erect branching stems that are 18-36 inches tall. Russian knapweed is distinguishable by its scaly, brown to black, spreading rhizomes and flowering bract features. Each plant produces 50-500 seeds that are viable for 2-3 years each.

Impact:

Russian knapweed is considered a Class B noxious weed in the state of New Mexico. Not only is it toxic to livestock, it reduces forage availability and leads to a decline in species diversity. Russian knapweed stands develop into monocultures and outcompetes native vegetation. Russian Knapweed readily invades pastures, degraded croplands, alfalfa fields, rangeland, roadsides, riparian areas, river bottoms, drainages, and irrigated fields. The plants have a creeping, perennial root system, so it spreads through both seeds and advantageous buds. In addition, Russian knapweed releases allelopathic chemicals that inhibit the growth of other plants. This makes re-vegetation efforts very difficult.

Treatment Plan:

Successful Russian knapweed control comes from a combination of the below techniques. This involves long term planning and monitoring. Some keys to controlling Russian knapweed are timing of treatments and stressing the plant enough to deplete stored energy in the roots.

1. Physical Control
 - a. Manual Methods
 - i. Hand pulling or hoeing is effective for small populations in late spring when soil is moist. Make sure to pull all parts of the plant, especially the root. Dispose of plants by bagging or burning.
 - b. Mechanical Methods
 - i. Mowing
 1. Mowing is not an effective method for controlling Russian knapweed. Repeated mowing throughout the growing season will suppress shoots and flowers, but will not reduce Russian knapweed populations.



Close-up of Russian knapweed flower



Russian knapweed rosette. Note the difference between this and the spotted knapweed rosette, which has a more defined stem and leaf structure.

- ii. Tillage/ Cultivation
 - 1. Tillage/ cultivation is not an effective method for controlling Russian knapweed.
 - c. Prescribed Fire
 - i. Prescribed fire is not an effective method for controlling Russian knapweed, because new plants often grow rapidly from the roots and leads to increased Russian knapweed populations.
 - d. Flooding
 - i. Flooding is not an effective method for controlling Russian knapweed.
 - e. Light and moisture exclusion
 - i. Use straw, manure, sheet metal, paper, or plywood to exclude light and moisture. Keep completely covered or buried for at least one year.
 - f. Solarization
 - i. Use 4 mil (or thicker) clear plastic to cover the area. Start in the winter and keep covered for one year, making sure to mow the area if stems are taller than 4 inches and moisten the area before covering. Make sure sunlight hits the site for at least 10 hours per day.
2. Cultural Control
 - a. Prevention
 - i. Make sure to clean off machines, clothes, and animals to avoid spreading the seeds.
 - ii. Use weed screens on irrigated water intakes to prevent spread by irrigation canals.
 - b. Reseeding
 - i. Reseed with native perennial grass.
 - ii. Use tillage before reseeding to alleviate remaining allelopathic effects from Russian knapweed.
 3. Biological Control
 - a. Grazing
 - i. Animals may graze during early growth, in late summer, early fall, or winter. However, Russian knapweed is toxic to horses and has a bitter flavor, so many livestock animals will not be inclined to graze. Avoid heavy grazing.
 - b. Classic Biological Control Methods
 - i. Classical biological control agents have not been shown to reduce Russian knapweed populations, just weaken them. There are several species that are being studied to control Russian knapweed:
 1. Gall-forming nematode (*Subanguina picridis*)
 2. Gall-forming wasp (*Aulacidea acroptilonica*)
 3. Rust fungus (*Puccinia acroptili*)
 4. Chemical Control
 - a. Make sure chemical applications do not prevent the establishment of desirable vegetation through residual soil effects.
 - b. Suggested:

- i. Picloram
 - ii. Aminocyclopyrachlor
 - iii. Aminopyralid
 - 1. "Milestone"
 - iv. Clopyralid
 - v. Chlorsulfuron
 - vi. Glyphosate
 - c. For more information on suggested herbicides and application strategies, go to:
 - i. https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5410125.pdf
 - ii. <https://www.techlinenews.com/articles/2006/12/31/managing-russian-knapweed-on-western-rangelands-with-milestone-herbicide>
 - iii. <https://www.unce.unr.edu/publications/files/ho/2005/fs0551.pdf>
- 5. Use an adaptive management strategy over many years to restore desirable plant communities and control Russian knapweed.

Knapweed, Spotted (*Centaurea steobe* L.)

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Characteristics:

Spotted knapweed is a short-lived perennial or biennial. Rosette leaves grow up to eight inches long and two inches wide and have oblong lobes coming off of the center vein. Full grown stems are between 24 and 48 inches tall and branch off in the upper half. Flower heads are solitary or in clusters of 2-3 on the branch ends. There are 20-30 purple to pink flowers per flower head. Spotted knapweed produces only by seeds, but seeds are viable for eight or more years.

Impact:

Spotted knapweed is considered a Class A noxious weed in the state of New Mexico. Spotted knapweed grows into dense, impenetrable stands that can displace desired vegetation. Knapweeds distribute phytotoxins onto a site, causing native plants to appear to be sick and soils to seem barren. Spotted knapweed develops a symbiotic association with a soil fungus that can divert carbon from grasses. This reduces the ability of grass species to compete and may shift vegetative composition toward a knapweed monoculture (USDA).

Treatment Plan:

To manage spotted knapweed, use a combination of the following techniques. Include monitoring and follow-up treatment plans. Limiting disturbance and preventing further seed spread is necessary.

1. Physical Control
 - a. Manual Methods
 - i. Hand pull, dig, or hoe to remove plants in the early bolt stage before flowers go to seed. Make sure to remove the entire crown and as much of the taproot as possible. Repeat 2 to 4 times a year for at least three years, or until plants are no longer present.
 - b. Mechanical Methods
 - i. Mowing
 1. Mowing during the early vegetative and bolt stages can be effective. However, the mowing of mature plants could lead to further spread.



Spotted knapweed flower head



Spotted knapweed rosette

- ii. Tillage/ Cultivation
 - 1. Tillage is not recommended as it could encourage further spread.
 - c. Prescribed Fire
 - i. Prescribed fire is not an effective method for controlling spotted knapweed.
 - d. Flooding
 - i. Flooding is not an effective method for controlling spotted knapweed.
- 2. Cultural Control
 - a. Prevention
 - i. Make sure to clean off machines, clothes, and animals to avoid spreading the seeds.
 - ii. Use weed screens on irrigated water intakes to prevent spread by irrigation canals.
 - iii. Make sure to dispose of plant debris properly. Mulching and incinerating are acceptable before the flowering or seed set stages.
 - b. Reseeding
 - i. Reseed with native perennial grass.
- 3. Biological Control
 - a. Grazing
 - i. Use sheep, goats, or cattle for intense short-term grazing in the spring during early growth stages to reduce spotted knapweed populations.
 - b. Classic Biological Control Methods
 - i. These biological control agents alone will not eradicate knapweed populations, but may reduce them. Be sure to consult the USDA Animal and Plant Health Inspection Service (APHIS) about obtaining and transporting these agents:
 - 1. *Urophora affinis* (gall-forming fly)
 - 2. *Urophora quadrifasciata* (gall-forming fly)
 - 3. *Larinus minutus* (beetle/weevil)
 - 4. *Bangastemus fausti* (beetle/weevil)
- 4. Chemical Control
 - a. Spotted knapweed is best controlled with a selective, post emergent, broadleaf herbicide that is safe to use on native grasses. Some suggested herbicides are:
 - i. Picloram (+ 2,4-D)
 - ii. Aminocyclopyrachlor (+ chlorsulfuron or + metsulfuron methyl)
 - iii. Aminopyralid
 - iv. Clopyralid (+ 2,4-D or + triclopyr)
 - v. Dicamba (+2,4-D)
 - b. For more information on suggested herbicides and application strategies, go to:
 - i. https://plants.usda.gov/plantguide/pdf/pg_cest8.pdf
 - ii. https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5410116.pdf
- 5. At least three or more years of consecutive treatment are necessary to eradicate spotted knapweed.

Kochia (*Bassia scoparia*)

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Characteristics:

Kochia is a summer annual that germinates in the spring and throughout the summer and can grow up to more than four feet tall. Its foliage is generally grey-green and covered in soft hairs, with alternate, flat, and linear-lanceolate to lanceolate leaves. Kochia stems often appear reddish late on the season. It flowers in the late summer and early fall with spikes of inconspicuous flowers that lack petals. Kochia fruit have five thickened or knoblike lobes, or sometimes short, horizontal wings, less than 1 mm long and wide. Its fruits contain one horizontal seed and remain enclosed within the calyx.



Kochia plant growing wildly.

Impact:

Kochia is not considered to be a noxious weed in the state of New Mexico. However, kochia spreads rapidly and can form dense stands. Thick stands increase fuel loads and fire hazard, obstruct right-of-ways, and compete with desirable plants for limited resources. Kochia foliage contains mild toxins and nitrates and can be toxic to livestock in large quantities.



Close-up of a kochia plant stem.

Treatment Plan:

Management efforts should occur early in the spring before germination occurs, and throughout the spring and summer when the plants are small. The physical, biological, and chemical control methods listed below can be used and combined to prevent and eradicate kochia. Then, those methods should be followed by the revegetation methods listed under Cultural Control.

1. Physical Control
 - a. Manual Methods
 1. See Tillage/ Cultivation
 - b. Mechanical Methods
 - i. Mowing
 1. Mow smaller plants
 - a. Make sure all above ground tissue is removed.
 - b. Mow before flowering to prevent seed production.
 - c. On sites with high soil moisture, plants need to be mowed frequently to prevent regrowth.
 - ii. Tillage/ Cultivation
 1. Use tilling, hand hoeing, or any other physical pulling method on either smaller or larger plants

- a. Make sure to disrupt the contact between the plant roots and soil. AKA sever the root below the soil surface.
 - b. Shallow tillage will control emerged plants but often stimulates recruitment. Deep tillage can reduce populations by burying seed deep enough to prevent germination.
 - c. Prescribed Fire
 - i. Prescribed burning is not an effective method for controlling kochia, as it will just cause damage to the landscape without killing the undesired plants.
 - d. Flooding
 - i. Flooding is not an effective method for controlling kochia, as it will just cause damage to the landscape without killing the undesired plants.
- 2. Cultural Control
 - a. Revegetation Methods
 - i. Create a plant community/ environment that is resistant to invasion by these plants.
 - ii. Tips:
 - 1. Before replanting, check each site for soil type, soil fertility, current plant species present, depth to groundwater, historical precipitation amount, and timing of predominant precipitation.
 - 2. Before replanting, consider time of year, planting method, and availability of water for irrigation. Take advantage of anticipated summer rains.
 - iii. Examples of native plants:
 - 1. Grasses: blue grama, Indian ricegrass, western wheatgrass, four-wing saltbrush, plains bristlegrass, etc.
 - 2. Shrubs: honey mesquite, desert-willow, wolfberry, etc.
 - 3. Wildflowers: Mexican poppy, prairie flax, Mexican-hat, purple aster, tufted evening primrose, etc.
- 3. Biological Control
 - a. Grazing
 - i. Have animals graze on the younger plants
 - ii. Make sure to supplement the diet of animals that are grazing on the site, poisoning may occur if the animals eat only kochia
 - b. Classic Biological Control Methods
 - i. There are no known classic biological control methods for kochia known in the United States.
- 4. Chemical Control
 - a. Applications should be made when the plants are less than 4 inches in diameter for effective control. Often pre-and post-emergent herbicides are mixed together to provide control of established weeds and continual control of repeated flushes of seed germination later in the season.
 - i. Pre-emergent herbicides (applied before the seedlings emerge)

1. Isoxaben
 2. Oryzalin
 3. Pendimethalin
 4. Trifluralin
 - ii. Post-emergent herbicides (applied after the seedlings emerge)
 1. 2,4-D
 2. Dicamba
 3. Glyphosate
 4. Triclopyr
 - iii. For more information on suggested herbicides and application strategies, go to:
 1. http://wric.ucdavis.edu/information/natural%20areas/wr_B/Bassia_hyssopifolia-scoparia.pdf
 2. http://weeds.nmsu.edu/pdfs/Russian_thistle_and_kochia_homeowner.pdf
5. Intensely manage the plants for 2-3 years without seed production for local eradication.

Perennial Pepperweed (*Lepidium latifolium* L.)

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Characteristics:

Perennial pepperweed shoots emerge early in the spring and form a rosette that persists for several weeks. By middle to late spring, the plants produce an inflorescence of white, 4-petaled flowers. The seeds deteriorate after production, although new rosettes sometimes emerge in the fall in moist soils. The fruits are small, round to oval shaped, 2-chambered pods with two flattened seeds. Pepperweed grows between three and five feet tall, but can reach up to eight feet. It has rhizome-like creeping roots and multiple dull-gray-green and waxy roots. Pepperweed rosettes have ovate to oblong leaves, each 1-2 inches wide and 4-12 inches long. The leaves are sessile to lanceolate with smooth to jagged edges.



Perennial pepperweed rosette.

Impact:

Perennial Pepperweed is considered a Class B noxious weed in the state of New Mexico. Perennial Pepperweed resembles hoary cress (“whitetop”), however, pepperweed is considerably taller than hoary cress, and its upper leaves do not clasp the stem. Perennial pepperweed develops dense, monotypic stands that can reduce quality forage available for cattle and horses, degrade wildlife habitat, and lower diversity of flora and fauna species. The weed acts as a salt pump, i.e., it draws salt ions from deep within the soil profile and increases salinity near the surface, which can be disadvantageous for plants intolerant to salt.



Close-up of a perennial pepperweed flower.

Treatment Plan:

Early detection and proactive management in early spring and late summer is the best approach for controlling perennial pepperweed since well-established stands are difficult to control. Frequent monitoring is critical to locate new plants before they become established. If new infestations are discovered, plants should be removed immediately to prevent further spread. The best approach for controlling perennial pepperweed is combining the following control methods:

1. Physical Control
 - a. Manual Methods
 - i. The seeds are short-lived and do not germinate well, and the plants spread primarily by the root system. Therefore:
 - ii. Seedlings are easily controlled by hand pulling or digging
 1. Hand pull or grub small patches as they pop up.

- iii. Established plants regrow easily from deep set roots, so remove as much of the above and below ground plant parts as possible
 - 1. Dispose of debris by bagging and depositing bags in a landfill, or by burning.
 - b. Mechanical Methods
 - i. Mowing
 - 1. Mow the pepperweed down at the flower bud stage in May-July
 - 2. Combine mowing with the application of herbicides, since mowing will not work by itself.
 - ii. Tillage/ Cultivation
 - 1. By itself, cultivation can spread viable root fragments and contribute to increased densities of perennial pepperweed.
 - 2. Combine tilling/ cultivation with herbicide application and mowing for better results:
 - a. Perennial pepperweed infestations should be disked in the fall.
 - b. When plants resprout and form flower buds in the spring, mowing should then be used.
 - c. Allow plants to resprout and reach flower bud stage once again before applying herbicide. Anticipate that further spraying may be needed later.
 - c. Prescribed Fire
 - i. Prescribed burning is not an effective method for controlling perennial pepperweed, because plants do not burn easily and the underground roots are unaffected and recover rapidly.
 - ii. However, burning can be used as a disposal method or to remove old growth material.
 - d. Flooding
 - i. Where conditions are feasible, continual flooding can be an effective control method.
 - ii. Flooding should be repeated for at least 2 consecutive years, and new plant growth should be continually monitored.
- 2. Cultural Control
 - a. Prevention
 - i. Make sure to clean off machines, clothes, and animals to avoid spreading the seeds.
 - b. Monitoring
 - i. Monitoring should be conducted in early spring and late summer to detect rosettes that form the leading edge of expanding populations.
 - c. Reseeding

- i. To enhance long-term control, consider an approach that encourages and maintains competitive desirable plants.
- 3. Biological Control
 - a. Grazing
 - i. Grazing can be used as a control method, when combined with other physical and chemical methods.
 - ii. Goats, sheep, and cattle will graze new foliage growth (early in the growing season) but will stop eating perennial pepperweed when the early flowering stage is reached. Horses reportedly have been poisoned after eating the weed in hay.
 - b. Classic Biological Control Methods
 - i. There are no classical biological control agents currently approved by USDA for management of perennial pepperweed.
- 4. Chemical Control
 - a. When Combined with other methods, herbicides are effective in controlling perennial pepperweed.
 - b. Suggested Herbicides:
 - i. Glyphosate, chlorsulfuron, metsulfuron, 2,4-D ester or amine, triclopyr, imazapyr, and imazapic
 - c. For more information on the suggested herbicides and application strategies, go to:
 - i. https://www.riversedgewest.org/sites/default/files/resource-center-documents/Field_Guide_Mgmt_PrnI_Pepperweed.pdf
 - ii. <https://wric.ucdavis.edu/PDFs/perennial%20pepperweed%20WRIC%20leaflet%2002-1.pdf>
- 5. Complete eradication will likely require 3 to 10 years of repeated management methods.
- 6. Tips:
 - a. When infestations are spotty and scattered, the best approach is to first kill the outlying populations to prevent spread and then work towards the center or origin of the invasion.

Russian Olive (*Eleaegnus angustifolia* L.)

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Characteristics:

Russian olives are deciduous trees that grow between 10 and 40 feet tall, or long-lived, multistemmed shrubs. The trees have diameters at breast heights of between 1 to 7 inches, with dark, smooth bark. The branches are reddish-brown and thorn-tipped twigs. The leaves are lance-shaped, 0.8 to 4 inches long, and ashy blue-green in color with silvery hairs. This is what gives the trees their silver appearance. The flowers of a Russian olive are yellow, arranged in clusters, and bloom from May to July. The fruit are also arranged in clusters, red-brown, small, hard, and resemble olives. The seeds are brown, oval shaped, and 0.25 to 0.5 inches long. The seeds drop from the trees in mid-June in New Mexico, and have a white appearance like snow.

Impact:

Russian Olive is considered a Class C noxious tree in the state of New Mexico. Russian Olives primarily grow in or around riparian zones, and inevitably crowd out native trees such as cottonwoods and willows. This reduces flora and fauna species in the riparian zone, and harms wildlife habitat by altering the flood regime, reducing the availability of nutrients to native species, and overcrowding stream banks. It is extremely difficult to restore native plant communities in areas where Russian olive is well established.

Treatment Plan:

A combination of the following methods will provide the best control of Russian olives:

1. Physical Control
 - a. Manual Methods
 - i. Use a shovel, hoe, or weed tool to remove small trees (less than 3.5 inches in diameter).
 - ii. Any remaining exposed root should be cut off below ground level and buried.
 - b. Mechanical Methods
 - i. Mowing
 1. Mowing can be used to cut back small Russian olive saplings (less than 1 inch in diameter). However, if the mowing is not repeated, the saplings will come back stronger and may become multistemmed.



Russian olive tree branch. Notice the ashy blue-green, almost silver color.



Close-up of Russian olive flowers, before they fall off the tree. The flowers on the RFP property are slightly lighter in color, so it almost looks like snow when they are falling.

2. Method:
 - a. Use a tractor fitted with a brush mower to shear plants close to the ground. Remove cut material to burn or shred. Repeat this method annually (or more often), before saplings reach a diameter of 1 inch.
 - ii. Tillage/Cultivation
 1. Disks and plows will effectively sever shallow Russian olive roots, and if the method is repeated and combined with other methods, it can control young Russian olive populations.
 - c. Large-Scale Clearing
 - i. If there are large infestations of older Russian olive trees present, consider using heavy machinery in the winter to remove trunks and stems. Removed materials should be shredded or burned soon after.
 - ii. However, be cautious of new sprouting from root parts that remain in the soil. Combine this complete removal method with other methods for more effective control.
 1. Burning the cut stumps or applying an herbicide may provide effective control.
 - d. Prescribed Fire
 - i. Prescribed burns should be considered a suppression technique, rather than a method for complete eradication.
 1. Larger plants or trees have been known to vigorously re-sprout after fire.
 - ii. Burning is more effective in summer and early fall than in the spring and winter.
 - e. Flooding
 - i. Flooding is not a recommended strategy for control of Russian olive trees.
 - ii. However, where possible, maintain or simulate seasonal flooding in riparian areas to support the health of the riparian zone.
 - f. Debris Management
 - i. Make sure to remove as much of the plant material as possible when executing these management methods. All root and stem materials should be removed and destroyed by burning shredding or mulching to prevent new root development from advantageous buds or new sprouting from root fragments.
 - g. Girdling and cutting can suppress Russian olives, but is not effective when used alone. The trees may just grow back denser, and this method requires frequent maintenance.
2. Cultural Control
 - a. Prevention
 - i. Prevent seeds from being transported through irrigation canals by placing wide screens on irrigation water intakes.

- ii. Make sure to clean off machines, clothes, and animals to avoid spreading the seeds.
 - b. Monitoring
 - i. Watch for new trees growing and eradicate them as early as possible.
 - c. Support native vegetation and trees to prevent new Russian olives from growing.
- 3. Biological Control
 - a. Grazing
 - i. Mature, trained goats will selectively graze Russian olive seedlings and young trees.
 - ii. Use short-term prescribed grazing along with other control methods to successfully manage Russian olives.
 - b. Classic Biological Control Methods
 - i. There are currently no classic biological control agents for use on Russian olives.
- 4. Chemical Control
 - a. The use of herbicides can be beneficial when attempting to control Russian olives. However, before spraying a site, it should be closely evaluated and the following must be considered:
 - i. The time of year it will be sprayed
 - ii. Plant growth form (a low-growing, multistemmed shrub versus a mid-sized, single-stem tree)
 - iii. Site accessibility
 - iv. Which herbicide to use
 - v. Method of application
 - b. For more information on the suggested herbicides and application strategies, go to:
 - i. https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5410126.pdf
 - ii. https://wric.ucdavis.edu/information/natural%20areas/wr_E/Elaeagnus.pdf
- 5. Russian olive control will likely take three years of control and up to two years of monitoring afterwards to prevent reestablishment.
- 6. Consider implementing streambank and floodplain modifications following Russian olive removal to ensure maintenance of riverbank flows, river-floodplain connections, and native plant communities.

Siberian Elm (*Ulmus pumila* L.)

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Characteristics:

Siberian elm is a hardy, fast-growing, mid-sized, deciduous tree that grows up to 70 feet tall in moist environments. In dry environments, it has a shorter and shrubbier appearance. The trunk of a Siberian elm has rough brown or grey bark with shallow grooves. The twigs have a leaf bud at each end and scattered spots. The leaves are alternate, 0.5-2.5 inches long, deep green, with serrated edges. Flowers appear in clusters of 2 to 5 small, green, drooping flowers without petals from February to April, then fruit appear in April to May in clusters of small, circular, winged, samara-type fruit with a single seed in the center. Siberian elms reproduce primarily by seeds, although the roots will re-sprout if damaged.

Impact:

Siberian elm is considered a Class C noxious tree in the state of New Mexico. Siberian elms outcompete native plants and trees, because of the trees' ability to grow readily in disturbed areas with poor soil and low moisture levels. Siberian elm seeds' germinating rate is high and seedlings establish in sparsely vegetated areas, which reduces quality forage and decrease species diversity.

Treatment Plan:

To control Siberian elm, it is necessary to destroy the root system. Use a combination of the following methods to effectively control Siberian elm:

1. Physical Control
 - a. Manual Methods
 - i. Hand Removal
 1. Remove saplings with a stem diameter less than 3/8 of an inch by hand pulling or hoeing. Remove small trees with a stem diameter of 3/8 to 2.5 inches by hand grubbing with a shovel, hoe, or weed tool.
 - ii. Suppression by Cutting
 1. Cut trunks close to the ground to remove top growth. Cutting is more effective when combined with other control methods, as the root and trunk will re-sprout after being cut.
 - iii. Girdling
 1. (use this method in late spring to midsummer on larger trees only)



Siberian elm leaves. This is usually the color of the leaves later in the season. Note the color and shape of the branches as well, as it is useful in identifying the tree.



2. Take an ax, saw, or chain saw and make two horizontal cuts around the entire tree trunk. One cut should be 3 to 4 inches above the other, and just through the bark and cambial tissue. Next, knock off and remove the bark between the two cuts. (Make sure to not cut too deep, or the tree will think it has been cut down and re-sprouting will occur.)
 3. Leave the girdled trees in place for 2 to 3 years, checking periodically to make sure that the bark does not grow back. Combine with other methods for more effective control.
- b. Mechanical Methods
 - i. Mowing
 1. Mowing is not an effective method for controlling Siberian elms, because mowing does not remove the root structure and will allow for the roots to easily re-sprout.
 - ii. Tillage/Cultivation
 1. Tillage/ Cultivation is not an effective method for controlling Siberian elms, because root fragments will be left behind in the soil, and re-sprouting will easily occur due to the disturbed and aired soil.
 - c. Large Scale Clearing
 - i. Consider removing trunks and stems during winter with heavy machinery such as an excavator or backhoe.
 - ii. These machines offer effective and selective removal of top growth and root material. Pulled materials should be shredded, burned, or used for mulching.
 - d. Prescribed Fire
 - i. Prescribed burning is not suggested for Siberian elm control, even though selective burning can be used to suppress top growth in some areas.
 - e. Flooding
 - i. Flooding is not an effective method for controlling Siberian elm infestations, as it will just cause damage to the landscape without killing the undesired trees.
2. Cultural Control
 - a. Prevention
 - i. Prevent seeds from being transported through irrigation canals by placing wide screens on irrigation water intakes.
 - ii. Make sure to clean off machines, clothes, and animals to avoid spreading the seeds.
 - b. Monitoring
 - i. Watch for new trees growing and eradicate them as early as possible.
 - c. Support native vegetation and trees to prevent new Siberian elms from growing.
 3. Biological Control
 - a. Grazing

- i. Mature male goats may selectively graze Siberian elms seedlings and young trees. Use goats in an intensive, sort-term, prescribed grazing approach in combination with other methods for control.
 - b. Classic Biological Control Methods
 - i. There are currently no classic biological control agents being used to control Siberian elms.
 - ii. However, there are many insects and diseases that harm Siberian elms. These include: elm leaf beetle (*Xanthogaleruca luteola*), aphids, *Tubercularia* canker, *Botryodiplodia* canker, powdery mildew, wetwood, leaf spot, and cankerworm.
- 4. Chemical Control
 - a. The use of herbicides on Siberian elms has had varying results. However, before spraying a site, it should be closely evaluated and the following must be considered:
 - i. The time of year it will be sprayed
 - ii. Plant growth form (a low-growing, multistemmed shrub versus a mid-sized, single-stem tree)
 - iii. Site accessibility
 - iv. Which herbicide to use
 - v. Method of application
 - vi. Density of the Siberian elm population
 - vii. Proximity to other desirable plants
 - b. For more information on the suggested herbicides and application strategies, go to:
 - i. https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5410128.pdf
 - c. After spraying an area, make sure to monitor the site for several years and watch for new growth.
- 5. It usually takes 5-10 years of implementing these control methods to effectively control Siberian elm infestations.
- 6. Consider implementing streambank and floodplain modifications following Siberian elm removal to ensure maintenance of riverbank flows, river-floodplain connections, and native plant communities.

Teasel (*Dipsacus fullonum* L.)

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Characteristics:

Teasel is a weedy biennial or short-lived perennial with prickly stems and a distinctive cone shaped flower head. Teasel flowers occur from early summer until early fall, and have oval-shaped flower heads with rings of small, densely packed lavender flowers. Each flower usually only lives for one day. Its rosette leaves are wrinkles, scalloped, oval shaped, and sometimes hairy. Its stem may grow up to seven feet tall with simple, stalk less, opposite lanceolate leaves with conspicuous veins. The upper leaves have entire margins, grow up to 10 inches long, slightly clasp the stem, and may hold water near the leaf axil.



Teasel rosette (first-year growth).

Impact:

Teasel is considered a Class B noxious weed in the state of New Mexico. Teasel can be an aggressive competitor allowing it to displace desirable plants and form a monoculture. Its presence reduces forage availability and contributes to decline in species diversity and range quality.



Teasel seed head and flowers, with three bees helping to pollinate.

Treatment Plan:

New populations of teasel should be eliminated as early in the year as possible, when the seedlings are in the rosette stage. Use a combination of mechanical, cultural, and chemical methods for the most effective teasel control. Strategies to contain, reduce, or eradicate teasel populations require long-term planning, integrated management, and follow-up monitoring. For more information on combined strategies, visit the [USDA Field Guide for Managing Teasel in the Southwest](#).

1. Physical Control
 - a. Manual Methods
 - i. Hoe or dig plants at the rosette to early bolt stage, in the late winter and spring, cutting the taproot 1-2 inches below the surface.
 - ii. Hand pull smaller infestations when the soil allows it.
 1. Dispose of debris by burning or bagging and throwing out.
 - iii. Hand pull old infestations, possibly cut off the seed pod beforehand to prevent spreading of the seed.
 1. Make sure to pull up as much of the root as possible and dispose of the debris by burning or bagging and throwing out.
 - b. Mechanical Methods
 - i. Mowing

1. Mow during bolting or when flower heads are just being produced
 - a. Do not mow when seeds are matured because they will spread.
 - ii. Tillage/ Cultivation
 1. Disk or plow the infestations in early growth stage to disrupt and discourage growth.
 - c. Prescribed Fire
 - i. Broadcast burning is not an effective method for controlling teasel.
 - ii. However, a propane torch can be used for individual plant treatment, like clipping off the seed heads.
 - iii. Burning is an acceptable method for disposing of plant debris from pulled/ clipped debris.
 - d. Flooding
 - i. Flooding is not an effective method for controlling teasel, as it will just cause damage to the landscape without killing the undesired plants.
 2. Cultural Control
 - a. Make sure to clean off machines, clothes, and animals to avoid spreading the seeds.
 - b. Prevention
 - i. Educate the public on identifying teasel.
 - ii. Early detection and removal are critical for preventing the establishment of teasel.
 - c. It is also important to monitor the return of desirable native plant species.
 - i. Teasel prefers open sunny habitats, thus encouraging competition from grasses while maintaining litter cover will help minimize its reestablishment.
 3. Biological Control
 - a. Grazing
 - i. While teasel does not withstand moderate to heavy grazing, it is not highly palatable or serve as desirable forage. Most foraging animals (including cattle, sheep, and goats) avoid teasel and will not graze it.
 - b. Classical Biological Control Methods
 - i. There are no classic biological control methods for teasel.
 4. Chemical Control.
 - a. Herbicides are not as effective on teasel since the roots persist even when sprayed.
 - b. Suggested Herbicides:
 - i. 2,4-D Amine
 1. Cannot use near water.
 - ii. Aminopyralid
 1. Can use around water and does not affect grasses.
 - iii. Triclopyr
 1. Cannot be used around water, does not harm grasses.
 - iv. Clopyralid, Glyphosate, Triclopyr + clopyralid

- c. For more information on the suggested herbicides and application restrictions/strategies, go to:
 - i. https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5410129.pdf
- 5. Continue to monitor sites, repeat treatments for several years until the weeds are completely gone. Treated areas should be monitored periodically and measures taken to control missed plants and newly emerged seedlings.

Thistle, Bull (*Cirsium vulgare* (Savi) Tenore)

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Characteristics:

Bull thistle is a biennial weed that reproduces by seed only. Bull thistle seeds usually sprout from late spring to late autumn, and they can flower anytime between mid-summer and early autumn. The stems of bull thistle may be 3 to 6 feet tall, are often branched, and are hairy. The leaves are deeply cut, spiny, have a leathery appearance, and run down the stem. Phyllary urn-shaped, deep purple or rose flower heads form during the second growing season. These heads are 1 to 2 inches in diameter and are surrounded by numerous spiny tipped bracts.



Bull thistle rosette.

Impact:

Bull thistle is considered a Class B noxious weed in the state of New Mexico. Bull thistle spreads only by seeds, not by the roots. Given suitable conditions, these weeds rapidly invade rangeland, pastures, abandoned fields, roadsides, and disturbed sites. A high density of thistles reduces availability of quality forage and the diversity of flora and fauna species. Additionally, most thistles have taproots that do not stabilize the soil as well as the fibrous roots of native grass species; therefore, high densities of thistles can contribute to soil erosion and stream sedimentation.



Bull thistle flower head.

Treatment Plan:

High priority for thistle management should be directed toward preventing establishment and eliminating new plants as soon as they are found. Treatment should occur throughout late spring, summer, and fall. The following control methods can be combined to provide the best control possible:

1. Physical Control
 - a. Manual Methods
 - i. Before Flowering:
 1. Hand pull smaller infestations.
 - a. If flowers or seed are not present, plants may be pulled and left onsite.
 2. For larger infestations:
 - a. Cut plants 2-4 inches below the surface with a hoe, grubbing tool, or spade.
 - ii. After Flowering:

1. For isolated thistles or small infestations, seed heads of individual plants may be clipped and placed in bags for disposal.
 2. If flowers or seed are present, debris should be bagged and removed from the site for safe disposal or else piled and burned onsite.
- b. Mechanical Methods
 - i. Cutting/ Mowing
 1. Cut or mow plants in the bolt to flower bud stage to reduce flowering and seed spread.
 - a. Mow ever 21 days during growing stage, but stop when plants begin to bolt and do not mow when there are flowers.
 - b. Consider walking through the infested area before mowing and either pull plants or cut stems that have open flowers.
 - ii. Tillage/ Cultivation
 1. Bull thistle does not survive in tilled fields.
 2. Properly timed and repeated tillage with a plow or disc can provide effective control.
 3. Do not till in areas with high densities of viable thistle seed.
 4. Tillage will not eradicate seeds, so it should be used in a combined strategy.
 5. If tillage is used:
 - a. Thistle plants should be cultivated shortly after they emerge but before they reach a height of 3 inches.
 - b. Use shallow cultivation in hot, dry weather to stress plants.
- c. Prescribed Fire
 - i. Prescribed burning is not suggested for managing bull thistle. However, individual plant treatment (IPT) with a blowtorch or flamethrower has been an effective means of control.
- d. Flooding
 - i. Flooding is not an effective method for controlling bull thistle, as it will just cause damage to the landscape without killing the undesired plants.
2. Cultural Control
 - a. Reseeding
 - i. Re-seed with desirable native plants.
 - b. Make sure to clean off machines, clothes, and animals to avoid spreading the seeds.
 - c. Prevention
 - i. Practice early detection and plant removal to prevent the establishment of thistles.
3. Biological Control
 - a. Grazing

- i. Use a prescribed grazing strategy on young thistles during the rosette stage.
 - a. Cattle, sheep, and goats
 - b. Classical Biological Control Methods
 - i. Classic biological control methods cannot be used in New Mexico, because of the risk of harming the native Sacramento thistle, which is an endangered plant species.
 - ii. Only use if infestations are large enough to sustain control agent populations. Cannot pair with other control methods.
 - iii. Suggested:
 - 1. Gall-forming fly (*Urophora stylata*)
 - 2. Beetle/ weevil (*Trichosirocalus horridus*)
- 4. Chemical Control.
 - a. Use individual plant treatment with a backpack sprayer on sparse populations. For extensive and dense infestations, use ground or aerial broadcast spraying.
 - b. Apply during the fall when new plants have emerged and are actively growing during the seedling to rosette stage.
 - c. Suggested Herbicides:
 - 1. Aminopyralid, Aminopyralid + 2,4-D, Clopyralid
 - d. For more information on suggested herbicides, restrictions, and application suggestions, go to:
 - i. https://www.riversedgewest.org/sites/default/files/resource-center-documents/Field_Guide_Mgmt_Invasive_Thistles.pdf
- 5. Repeat treatments for multiple years until the weeds are completely gone.

Thistle, Canada (*Cirsium arvense* L.)

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Characteristics:

Canada thistle is a perennial weed that reproduces by seeds and a horizontal root system. The root system is extensive, with lateral and vertical roots extending up to 15 feet wide and deep. Because of how established the root system is, individual plants can live for more than two years. Canada thistle stems are grooved, somewhat hairy, and 2 to 5 feet tall with branching at the top. The leaves are smooth, alternate, lance shaped, deeply lobed, and have crinkled edges and spiny margins. The flowers are lavender colored, $\frac{3}{4}$ of an inch or less in diameter. There are male and female plants, so some patches never produce seeds.



Second year Canada thistle stem.

Impact:

Canada thistle is considered a Class A noxious weed in the state of New Mexico. Canada thistle is exceptionally hard to control, since the plant spreads by both the roots and the seeds. Canada thistle is a highly competitive, persistent plant that grows in dense, impenetrable colonies. A high density of spiny-leaved Canada thistle reduces the availability of quality forage and the diversity of flora and fauna species.



Canada thistle seed head.

Treatment Plan:

When attempting to manage Canada thistle, small localized infestations occurring in otherwise healthy sites should be given priority for control treatments. For the most effective control, combine mechanical, cultural, biological, and chemical methods.

1. Physical Control
 - a. Manual Methods
 - i. Hand pulling, digging, and hoeing can be done any time of year.
 1. However, given the perennial nature of this weed, hand removal is difficult and typically not very effective. Proper disposal of debris is essential in preventing spread.
 - a. If flowers or seeds are not present, plants may be pulled and left onsite.
 - b. If flowers or seed are present, debris should be bagged and removed from the site.
 - b. Mechanical Methods
 - i. Mowing

1. Mow in early spring and every 21 days throughout late spring and summer as the plants grow and begin to bolt
 - ii. Tillage/Cultivation
 1. Till every 20 days throughout the winter as the plants begin to emerge.
 - a. Plants should be cultivated after plants have emerged in late winter but before they reach a height of 3 inches.
 - c. Prescribed Fire
 - i. Prescribed burning is not an effective method for controlling Canada thistle.
 1. Burning will not destroy the root system of Canada thistle and is likely to increase thistle presence in succeeding years after a fire.
 - ii. However, fire can be used to discard of plant debris.
 - d. Flooding
 - i. Flooding is not an effective method for controlling Canada thistle, as it will just cause damage to the landscape without killing the undesired plants.
 - e. Smothering the roots
 - i. If the plant can be isolated, it can be smothered with an impenetrable barrier like plastic or a landscape weed barrier.
 1. This would require clearing out the bed and dedicated time to starving the root system.
 2. The key problem here is isolating a plant with a creeping underground root system.
2. Cultural Control
 - a. Prevention
 - i. Watch for new growths and manage them, repeat this process for years until the plants are fully gone.
 - ii. Make sure to clean off machines, clothes, and animals to avoid spreading the seeds.
 - b. Re-seeding
 - i. Reseed, fertilize, and irrigate (if possible) to make desirable plants more competitive.
 - ii. Limit disturbance and/or promptly revegetate disturbed areas with desirable perennial forage species, especially perennial grasses.
 3. Biological Control
 - a. Grazing
 - i. Use grazing animals on young thistles as part of short-term, intensive grazing approach in the spring.
 1. Goats, sheep, and cattle will graze rosettes and seedlings. Horses, donkeys, and llamas will also graze Canada thistle (to an extent).
 2. Do not pair herbicides with grazing
 - b. Classical Biological Control Methods

- i. Classic biological control agents for thistles are discouraged in New Mexico, because of the native Sacramento thistle. However, there are several agents that can be used:
 - 1. *Cassida rubiginosa* (beetle)
 - 2. *Rhinocyllus conicus* (beetle/ weevil)
 - 3. *Trichosiracalus horridus* (beetle/weevil)
 - 4. *Urophora cardui* (gall-forming fly)
 - ii. For more information on classic biological control agents, go to:
 - 1. https://www.riversedgewest.org/sites/default/files/resource-center-documents/Field_Guide_Mgmt_Canada_Thistle.pdf
- 4. Chemical Control
 - a. Canada thistle is best controlled with a selective post-emergent broadleaf herbicide.
 - b. Suggested herbicides:
 - i. Spring Treatment
 - 1. Anything that will kill top growth
 - a. Dicamba, 2,4-D
 - b. Clopyralid + other agents
 - ii. Fall Treatment
 - 1. Maximizes injury to the root system
 - a. Aminopyralid, Aminopyralid + 2,4-D, “Vanquish”
 - c. For more information on suggested herbicides, restrictions, and application strategies, go to:
 - i. https://www.riversedgewest.org/sites/default/files/resource-center-documents/Field_Guide_Mgmt_Canada_Thistle.pdf
 - ii. https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_018027.pdf
- 5. Complete control of Canada thistle will likely require 2 to 4 years of repeated management methods.
- 6. Tips:
 - a. The most important opportunity for control is the fall when thistle is recharging its root system for the next growing season.
 - b. Late spring, when thistle is at the bud-to-early-bloom stage is the second important opportunity for control.

Thistle, Musk (*Carduus nutans* L.)

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Characteristics:

Musk thistle is a biennial weed (occasionally an annual) that spreads only by seeds. Musk thistle seeds usually sprout from late spring to late autumn, and they can flower anytime between mid-summer and early autumn. Rosettes are usually large (2 feet or more in diameter) and compact with a large, corky taproot that is hollow near the crown. Leaves have consistent shape, sometimes expressing a frosted appearance around the leaf margins, and often have a cream-colored midrib. Musk thistle has very large bracts

beneath flowers that are armed with sharp spines and shoots beneath flowers are almost devoid of leaves. The flowers are purplish-red disk flowers that “nod” at a 90-degree angle.

Impact:

Musk Thistle is considered a Class C noxious weed in the state of New Mexico. Musk thistle spreads only by seeds, not by the roots. Given suitable conditions, these weeds rapidly invade rangeland, pastures, abandoned fields, roadsides, and disturbed sites. A high density of thistles reduces availability of quality forage and the diversity of flora and fauna species.

Additionally, most thistles have taproots that do not stabilize the soil as well as the fibrous roots of native grass species; therefore, high densities of thistles can contribute to soil erosion and stream sedimentation.

Treatment Plan:

High priority for thistle management should be directed toward preventing establishment and eliminating new plants as soon as they are found. Treatment should occur throughout late spring, summer, and fall. The following control methods should be combined to provide the best control possible:

1. Physical Control
 - a. Manual Methods
 - i. Before Flowering:
 1. Hand pull smaller infestations.
 - a. If flowers or seed are not present, plants may be pulled and left onsite.
 2. For larger infestations:
 - a. Cut plants 2-4 inches below the surface with a hoe, grubbing tool, or spade.



Close-up of a musk thistle rosette, before the stem begins to grow.



Musk thistle flower head.

- ii. After Flowering:
 1. For isolated thistles or small infestations, seed heads of individual plants may be clipped and placed in bags for disposal.
 2. If flowers or seed are present, debris should be bagged and removed from the site for safe disposal or else piled and burned onsite.
 - b. Mechanical Methods
 - i. Cutting/ Mowing
 1. Cut or mow plants in the bolt to flower bud stage to reduce flowering and seed spread.
 - a. Mow ever 21 days during growing stage, but stop when plants begin to bolt and do not mow when there are flowers.
 - b. Consider walking through the infested area before mowing and either pull plants or cut stems that have open flowers.
 - ii. Tillage/ Cultivation
 1. **Musk thistles WILL NOT TOLLERATE tillage**
 2. Properly timed and repeated tillage with a plow or disc can provide effective control.
 3. Do not till in areas with high densities of viable thistle seed.
 4. Tillage will not eradicate seeds, so it should be used in a combined strategy.
 5. If tillage is used:
 - a. Thistle plants should be cultivated shortly after they emerge but before they reach a height of 3 inches.
 - b. Use shallow cultivation in hot, dry weather to stress plants.
 - c. Prescribed Fire
 - i. Prescribed burning is not suggested for managing musk thistle. However, individual plant treatment (IPT) with a blowtorch or flamethrower has been an effective means of control.
 - d. Flooding
 - i. Flooding is not an effective method for controlling musk thistle, as it will just cause damage to the landscape without killing the undesired plants.
- 2. Cultural Control
 - a. Reseeding
 - i. Re-seed with desirable native plants.
 - b. Make sure to clean off machines, clothes, and animals to avoid spreading the seeds.
 - c. Prevention
 - i. Practice early detection and plant removal to prevent the establishment of thistles.
- 3. Biological Control
 - a. Grazing

- i. Use a prescribed grazing strategy on young thistles.
 - 1. Rosette to bolting stage
 - a. Sheep and goats
 - 2. Before bud stage is reached
 - a. Cattle
 - 3. Do not overgraze.**
 - b. Classical Biological Control Methods
 - i. Classic biological control methods cannot be used in New Mexico, because of the risk of harming the native Sacramento thistle, which is an endangered plant species.
 - ii. Only use if infestations are large enough to sustain control agent populations. Cannot pair with other control methods.
 - iii. Suggested:
 - 1. Beetle/ weevil (*Rhinocyllus conicus*)
 - 2. Beetle/ weevil (*Trichosirocalus horridus*)
- 4. Chemical Control.
 - a. Use individual plant treatment with a backpack sprayer on sparse populations. For extensive and dense infestations, use ground or aerial broadcast spraying.
 - b. Apply during the fall when new plants have emerged and are actively growing during the seedling to rosette stage.
 - c. Suggested Herbicides:
 - 1. Aminopyralid, Aminopyralid + 2,4-D, Clopyralid
 - d. For more information on suggested herbicides, restrictions, and application suggestions, go to:
 - i. [https://www.riversedgewest.org/sites/default/files/resource-center-documents/Field Guide Mgmt Invasive Thistles.pdf](https://www.riversedgewest.org/sites/default/files/resource-center-documents/Field%20Guide%20Mgmt%20Invasive%20Thistles.pdf)
 - ii. <http://extension.colostate.edu/topic-areas/natural-resources/musk-thistle-3-102/>
- 5. Repeat treatments for multiple years until the weeds are completely gone.

Thistle, Russian (*Salsola tragus*)

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Characteristics:

Russian thistle is a bushy summer annual with numerous ascending stems that become woody at maturity. Stems can be between 8 to 36 inches in length and have reddish stripes (see the bottom right image). Seedlings have very finely dissected leaves that almost look like pine needles. Leaves of young plants are fleshy, dark green, narrow, and about 1 inch in length. As the plant matures in July through October, the older leaves become short and stiff with a sharp-pointed tip. The flowers are inconspicuous due to their lack of petals.

Russian thistle plants become round shaped with a diameter of 18 inches to 6 feet at maturity. Then, the plant breaks off at the base of the stem and “tumbles” with the wind, earning its name of “tumbleweed”.

Impact:

Russian thistle is not considered a noxious weed in the state of New Mexico. In agricultural areas, Russian thistle can reduce yield and quality of numerous crops, particularly alfalfa and small grains. It depletes soil moisture, interferes with tillage operations, and serves as a shelter or food source to many insects, vertebrate pests, and crop diseases such as curly top. Russian thistle can also threaten native plant ecosystems. Russian thistle also increases fire hazard, and can cause skin rashes or allergic reactions for many people.

Treatment Plan:

To best control Russian thistle, first use a physical or chemical control method to discourage the plants from growing, then implement the reseeding method listed under Cultural Control for long-term eradication/management.

6. Physical Control

a. Manual Methods

i. See Tillage/ Cultivation

b. Mechanical Methods

i. Mowing

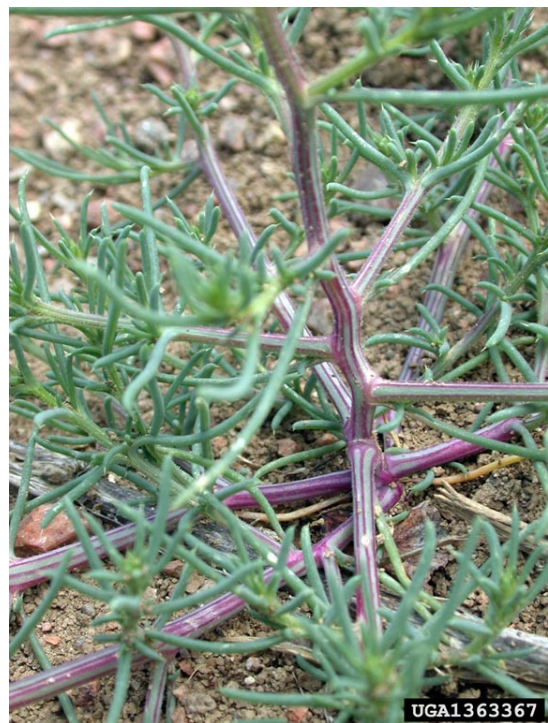
1. Mow smaller plants

a. Make sure all above ground tissue is removed

ii. Tillage/ Cultivation



Young Russian thistle seedling plant.



Characteristic striped stem of Russian thistle.

1. Use tilling, hand hoeing, or any other physical pulling method on either smaller or larger plants
 - a. Make sure to disrupt the contact between the plant roots and soil. AKA sever the root below the soil surface.
 - b. Avoid discing or loosening the soil in abandoned areas because loose soil is necessary for Russian thistle germination and is therefore likely to aggravate the situation.
 - c. Prescribed Fire
 - i. Burning is sometimes used to destroy accumulated Russian thistle plants.
 1. However, while this may eliminate the accumulated organic debris and some seed, much of the seed will already have been disseminated.
 - d. Flooding
 - i. Flooding is not an effective method for controlling Russian thistle, as it will just cause damage to the landscape without killing the undesired plants.
 7. Cultural Control
 - a. Revegetation Methods
 - i. Create a plant community/ environment that is resistant to invasion by these plants.
 - ii. Tips:
 1. Before replanting, check each site for soil type, soil fertility, current plant species present, depth to groundwater, historical precipitation amount, and timing of predominant precipitation.
 2. Before replanting, consider time of year, planting method, and availability of water for irrigation. Take advantage of anticipated summer rains.
 - iii. Examples of native plants:
 1. Grasses: blue grama, Indian ricegrass, western wheatgrass, four-wing saltbrush, plains bristlegrass, etc.
 2. Shrubs: honey mesquite, desert-willow, wolfberry, etc.
 3. Wildflowers: Mexican poppy, prairie flax, Mexican-hat, purple aster, tufted evening primrose, etc.
 8. Biological Control
 - a. Grazing
 - i. Have animals graze on the younger plants
 - ii. Make sure to supplement the diet of animals that are grazing on the site, **poisoning may occur if the animals eat only kochia and/ or Russian thistle.**
 - b. Classical Biological Control Methods
 - i. There are currently no successful attempts at using classic biological control agents to control Russian thistle.
 9. Chemical Control

- a. Herbicides are rarely necessary in home gardens and landscapes for Russian thistle control.
 - b. Applications should be made when the plants are less than 4 inches in diameter for effective control. Often pre-and post-emergent herbicides are mixed together to provide control of established weeds and continual control of repeated flushes of seed germination later in the season.
 - i. Pre-emergent herbicides (applied before the seedlings emerge)
 - 1. Isoxaben
 - 2. Oryzalin
 - 3. Pendimethalin
 - 4. Trifluralin
 - ii. Post-emergent herbicides (applied after the seedlings emerge)
 - 1. 2,4-D
 - 2. Dicamba
 - 3. Glyphosate
 - 4. Triclopyr
 - c. For more information on suggested herbicides, restrictions, and application strategies, go to:
 - i. [http://weeds.nmsu.edu/pdfs/Russian thistle and kochia homeowner.pdf](http://weeds.nmsu.edu/pdfs/Russian_thistle_and_kochia_homeowner.pdf)
 - ii. <http://ipm.ucanr.edu/PMG/PESTNOTES/pn7486.html>
10. Intensely manage the plants for 2-3 years without seed production for local eradication.

Thistle, Scotch (*Onopordum acanthium* L.)

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Characteristics:

Scotch thistle is a biennial or short-lived perennial weed that spreads only by seeds. Scotch thistle seeds usually sprout from late spring to late autumn, and they can flower anytime between mid-summer and early autumn. The rosettes can grow up to 6 feet in diameter, and have a fleshy taproot extending up to 12 inches long. The stem is covered in small white hairs along the length of it, can be up to four inches thick, and may reach a height of 8 feet. Scotch thistle has large, green-grey, coarsely lobed, spiny edged leaves with

wooly hairs. The plant has dark pink to violet spiny disk flowers on globe-shaped heads with many spiny phyllaries in overlapping rows. The flowers can range from two to six centimeters in diameter, and are accompanied by small leaves at their bases which contain pointy, yellow spines.

Impact:

Scotch Thistle is considered a Class A noxious weed in the state of New Mexico. Scotch thistle must grow in light soil, preferably containing high amounts of nitrogen. Scotch thistle spreads only by seeds, not by the roots. Given suitable conditions, these weeds rapidly invade rangeland, pastures, abandoned fields, roadsides, and disturbed sites. A high density of thistles reduces availability of quality forage and the diversity of flora and fauna species. Additionally, most thistles have taproots that do not stabilize the soil as well as the fibrous roots of native grass species; therefore, high densities of thistles can contribute to soil erosion and stream sedimentation.

Treatment Plan:

High priority for thistle management should be directed toward preventing establishment and eliminating new plants as soon as they are found. Treatment should occur throughout late spring, summer, and fall. The following control methods can be combined to provide the best control possible:

1. Physical Control
 - a. Manual Methods
 - i. Before Flowering:
 1. Hand pull smaller infestations.
 - a. If flowers or seed are not present, plants may be pulled and left onsite.



Scotch thistle rosette. Note the size and color, these are distinguishing features of scotch thistle.



Scotch thistle flower.

2. For larger infestations:
 - a. Cut plants 2-4 inches below the surface with a hoe, grubbing tool, or spade.
- ii. After Flowering:
 1. For isolated thistles or small infestations, seed heads of individual plants may be clipped and placed in bags for disposal.
 2. If flowers or seed are present, debris should be bagged and removed from the site for safe disposal or else piled and burned onsite.
- b. Mechanical Methods
 - i. Cutting/ Mowing
 1. Cut or mow plants in the bolt to flower bud stage to reduce flowering and seed spread.
 - a. Mow ever 21 days during growing stage, but stop when plants begin to bolt and do not mow when there are flowers.
 - b. Consider walking through the infested area before mowing and either pull plants or cut stems that have open flowers.
 - ii. Tillage/ Cultivation
 1. Properly timed and repeated tillage with a plow or disc can provide effective control.
 2. Do not till in areas with high densities of viable thistle seed.
 3. Tillage will not eradicate seeds, so it should be used in a combined strategy.
 4. If tillage is used:
 - a. Thistle plants should be cultivated shortly after they emerge but before they reach a height of 3 inches.
 - b. Use shallow cultivation in hot, dry weather to stress plants.
- c. Prescribed Fire
 - i. Prescribed burning is not suggested for managing scotch thistle. However, individual plant treatment (IPT) with a blowtorch or flamethrower has been an effective means of control.
- d. Flooding
 - i. Flooding is not an effective method for controlling scotch thistle, as it will just cause damage to the landscape without killing the undesired plants.
2. Cultural Control
 - a. Reseeding
 - i. Re-seed with desirable native plants.
 - b. Make sure to clean off machines, clothes, and animals to avoid spreading the seeds.
 - c. Prevention
 - i. Practice early detection and plant removal to prevent the establishment of thistles.

3. Biological Control

a. Grazing

- i. Use a prescribed grazing strategy on young thistles during the seedling to vegetative stage.

a. Goats and cattle.

b. Classical Biological Control Methods

- i. Classic biological control methods cannot be used in New Mexico, because of the risk of harming the native Sacramento thistle, which is an endangered plant species.
- ii. Only use if infestations are large enough to sustain control agent populations. Cannot pair with other control methods.
- iii. Suggested:

1. Beetle/ weevil (*Trichosirocalus horridus*)

4. Chemical Control.

- a. Use individual plant treatment with a backpack sprayer on sparse populations. For extensive and dense infestations, use ground or aerial broadcast spraying.

- b. Herbicides should be used in the spring when the plants begin to bolt, or in the autumn, on the rosettes.

c. Suggested Herbicides:

1. Dicamba, metsulfuron, and picloram are some of the only chemicals proven to destroy Scotch thistle.

2. Other suggestions: Aminopyralid, Aminopyralid + 2,4-D, Glypyralid

- d. For more information on suggested herbicides, restrictions, and application suggestions, go to:

- i. [https://www.riversedgewest.org/sites/default/files/resource-center-documents/Field Guide Mgmt Invasive Thistles.pdf](https://www.riversedgewest.org/sites/default/files/resource-center-documents/Field%20Guide%20Mgmt%20Invasive%20Thistles.pdf)

5. Repeat treatments for multiple years until the weeds are completely gone.

Management Charts and Maps**

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Rio Fernando Park Invasive Species

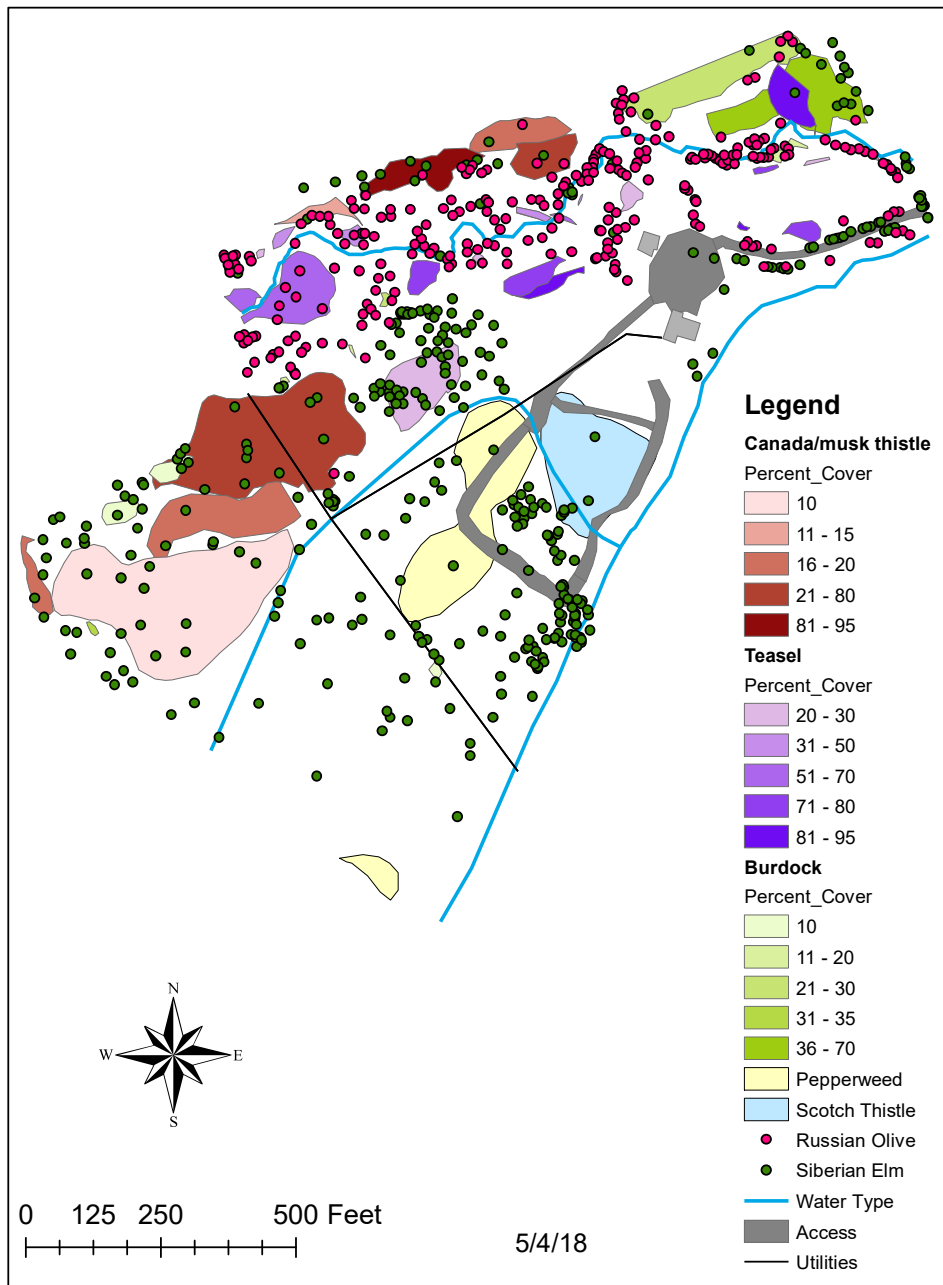


Image 1. This is a preliminary map of the invasive species present on the Rio Fernando Park Property as of May 4th, 2018. This map serves as a reference guide for the following management charts.

Rio Fernando Park All Invasive Species

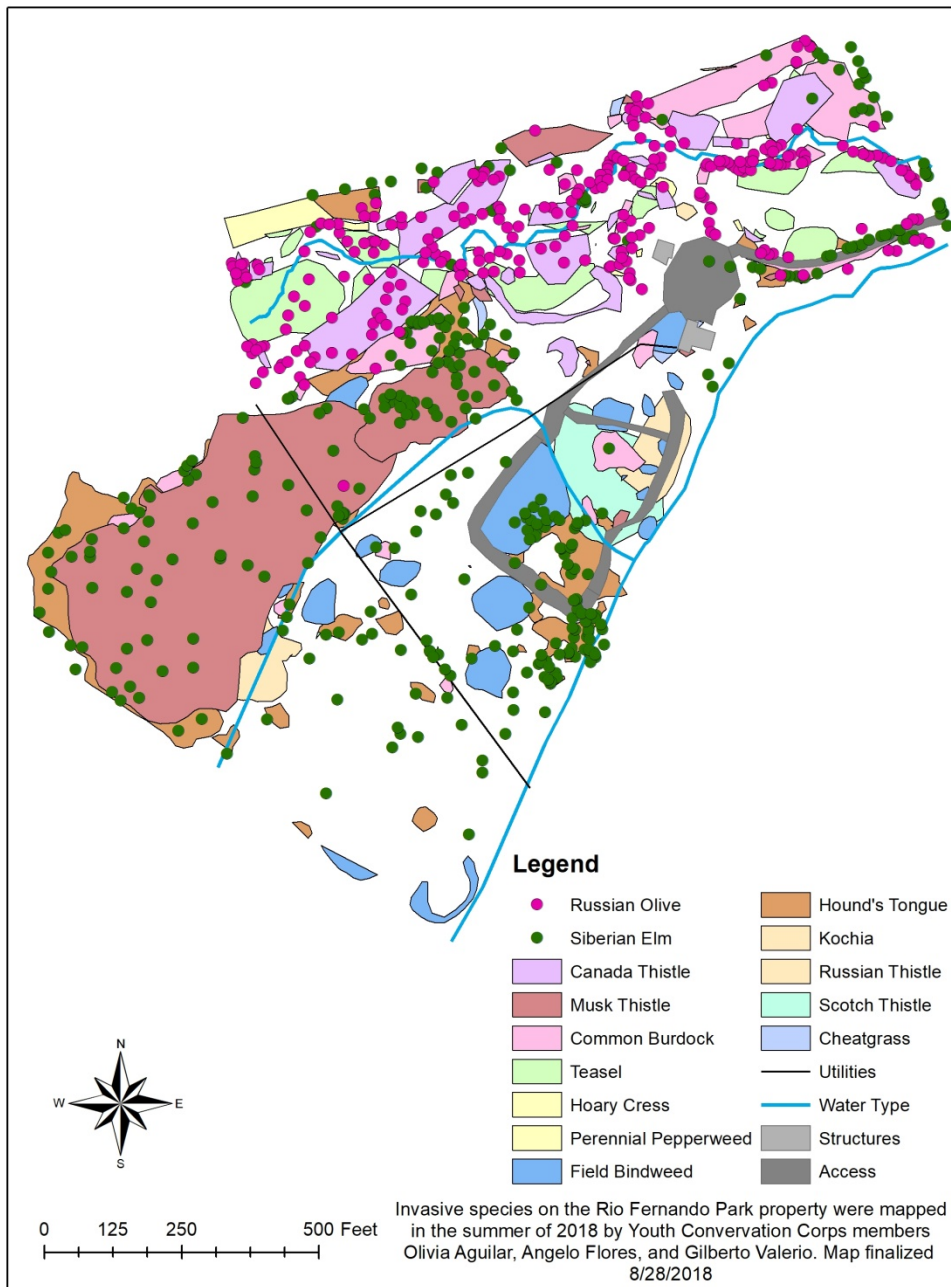


Image 2. This is an updated version of Image 1, as of August 28, 2018. This shows all of the known invasive plant species on the Rio Fernando Park property. This map will continue to be updated by new mapping each summer.

Control Methods -->	Physical Control						Cultural Control		Biological Control		Chemical Control
Plant Name	Hand pulling, plowing, or digging	Mowing	Tillage/ Cultivation	Landscape Fabrics	Prescribed Fire	Flooding	Prevention/ Early Detection	Reseeding/ Supporting Native Vegetation	Grazing	Classic Biological Control Agents	Herbicides
Common Burdock	Green	Green	Yellow	Grey	Red	Red	Green	Green	Red	Yellow	Green
Field Bindweed	Green	Yellow	Green	Green	Green	Red	Green	Green	Red	Green	Green
Cheatgrass	Green	Green	Yellow	Grey	Red	Red	Green	Green	Yellow	Red	Yellow
Hoary Cress	Green	Red	Green	Grey	Red	Yellow	Green	Green	Yellow	Red	Green
Hound's Tongue	Green	Green	Yellow	Grey	Red	Red	Green	Green	Red	Green	Yellow
Kochia	Green	Green	Green	Grey	Red	Red	Green	Green	Yellow	Red	Green
Perennial Pepperweed	Green	Green	Yellow	Grey	Red	Green	Green	Yellow	Green	Red	Yellow
Russian Olive	Grey	Grey	Grey	Grey	Grey	Grey	Grey	Grey	Grey	Grey	Grey
Siberian Elm	Grey	Grey	Grey	Grey	Grey	Grey	Grey	Grey	Grey	Grey	Grey
Teasel	Green	Green	Green	Grey	Yellow	Red	Green	Green	Red	Red	Red
Bull Thistle	Green	Green	Green	Grey	Yellow	Red	Green	Green	Green	Red	Green
Canada Thistle	Yellow	Green	Green	Green	Red	Red	Green	Green	Green	Red	Green
Musk Thistle	Green	Green	Yellow	Grey	Yellow	Red	Green	Green	Green	Red	Green
Russian Thistle	Green	Green	Yellow	Grey	Yellow	Red	Green	Green	Yellow	Red	Yellow
Scotch Thistle	Green	Green	Yellow	Grey	Yellow	Red	Green	Green	Green	Red	Green

KEY:

 Go ahead and use this method
 Use this method with caution
 Do not use this method
 No Data

Table 1. This table shows which methods are good to use for each invasive species on the property. Green indicates a method that is effective and safe to use without too much caution. Yellow indicates a method that can be used, but with caution as it is either dangerous or not very effective. Red indicates a method that should never be used for that specific species, because it will only worsen the situation. Grey means that there is no data for that method and species.

Plant Name	Zones Present In	Priority Areas	Selected Treatments	Resources Needed
Common Burdock	5, 3	Zone 5	See Table 1	Hand trowels, shovels, mower/ weed whacker, native plant seeds, seeding equipment
Field Bindweed	1, 2, 3, 4	Zones 2 and 3	See Table 1	Hand trowels, shovels, tillage discs/ equipment, landscape fabrics, prescribed burning equipment, native plant seeds, seeding equipment, bindweed mite
Cheatgrass	2, 4	Zone 2	See Table 1	Hand trowels, shovels, mower/ weed whacker, native plant seeds, seeding equipment
Hoary Cress	1, 4, 5	Zone 5	See Table 1	Hand trowels, shovels, tillage discs/ equipment, native plant seeds, seeding equipment
Hound's Tongue	All zones?	?	See Table 1	Hand trowels, shovels, mower/ weed whacker, native plant seeds, seeding equipment, classic biological control agents
Kochia	1, 2, 3, 4	Zones 2 and 3	See Table 1	Hand trowels, shovels, tillage discs/ equipment, native plant seeds, seeding equipment
Perennial Pepperweed	1, 2, 4, 5	Zones 4 and 5	See Table 1	Hand trowels, shovels, equipment for flooding, animals for grazing
Russian Olive	3, 4, 5	Zone 5	See Table 1	
Siberian Elm	All zones		See Table 1	
Teasel	2, 3, 4, 5	Zone 5	See Table 1	Hand trowels, shovels, mower/ weed whacker, tillage discs/ equipment native plant seeds, seeding equipment
Bull Thistle	Not Present	N/A	See Table 1	Hand trowels, shovels, mower/ weed whacker, tillage discs/ equipment, native plant seeds, seeding equipment,
Canada Thistle	3, 4, 5	Zones 3 and 5	See Table 1	Mower/ weed whacker, tillage discs/ equipment, landscape fabrics, native plant seeds, seeding equipment,
Musk Thistle	3, 4	Zone 3	See Table 1	Hand trowels, shovels, mower/ weed whacker, native plant seeds, seeding equipment, animals for grazing

Table 2. This table shows which proposed park zones that each invasive species is present in (refer to Image 2 below), which zones are a priority for management, and what supplies are needed to carry out the management of each invasive species.



Image 2. This is a map of the proposed zones for the Rio Fernando Park, created in collaboration with Groundworks Studio in July 2018. This map corresponds to the zones listed in Table 2 above.

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Image Sources

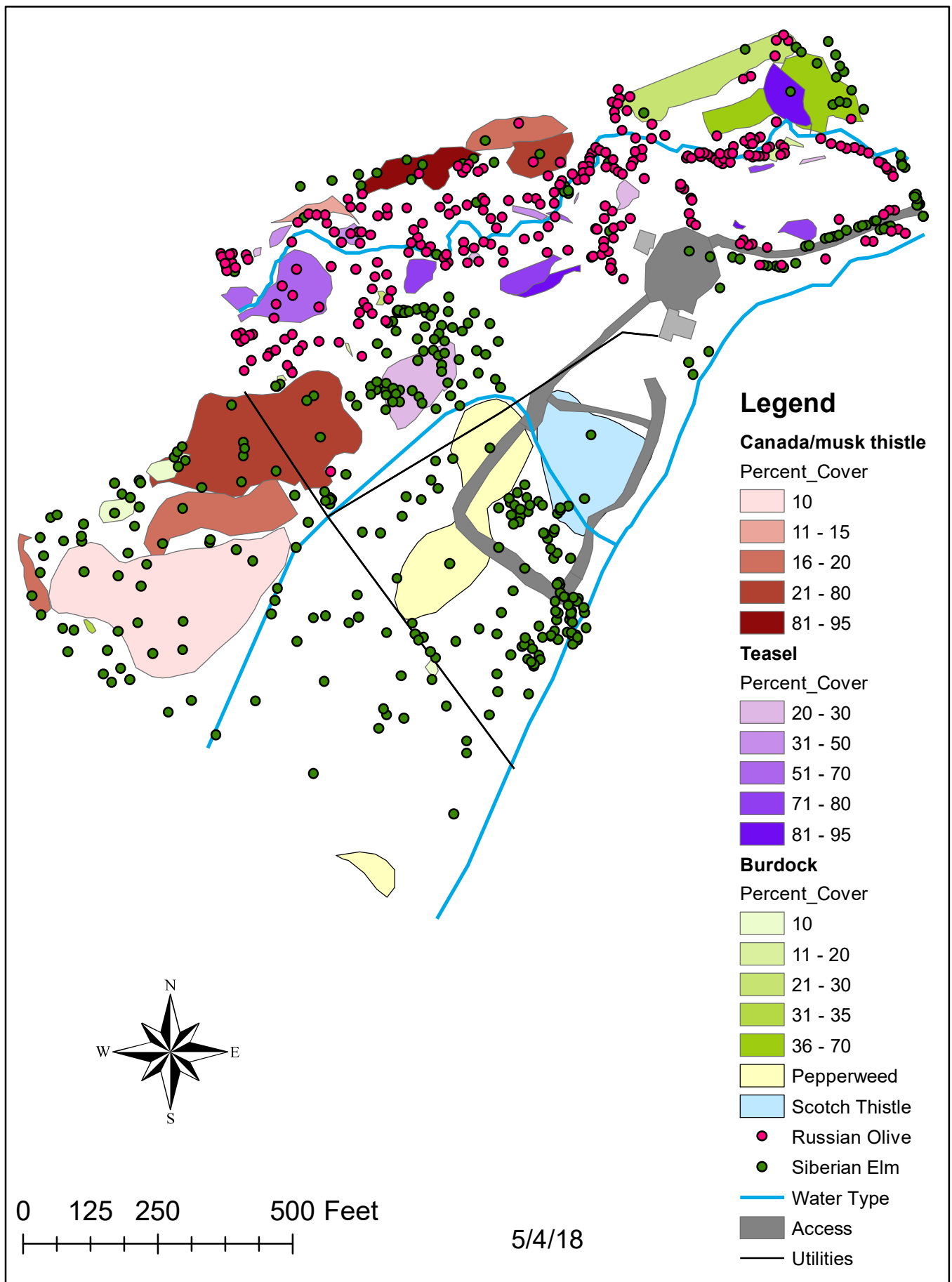
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 - http://www.minnesotawildflowers.info/udata/r9ndp23q/purple/common-burdock-0506_163814.jpg
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Rio Fernando Park Invasive Species



Rio Fernando Park All Invasive Species

