City of Rocks National Reserve
A partnership between the National Park Service
and the Idaho Department of Parks and Recreation

WEED MANAGEMENT PLAN
2006-2010

City of Rocks National Reserve
Castle Rocks State Park

Spotted Knapweed

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Approved: _____ July 3, 2006
Wallace Keck, CIRO Superintendent Date

Abstract

This weed plan was developed to provide a management strategy and technical guidance for the prevention, reduction and eradication where possible, of high priority non-native noxious weed species. This plan provides specific control plans for eleven noxious weed species including description of the plant, distribution with aerial maps, the goal and objectives, management options, actions planned and the resources needed to carry out the planned events for each weed species. Mapping standards including data collection protocols are provided to ensure accurate measurable results from year to year. An education outreach program has also been developed to generate public awareness and assistance in integrated pest management.

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1) Purpose

The purpose of this Weed Management plan is to provide the information and tools necessary to aid staff in the prevention of new infestations of non-native invasive plant species while reducing known populations on a yearly basis until control of non-native plant species has been achieved in and around City of Rocks National Reserve and Castle Rocks State Park.

City of Rocks National Reserve's (CIRO) purpose and objectives were developed in the Reserves Comprehensive Management Plan (CMP). Natural Resource management objectives include:

- Strive to preserve and restore natural resources
- Maintain natural conditions as much as possible
- Control exotic species that could disrupt the ecological, archeological, historical, or scenic integrity of the reserve

This Weed Management Plan outlines the Reserves strategic plan for the eradication of exotic weed species with a tactical program identifying how this will be achieved. The plan establishes realistic goals and targets to be achieved within a 5 year period and a long-range vision of weed eradication for CIRO.

Priorities for the control or elimination of weeds that already exist in the Reserve will be established according to their actual and potential impacts on native species and communities. Preventative programs will also be implemented to keep the site free of species that are not yet established but which are known to be pests elsewhere in the region.

2) Introduction

I. Regulatory Obligations

Federal and state governments have enacted laws to try and prevent the spread of noxious weed species on public and private lands in the United States. The following gives a synopsis of weed laws that CIRO is obligated to follow aside from its own established policies in the CMP which state "Control exotic species that could disrupt the ecological, archeological, historical, or scenic integrity of the reserve".

a) *Federal*

FEDERAL NOXIOUS WEED ACT OF 1974 7 U.S.C. §§ 2801-2814, January 3, 1975, as amended 1988 and 1994. **Management of Undesirable Plants on Federal Lands.** The Act requires that each federal agency: develop a management program to control undesirable plants on federal lands under the agency's jurisdiction; establish and adequately fund the program; implement cooperative agreements with state agencies to coordinate management of undesirable plants on federal lands; establish integrated management systems to control

undesirable plants targeted under cooperative agreements. A federal agency is not required to carry out management programs on federal lands unless similar programs are being implemented on state or private lands in the same area."

b) *State of Idaho*

TITLE 22 AGRICULTURE AND HORTICULTURE, CHAPTER 24: NOXIOUS WEEDS 22-2407 states: " LANDOWNER AND CITIZEN DUTIES. (1) It shall be the duty and responsibility of all landowners to control noxious weeds on their land and property, in accordance with this chapter and with rules and regulations promulgated by the director.

22-2402. (1)(8) defines "Eradication" as the complete elimination of all above-ground plant growth of a target noxious weed species for a period of two (2) years.

c) Cooperative Agreement

City of Rocks National Reserve was established in 1988 through Public Law 100-696 stating in Section 201 (a) "There is hereby established the City of Rocks National Reserve in order to preserve and protect the significant historical and cultural resources; to manage recreational use; to protect and maintain scenic quality; and to interpret the nationally significant values of the reserve".

The creation of CIRO initiated a unique relationship with the National Park Service and Idaho Department of Parks and Recreation (IDPR). The enabling legislation dictates a cooperative effort between the National Park Service and Idaho Department of Parks and Recreation in the protection and management of City of Rocks National Reserve. Agreement No. 1443-CA9000-96-002 Article II.1. states: "The National Park Service will transfer management and administration of CIRO to IDPR effective upon the approval date of this Cooperative Agreement….provide oversight ...and evaluation of IDPRs' management…provide technical assistance, expertise and training in programs such as …resource management."

Castle Rocks State Park (CRSP) established in 2000 through a land exchange between NPS and IDPR, located only 2 miles from CIROs' boundary, adds to the complexity of managing these park lands.

d) *Collaborating Partners*

As dictated in the Weed Act of 1974, CIRO has many collaborating partners in the struggle to control noxious weeds in and around its boundaries. Idaho Department of Parks and Recreation employees work in conjunction with the National Park Service Exotic Weed Management Team to establish effective strategies to eradicate noxious

weeds within CIRO/CRSP boundaries. NPS Integrated Pest Management Program (IPM) ensures that NPS approved pesticides are used appropriately and documented. Cassia County has a vested interest in weed populations within CIRO and CRSP to ensure spread does not occur to other areas of the county. Private landowners also play an important role in weed eradication. Because CIRO has private in holdings and CIRO/CRSP are surrounded in private lands, weed populations need to be controlled in all areas and this can only be accomplished through private landowner cooperation.

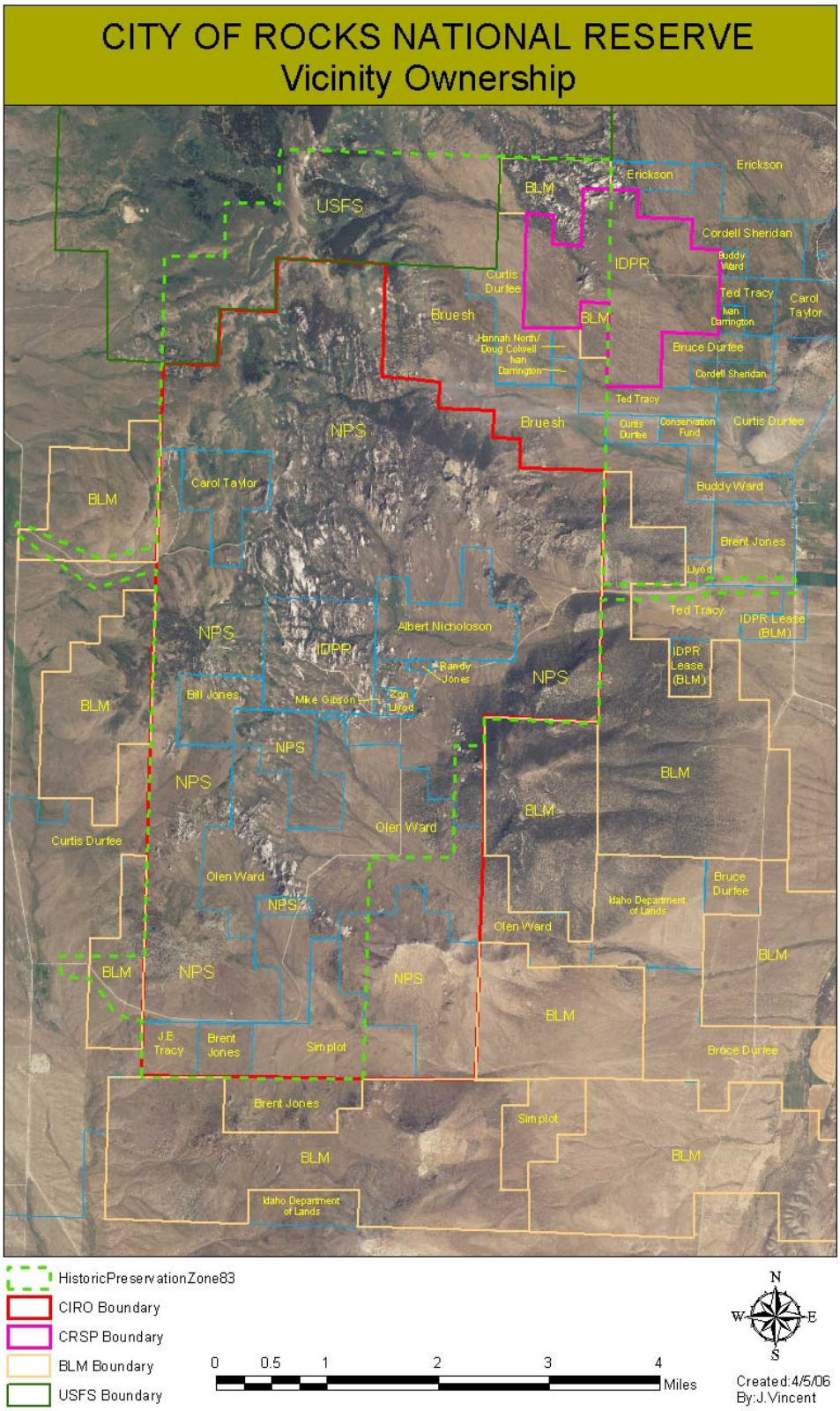
II. Location

City of Rocks National Reserve and Castle Rocks State Park are located near Almo, Idaho, 55 miles south of Burley, Idaho in Cassia County. Map 1

Map 1: Location Map

Both parks are located within 2 miles of each other surrounded by public and private lands. CIRO is 14, 000 acres and CRSP is 1200 acres. (Map 2)

Map 2. Ownership Map



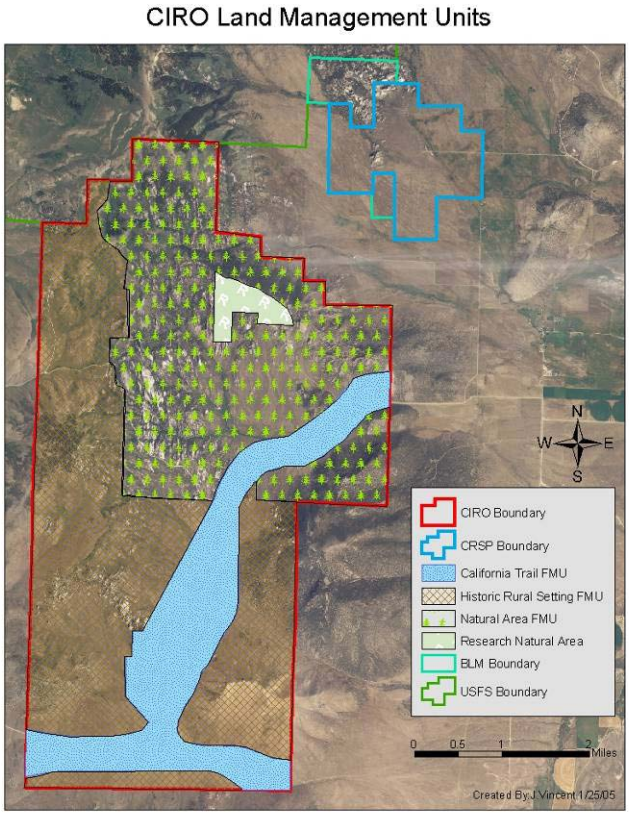
III. *Sight Description*

A total relief of 3,000 feet in a variety of exposures together with protruding granite rock monoliths produce many types of vegetation communities in City of Rocks. The dominant plant communities in the reserve, as outlined in CIROs' Resource Management Plan (RMP), include 1) pinyon/juniper forests, 2) conifer/aspen woodlands, 3) riparian scrub and herbaceous wetlands, 4) big sagebrush and grasslands, 5) mixed scrub, 6) mountain mahogany scrub, 7) high elevation meadows, and 8) unvegetated areas.

The area was settled mostly by Mormon settlers during the late 1800's after the passing of the California Trail which brought upwards of 140,000 people through what is now the reserve. Land uses in the area are dominated by agricultural industries including grazing and farming with some mining.

City of Rocks is divided into 4 subzones with different management objectives. For the purposes of this plan, the California Trail, natural, historic and the Research Natural Area subzones will not be differentiated as weed eradication is necessary in all subzones. (Map 3)

Map 3: Land Management Units



3) CIRO/CRSP Weeds

Idaho has about 300 exotic weed species throughout the state. Of those, 36 species are on Idaho's designated "noxious" weed list and by law, are required to be controlled and exterminated. IDAPA 22-2402. (1) (12) defines "Noxious weed" as any plant having the potential to cause injury to public health, crops, livestock, land or other property; and which is designated as noxious by the director. (Appendix I) In addition to the 36 designated species, there are 8 additional species of concern. (Appendix II).

In 1995, University of Idaho conducted an Exotic pest plant Inventory in parks of the Pacific Northwest. Canada and scotch thistle were the only two noxious weeds species found within City of Rocks (Monello 1995). There was no mention to the time spent or area covered in CIRO.

University of Idaho conducted invasive plant inventories again in 2003. Timothy Prather ran the field crew in City of Rocks and covered 790 acres. Approximately 38 of those acres were found to be infested with 12 noxious weed species (Prather 2003).

City of Rocks National Reserve and Castle Rocks State Park together have seven noxious weed species designated by the State of Idaho (Table 1), three that are listed as species of concern (Table 2), and 5 non-native weed species that are not on the Idaho list but are of concern to CIRO/CRSP (Table 3).

Table 1: State of Idaho designated "noxious" weed species within CIRO/CRSP

Common Name	Genus Species	Primary Locations	Priority
Black henbane	Hyoscyamus niger	Roadsides	Low
Canada thistle	Cirsium arvense	Water Sources	Medium
Field bindweed	Convolvulus arvensis	Homesteads, parking lots	Medium
Musk thistle	Carduus nutans	Bath Rock,	Medium
Scotch thistle	Onopordum acanthium	CRSP, Circle Creek, Twin Sisters	High
Spotted knapweed	Centaurea maculosa	CRSP Ranch House & laneway, Bread Loaves, Bath Rock and Trail, Camp Rock	Very high
Whitetop	Cardaria draba	VC Center	Very high

Table 2: State of Idaho designated weed species of concern in CIRO/CRSP

Common Name	Genus Species	Primary Locations	Priority
Houndstongue	Cynoglossum officinale	Emery Well, Bath Rock	High
Salt cedar	Tamarix ramosissima	South Fork Circle Creek	Very high
Sulphur cinquefoil	Potentilla recta	Unconfirmed Emery Canyon Road	High

Table 3: Other exotic weed species of concern in CIRO/CRSP

Common Name	Genus Species	Primary Locations	Priority
Bull Thistle	Cirsium vulgare	Water Sources, Disturbed areas	Medium
Chicory	Cichorium intybus	East of CRSP	Medium
Common mullein	Verbascum thapsus	Dispersed throughout park	Low
Common burdock	Arctium minus	Homesteads	Low
Cheat grass	Bromus tectorum	Cedar Hills	Medium

Priority has been assigned to the weed species based on the acre coverage and the ability of the species to dominant and cause imminent threat to the surrounding natural resources. Higher priority is assigned to those species that have a relatively small infestation, as control of those species can be easier to achieve.

4. SPECIFIC CONTROL PLANS FOR HIGH PRIORITY WEED SPECIES

I. Spotted Knapweed *(Centaurea maculosa)*

A. PRIORITY: Very High

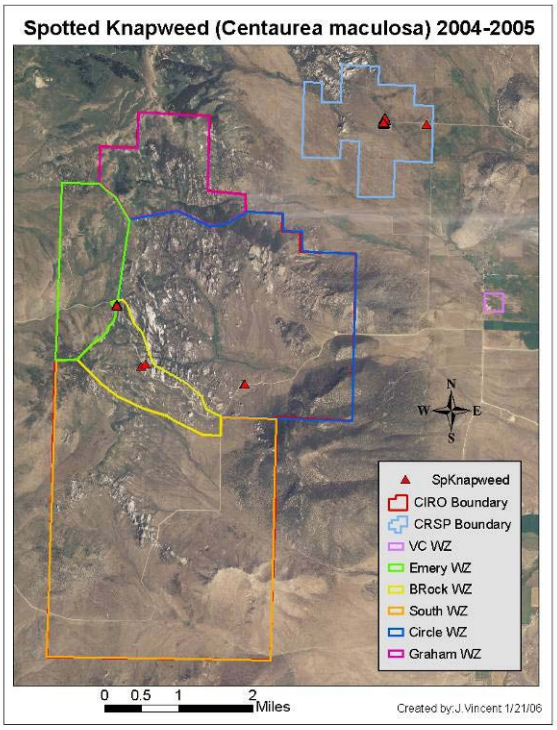
B. DESCRIPTION

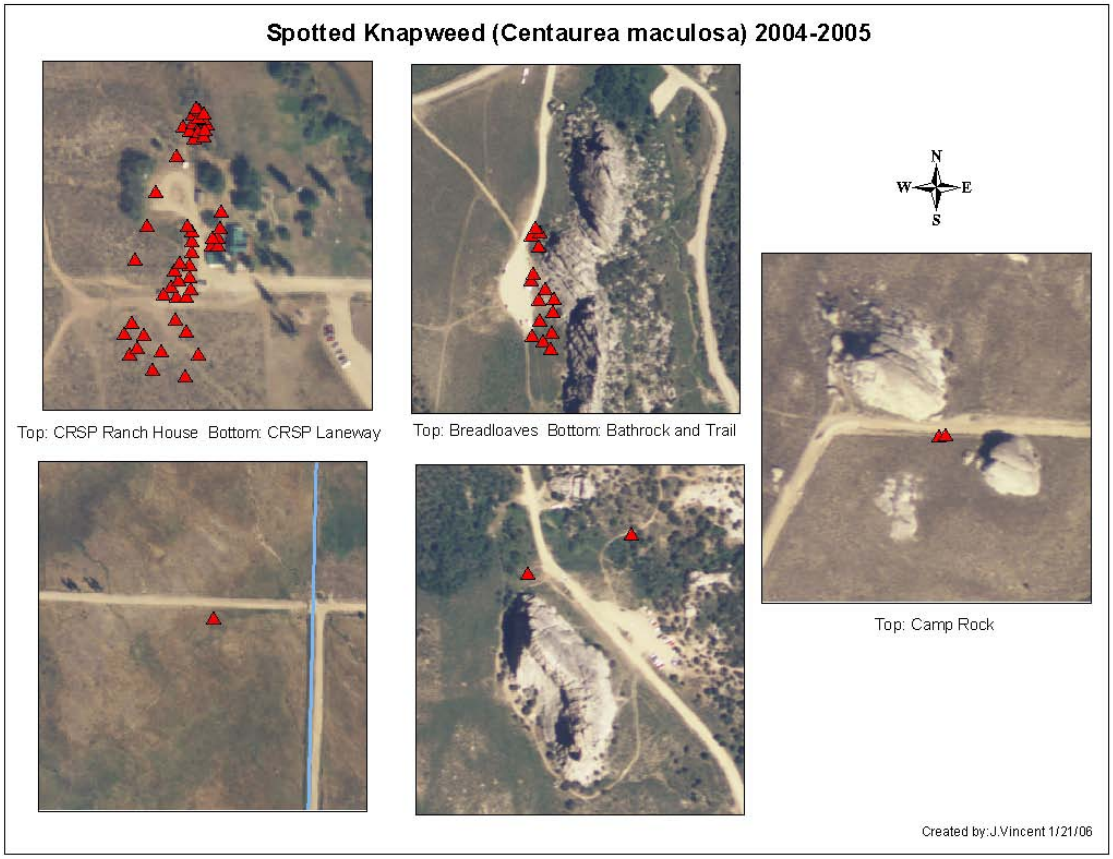
Spotted knapweed is a biennial or short-lived perennial with a stout taproot. It is branched and grows 1 to 3 feet tall. Basal leaves up to 6 inches long, blades narrowly elliptic, entire to pinnately part. Flowering heads are solitary at end of branches; involucral bracts stiff and tipped with a dark comblike fringe. Ray flowers are pinkish-purple or rarely cream-colored. Spotted knapweed was introduced from Eurasia and is a number one weed problem in many areas in North America. They establish themselves on any disturbed soil and become very prolific out competing native vegetation.

C. CURRENT DISTRIBUTION ON THE SITE

Spotted Knapweed is found in 6 locations throughout the park, three of which were new discoveries in 2005. CRSP has the largest population density and is located in a high water table area north and west of the ranch house. Bread Loaves has the second highest density and is located on a dry site. Bath Rock has a lower population density and is on a wet site. New infestations were discovered in 2005 at CRSP laneway, Camp Rock and Bath Rock Trail and were immediately removed. (Map 4&5)

Map 4: Spotted Knapweed Infestations in CIRO/CRSP





Map 5: Close up of Spotted Knapweed locations in CIRO/CRSP

1. **CRSP Ranch House**: Spotted knapweed is found south, west and north of the ranch house within the fenced off area. Plants are in the open sagebrush south of the house up to the trailhead sign; follow the lower drainage west of the house along the road, spread across the lawn north of the shop and house, to the willow patch located north of the ranch house. This area has been hand treated in 2004 and 2005, several times until no more plants were observed. This is a high water table area with standing water due to flood irrigation. All slopes run to Almo Creek. Extreme caution if using herbicide in this site. Recommended chemical as of 4/2006: Milestone (aminopyralid). Milestone is selective and has no ground water advisory restrictions on the label. It can be used in areas with high water tables and right up to the water's edge. It can also be used in sub-irrigated meadows and seasonally wet areas when they are dry.

2. **CRSP Laneway**: A new infestation was located 20 meters west of the entrance gate on the south side of the road in 2005. These plants were hand removed upon discovery and the site needs to be revisited to ensure there are no other viable seeds. This is a high water table area with standing water due to flood irrigation. All water drains to Almo Creek through irrigation ditches. Extreme caution if using herbicide in this site.

3. **Bread Loaves**: Located west of Bread Loaves Rock and east of the parking lot. Plants are dispersed through out this area in and around Bread Loaves group site. This site has existed for some time. Weeds have been intermittently hand pulled in 2001, 02, and 03. 2004 and 2005 the site was revisited and treated several times until no more plants were observed. Herbicide can be used at this site as it is dry, but caution with the visitor and campsites.

4. **Bath Rock North**: This site has been known and treated for some time. Approximately 20 plants are located just north of Bath Rock west of the road to the aspen stands and east of the road following the drainage. This site has been retreated by hand removal in 2004 and 2005 until no more plants were visible. Extreme caution if using herbicide in this site.

5. **Bath Rock Trail**: One plant was discovered fall of 2005 thirty meters into the Bath Rock Trail. This plant was hand removed. The site is dry and herbicide can be used although hand pulling is recommended as long as the population remains low and resources are available.

6. **Camp Rock**: This site is new discovered in July 2005 located just west of Camp Rock on the south side of the road. 5 plants were located and hand pulled. This is a dry site and herbicide can be used although hand pulling is recommended as long as the population remains low and resources are available.

D. DAMAGE & THREATS

Spotted Knapweed is a highly invasive weed that is cable of forming large infestations. It is a high threat to natural resources in CRSP and CIRO as it spreads easily and moves into and dominates or disrupts natural communities in 2-3 years. Seeds can spread via pets, vehicles and person and because visitors to the Almo area often visit both parks, the potential for spread is very high and has been observed.

E. GOAL

Because of the extremely noxious nature of Spotted Knapweed and relatively low populations, it must be eradicated from CIRO/CRSP by 2010.

F. OBJECTIVES

i) Populations of Spotted Knapweed at CRSP and Bread Loaves will be decreased at a rate of 25% a year until eradicated by 2010
ii) Camp Rock, CRSP Laneway and Bath Rock Trail populations will be eradicated by 2007.
iii) New or small infestations of Spotted Knapweed will be exterminated upon discovery through the appropriate management for the site and will be revisited throughout the season and annually to ensure a successful treatment

iv) Establish an educational program for visitors to encourage assistance in spotted knapweed annihilation.

G. MANAGEMENT OPTIONS

See Appendix III for definitions:

(1) Mechanical	New or small infestations, moist areas
(2) Burn	No - Weed can increase
(3) Biological	Rehabilitation, Many species, Fair to Excellent
(4) Chemical	Where appropriate: 2,4-D, aminopyralid, clopyralid, picloram, triclopyr
(5) Cultural	Information at CIRO/CRSP and kiosks
(5) Grazing	Long-term intense grazing may provide control
(7) No Action	No

*Bold/underline is the preferred management option

Because most of the spotted knapweed is located around a high water table and all the infestations are relatively small, hand pulling is an effective, environmentally friendly treatment option. Bread Loaves and Camp Rock infestations are the only dry sites open to herbicide application; other sites will be evaluated as needed to determine if an approved herbicide is appropriate. Cultural control is a necessity to educate visitors and minimize spread.

H. ACTIONS PLANNED

- Site visits of no less than 5 will begin in early June and cease when weeds are no longer observed.
- Inventory using mapping standards (Section 6b)
- Mechanical removal at all sites if chemical is not an option.
- Plants in flower or with the potential to produce viable seed will be collected in black garbage bags, tied securely and left at CRSP (north of the ranch house near the infestation in the willows) for a period of 2 weeks to ensure degermination of seeds. After the 2 week period, bags will be taken to the Almo roll-off station for disposal.
- Chemical application at sites where mechanical removal is not feasible and is approved through NPS IPM PUPS
- Education will be a significant part of early detection of new infestations. Plastic model plants with wanted posters will be placed at CIRO and CRSP offices, and kiosks to encourage visitors to report sightings or to participate in the Weed Eradication program. (Appendix IV)

I. HOW ACTIONS WILL BE EVALUATED (Criteria for success)

- Field data will be compiled in ArcInfo and assembled on maps with a final report by the end of the season to ensure accurate data composition
- Current data will then be analyzed with previous seasons data to track success and ensure objectives are on target
- If objectives are not on target, chemical application will be considered and NPS IPM/EPMT guidelines will be followed

J. RESOURCE NEEDS

An average crew of five consisting of one program lead and 4 Youth Conservation Corps (YCC) will be utilized on the spotted knapweed infestations. The estimated man hours and salary costs are shown in Table 4. Vehicles and equipment will be employed and GIS Dataloggers (Trimble Geo XM) and hardware with ArcInfo will be utilized for inventorying and monitoring purposes. Table 5. Dollars needed for Spotted Knapweed in CIRO/CRSP for 2006 is approximately **$2,600**. Dollars for continuing years will be based on success of the program and will be updated as warranted.

Table 4: Labor and dollars estimated for 2006 Spotted Knapweed infestations

Site	Crew	Est. Man hrs	Approx. Salary Cost
CRSP Ranch House	5	80	$600.00
CRSP Lane Way	5	2	$75.00
Bread Loaves	5	40	$300.00
Bath Rock & Trail	5	40	$300.00
Camp Rock	5	1	$40.00
New Sites/Early Detection	5	40	$300.00
Data Analysis	1	40	$530
TOTAL		**243**	**2,145.00**

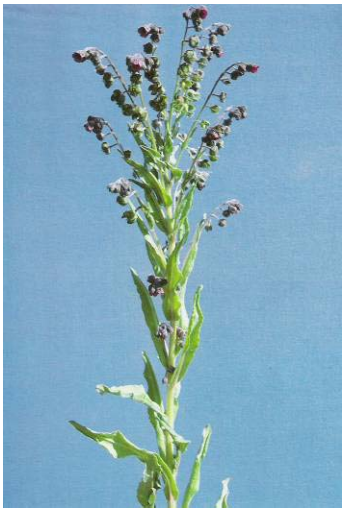
Table 5: Approx. Equipment Costs

Equipment	Cost
Gloves, Shovels/Hoes, garbage bags	$200.00
Vehicle (5 trips@15mi@ $.38/mi)	$30
GIS hardware use	$200
Chemical (Milestone)	
TOTAL Equipment	**$430.00**

K. RESULTS OF EVALUATION

(This section is to be updated each season, when monitoring data has been taken and evaluated. The evaluation should be used to determine whether the program should be modified to ensure successful objectives.)

II. **Houndstongue (***Cynoglossum officinale)*



A. PRIORITY: High

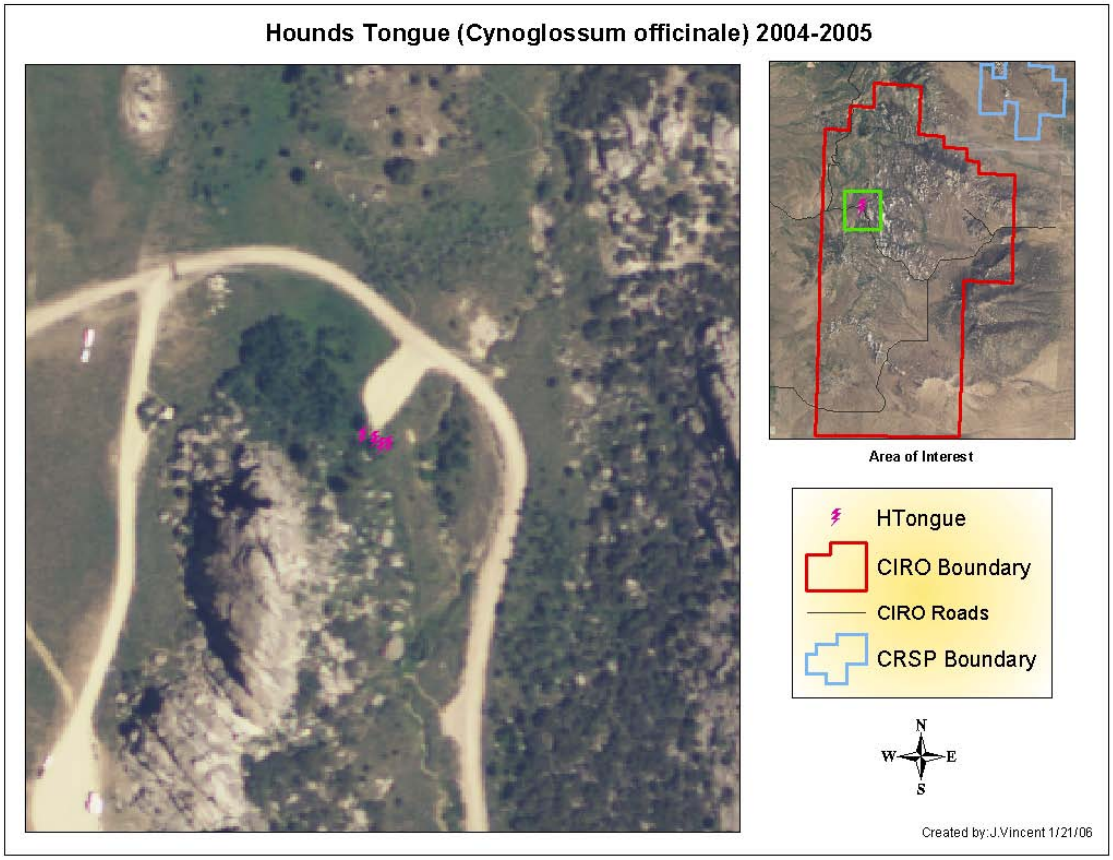
B. DESCRIPTION

Houndstongue is a biennial growing 1 to 3 feet tall and reproduces by seed. Leaves are alternate, 1-12 inches long, 1-3 inches wide, rough, hairy and lacking teeth and lobes. Flowers are reddish-purple and terminal; fruit is composed of 4 prickly nutlets 1/3 inch long; which contain seed and cling to clothing or animals. It was introduced from Europe; found along roadsides and disturbed areas.

C. CURRENT DISTRIBUTION ON THE SITE

Houndstongue is located at Emery Canyon well site in CIRO. One population with 12 individual plants was located and removed in 2005.

Map 6: Houndstongue locations in CIRO/CRSP



D. DAMAGE & THREATS

Houndstongue is known to be toxic to livestock including cattle and especially horses; sheep are more resistant. This population is around a high use area, the Emery Well site. The majority of visitors stop here as this is one of two water locations in City of Rocks. The seed containing nutlets of houndstongue are very sticky which accelerates dispersal and represents an extreme risk of spread.

E. GOALS

Because of the extremely low population, houndstongue will be eradicated from CIRO by 2008.

F. OBJECTIVES

i) Houndstongue will be decreased by 50% each year
ii) Houndstongue will be eradicated from CIRO by 2008.
iii) New or small infestations of houndstongue will be exterminated upon discovery by mechanical removal and revisited to ensure a successful treatment
iv) Establish an educational program for visitors to encourage assistance in early detection

G. MANAGEMENT OPTIONS

See Appendix III for definitions:

(1) Mechanical	Highly effective on small infestations
(2) Burn	No
(3) Biological	Rehabilitation
(4) Chemical	Not at present – methsulfuron methyl, imazapic
(5) Cultural	Information placed at Emery Well
(6) Grazing	No – toxic to livestock
(7) No Action	No

*Bold/underline is the preferred management option

The houndstongue infestation is less than 20 plants at present. Due to the high traffic area around the Emery Canyon well and wet riparian area and the relatively low population, chemical treatment is not recommended but if appropriate management dictates otherwise, use of Plateau up to the waters edge or spot spraying with Rodeo can be an option. Mechanical removal of plants in garbage bags is necessary if the plant is in flower or has the potential to produce viable seed. Education posters will be displayed at the Emery Canyon kiosk to educate visitors of the infestation.

H. ACTIONS PLANNED

- Site visits of no less than 3 will begin in early June and cease when snow is on the ground. This plant can produce rosettes in both spring and fall.
- Inventory using mapping standards (Section 6b)
- Mechanical removal. Caution while handling as seed pods are very sticky and can be easily transported without knowing.
- Plants in flower or with the potential to produce viable seed will be collected in black garbage bags, tied securely and left at CRSP (north of the ranch house near the Spotted Knapweed infestation in the willows) for a period of 2 weeks to ensure degermination of seeds. After the 2 week period, bags will be taken to the Almo roll-off station for disposal.
- Education will be a significant part of early detection of new infestations. Information posters will be placed at the Emery well kiosk to encourage visitors to report sightings or to participate in the Weed Eradication program. (Appendix IV)

I. HOW ACTIONS WILL BE EVALUATED

- Field data will be compiled in ArcInfo and assembled on maps with a final report by the end of the season to ensure accurate data composition
- Current data will then be analyzed with previous seasons data to track success and ensure objectives are on target
- If objectives are not on target, methods will be reevaluated to ensure objectives will be met.

J. RESOURCE NEEDS

An average crew of five consisting of one program lead and 4 Youth Conservation Corps (YCC) will be utilized on houndstongue infestation. The estimated man hours and salary costs are shown in Table 6. Vehicles and equipment will be employed and GIS Dataloggers (Trimble Geo XM) and hardware with ArcInfo will be utilized for inventorying and monitoring purposes. Table 7. Dollars needed for Houndstongue in CIRO for 2006 is approximately **$300.00**. Dollars for continuing years will be based on success of the program and will be updated as warranted.

Table 6: Labor and dollars estimated for 2006 houndstongue infestations

Site	Crew	Est. Man hrs	Approx. Salary Cost
Emery Canyon Well	5	4	$150.00
Data Analysis	1	1	$20.00
TOTAL		**5**	**$170.00**

Table 7: Approx. Equipment Costs

Equipment	Cost
Gloves, Shovels/Hoes, garbage bags	$50.00
Vehicle (3 trips@15mi@ $.38/mi)	$20
GIS hardware use	$50
TOTAL Equipment	**$120.00**

K. RESULTS OF EVALUATION

(This section is to be updated each season, when monitoring data has been taken and evaluated. The evaluation should be used to determine whether the program should be modified to ensure successful objectives.)

III. **Whitetop** a.k.a. Hoary cress (*Cardaria draba)*

A. PRIORITY: High

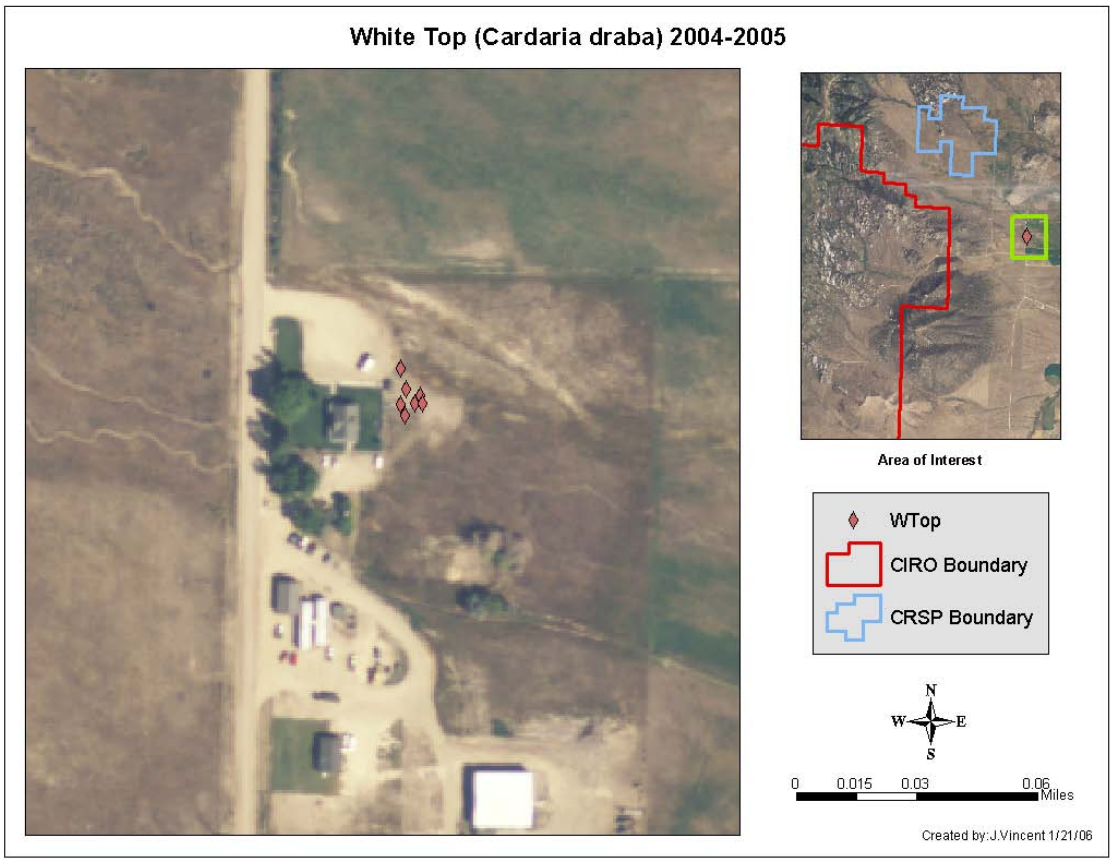
B. DESCRIPTION

A deep rooted perennial up to two feet tall, reproducing from root segments and seeds. Leaves are blue-green in color, lance-shaped. Lower leaves are stalked; upper leaves have two lobes clasping the stem. Plants have many white flowers with four petals, giving the plant a flat white top appearance. Plants emerge in very early spring and have bloomed and set seed by mid summer. It is common on disturbed soils.

C. CURRENT DISTRIBUTION ON THE SITE

Whitetop is found on the east side of the Visitor Center in a disturbed area near the washroom.

Map 7: Whitetop Locations in CIRO/CRSP



D. DAMAGE & THREATS

Whitetop is highly competitive with other species once it becomes established and has the potential to out compete native vegetative communities. This population is close to a high public use area dramatically increasing the potential for dispersal.

E. GOALS

Because of Whitetops relatively low population and its highly competitive nature, it will be eradicated.

F. OBJECTIVES

i) Whitetop will be decreased at a rate of 25% a year until eradicated by 2010
ii) New or small infestations of whitetop will be exterminated upon discovery by chemical application and mechanical removal and revisited to ensure a successful treatment
iii) Establish an educational program for visitors to prevent population spread.

G. MANAGEMENT OPTIONS

See Appendix III for definitions:

(1) Mechanical	Digging is minimally effective, may be helpful with chemical control
(2) Burn	Not likely to be effective for perennials
(3) Biological	Rehabilitation, legumes will compete
(4) Chemical	chlorsulfuron, imazapic, metsulfuron methyl
(5) Cultural	Information at Visitor center and Outhouse
(6) Grazing	Sheep will graze it
(7) No Action	No

*Bold/underline is the preferred management option

H. ACTIONS PLANNED

- <u>Site visits of no less than 3</u> will begin in late May and cease when weeds are no longer observed.
- <u>Inventory</u> using mapping standards (Section 6b)
- Chemical Application – Early to late May (bud to early flower stage or in the fall is best), metsulfuron methyl
- <u>Mechanical removal</u> of any survivors in June
- <u>Plants in flower or have potential to produce viable seed will be collected</u> in black garbage bags, tied securely and left at the site (east of CIRO admin building) for a period of two weeks to ensure degermination of seeds. After the two week period, bags will be taken to the Almo roll-off station for disposal.

- Education will be a significant part of early detection of new infestations. Information posters will be placed at CIRO outhouse to encourage visitors to have caution in the area and report sightings. (Appendix IV)

I. HOW ACTIONS WILL BE EVALUATED

- Field data will be compiled in ArcInfo and assembled on maps with a final report by the end of the season to ensure accurate data composition
- Current data will then be analyzed with previous seasons data to track success and ensure objectives are on target
- If objectives are not on target, methods will be reevaluated to achieve objectives

J. RESOURCE NEEDS

An average crew of five consisting of one program lead and 4 Youth Conservation Corps (YCC) will be utilized on the white top infestation. The estimated man hours and salary costs are shown in Table 8. Vehicles and equipment will be employed and GIS Dataloggers (Trimble Geo XM) and hardware with ArcInfo will be utilized for inventorying and monitoring purposes. Table 9. Dollars needed for Whitetop for 2006 is approximately **$187.00**. Dollars for continuing years will be based on success of the program and will be updated as warranted.

Table 8: Labor and dollars estimated for 2006 whitetop infestations

Site	Crew	Est. Man hrs	Approx. Salary Cost
Headquarters	5	8	$200.00
Data Analysis	1	1	$20.00
TOTAL		**5**	**$220.00**

Table 9: Approx. Equipment Costs

Equipment	Cost
Gloves, Shovels/Hoes, garbage bags	$50.00
Vehicle (3 trips@10mi@ $.38/mi)	$12.00
GIS hardware use	$50.00
Escort (metsulfuron methyl)	$75.00
TOTAL Equipment	**$187.00**

K. RESULTS OF EVALUATION

(This section is to be updated each season, when monitoring data has been taken and evaluated. The evaluation should be used to determine whether the program should be modified to ensure successful objectives.)

IV. **Scotch Thistle** *(Onopordum acanthium)*

A. PRIORITY: High

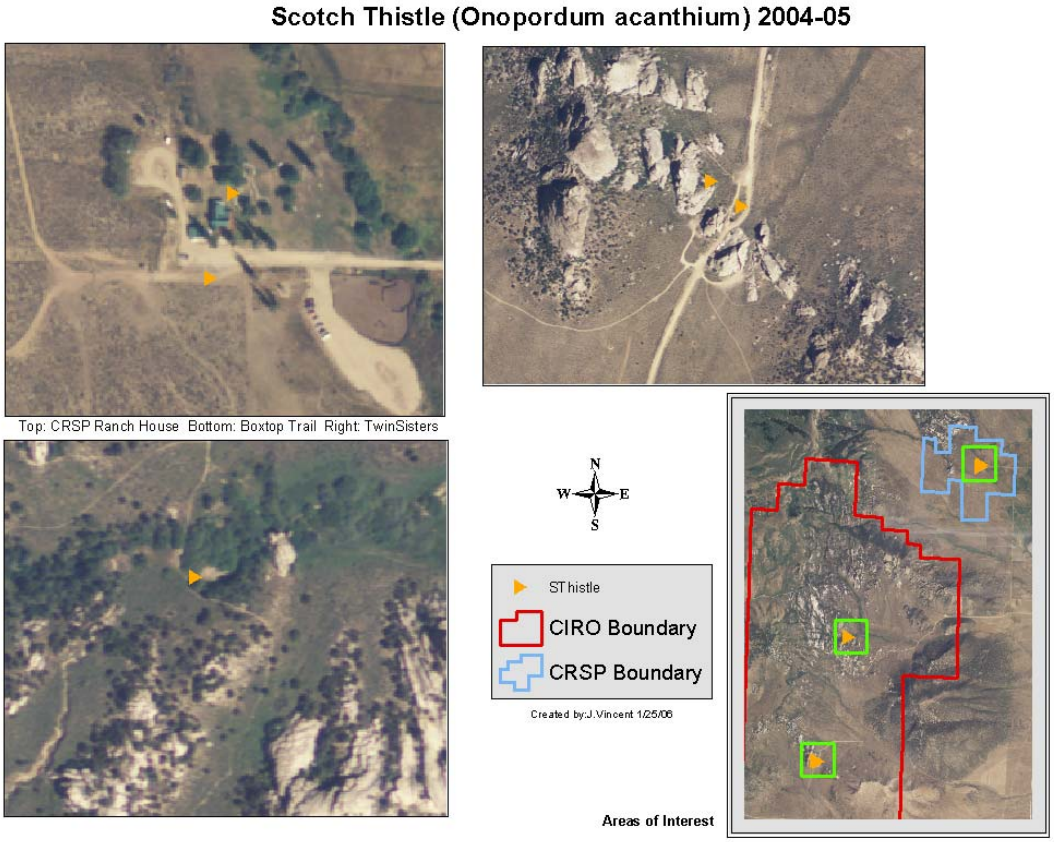
B. DESCRIPTION

Scotch Thistle is a biennial that grows up to 12 feet tall. Stems have broad, spiny wings, leaves are large, spiny and covered in fine dense hair giving a grayish appearance. Flower heads are numerous, 1-2 inches in diameter, violet to reddish. Scotch thistle is a native of Europe and eastern Asia and is now sparsely naturalized over much of North America. It is an aggressive plant and may form stands so dense that they are impenetrable to livestock.

C. CURRENT DISTRIBUTION ON THE SITE

Scotch thistle is found at CRSP Ranch House and on Box Top trail near South fork junction in CIRO.

Map 8: Scotch Thistle Locations in CIRO/CRSP



D. DAMAGE & THREATS

Scotch thistle is an aggressive plant and may form stands so dense that they are impenetrable to livestock. If not controlled it will spread uncontrollably and consume native vegetative communities.

E. GOAL

Scotch thistle is very aggressive and exists in very small populations consisting of less than 5 individuals and therefore will be eradicated by 2008.

F. OBJECTIVES

i) Infestations on Box Top trail head will inventoried to determine extent of infestation in 2006 and objectives will be updated
ii) CRSP populations will be decreased by 50% per year and eradicated by 2008
iii) New or small infestations of scotch thistle will be exterminated upon discovery by mechanical removal and revisited to ensure a successful treatment

G. MANAGEMENT OPTIONS

See Appendix III for definitions:

(1) Mechanical	Effective
(2) Burn	No
(3) Biological	Very limited
(4) Chemical	Not at present, aminopyralid, chlorsulfuron, clopyralid, metsulfuron methyl, picloram
(5) Cultural	Very small populations – no need to over sign on this weed
(6) Grazing	Ineffective
(7) No Action	No

*Bold/underline is the preferred management option

H. ACTIONS PLANNED

- Box Top Trail infestation will be inventoried to determine level of infestation
- <u>Site visits of no less than 3</u> will begin in late May and cease when weeds are no longer observed.
- <u>Inventory</u> using mapping standards (Section 6b)
- <u>Mechanical removal</u>.
- <u>Plants will be collected</u> only if in flower or gone to seed. Black garbage bags, tied securely and left at site for a period of 2 weeks to ensure degermination of seeds. After the 2 week period, bags will be collected and taken to the Almo roll-off station for disposal.
- Education will be useful if infestations grow but informative efforts, for now, should be placed on other weed species.

I. HOW ACTIONS WILL BE EVALUATED

- Field data will be compiled in ArcInfo and assembled on maps with a final report by the end of the season to ensure accurate data composition
- Current data will then be analyzed with previous seasons data to track success and ensure objectives are on target
- If objectives are not on target, methods will be reevaluated to achieve objectives

J. RESOURCE NEEDS

An average crew of five consisting of one program lead and 4 Youth Conservation Corps (YCC) will be utilized on the scotch thistle infestation.. The estimated man hours and salary costs are shown in Table 10. Vehicles and equipment will be employed and GIS Dataloggers (Trimble Geo XM) and hardware with ArcInfo will be utilized for inventorying and monitoring purposes. Table 11. Dollars needed for Scotch thistle in CIRO/CRSP for 2006 is approximately **$300**. Dollars for continuing years will be based on success of the program and will be updated as warranted.

Table 10: Labor and dollars estimated for 2006 scotch thistle infestations

Site	Crew	Est. Man hrs	Approx. Salary Cost
CRSP Ranch House	5	2.5	$20.00
Box Top Trail	5	20	$150.00
Data Analysis	1	1	$20.00
TOTAL		**23.5**	**$190.00**

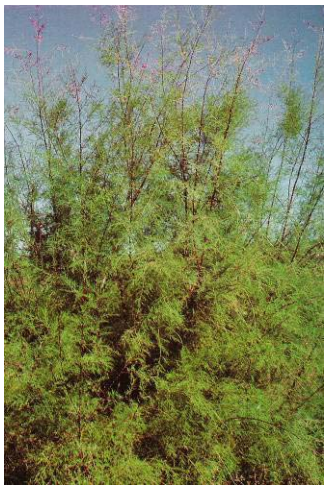
Table 11: Approx. Equipment Costs

Equipment	Cost
Gloves, Shovels/Hoes, garbage bags	$50.00
Vehicle (3 trips@15mi@ $.38/mi)	$20
GIS hardware use	$50
TOTAL Equipment	**$120.00**

K. RESULTS OF EVALUATION

(This section is to be updated each season, when monitoring data has been taken and evaluated. The evaluation should be used to determine whether the program should be modified to ensure successful objectives.)

V. **Saltcedar** (***Tamarix ramosissima)***



A. PRIORITY : Very High

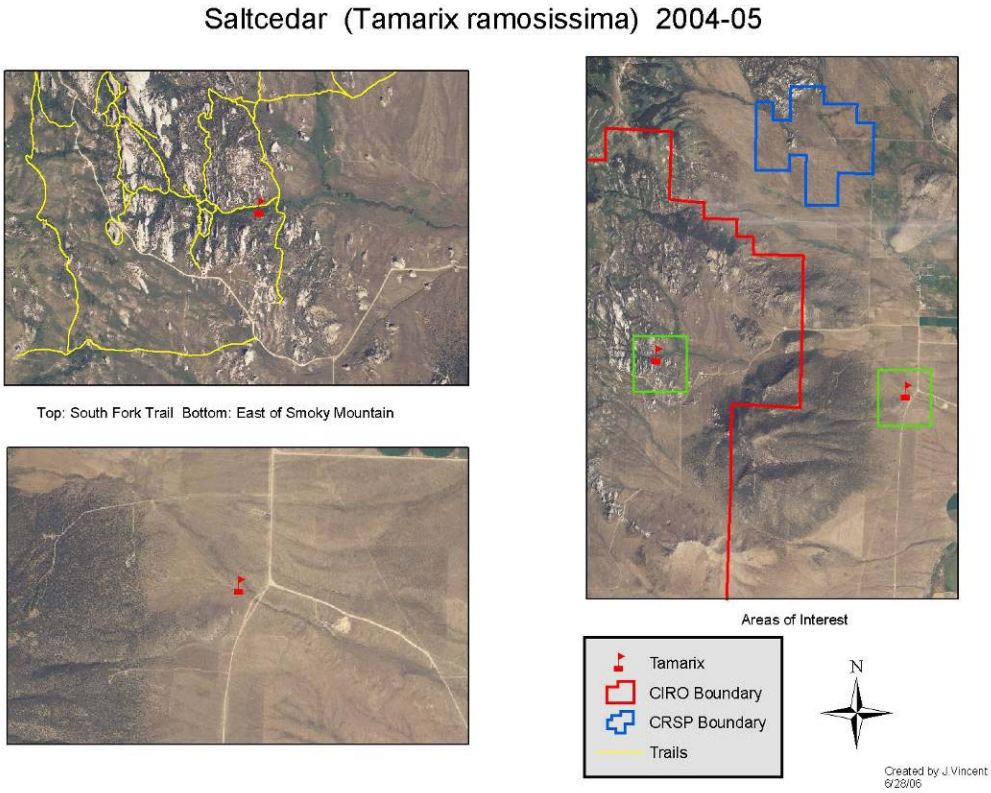
B. DESCRIPTION

Deciduous or evergreen shrubs or small trees, 5-20 feet tall. Bark is reddish brown, leaves are small, wispy and scale- like on slender stems. Covered in pink flowers in June. Saltcedar was introduced from Eurasia for stream bank stabilization and is now wide spread in the US.

C. CURRENT DISTRIBUTION ON THE SITE

One saltcedar plant was found outside of CIRO/CRSP boundaries on Circle Creek. The plant was discovered and removed by the county weed supervisor. Another possible plant was reported on South Fork Circle Creek but after multiple site searches it is believed that the tree was misidentified.

Map 9: Saltcedar locations near CIRO/CRSP



D. DAMAGE & THREATS

Saltcedar is extremely invasive; stands form tight monocultures along bodies of water severely limiting wildlife biodiversity and out competing most native vegetation. It can transpire 200 gallons of water per plant per day and will often dry up ponds and streams.

E. GOALS

Early detection and immediate eradication of any saltcedar plant in or around CIRO/CRSP boundaries.

F. OBJECTIVES

i) Establish an educational program for visitors to aid in early detection of saltcedar
ii) New infestations of saltcedar will be inventoried and immediately exterminated upon discovery by mechanical removal.
iii) Any known infestation site will be revisited at least once a year for five years after removal to ensure a successful treatment

G. MANAGEMENT OPTIONS

See Appendix III for definitions:

(1) Mechanical	Works with one or two small plants
(2) Burn	No – increases plant
(3) Biological	Not with one-two plants
(4) Chemical	imazapyr (Habitat or Arsenal) or triclopyr (Garlon 4 or 3A) for larger infestations
(5) Cultural	Establish education information
(6) Grazing	No
(7) No Action	No

*Bold/underline is the preferred management option

H. ACTIONS PLANNED

- Circle Creek and other drainages within and around CIRO/CRSP will be monitored for any new infestations
- <u>Site visits of no less than 1</u> in previously infested areas will begin in early May; plants flower PINK in June; search efforts should be focused in June
- <u>Inventory</u> and new plants using mapping standards (Section 6b)
- <u>Mechanical removal</u> of ALL newly discovered saltcedar.
- <u>Plants will be collected</u> only if in flower or gone to seed. Black garbage bags, tied securely and left at site for a period of 2 weeks to ensure degermination of seeds. After the 2 week period, bags will be collected and taken to the Almo roll-off station for disposal.
- Education is crucial in early detection efforts

I. HOW ACTIONS WILL BE EVALUATED

- Field data will be compiled in ArcInfo and assembled on maps with a final report by the end of the season to ensure accurate data composition
- Current data will then be analyzed with previous seasons data to track success and ensure objectives are on target
- If objectives are not on target, methods will be reevaluated to achieve objectives

J. RESOURCE NEEDS

An average crew of five consisting of one program lead and 4 Youth Conservation Corps (YCC) will be utilized on early detection of saltcedar. The estimated man hours and salary costs are shown in Table 12. Vehicles and equipment will be employed and GIS Dataloggers (Trimble Geo XM) and hardware with ArcInfo will be utilized for inventorying and monitoring purposes. Table 13. Dollars needed for saltcedar in CIRO/CRSP for 2006 is approximately **$820**. Dollars for continuing years will be based on the discovery of plants and will be updated as warranted.

Table 12: Labor and dollars estimated for 2006 saltcedar infestations

Site	Crew	Est. Man hrs	Approx. Salary Cost
Lower Circle Creek Drainage	5	10	$75.00
Other drainages	5	80	$600.00
Data Analysis	1	1	$20.00
TOTAL		91	**$695.00**

Table 13: Approx. Equipment Costs

Equipment	Cost
Vehicle (3 trips@15mi@ $.38/mi)	$20
GIS hardware use	$50
TOTAL Equipment	**$120.00**

K. RESULTS OF EVALUATION

(This section is to be updated each season, when monitoring data has been taken and evaluated. The evaluation should be used to determine whether the program should be modified to ensure successful objectives.)

VI. **Musk Thistle** (*Cirsium arvense*)

A. PRIORITY: Medium

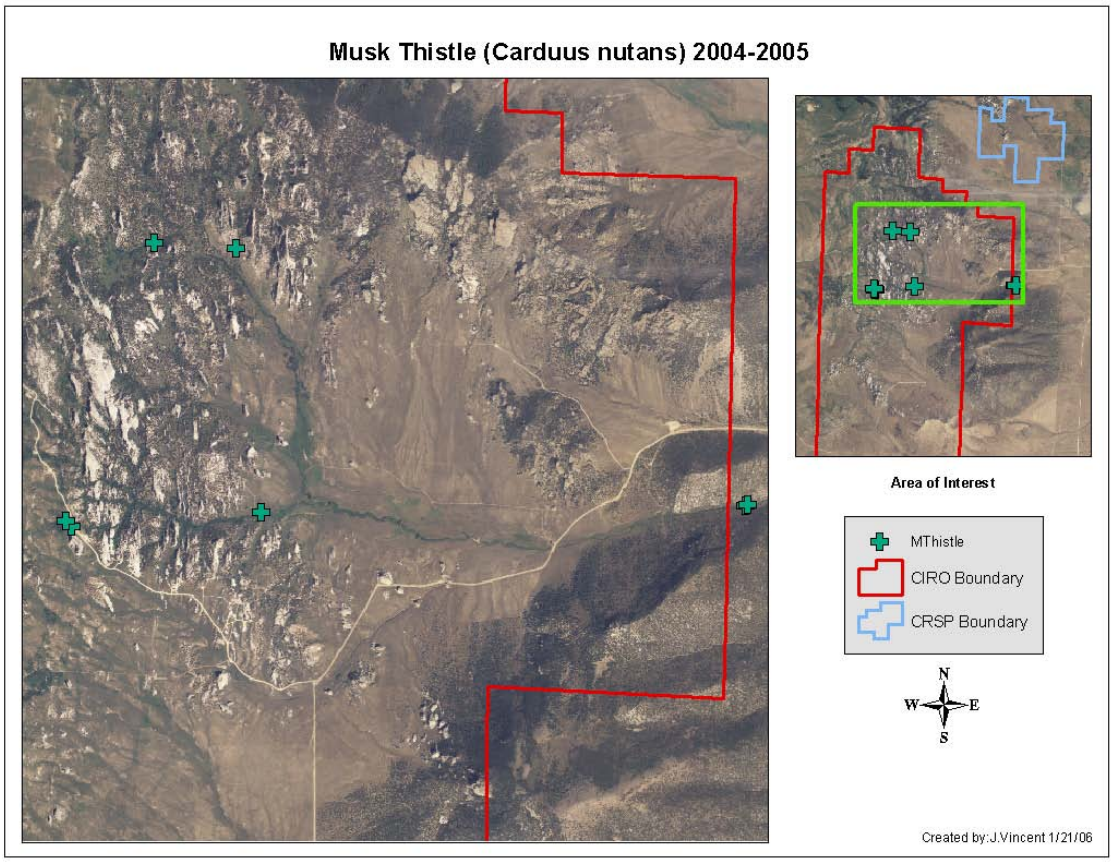
B. DESCRIPTION

Musk thistle is a biennial and sometimes a winter annual growing up to 6 feet tall. Leaves are dark green with a light green midrib, deeply lobed and spiny margined. Leaves extend onto the stem giving a winged appearance. Flower heads are deep rose, violet or purple, terminal and solitary 1 ½ to 3 inches in diameter and usually bent over. It is a native to Europe and western Asia.

C. CURRENT DISTRIBUTION ON THE SITE

Known areas infested include west of Bath Rock following the drainage across the road, South Fork Circle Creek, North Fork Circle Creek and lower Circle Creek.

Map 10: Musk Thistle Locations in CIRO/CRSP



D. DAMAGE & THREATS

Musk thistle spreads rapidly forming extremely dense stands which crowd out desirable forages.

E. GOALS

Known populations of musk thistle will be decreased over 4 years and new infestations will be eradicated

F. OBJECTIVES

i) Known musk thistle infestations will be decreased at a rate of 25% a year until eradicated by 2010
ii) New or small infestations of musk thistle will be exterminated upon discovery by mechanical removal and revisited to ensure a successful treatment
iii) Establish an educational program for visitors to prevent population growth.

G. MANAGEMENT OPTIONS

See Appendix III for definitions:

(1) Mechanical	Consecutive times
(2) Burn	No
(3) Biological	Rust fungus, Seed head Weevil, Root Crown Weevil
(4) Chemical	2, 4-D, aminopyralid, clopyralid, metsulfuron methyl, picloram
(5) Cultural	Yes
(6) Grazing	No
(7) No Action	No

H. ACTIONS PLANNED

- Site visits of no less than 2 will begin in late May and cease when weeds are no longer observed.
- Inventory using mapping standards (Section 6b)
- Mechanical removal. small infestations
- Plants will be collected only if in flower or gone to seed. Black garbage bags, tied securely and left at site for a period of 2 weeks to ensure degermination of seeds. After the 2 week period, bags will be collected and taken to the Almo roll-off station for disposal.
- Chemical application at sites where mechanical removal is not feasible and is approved through NPS IPM PUPS
- Education will be a significant part of early detection of new infestations. Information posters will be placed at Bath Rock to encourage visitors to have caution in the area and report sightings. (Appendix IV)

I. HOW ACTIONS WILL BE EVALUATED

- Field data will be compiled in ArcInfo and assembled on maps with a final report by the end of the season to ensure accurate data composition
- Current data will then be analyzed with previous seasons data to track success and ensure objectives are on target
- If objectives are not on target, methods will be reevaluated to achieve objectives

- Field data will be compiled in ArcInfo and assembled on maps with a final report by the end of the season to ensure accurate data composition
- Current data will then be analyzed with previous seasons data to track success and ensure objectives are on target
- If objectives are not on target, methods will be reevaluated to achieve objectives

J. RESOURCE NEEDS

An average crew of five consisting of one program lead and 4 Youth Conservation Corps (YCC) will be utilized on musk thistle infestations. The estimated man hours and salary costs are shown in Table 13. Vehicles and equipment will be employed and GIS Dataloggers (Trimble Geo XM) and hardware with ArcInfo will be utilized for inventorying and monitoring purposes. Table 14. Dollars needed for musk thistle in CIRO/CRSP for 2006 is approximately **$800**. Dollars for continuing years will be based on the discovery of plants and will be updated as warranted.

Table 13: Labor and dollars estimated for 2006 musk thistle infestations

Site	Crew	Est. Man hrs	Approx. Salary Cost
Bath Rock	5	15	$115.00
South Circle Creek	5	10	$65.00
North Fork Circle Creek	5	20	$385.00
Lower Circle Creek	5	15	$115.00
TOTAL			**$680.00**

Table 14: Approx. Equipment Costs

Equipment	Cost
Vehicle (3 trips@15mi@ $.38/mi)	$20
GIS hardware use	$50
Gloves, Shovels/Hoes, garbage bags	$50.00
TOTAL Equipment	**$120.00**

K. RESULTS OF EVALUATION

(This section is to be updated each season, when monitoring data has been taken and evaluated. The evaluation should be used to determine whether the program should be modified to ensure successful objectives.)

VII. **Canada Thistle** *(Cirsium arvense)*

A. PRIORITY: Medium

B. DESCRIPTION

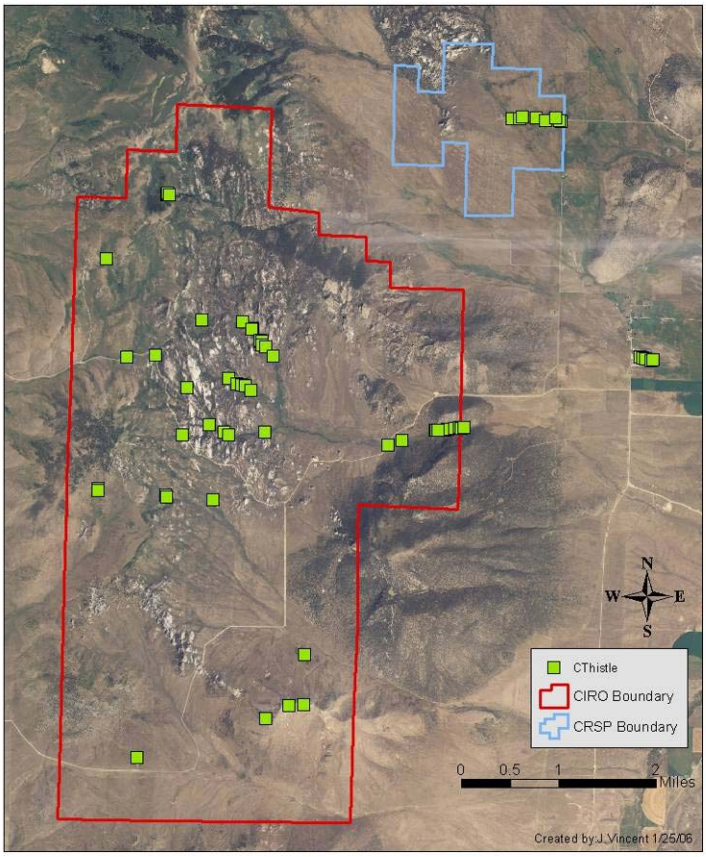
Canada thistle is a colony-forming perennial from deep and extensive horizontal roots. Stems are 1-4 feet tall, ridged, branching above. Flowers are purple (occasionally white) in heads ½ to ¾ inch in diameter. Leaves are alternate, lance shaped and divided into spiny tipped irregular lobes. It is native to Eurasia and was introduced to Canada by a crop seed contaminant.

C. CURRENT DISTRIBUTION ON THE SITE

Canada thistle is found in most water systems in CIRO/CRSP including drainages, springs and seeps.

Map 11: Canada thistle Locations in CIRO/CRSP

Canada Thistle (Cirsium arvense) 2004-05



D. DAMAGE & THREATS

Canada thistle is an aggressive weed that is extremely hard to control. Cutting buds or pulling plants only initiates new growth from the deep rhizomatous roots.

E. GOALS

Limit new Canada thistle infestations within CIRO/CRSP and control known populations as much as possible.

F. OBJECTIVES

i) Known Canada thistle infestations will be controlled as much as possible
ii) New or small infestations of Canada thistle will be exterminated upon discovery by chemical application and revisited to ensure a successful treatment

G. MANAGEMENT OPTIONS

See Appendix III for definitions:

(1) Mechanical	Ineffective
(2) Burn	Ineffective
(3) Biological	Ineffective
(4) Chemical	2, 4-D, aminopyralid, chlorulfuron, clopyralid, glyphosate, metsulfuron methyl, picloram,
(5) Cultural	Limited
(6) Grazing	Ineffective
(7) No Action	Ineffective

*Bold/underline is the preferred management option

H. ACTIONS PLANNED

- <u>Chemical application</u> of sites along high use areas such as roads and campgrounds and any new infestations – caution - most sites around water and will need to utilize herbicides with appropriate label for those sites such as aminopyralid or glyphosate
- <u>Inventory</u> using mapping standards (Section 6b)
- PMIS funding request submitted for FY08 to provide crew and equipment to treat all of Circle Creek drainage system

I. HOW ACTIONS WILL BE EVALUATED

- Field data will be compiled in ArcInfo and assembled on maps with a final report by the end of the season to ensure accurate data composition

- Current data will then be analyzed with previous seasons data to track success and ensure objectives are on target
- If objectives are not on target, methods will be reevaluated to achieve objectives
- Field data will be compiled in ArcInfo and assembled on maps with a final report by the end of the season to ensure accurate data composition
- Current data will then be analyzed with previous seasons data to track success and ensure objectives are on target
- If objectives are not on target, methods will be reevaluated to achieve objectives

J. RESOURCE NEEDS

An EPMT crew of 3 and an IDPR crew of 2-3 will be utilized on targeted Canada thistle infestations. The estimated man hours and salary costs are shown in Table 15. Vehicles and equipment will be employed and GIS Dataloggers (Trimble Geo XM) and hardware with ArcINFO will be utilized for inventorying and monitoring purposes. Table 16. Dollars needed for Canada thistle in CIRO/CRSP for 2006 is approximately **$238.00**. Dollars for continuing years will be based on project progress and will be updated as warranted.

Table 15: Labor and dollars estimated for 2006 Canada thistle infestations

Site	Crew	Est. Man hrs	Approx. Salary Cost
Bath Rock	3	12	$180.00
Bread Loaves road	3	12	$180.00
Site 78	3	6	$90.00
CRSP Laneway	3	24	$240.00
TOTAL		**43**	**$690.00**

Table 16: Approx. Equipment Costs

Equipment	Cost
Vehicle (5 trips@20mi@ $.38/mi)	$38
GIS hardware use	$50
Chemical Milestone (aminopyralid)	$150.00
TOTAL Equipment	**$238.00**

K. RESULTS OF EVALUATION

(This section is to be updated each season, when monitoring data has been taken and evaluated. The evaluation should be used to determine whether the program should be modified to ensure successful objectives.)

VIII. **Black Henbane** (*Hyoscyamus niger)*

A. PRIORITY: Low

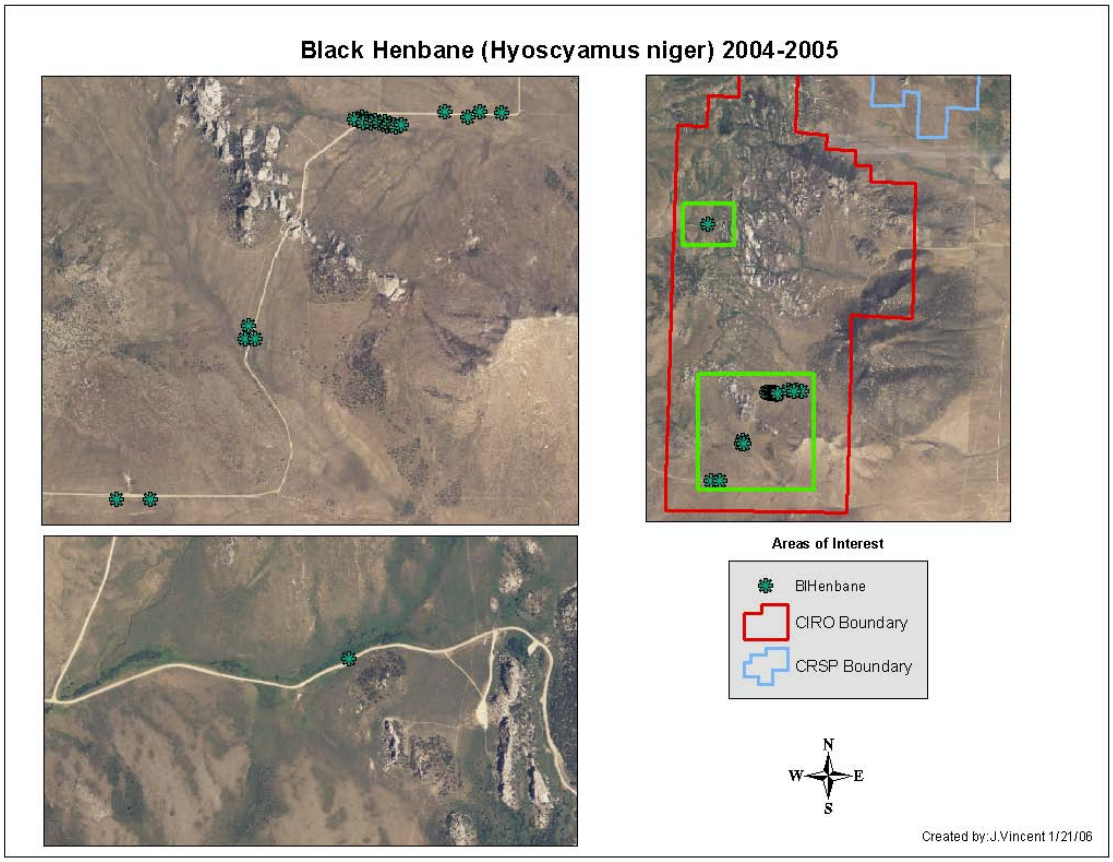
B. DESCRIPTION

Black henbane is an annual or biennial, 1 to 3 feet tall. Leaves are coarsely toothed to shallowly lobed and pubescent. Foliage has a foul odor. Flowers are brownish yellow with a purple center and purple veins. Fruits are 1 inch long, 5 lobed and form clusters along the stem resembling small pineapples. It is a native to Europe and is used as an ornamental. Common on roadsides, water areas and pastures.

C. CURRENT DISTRIBUTION ON THE SITE

Most of the black henbane infestations are located at the south end of the park along roadsides. The largest infestation is located on private land north of the Twin Sisters in a drainage crossing the main road.

Map 12: Black Henbane locations in CIRO/CRSP



D. DAMAGE & THREATS

Black henbane contains hyoscyamine and other alkaloids which have caused occasional livestock poisoning.

E. GOALS

To prevent new infestations from occurring and decreasing known infestations.

F. OBJECTIVES

i) Known black henbane infestations will be mechanically removed once a year before it has set seed
ii) New or small infestations of black henbane will be exterminated upon discovery by mechanical removal

G. MANAGEMENT OPTIONS

See Appendix III for definitions:

(1) Mechanical	Yes
(2) Burn	?
(3) Biological	No
(4) Chemical	No
(5) Cultural	Yes – to prevent collecting the unique looking plant
(6) Grazing	No – poisonous to livestock
(7) No Action	No

H. ACTIONS PLANNED

- Site visits of no less than 1 will begin in late May and cease when weeds are no longer observed.
- Inventory using mapping standards (Section 6b)
- Mechanical removal.
- Plants will be collected only if in flower or gone to seed. Black garbage bags, tied securely and left at site for a period of 2 weeks to ensure degermination of seeds. After the 2 week period, bags will be collected and taken to the Almo roll-off station for disposal.
- Education will be a significant part of preventing spread by collecting the plant. Information posters will be placed at Twin Sisters to discourage visitors from picking the plant and to report sightings. (Appendix IV)

I. HOW ACTIONS WILL BE EVALUATED

- Field data will be compiled in ArcInfo and assembled on maps with a final report by the end of the season to ensure accurate data composition

- Current data will then be analyzed with previous seasons data to track success and ensure objectives are on target
- If objectives are not on target, methods will be reevaluated to achieve objectives
- Field data will be compiled in ArcInfo and assembled on maps with a final report by the end of the season to ensure accurate data composition
- Current data will then be analyzed with previous seasons data to track success and ensure objectives are on target
- If objectives are not on target, methods will be reevaluated to achieve objectives

J. RESOURCE NEEDS

An average crew of five consisting of one program lead and 4 Youth Conservation Corps (YCC) will be utilized on black henbane infestations. The estimated man hours and salary costs are shown in Table 17. Vehicles and equipment will be employed and GIS Dataloggers (Trimble Geo XM) and hardware with ArcInfo will be utilized for inventorying and monitoring purposes. Table 18. Dollars needed for black henbane in CIRO/CRSP for 2006 is approximately **$515.00**. Dollars for continuing years will be based on the discovery of plants and will be updated as warranted.

Table 17: Labor and dollars estimated for 2006 Black Henbane infestations

Site	Crew	Est. Man hrs	Approx. Salary Cost
Twin Sisters Area	5	40	$300.00
Bread Loaves road	5	10	$75.00
Data Analysis	1	1	$20.00
TOTAL		**51**	**$395.00**

Table 18: Approx. Equipment Costs

Equipment	Cost
Vehicle (2 trips@20mi@ $.38/mi)	$20
GIS hardware use	$50
Gloves/shovels/garbage bags	$50
TOTAL Equipment	**$120.00**

K. RESULTS OF EVALUATION

(This section is to be updated each season, when monitoring data has been taken and evaluated. The evaluation should be used to determine whether the program should be modified to ensure successful objectives.)

IX. **Bull Thistle** (*Cirsium vulgare)*

A. PRIORITY : Low

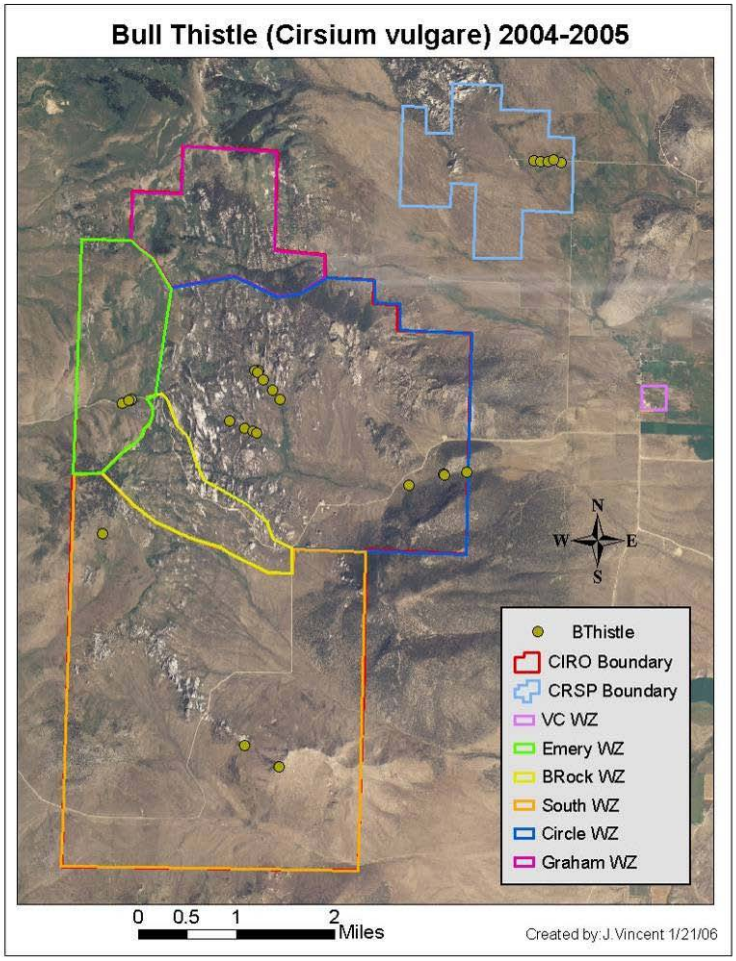
B. DESCRIPTION

Bull thistle is biennial with a short fleshy taproot. Stem is 2 to 5 feet tall with many branches. Leaves in the first year form a rosette, second year leaves are spear shaped and sharp. Flowers are 1 ½ to 2 inches wide, dark purple, occurring from July to September. Seeds are topped by a circle of plume-like white hairs. It is a native of Eurasia and is now widely spread in North America. Pastures, roadsides and disturbed areas are potential habitat.

C. CURRENT DISTRIBUTION ON THE SITE

Bull thistle is found throughout the park along water sources including creeks, springs and seeps**.**

MAP 12: Bull thistle locations in CIRO/CRSP



D. DAMAGE & THREATS

Bull thistle is a highly competitive non-native weed and can out-compete native vegetation.

E. GOALS

Preventing new infestations of bull thistle while decreasing known infestations

F. OBJECTIVES

i) Known bull thistle infestations will be controlled as much as possible
ii) New or small infestations of bull thistle will be exterminated upon discovery by mechanical removal or chemical application and revisited to ensure a successful treatment

G. MANAGEMENT OPTIONS

See Appendix III for definitions:

(1) Mechanical Yes
(2) Burn No
(3) Biological ?
(4) Chemical Only if in area where Canada thistle is being treated - 2, 4-D, aminopyralid, chlorulfuron, clopyralid, glyphosate, metsulfuron methyl, picloram,
(5) Cultural Yes
(6) Grazing ?
(7) No Action No

H. ACTIONS PLANNED

- Mechanical removal or chemical application if near Canada Thistle infestation being treated
- Inventory using mapping standards (Section 6b)
- Plants will be collected only if in flower or gone to seed. Black garbage bags, tied securely and left at site for a period of 2 weeks to ensure degermination of seeds. After the 2 week period, bags will be collected and taken to the Almo roll-off station for disposal.
- Education will be a significant part of preventing spread and early detection of new infestations. Information posters will be placed at Bath Rock and Emery Canyon to educate visitors and report sightings. (Appendix IV)

I. HOW ACTIONS WILL BE EVALUATED

- Field data will be compiled in ArcInfo and assembled on maps with a final report by the end of the season to ensure accurate data composition

- Current data will then be analyzed with previous seasons data to track success and ensure objectives are on target
- If objectives are not on target, methods will be reevaluated to achieve objectives
- Field data will be compiled in ArcInfo and assembled on maps with a final report by the end of the season to ensure accurate data composition
- Current data will then be analyzed with previous seasons data to track success and ensure objectives are on target
- If objectives are not on target, methods will be reevaluated to achieve objectives

J. RESOURCE NEEDS

An average crew of five consisting of one program lead and 4 Youth Conservation Corps (YCC) will be utilized on bull thistle infestations. The estimated man hours and salary costs are shown in Table 19. Vehicles and equipment will be employed and GIS Dataloggers (Trimble Geo XM) and hardware with ArcInfo will be utilized for inventorying and monitoring purposes. Table 20. Dollars needed for bull thistle in CIRO/CRSP for 2006 is approximately **$290**. Dollars for continuing years will be based on the discovery of plants and will be updated as warranted.

Table 20: Labor and dollars estimated for 2006 bull thistle infestations

Site	Crew	Est. Man hrs	Approx. Salary Cost
Areas as discovered	5	20	$150.00
Data Analysis	1	1	$20.00
TOTAL		**51**	**$170.00**

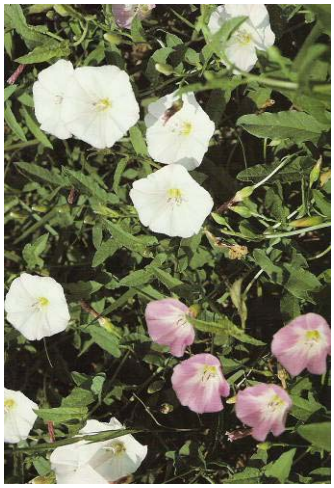
Table 20: Approx. Equipment Costs

Equipment	Cost
Vehicle (2 trips@20mi@ $.38/mi)	$20
GIS hardware use	$50
Gloves/shovels/garbage bags	$50
TOTAL Equipment	**$120.00**

K. RESULTS OF EVALUATION

(This section is to be updated each season, when monitoring data has been taken and evaluated. The evaluation should be used to determine whether the program should be modified to ensure successful objectives.)

X. **Field Bindweed** (*Convolvulus arvensis)*



A. PRIORITY: Low

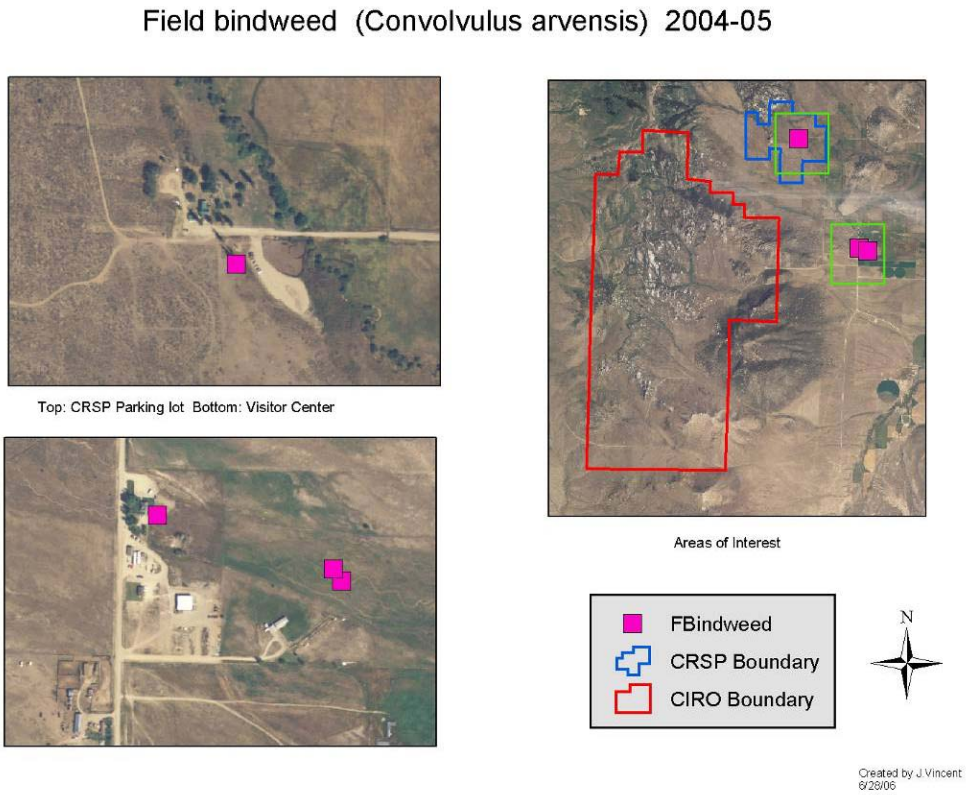
B. DESCRIPTION

Field Bindweed is a perennial from an extensive root system, often climbing and forming dense tangled mats. Stems are prosrate, 1 to 4 feet long. Leaves are alternate, arrowhead shaped, pointed or blunt lobes at base. Flowers are trumpet-shaped, white to pinkish, 1 inch in diameter with 2 small bracts located 1 inch below flower.

C. CURRENT DISTRIBUTION ON THE SITE

Field bindweed is found at CIRO headquarters east of the staff parking lot and in the open field east of the house. It is also found at CRSP ranch unit west of the parking lot on the burm.

Map 13: Field Bindweed locations in CIRO/CRSP



D. DAMAGE & THREATS

Field bindweed grows in thick dense mats along the ground chocking out all other vegetation. If allowed to spread it will severely decrease biodiversity in the infested areas.

E. GOALS

To decrease known infestations and to prevent new infestations from being established.

F. OBJECTIVES

i) Known field bindweed infestations will be chemically controlled as much as possible
ii) New or small infestations of field bindweed will be exterminated upon discovery by chemical application and revisited to ensure a successful treatment

G. MANAGEMENT OPTIONS

See Appendix III for definitions:

(1) Mechanical	Ineffective – 3to5 years, every two weeks
(2) Burn	Ineffective
(3) Biological	Undetermined
(4) Chemical	2, 4-D, metsulfuron methyl, picloram
(5) Cultural	Yes – prevent morning glory plants from being cultivated
(6) Grazing	Ineffective
(7) No Action	No

H. ACTIONS PLANNED

- Chemical application of known sites and retreat as necessary
- Reseed areas with native grass seed after plant is eradicated from site
- Inventory using mapping standards (Section 6b)

I. HOW ACTIONS WILL BE EVALUATED

- Field data will be compiled in ArcInfo and assembled on maps with a final report by the end of the season to ensure accurate data composition
- Current data will then be analyzed with previous seasons data to track success and ensure objectives are on target
- If objectives are not on target, methods will be reevaluated to achieve objectives
- Field data will be compiled in ArcInfo and assembled on maps with a final report by the end of the season to ensure accurate data composition

- Current data will then be analyzed with previous seasons data to track success and ensure objectives are on target
- If objectives are not on target, methods will be reevaluated to achieve objectives

J. RESOURCE NEEDS

A crew of 1-2 consisting of one Pesticide Applicators license holder will be utilized on field bindweed infestations. The estimated man hours and salary costs are shown in Table 21. Vehicles and equipment will be employed and GIS Dataloggers (Trimble Geo XM) and hardware with ArcInfo will be utilized for inventorying and monitoring purposes. Table 22. Dollars needed for field bindweed in CIRO/CRSP for 2006 is approximately **$590.00**. Dollars for continuing years will be based on the discovery of plants and will be updated as warranted.

Table 21: Labor and dollars estimated for 2006 field bindweed infestations

Site	Crew	Est. Man hrs	Approx. Salary Cost
CIRO Headquarters	1	4	$55.00
CRSP ranch house	1	4	$55.00
Data Analysis	1	1	$20.00
TOTAL		**51**	**$130.00**

Table 22: Approx. Equipment Costs

Equipment	Cost
Vehicle (2 trips@10mi@ $.38/mi)	$10
GIS hardware use	$50
PPE/Chemical	$100
Native grass seed	$300
TOTAL Equipment	**$460.00**

K. RESULTS OF EVALUATION

(This section is to be updated each season, when monitoring data has been taken and evaluated. The evaluation should be used to determine whether the program should be modified to ensure successful objectives.)

XI. **Sulphur Cinquefoil** (*Potentilla recta)*

A. PRIORITY : High

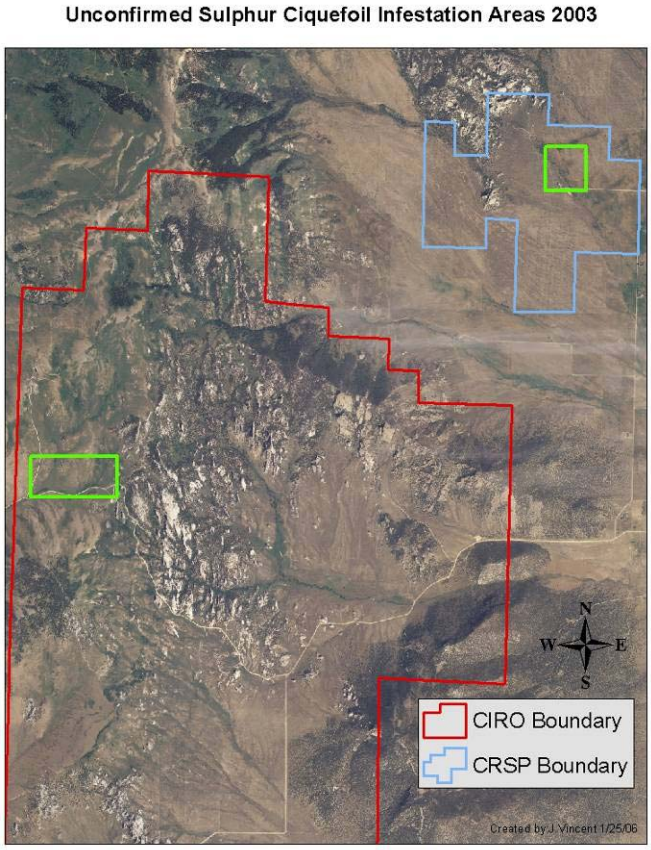
B. DESCRIPTION

Sulphur cinquefoil is a perennial, 1-1 ½ feet tall with well developed root-stocks. Leaves palmately compound with 5 or 7 toothed leaflets of each leaf. Leaves are sparsely hairy on underside of leaf appear green rather than silvery as in many *Potentilla* species. Flowers light yellow with 5 petals occurring from May to July. Often found in disturbed sites such as roadsides and pastures. Hard to distinguish from other *Potentilla* species.

C. CURRENT DISTRIBUTION ON THE SITE

Possible sulphur cinquefoil infestations have been reported in the areas highlighted on the map below. These possible infestations are unconfirmed as of February 2006 due to the likeness to native *Potentilla* species.

Map 14: Sulphur Cinquefoil – reported but unconfirmed locations in CIRO/CRSP



D. DAMAGE & THREATS

Sulfur cinquefoil can form monocultures over large areas of rangeland and roadsides where it is not easily controlled by mowing. Sulfur cinquefoil is a strong competitor that reduces native flora on many rangeland sites. Because of its high tannin content, sulfur cinquefoil is unpalatable to most wildlife and livestock.

E. GOALS

Determine if sulphur cinquefoil populations exist in CIRO/CRSP

F. OBJECTIVES

i) Investigate and confirm possible populations of sulphur cinquefoil
ii) Update plan based on findings

G. MANAGEMENT OPTIONS

See Appendix III for definitions:

(1) Mechanical	Minimally successful on small infestations – must pull root as well
(2) Burn	Not likely to be effective for perennials
(3) Biological	No – to close of an association with native plants
(4) Chemical	aminopyralid, , clopyralid, metsulfuron methyl, picloram
(5) Cultural	Yes – for early detection
(6) Grazing	Ineffective
(7) No Action	No

H. ACTIONS PLANNED

- Visit unconfirmed populations of sulphur cinquefoil to determine if the plant exists in CIRO/CRSP
- If possible plants are found Inventory using mapping standards (Section 6b) and collect plant to send to expert for proper identification
- Update weed management plan based on findings
- Use appropriate herbicide treatment if possible infestations identification as sulfur cinquefoil are confirmed by experts

HOW ACTIONS WILL BE EVALUATED

- If sulphur cinquefoil is confirmed the following will be applied.

- Field data will be compiled in ArcInfo and assembled on maps with a final report by the end of the season to ensure accurate data composition
- Current data will then be analyzed with previous seasons data to track success and ensure objectives are on target
- If objectives are not on target, methods will be reevaluated to achieve objectives
- Field data will be compiled in ArcInfo and assembled on maps with a final report by the end of the season to ensure accurate data composition
- Current data will then be analyzed with previous seasons data to track success and ensure objectives are on target
- If objectives are not on target, methods will be reevaluated to achieve objectives

J. RESOURCE NEEDS

A crew of 4 will be utilized to search possible sulphur cinquefoil infestations. The estimated man hours and salary costs are shown in Table 23. Vehicles and equipment will be employed and GIS Dataloggers (Trimble Geo XM) and hardware with ArcInfo will be utilized for inventorying and monitoring purposes. Table 24. Dollars needed for sulphur cinquefoil in CIRO/CRSP for 2006 is approximately **$230.00**. Dollars for continuing years will be based on the discovery of plants and will be updated as warranted.

Table 23: Labor and dollars estimated for 2006 sulfur cinquefoil infestations

Site	Crew	Est. Man hrs	Approx. Salary Cost
CIRO Site	4	2	$75.00
CRSP Site	4	2	$75.00
Data Analysis	4	1	$20.00
TOTAL		**51**	**$170.00**

Table 24: Approx. Equipment Costs

Equipment	Cost
Vehicle (2 trips@10mi@ $.38/mi)	$10
GIS hardware use	$50
TOTAL Equipment	**$60.00**

K. RESULTS OF EVALUATION

(This section is to be updated each season, when monitoring data has been taken and evaluated. The evaluation should be used to determine whether the program should be modified to ensure successful objectives.)

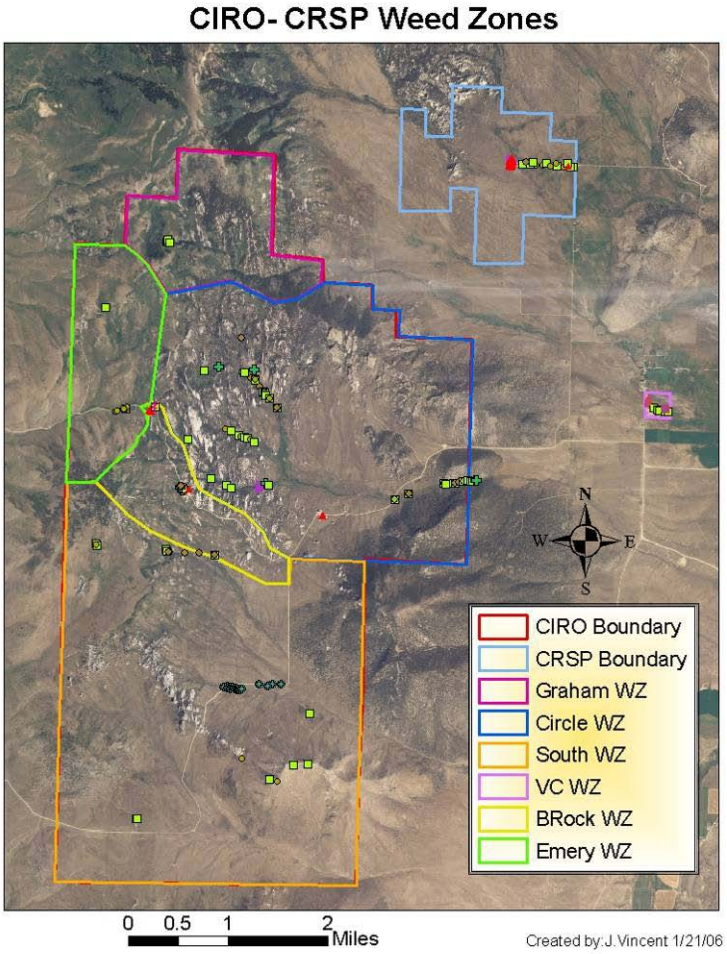
6. **Mapping Standards**

Standardizing inventorying techniques between individuals and organizations dedicated to weed management continues to be a struggle due to the diversity of site and infestation characteristics. This section has been included to help reduce uncertainty and variability of data collection methods in the field at CIRO/CRSP.

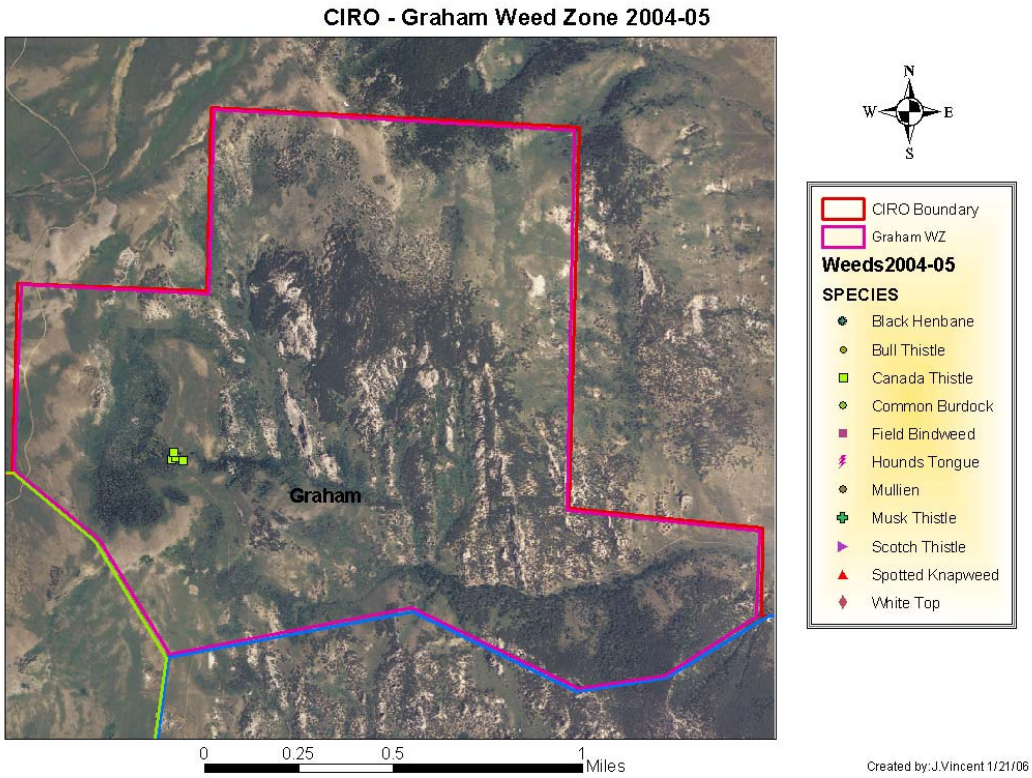
a) *Weed Management Zones*

CIRO/CRSP contains an array of site conditions from varying elevations, changing degrees of water tables and water drainages, high and low visitor usage, and several native plant communities. To help dissect this diverse landscape weed management zones have been designated to correspond to the various drainage basins in the park due to the propensity of weeds to disperse along water flows. These zones will be beneficial in revealing weed dispersal areas, developing site specific weed eradication schemes, and will assist in analyzing data collected. (Map 15)

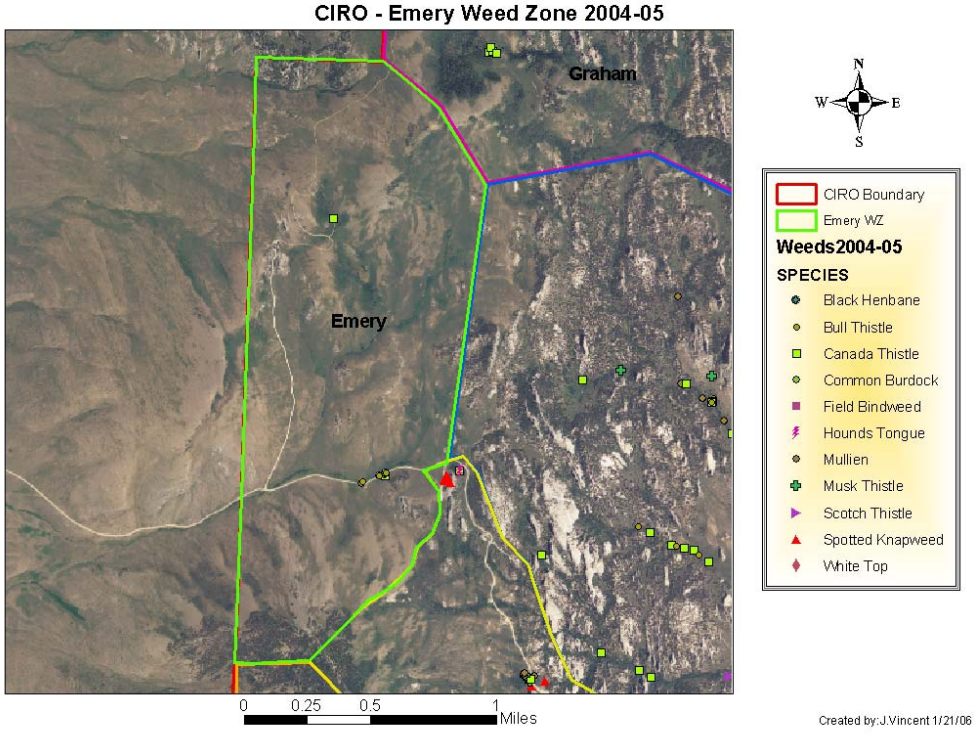
Map 15: CIRO/CRSP Weed Zones



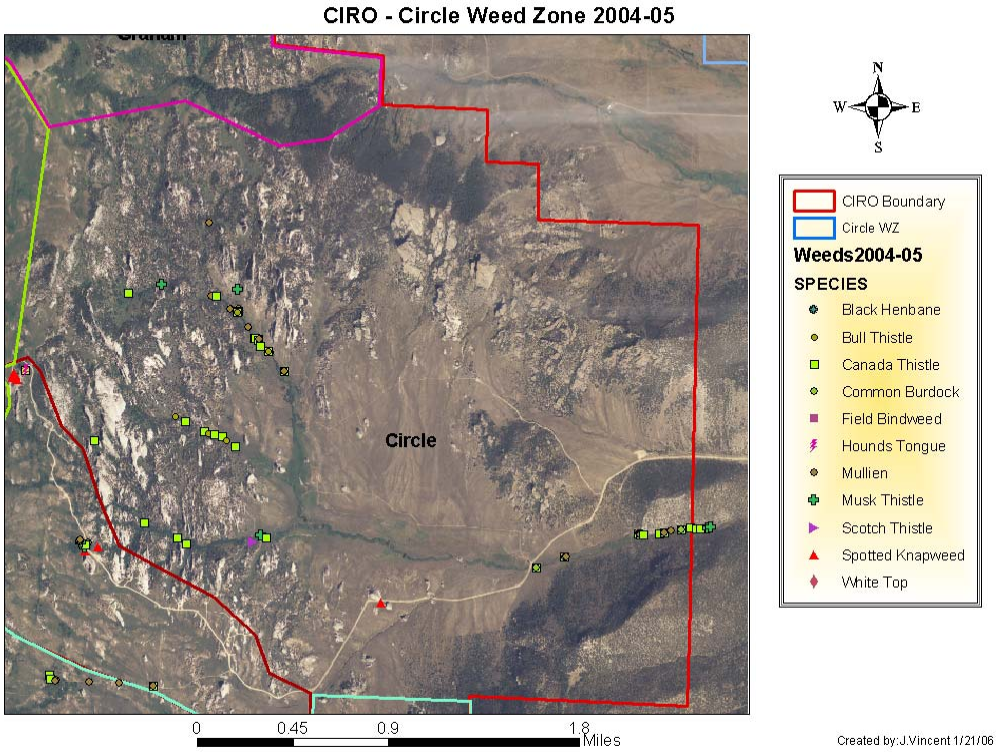
Map 16: Graham Weed Zone



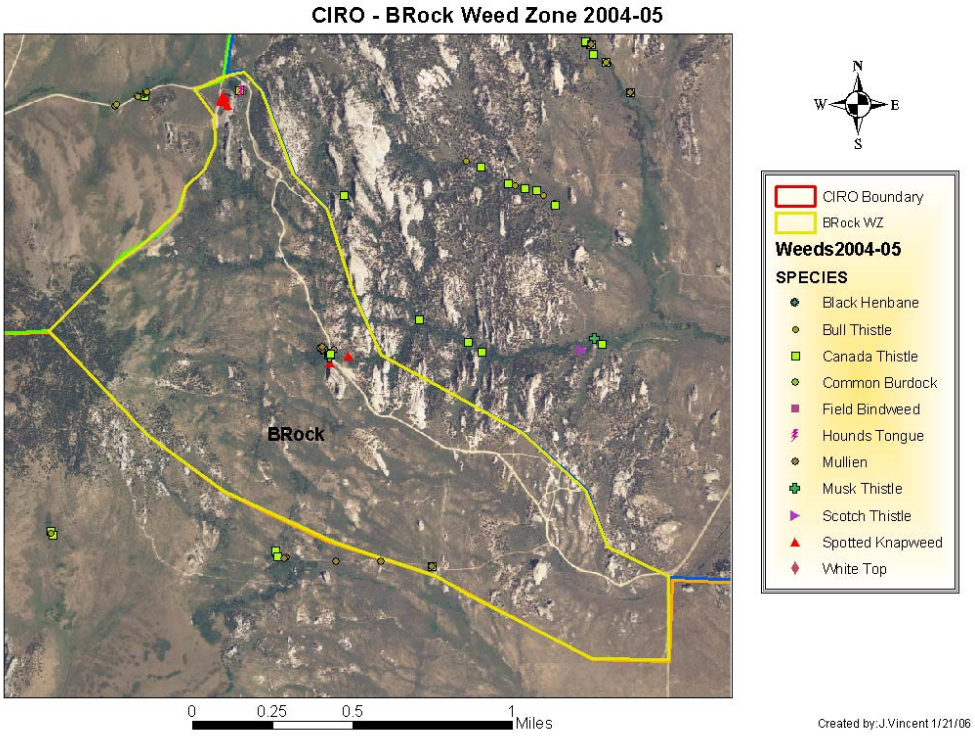
Map 17: Emery Weed Zone



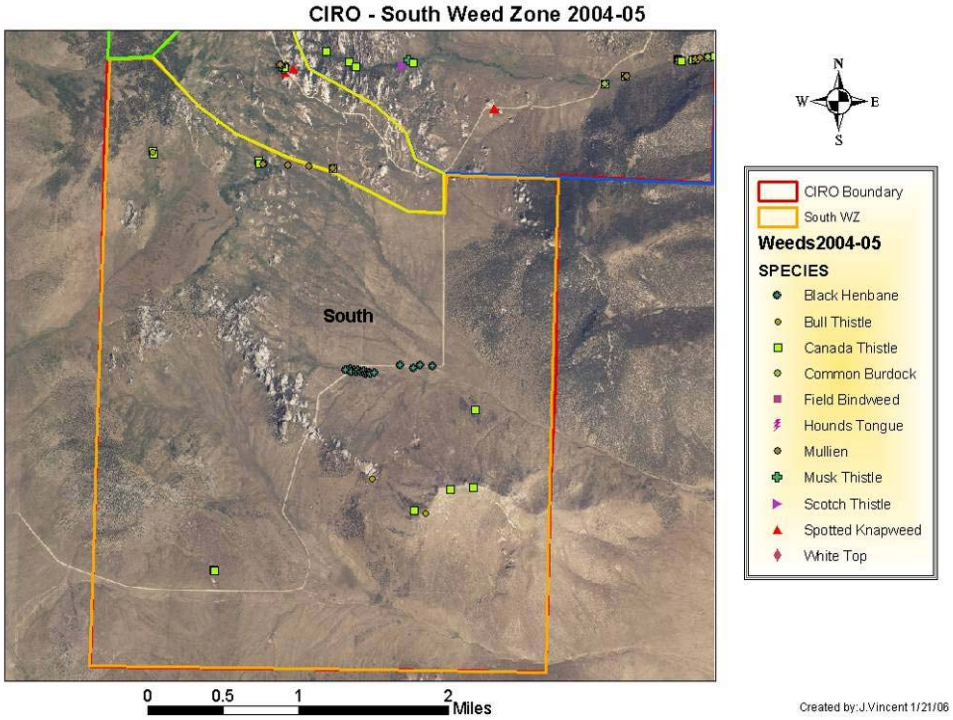
Map 18: Circle Weed Zone



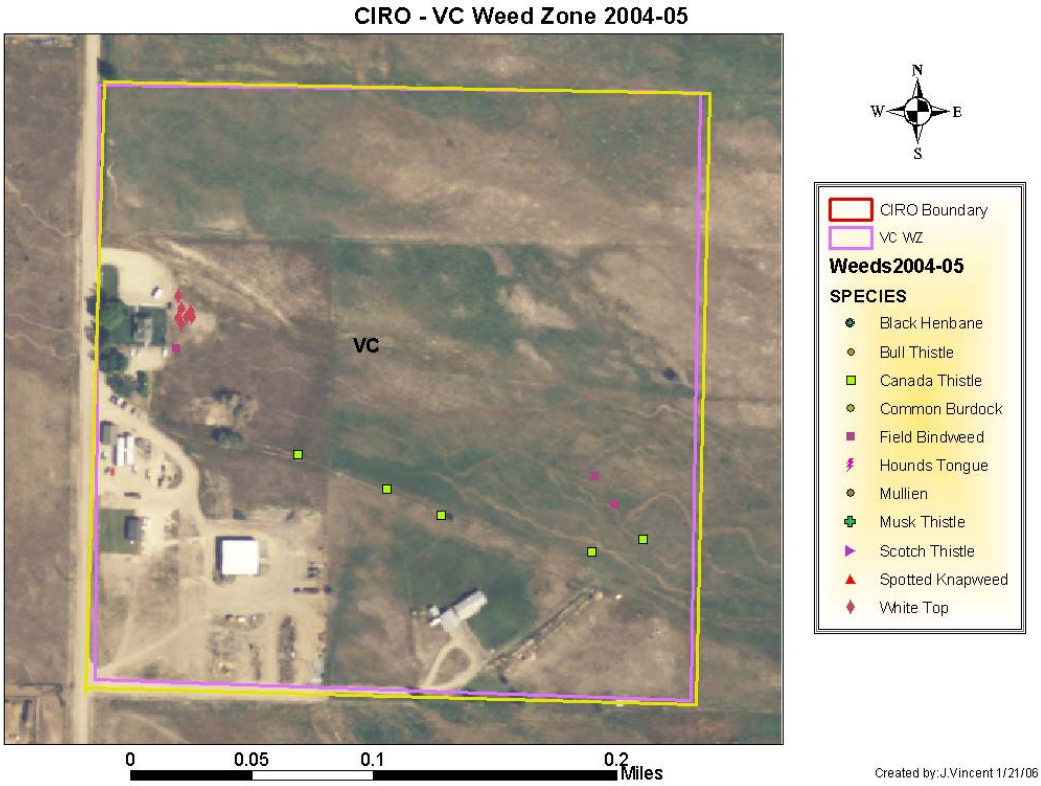
Map 19: Brock Weed Zone



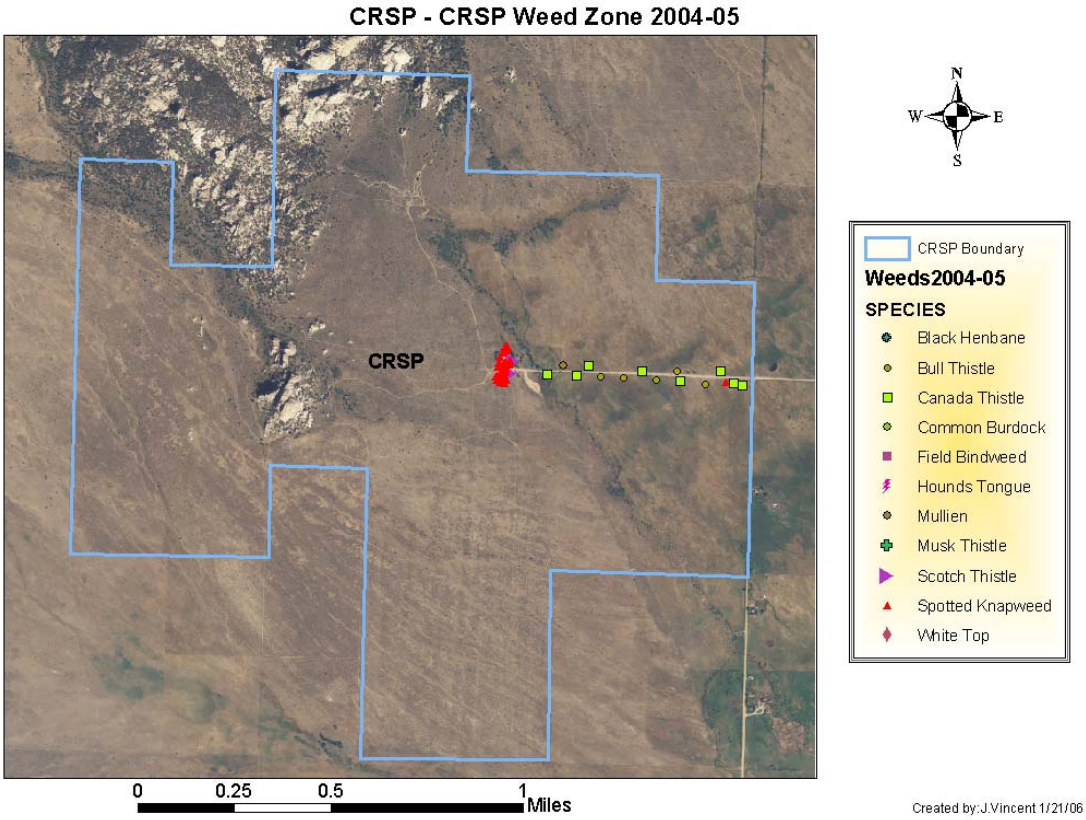
Map 20: South Weed Zone



Map 22: VC Weed Zone



Map 23: CRSP Weed Zone



B) *Data Collection*

Data collection is the basis for determining the extent of weed infestations and to effectively analyze progress from year to year it is essential that uniform data collection is in place. This section has been created to ensure that CIRO/CRSP field personnel collect the data required to be able to effectively evaluate the status of weed populations. This effort is not to create a uniform database, but rather to develop minimum standards so all information being collected is compatible each year and with other partners. These are minimum standards to address the most basic information necessary to compare invasive species problems from year to year.

North American Weed Management Association has addressed this issue and has created, in collaboration with Canada, United States and Mexico, minimum mapping standards. They describe three basic elements of weed inventorying: 1. what is the weed, 2. where is it located, and 3. how large is the infestation. This protocol was developed to meet the necessary NPS I&M data management standards as well as those core elements outlined by the NPS Intermountain Region Weed Mapping Committee and the North American

Weed Management Association. Important input was provided by Brenda Waters, Northern Rocky Mountain EPMT coordinator, Tim Prather of the University of Idaho, Steven Dewey of Utah State University, Shana Wood of Montana State University, and I&M colleagues from the UCBN, NCPN and SODN. Field forms and databases should be developed from this dictionary following instructions in the "coding" section of each attribute description.

Each attribute is subdivided into sections as follows:

Attribute: This is name that will appear on the inventory form It will provide common vocabulary for sharing information.

Definition: Provides a description and explanation of the data field.

Why it is Useful: Describes why this information may be important and how it will be useful in describing weed infestations.

Core Element: This tells you whether this is an optional or required data field.

Coding: Describes the input values for data fields

The following is the information to be collected while conducting weed inventories at CIRO/CRSP**.** Spread sheets and data dictionaries should be developed accordingly.

i. Date

Definition: The date the weed infestation was observed in the field. It does not refer to the date information was entered into the computer.

Why it is useful: This field tells you when the inventory was conducted. It provides information on the time of year plants were observed. A weed infestation may look very different in the spring of the year or in the fall of the year after flowering and seed formation. This field also tells you how old your information is; last month, last year, or ten years ago. These cues will help you decide how reliable the information is and whether a follow-up visit to the site may be warranted. Changes in the size and density of a weed population from one visit to the next form the basis of monitoring.

Core Element: Required

Coding: Date field, month/day/year e.g. 2/15/2006

ii. Collector

Definition: The individual(s) who collected the information in the field, at the site of the infestation.

Why it is useful: This is useful information when several individuals may have contributed to an inventory. A name allows the person compiling the inventory to verify and correct any questions on the information, as well as assess quality.

Core Element: Required

Coding: Text field, 50 characters; Enter the full name of the individual(s) who collected the data.

iii. Ownership

Definition: The national ownership of the land where the infestation is located.

Why it is useful: This field allows information to be grouped or displayed by broad ownership patterns.

Core Element: Required

Coding: Text field, pick list developed for each park, 10 characters; Codes for this field include the following:

a) CIRO
b) CRSP
c) BLM
d) USFS
e) Private
f) Other

iv. Management Zone (Mngt_Zone)

Definition: This field will be used to record what weed management zone the weed infestation falls in. This will be useful to develop site specific weed eradication schemes, and will assist in analyzing data collected

Why it is useful: This field is most useful to CIRO staff as it will allow information to be grouped by weed management zones

Core Element: Required – but can be filled in while analyzing data

Coding: Codes for this field are as follows: (refer to page 45 for maps)

g) Circle
h) South
i) Graham
j) Emery
k) Brock
l) VC
m) CRSP

v. Location

Definition: Description of infestation location, such as a trail or road name, junction, or other descriptive feature.

Why it is useful: Facilitates relocation and interpretation of infestation data.

Core Element: Optional

Coding: Text field, 50 characters.

vi. Vegetation Description (Veg_Descrip)

Definition: Dominant vegetation community in the infested area. Vegetation communities have been decided based on vegetation maps created for CIRO/CRSP.

Why it is useful: Provides a concise and consistent description of the dominant vegetation present in an area of infestation.

Core Element: Required

Coding: Text field, pick list, 50 characters

Code	Veg_Class
JUOS	Utah Juniper
PIMO	Pinyon pine
JUOS/PIMO	juniper/pinyon
PIMO/JUOS	pinyon/juniper
CELE	Mtn. mahogany
JUOS/PIMO/CELE	Juniper/pinyon/mahogany
PIMO/JUOS/CELE	Pinyon/juniper/mahogany
PSME,PIFL, ABLA	Doug fir, limper pine, subalpine fir
ARTR/JUOS	big sagebrush/juniper
ARTR/AGSP	sagebrush/bluebunch wheatgrass
ARTR/AGCR	sagebrush/crested wheat
POTR	aspen
Salix/Poa	willow/bluegrass
B-PIMO/JUOS	burned pimo/juos

vii. Dominant Species (DOMSPP)

Definition: 1 to several plant species that dominate the area of infestation, which may or may not be the same as the species used to define the alliance above.

Why it is useful: Provides additional information about the site characteristics and may support further analysis or modeling of invisibility and resilience.

Core Element: Optional

Coding: Text field, 50 characters

viii. Disturbance

Definition: Description of infested area site disturbance. Multiple disturbances may be present in a site, and the most recent or influential should be chosen.

Why it is useful: Provides additional information about the site characteristics and may support further analysis or modeling of invisibility and resilience.

Core Element: Optional

Coding: Text field, 25 characters; The pick list will include the following:

a) Ag/Grazing
b) Other animal
c) Development
d) Fire suppression
e) Habitat improvement
f) Hydrology
g) Irrigation
h) Recreation
i) Trails
j) Utility
k) Roads
l) Wildfire
m) None
n) Other

ix. Taxon

Definition: The standard botanical nomenclature consisting of genus and species (specific epithet) as recognized by ITIS. (Integrated Taxonomic Information System)

Why is it useful? Scientific names are in Latin and can be intimidating and cumbersome to learn, but they have a decided advantage over common names. These scientific names provide a universal code or language for naming plants, so people all over the world will use the same name. Even when the name changes due to new discoveries or new information, a trail of synonyms or conserved names is retained so the plant can still be identified. Scientific names also show how groups of plants are related.

Core Element: Optional

Coding: Text field, 50 characters;

x. Name

Definition: The most widely recognized common name of the plant.

Why it is useful: These are the weed names most commonly used in conversation. They are often descriptive like Canada thistle and are always in the spoken language of the country. The common names are easy to pronounce and remember. Unfortunately, there is no consistency in common names and there may be several regional names for the same plant. Conversely, the same name may refer to several different plants.

Core Element: Required

Coding: Text field, 50 characters; park pick lists will be developed according to park and network target priorities.

xi. Growth Stage

Definition: Plant growth stage.

Why it is useful?: Provides a concise description of plant phenology and facilitates effective management response.

Core Element: Optional

Coding: Text field, 25 characters. The UCBN pick list will be:

a) seedling
b) Rosette
c) Bolt
d) Bud
e) Early Bloom
f) Full Bloom
g) Fruit
h) Fall regrowth

i) Dead

xii. Buffer (BUFFERM)

Data is collected in either a point, line or polygon. If plants tend to grow in a clumped distribution then use points and lines for the data collection. If plants tend to be located in a more random distribution, then polygons are more efficient in collecting the data. Often the decision to use a point, line or polygon is strongly based on how much effort must be used to treat the plants.

Definition: Points and lines require a buffer estimate to be able to determine acreage when analyzing date. Points are assigned a radius, in meters, that represents half the distance across the clump; Lines are assigned "half-widths" which represent half the clump's width, in meters; Polygons are created by walking the edge of the infestation until you return to your start point.

POINTS: Points are primarily used for recording "clumps" of vegetation that are relatively close to one another. The individual plants or stems making up this clump do not need to be touching or overlapping to be included in the same clump. There is no predetermined distance that must be between plants for them to be considered two different clumps. A clump can be any shape as long as the radius assigned to the clump represents the combined area coverage of all the plants included in that clump. If there are two plants near one another, each covering about one meter, pretend to move one plant next to the other and collect one point covering two meters. Natural breaks often exist between clumps of the same plant species. An approximate distance of 20-30 meters will be the distance used to determine when plants of the same species are broken into two separate infestations and mapped separately. The decision to include one plant but not another in a clump is made by the data collector and should balance ease of data collection with accuracy of data being collected.

LINES: Lines are used to collect data for plant clumps that are distributed in a generally linear pattern. This is often the situation along roadsides. There are no limits on how big lines can be, but they should not be used for short distances. Do not use lines to collect the data unless infestations are greater than 25 meters in length. The half-width, or buffer, assigned to the line should represent the average half-width of the weed infestation line you walk. If there is a significant change in the width of a line at some point, it is probably better to start a new line, beginning where the change occurs, instead of trying to average them out over the whole length of one line.

POLYGONS: Polygons are used when it is reasonable to walk around an entire area that is infested with a plant. As with the line method, reserve this method for infestations that are fairly large. Enter a percent coverage estimate representing percent cover of the plant within the polygon. You have the option of walking an area that is not exactly the perimeter of the infestation, and then simply decreasing

the percent cover estimate you assign the polygon, by how much "extra" space you included.

Why it is useful: This information is used to estimate area covered of a weed infestation and to more accurately display the information on maps.

Core Element: Required

Coding: Numeric whole number in meters

xiii. Cover Class Code (CVRCLSSC)

Definition: Plant infestations are based on ground coverage. Counting individual plants or weeds does not take into consideration the extent to which the plant occupies the land and monopolizes the soil water and nutrients. The root system of a plant, in addition to its above ground vegetation, directly correlates to the amount of effort it will take to control it. Cover class is the area a plant occupies over the ground (i.e. a plant's shadow when the sun is straight over head). Include the area between branches as being part of the area occupied (e.g. if you assume your hand with outstretched fingers represents a plant with branches, your area covered would include the area between your fingers). Cover class is estimated as a percent of the ground covered by a particular weed species. It is used to help determine the area infested by utilizing an ocular estimate. Ten Point is the standard used by the NRMEPNT to record cover class estimates, see table below for details.

Why it is useful: Canopy cover is a way to estimate the amount or severity of a weed infestation. Area tells you the extent of the population across the landscape. Cover class tells how that weed dominates the vegetation within that area. The greater the cover class the more weeds there are. It is a monitoring tool, providing information on the changes in weed population from year to year.

Core Element: Required

Coding: Cover class will be estimated as a percent of the ground, covered by foliage of a particular weed species. Cover will be recorded as a numeric value. Inventory procedures will include the use of the Ten Point Cover Class codes.

- *Note that the mid-point is the value that is used to calculate the cover of the area inventoried (e.g. If the infestation is a T or 0-1.0% in a 5 acre infestation then the area is calculated using the mid-point value 0.5% multiplied by 5 acres = 0.00025 acres of canopy cover in that 5 acres).*

Ten Point Cover Class Code	Cover Class %	Mid-Point %
T	0-1.0	0.5
0	1.1-5.0	3.0
1	5.1 – 15.0	10.0
2	15.1-25.0	20.0
3	25.1-35.0	30.0
4	35.1-45.0	40.0
5	45.1-55.0	50.0
6	55.1-65.0	60.0
7	65.1-75.0	70.0
8	75.1-85.0	80.0
9	85.1-95.0	90.0
A	95.1-99.0	97.0
X	99.1-100.0	99.5

xiv. Distribution

Definition: The spatial distribution or spatial pattern of the infestation.

Why it is useful: Provides additional qualitative information about the infestation.

Core Element: Optional

Coding: Text field, 25 characters; The UCBN pick list will be:

a) Clumped - Weeds growing in distinct clusters separated by weed free areas within the larger area considered to be the patch
b) Continuous – Weeds essentially growing in a monoculture with a very distinct edge
c) Gradient – Weed cover dense in the center if the patch, thinning out toward the edges
d) Isolated Individual(IsoInd) – Single weed plant
e) Isolated Patch(IsoPatch) – Isolated group of weeds with contiguous individuals mapped as a unique feature
f) Scattered - Individual or small clusters of weeds thinly scattered with no apparent spatial pattern.

xv. Density

Definition: Typically defined as the number of stems (ramets) per unit area (i.e. stems/m^2). It is qualitative and descriptive only.

Why it is useful: This information can help the manager decide on the required treatment and determine if that treatment is working.

Core element: Optional

Coding:

j) None
k) Trace
l) Light
m) Moderate
n) Heavy

xvi. Ecological Status (EcoStatus)

Definition: A numeric value from 1 – 4 based on a qualitative description of the level of infestation that identifies ability of site to recover to natural state once the non-native plants have been removed.

Why it is useful: Provides a qualitative description of the infested site and will aid in treatment strategies and prioritization.

Core Element: Optional

Coding: Numeric field, 0 precision; Pick list as follows:

a) 1 - No weeds. The management emphasis is preventing weed encroachment

b) 2 - New and/or small infestations. These infestations have good potential for eradication because they are small and there is a good understory of desirable plants.

c) 3 - Large-scale infestation with 30% or greater understory of residual grasses and good potential productivity. Management of these sites in a way that selects for the recovery of the residual native grasses and shrubs has good potential for control but not eradication of the weeds. There may be more that one noxious weed species but the underlying biologic integrity of the unit is good.

d) 4 - Large-scale infestations with few or no (less than 30% cover) desirable grasses in the understory. Infestation often dense and/or multiple weed species. Control will require intense treatment and probably renegotiation. Control may be possible but not eradication. In some areas,

the infestation may have changed the character of the land so much that attempts for rehabilitation are cost prohibitive.

xvii. Slope

Definition: The average slope of the infested site, in degrees. Slope categories included low (0-20°), moderate (21-45°), high (46-80°), and vertical (81-90°).

Why it is useful: Part of a suite of biophysical site conditions that will help with analysis of invasibility.

Core Element: Optional

Coding: Numeric field, 0 precision; Pick list as follows:

a) 1 – low (0-20°)
b) 2 – moderate (21-45°)
c) 3 – high (46-80°)
d) 4 – vertical (81-90°)

xviii. Aspect

Definition: The aspect of the slope

Why it is useful: Part of a suite of biophysical site conditions that will help with analysis of invasibility.

Core Element: Optional

Coding: Text field, 5 characters

a) N – North
b) NE-North East
c) SE-Southeast
d) S – South
e) SW – Southwest
f) W – West
g) NW – Northwest

xix. Management Action (Mgmt_Action)

Definition: Description of treatment applied to an infestation.

Why it is useful: Provides a linkage between map and treatment activities.

Core Element: Optional

Coding: Text field, 50 characters; Pick list as follows:

a) Mechanical
b) Chemical
c) No Action
d) Burn
e) Biological
f) Cultural
g) Grazing

xx. Treatment

Definition: Category of treatment type

Why it is useful: Provides a linkage between map and treatment activities. This field will allow for querying by treatment types.

Core Element: Optional

Coding: Text field, 25 characters;

Basal Bark
a) Cut (only)
a) Cut/Stump
b) Flower/Seed Removal
c) Foliar/Ground/Spot
d) Foliar/Ground/Broadcast
e) Inventory
f) Pull/Dig-Manual
g) Monitor
h) Other

xxi. Infestation ID (Infestation_ID)

Definition: Unique identifying number assigned to each discrete weed infestation.

Why it is useful: Provides a critical tracking and querying tool.

Core Element: Required

Coding: Numerical Field, 0 precision. – To be determined by NRM-EMPT

xxii. Unit

Definition: The measurement unit of the areal calculations.

Why it is useful: Avoids confusion

Core Element: Required

Coding: Text field, 10 characters; Hectares or Acres

xxiii. UTM X (UTM_X)

Definition: Easting or x-axis coordinate for the Universal Transverse Mercator coordinate system used by all UCBN programs.

Why it is useful: Critical component of the geographic location of infestations

Core Element: Required

Coding: Numerical Field, 0 precision; Measured in meters

xxiv. UTM Y (UTM_Y)

Definition: Northing or y-axis coordinate for the Universal Transverse Mercator coordinate system used by all UCBN programs.

Why it is useful: Critical component of the geographic location of infestations

Core Element: Required

Coding: Numerical field, 0 precision; Measured in meters

xxv. Elevation

Definition: Height above sea level for the infestation

Why it is useful: Critical information related to geographic location of the infestation as well as for analysis and modeling of nvisibility.

Core Element: Required

Coding: Numerical field, 0 precision; Measured in meters

xxvi. Comments

Definition: Open field for additional important information, including QA/QC details, as well information collected during the field work that does not fit into another field

Why it is useful: Provides additional important information

Core Element: Optional

Coding: Text field, 50 characters

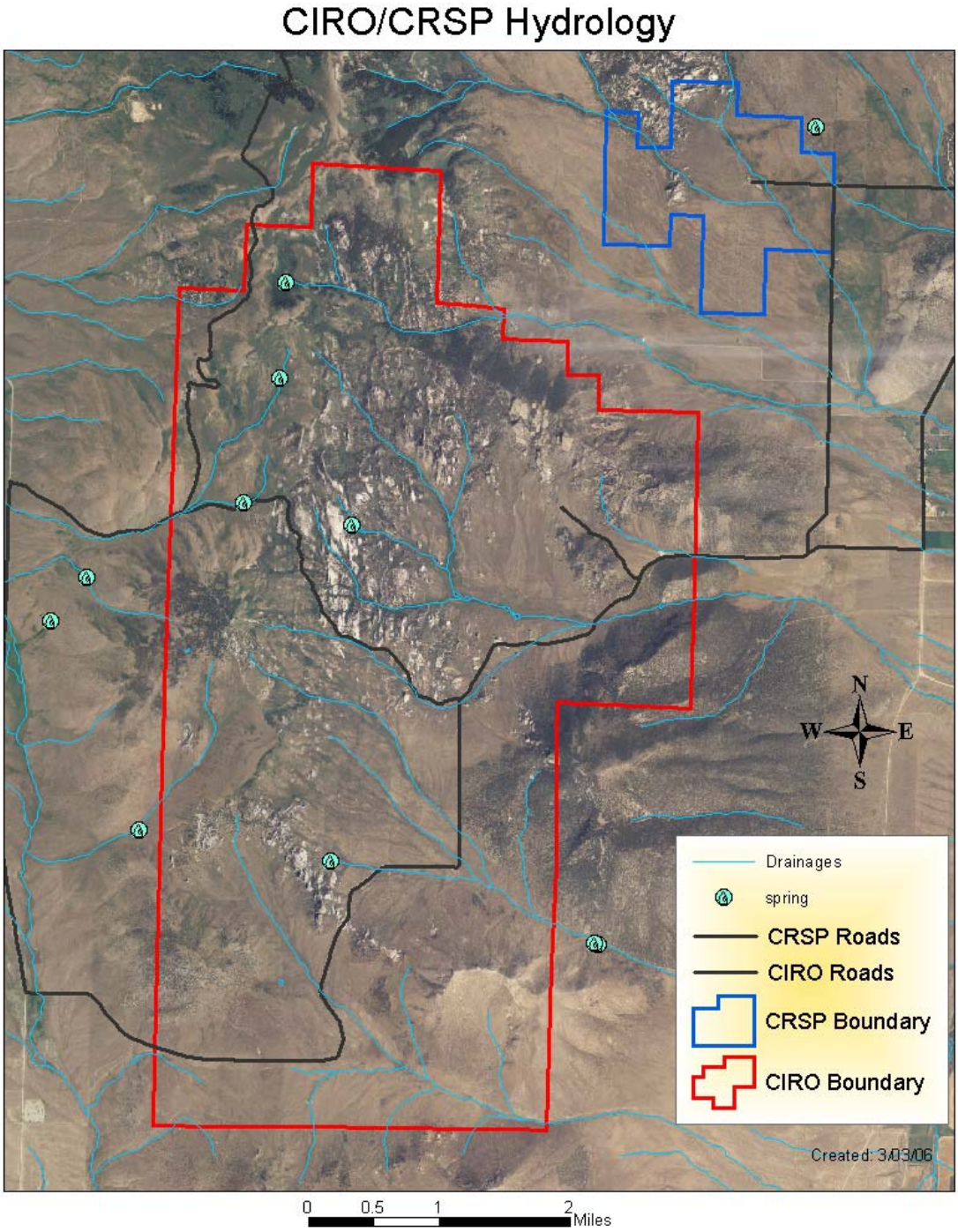
7) Environmental Concerns and Mitigation

City of Rocks National Reserve sees over 80,000 visitors a year, has high public use areas, has 8 grazing allotments, private land, and many riparian areas. These aspects are important to be aware of in terms of weed control projects. Seed dispersal, ground disturbance and use of herbicides all have the potential to negatively affect the native ecosystem within and around CIRO. It is important to be cognizant of these areas and to avoid potential impacts that could occur.

a) Riparian Areas

City of Rocks has a number of tributaries within its boundaries including three forks of the Circle Creek, Trail Canyon Creek, Graham Creek and Emery Creek. Almo, Stines and Johnson Creek along with approximately 400 acres of flooded meadows fed by Almo Creek are located in Castle Rocks State Park. Seed dispersal and herbicide seepage into these drainages is a possibility therefore it is important to understand these drainages and the direction of flow to mitigate impacts that could occur.

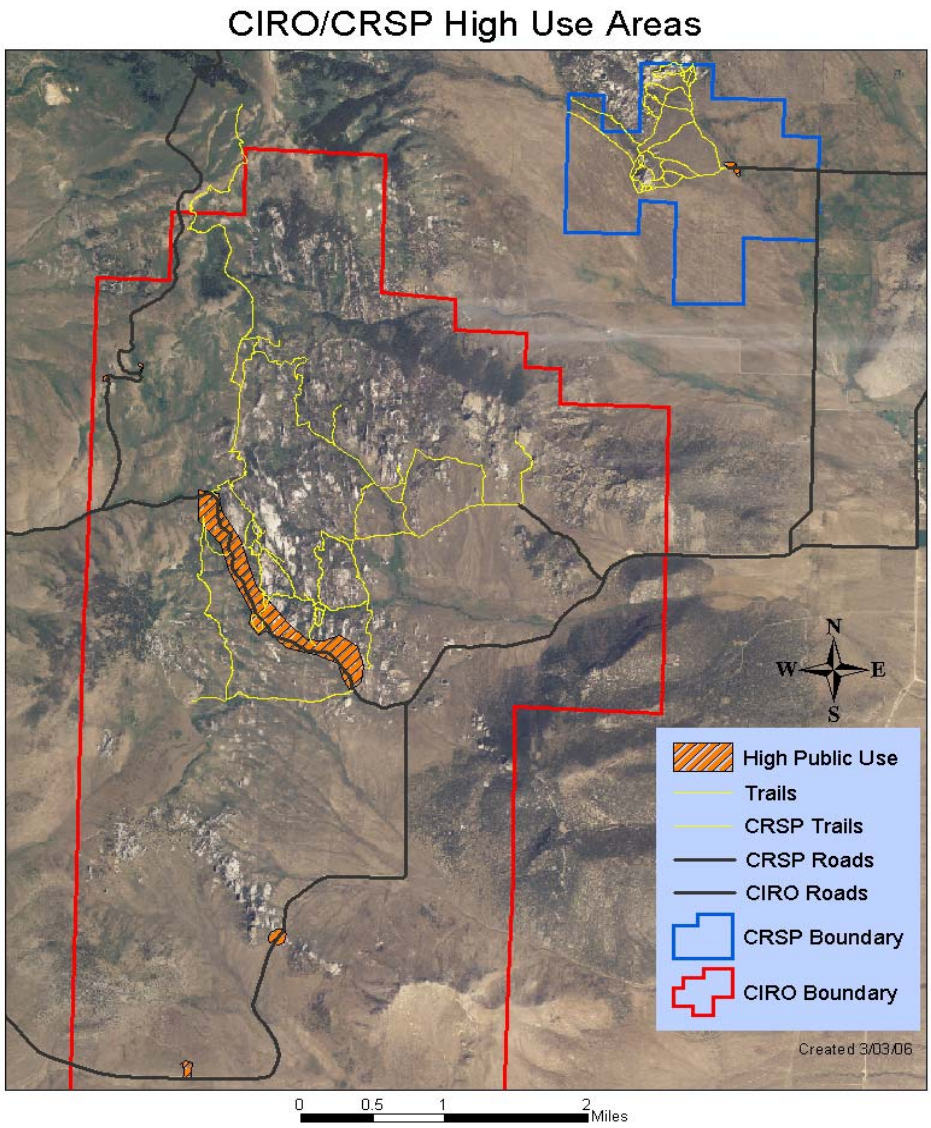
Map 24: Riparian Areas in CIRO/CRSP



b) Public Use Areas

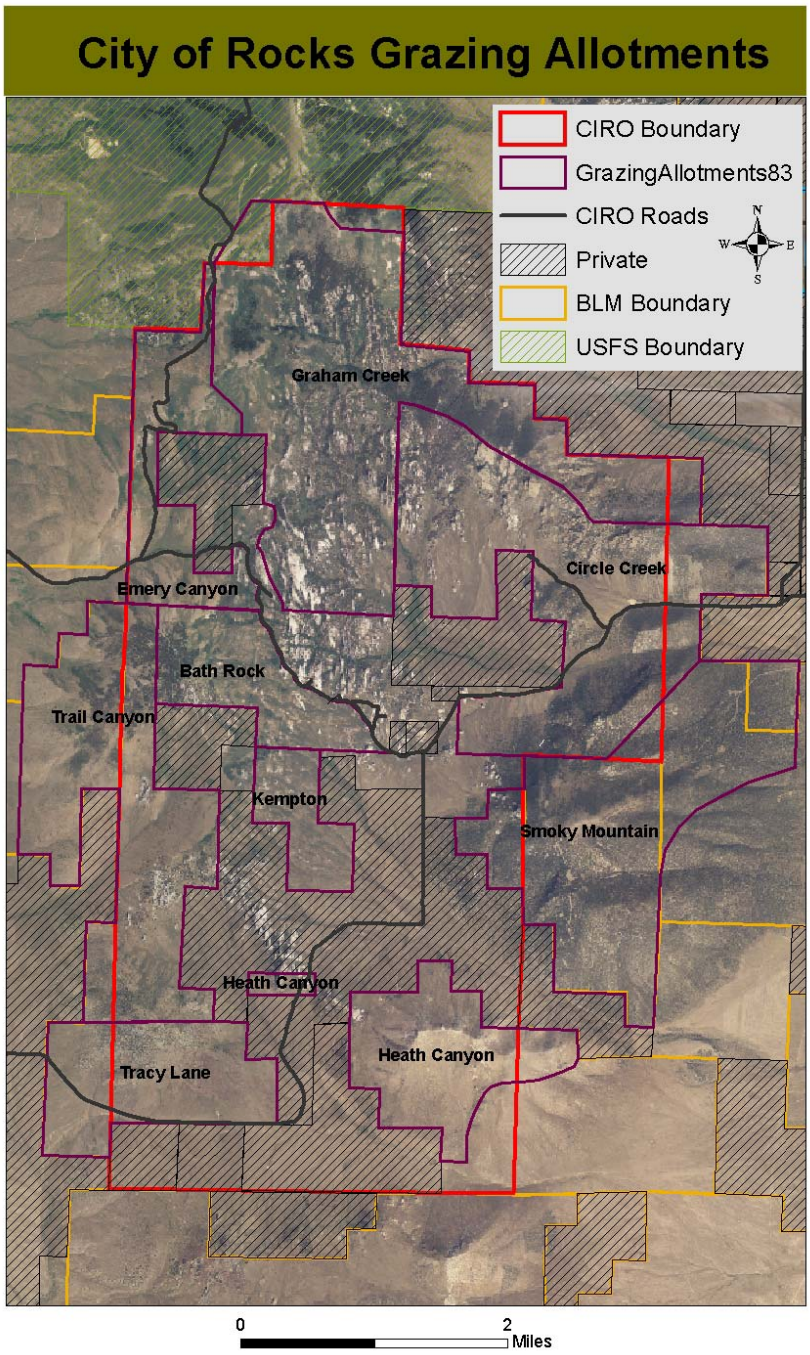
CIRO accommodates 80,000 visitors a year and houses 75 campsites. Use of the park includes rock climbing, horseback riding, hiking, mountain biking and sight seeing. Caution needs to be taken and areas need to be posted around trails and campsites while using herbicides, and monitoring weed populations for dispersal in these areas is vital. The maps below indicate trails, campsites and high use areas in CIRO/CRSP.

Map 25: High Use areas in CIRO/CRSP



c) Grazing Livestock

City of Rocks manages 8 grazing allotments with 450 Animal Unit Months (AUM) which is approximately 290 cattle. The permitted grazing season starts in May and concludes in mid-September. Livestock grazing presents a great challenge to weed eradication as livestock can act as a medium to seed dispersal. Caution must also be taken while using herbicides and permittees should be notified if spraying in their allotment.



8. Conclusion

The complete eradication of non-native weed species is no small task and realistically may be unachievable. However, focusing efforts on high priority noxious weeds and involving a number of partners to aid in the efforts presents a more practical objective. This weed plan was developed to establish realistic objectives on higher priority non-native weed species and to provide a starting point in the war against weeds. This plan was designed for a five year period with yearly reviews of progress. After the five year time period has elapsed, new objectives and targets will need to be established based on the success or failure of this plan.

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Appendix I

Definitions

TITLE 22
AGRICULTURE AND HORTICULTURE
CHAPTER 24
NOXIOUS WEEDS

22-2402. DEFINITIONS

"**Eradication**" means the complete elimination of all above-ground plant growth of a target noxious weed species for a period of two (2) years

"**Noxious weed**" means any plant having the potential to cause injury to public health, crops, livestock, land or other property; and which is designated as noxious by the director.

"**Prevention**" means any action that reduces the potential for the introduction or establishment of a plant species in areas not currently infested with that species.

"**Restoration**" means the process of reconditioning formerly weed infested land to a productive or desirable condition.

"**Weed control**" means any or all of the following: prevention, restoration, eradication, or modified treatments specified in a special management zone.

As defined by Redwood National and State Parks:

exotic

1. *adj.* (biology) Occurring in a given place as a result of direct or indirect, deliberate or accidental actions by humans. **Synonyms**: alien, introduced, non-native, and non-indigenous. Some exotic species look very attractive but, like con artists, can cause serious harm.

2. *n.* (biology) An exotic species

innocuous

adj. Not a threat to native species or ecosystems

invasive

adj. Common language term meaning tending to spread, intrude, or encroach, usually aggressively and in a hurtful manner. Gardeners characterize cultivated plants as "invasive" when

they spread aggressively beyond where they were intended to remain, particularly if they outcompete and displace other plants in the garden.

invasive species

Official term for an exotic species whose introduction can cause economic or environmental harm or harm to human health. The term originated in Presidential Executive Order 13112 issued February 3, 1999. This E.O. directs federal agencies to prevent the introduction of invasive species, to provide for their control, and to minimize the economic, ecological, and human health impacts that invasive species cause to the extent practicable and permitted by law.

threat

n. An agent that can significantly alter a natural scene, displace a native species, damage genetic integrity, disrupt natural physical or biological processes, or otherwise damage native ecosystems, or which can cause economic harm or harm to human health (NPS Policy and EO 13112). See also: Exotic Species Threat Assessment.

weed

n. Common-language term for a plant judged to be a nuisance. What makes a weed a nuisance is not necessarily an ecological threat, as defined above. Furthermore, a weed is not necessarily an exotic species. The term, ***noxious weed***, is an official designation for weeds which cause major economic harm. Traditionally, plants introduced for their ornamental, utilitarian, or food value are not viewed as weeds. It is only recently that the potential of some of these plants to "escape" and to disrupt natural ecosystems has been recognized. Many people assume that weeds look ugly. Calling an escaped ornamental a "weed" may seem non-sensical. More precise, accepted, and general terms for environmentally harmful non-natives are ***exotic pest plant*** and ***invasive plant species***. In Australia, exotic pest plants are termed ***environmental weeds***.

Appendix II

Idaho's 36 Noxious Weeds

http://www.agri.state.id.us/Categories/PlantsInsects/NoxiousWeeds/watchlist.php

Black Henbane	Buffalobur	Canada Thistle
Common Crupina	Dalmatian Toadflax	Diffuse Knapweed
Dyer's Woad	Eurasian Watermilfoil	Field Bindweed
Hoary Cress	Johnsongrass	Jointed Goatgrass
Leafy Spurge	Matgrass	Meadow Hawkweed
Meadow Knapweed	Milium	Musk Thistle
Orange Hawkweed	Perennial Pepperweed	Perennial Sowthistle
Poison Hemlock	Puncturevine	Purple Loosestrife
Rush Skeletonweed	Russian Knapweed	Scotch Broom
Scotch Thistle	Silverleaf Nightshade	Skeletonleaf Bursage
Spotted Knapweed	Syrian Beancaper	Tansy Ragwort
Toothed Spurge	Yellow Starthistle	Yellow Toadflax
Other Species of Concern		
Blueweed	Houndstongue	Japanese Knotweed
Mediterranean Sage	Oxeye Daisy	Saltcedar
Sulfur Cinquefoil	White Bryony	

Appendix III

Control Techniques

Below is a description of exotic plant control techniques adapted from The Nature Conservancy (TNC), other resource management agencies and universities. The most promising control techniques are tested on high priority species. Following NPS IPM guidelines, the following classes of control techniques are options for individual species:

Mechanical Controls

Hand tools: Shovels, Pulaski's, hoes, loppers, machetes, etc.

Manual removal: Manual removal of herbaceous and shallowly-rooted plants is relatively inexpensive and can control some species.

Power tools: Chain saws, weed whips, winches.

Cautions for mechanical controls:

Some exotic species deposit long lived seeds into the soil and these seeds may be in mud from infested locations. Before departing an infested worksite, crews are directed to clean their boots, tools, tires and machinery in order to prevent seed dispersal.

People, equipment, noise and smoke may disturb rare, threatened and endangered wildlife. Therefore, all plans to use mechanical controls are reviewed and carefully timed to avoid any adverse impacts to sensitive species, in compliance the Endangered Species Act.

Burn

Prescribed burning consumes above-ground vegetation and my kill seeds of exotic species or break their dormancy, allowing later removal of the plants. Fire affects the composition of native flora, and this may be manipulated to re-establish and support its natural resistance to invasion by non-native species. Personnel working in exotic plant management will work closely with prescribed burn staff to accomplish the multiple objectives of each burn. Rehabilitation of fires and firelines are planned carefully to avoid establishment and spread of exotic species from surrounding areas.

Biological Controls

Natural Enemies: Certain insects or pathogens (e.g., fungus, bacteria) attack specific plants and limit their growth or reproduction. Introductions must be carefully controlled so as not to harm other native plants or species of economic importance, and are introduced only after several years of scientific evaluation.

Rehabilitation/Restoration: Planting native species endemic to the specific area after ground disturbance or treatment of weed infestations is one of the best ways to control a non-native vegetation outbreak. Refer to CIRO plant list for selection in Appendix V. CIRO has dealt with native plant nurseries that collect native seed within a 200 mile radius of the park increasing survival rates. Contact information:

Native Grass seed:
Granite Seed (wholesale, retail); ***Members of the Intermountain Native Plant Growers Association***
1697 West 2100 North
Lehi, UT 84043
801-768-4422
http://www.graniteseed.com

Native bare root plants:
Lone Peak Conservation Nursery
State of Utah, Department of Natural Resources,
Division of Forestry, Fire & State Lands:
271 West Bitterbrush, Draper, Utah, 84020;
801-571-0900;
www.forestry.utah.gov.

Vegetation succession: Canopy closure by native evergreen conifers and/or hardwoods suppresses or eliminates shade-intolerant exotic species. Succession can be encouraged.

Chemical Controls

Herbicides: An herbicide may be considered as a means to control an invasive plant species if it is determined that alternative mechanical, physical, cultural, or biological means are either not acceptable or not feasible. Herbicides will not be considered for control in natural vegetation unless other control techniques prove ineffective. If herbicides are used, they are applied in strict accordance with IPM guidelines under the supervision of the park IPM coordinator by a trained, certified pesticide applicator.

Soil chemistry and microflora: Soils can be managed toward conditions that favor native species or that selectively target invasive species when the natives and invasives have differing soil requirements. Plant-available nutrients, salinity, acidity, and oxygen can be managed, and native symbiotic microflora can be re-introduced. For example, a hot surface fire tends to kill native mycorrhizae and to release much plant-available nitrogen. Abundant nitrogen favors weedy pioneers, such as thistles and cheatgrass. A dense stand of competing weeds, combined with a lack of native seed and mycorrhizae slows re-establishment of native plant species. Introducing a little topsoil from the undisturbed surroundings may be enough to re-introduce native seed and mycorrhizae, and a light surface application of natural litter or sawdust will cause decomposer fungi to multiply and to remove excess plant-available nitrogen from the soil.

Cultural Controls

"Cultural control" means educating people and encouraging them to adjust their activities and surroundings (insofar as possible) to minimize the spread of harmful plants.

Cleanliness: Vehicles and equipment can disperse seeds great distances. There may be long lived seeds of species in mud or debris from infested locations. If just one seed germinates and the plant matures to reproductive age, it can start a new population. Before working in a vulnerable ecosystem, earth moving equipment used for any purpose, including road construction, maintenance and watershed rehabilitation, should be thoroughly cleaned and inspected by park staff to prevent seed dispersal. Certified weed-free hay, feed, and straw is mandatory in the park and control measures should be employed to ensure compliance. Weed-free gravel, soil, etc. in any improvement/repair/road/development projects are all very important prevention tools that should be implemented.

Disposal of plant debris: Exotic plants that have been removed from the ground can be either left on site for consumption if it's not in flower or seed, or moved to another area in garbage bags to degerminate for a two week period. After that, garbage bags can be taken to the Almo Roll off station for disposal. If facilities exist, the debris should be either burned or used as mulch so that it does not add to solid waste. Extra care is necessary when such debris is moved off-site in order to avoid contaminating other areas with live plants and seed.

Information: Information is provided to the public and park employees in the form of signs, interpretive displays, brochures, and programs on the threat of exotic species and the need to control them to limit spread.

Grazing

Livestock including sheep, goats, cattle and horses can be utilized if it has been shown to be effective on the weed species, it will not cause further damage to the resource, and if all cooperating partners are in support of implementation.

No Action

This option is elected if the ecological threat from an exotic species is insignificant (the species is innocuous), or if no further action is needed to achieve or maintain control of the species.

Appendix IV

Education Program

This education program is to help aid in the eradication of high priority weeds in City of Rocks National Reserve. The posters located on the following pages will be displayed only in the areas where that particular weed is found to not overload the public on weed information.

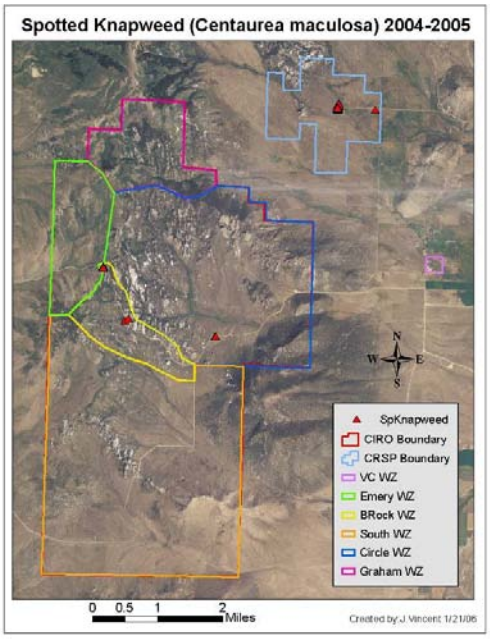
A pilot program can be initiated to allow the collection of spotted knapweed or musk thistle by the visitor providing them a free night stay at City of Rocks NR to encourage public participation in the program. The visitor is informed to inquire at the ranger office for details at which time they will be given a garbage bag for spotted knapweed and a grocery bag for the musk thistle flowers. They will also be given a card that outlines the cautions to take while picking the weeds. The cards will read as follows:

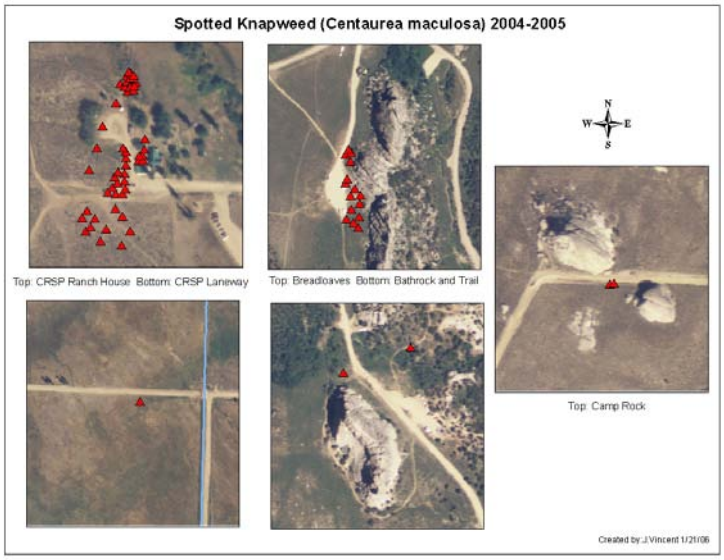
Spotted Knapweed

Instructions for Weed Program

1. Pull as much of the root as possible
2. Take caution to not disperse the seeds/flowers
3. Take caution to disturb the ground as little as possible
4. **Seal** bag when full and return bag to Office for **FREE** camping voucher

Location:





Description

Spotted knapweed is a biennial or short-lived perennial with a stout taproot. It is branched and grows 1 to 3 feet tall. Basal leaves up to 6 inches long, blades narrowly elliptic, entire to pinnately parted. Flowering heads are solitary at end of branches; involucral bracts stiff and tipped with a dark comblike fringe. Ray flowers are pinkish-purple or rarely cream-colored. Spotted knapweed was introduced from Eurasia and is becoming a number one weed problem in many areas in North America. They establish themselves on any disturbed soil and then spread thereby out competing native vegetation.

Your participation is greatly appreciated!!

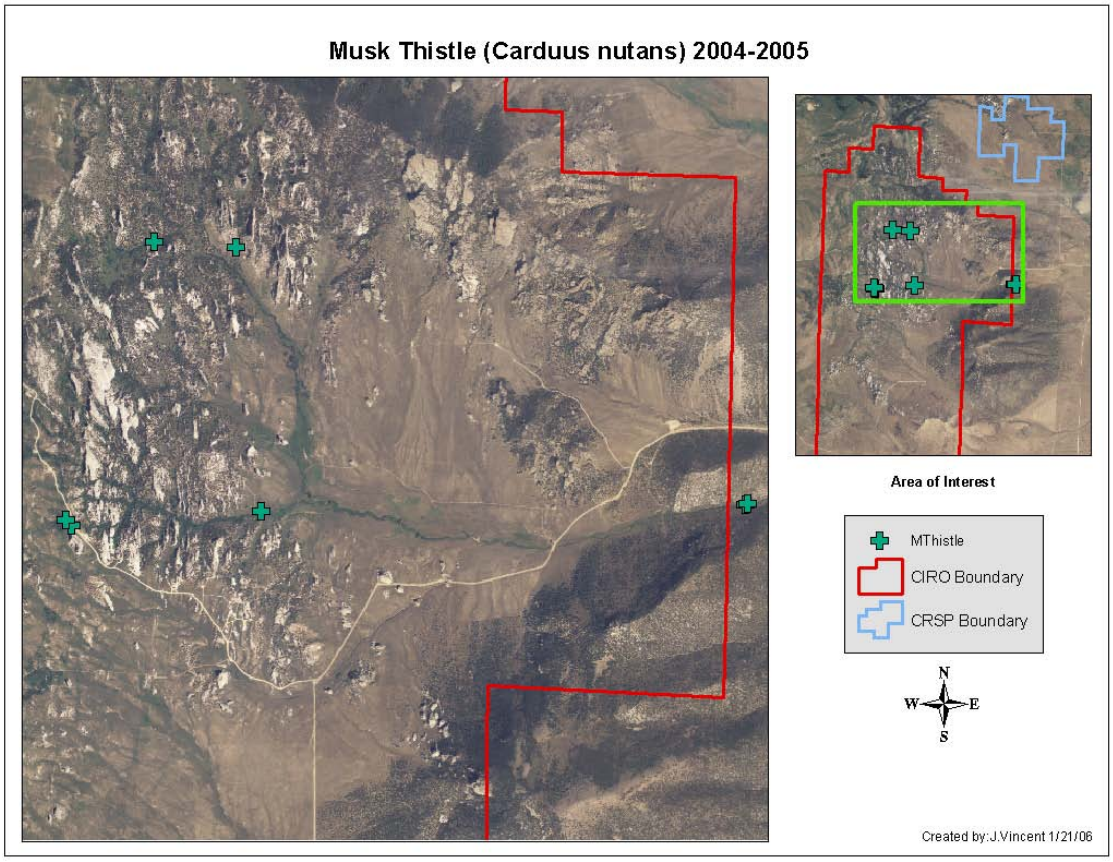
Please Return Card with Weed – Thanks!!!!!

Musk Thistle

Instructions for Weed Program

1. Snip all flower heads off the plant
2. Take caution to not disperse the seeds/flowers
3. Disturb the ground as little as possible
4. **Seal** bag when full and return bag to Office for free camping voucher

Location:



Description:
Musk thistle is a biennial and sometimes a winter annual growing up to 6 feet tall. Leaves are dark green with a light green midrib, deeply lobed and spiny margined. Leaves extend onto the stem giving a winged appearance. Flower heads are deep rose, violet or purple, terminal and solitary 1 ½ to 3 inches in diameter and usually bent over. It is a native to Europe and western Asia.

Your participation is greatly appreciated!!

Please Return Card with Weed – Thanks!!!!!

WANTED

DEAD

SPOTTED KNAPWEED

Fill a garbage bag and get a campsite FREE for a night

See City of Rocks Office for details

Caution: Do not spread the seeds

WANTED

DEAD

MUSK THISTLE

Fill a bag with flower heads and get a campsite FREE for a night

See City of Rocks Office for details

Caution: Do not spread the seeds

CAUTION

SPOTTED KNAPWEED

In this area

Spotted Knapweed is found in this area and is currently being treated.

With your help it can be controlled.

Please take caution as to not spread these sticky seeds via dog, pants etc.

If you find another infestation, please report to City of Rocks Office

CAUTION

White Top

In this area

Whitetop is found around the City of Rocks Ranger Office outside toilet.

This is a small weed patch that can be controlled with your help.

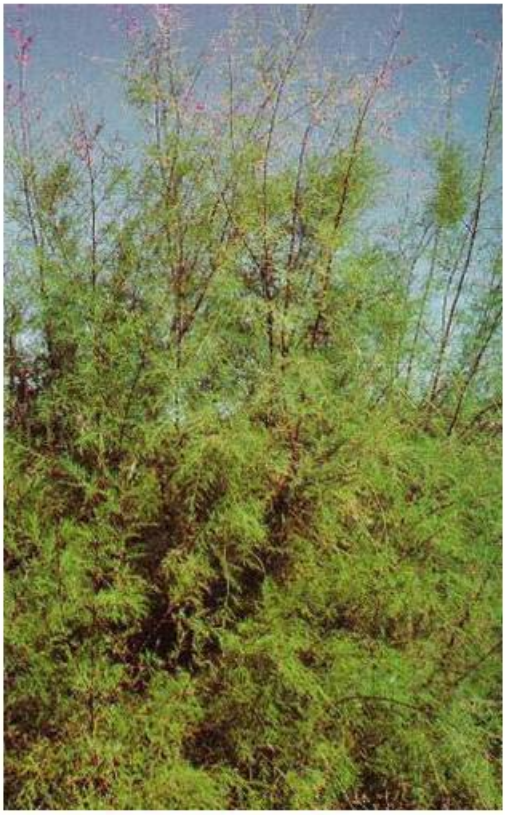
Please take caution as to not spread seeds via dog, pants etc.

If you find another infestation, please report to City of Rocks Office

WANTED

Salt Cedar (Tamarix)

Sightings



Have you seen this whispy willowly looking tree?

2 have been found in and around City of Rocks

This tree is devastating to riparian areas, choking out all native vegetation

If you see this tree (pink flowers in early summer) please report to City of Rocks Office

Appendix V
CIRO/CRSP Plant List

DIVISION LYCOPODIOPHYTA

Selaginellaceae

Selaginella watsonii Underw.
Watson Spikemoss
Quartzite rocks on the southwest face of Graham Peak, pure quartz outcrop in SW4 Sec 31 T15S R24E. Also abundant on quartz outcrop at Castle Rocks.

DIVISION EQUISETOPHYTA

Equisetaceae

Equisetum arvense L.
Field Horsetail
Ditchbanks and meadows NW of Almo.

Equisetum laevigatum A. Br.
Smooth Scouring Rush
Terraces and streambanks along Circle Creek near road crossing. Sometimes among willow clumps and in sagebrush.

DIVISION POLYPODIOPHYTA

Adiantaceae

Pellaea breweri D.C. Eaton
Brewer Cliff-Brake Fern
Rock ledges on Graham Peak and northward.

Aspleniaceae

Cystopteris fragilis (L.) Bernh.
Brittle Bladder Fern
At the base of rock outcrops, on ledges, and along both vernal and perennial streams.

Dryopteris felix-mas (L.) Schott
Male Fern
Known only from a single, deeply shaded rock cleft along the ridge between Circle and Graham Creeks. This plant has a wide range, but is seldom abundant.

Polystichum kruckebergii Wagner
Kruckeberg's Sword Fern
Shaded rock clefts on south slope of the ridge between Circle and Graham Creeks. Also at Castle Rocks and fairly common on the Raft River Mountains.

Polystichum scopulinum (D.C. Eaton) Maxon
Western Holly Fern
Protected rock ledges at Twin Sisters.

DIVISION PINOPHYTA

Cupressaceae

Juniperus osteosperma (Torr.) Little
Utah Juniper
Foothills and sunny slopes to middle elevations. More frost hardy than pinyon pine, and thus extending further into the valley.

Juniperus scopulorum Sarg.
Rocky Mountain Juniper
On rock outcrops and in deeper soils from Bath rock upward in elevation.

Pinaceae

Abies lasiocarpa (Hook.) Nutt.
Alpine Fir
From Indian Grove northward in the mountains.

Pinus contorta Dougl. var. ***latifolia*** Engelm.
Inland Lodgepole Pine
Indian Grove and northward. This pine is near the southwestern extremity of its range.

Pinus flexilis James
Limber Pine
On rock outcrops where its seeds are often cached by Nutcrackers and Pinyon Jays. Also on Graham Peak. Several tall specimens are near Emery Canyon Well.

Pinus monophylla Torrey & Fremont
Single-Leaf Pinyon
Middle elevations throughout the Reserve. The Albion Mountains mark the northern extremity of this pine's modern range.

Pseudotsuga menziesii (Mirb.) Franco var. ***glauca*** (Beissn.) Franco Douglas Fir
On the north-facing slope of Graham Creek Canyon. Spreading into upper Circle Creek. City of Rocks marks the westward limit of the present range of Douglas Fir in the northern Great Basin.

DIVISION MAGNOLIOPHYTA

CLASS MAGNOLIOPSIDA

Aceraceae

Acer glabrum Torr. var. ***douglasii*** (Hook.) Dippel
Rocky Mountain Maple
Scattered through upper tributaries of Circle Creek and into Graham Creek Canyon.

Acer negundo L.
Box Elder
Near farmsteads and along streams.

Amaranthaceae

****Amaranthus albus*** L.
Tumble Pigweed
Along roadways and in areas where the soil is disturbed.

Amaranthus blitoides Watson
Prostrate Pigweed
Roadsides.

****Amaranthus retroflexus*** L.
Redroot Pigweed
Disturbed areas around farmsteads. Near the old rock house on Circle Creek.

Apiaceae

****Carum carvi*** L.
Caraway
Pastures and meadows NW of Almo.

Cicuta maculata L.
Water Hemlock
In and near the waters of Circle Creek.
Cicuta douglasii

****Conium maculatum*** L.
Poison Hemlock
Along Circle Creek.

Cymopterus davisii R. L. Hartman
Davis Wavewing
Easterly slope just north of Graham Peak. This plant is known only from the Albion Mountains.

Cymopterus purpurascens (Gray) Jones
Widewing Spring Parsley
In pinyon-juniper near the east entrance to City of Rocks and north of Almo.

Heracleum lanatum Michx.
Cow Parsnip
Along streams and ditches NW of Almo.

Lomatium dissectum (Nutt.) Math. & Const. var. ***eatonii*** (Coult. & Rose) Cronq.
Giant Lomatium
Bath Rock northward to Emery Canyon well.

Lomatium foeniculaceum (Nutt.) Coult. & Rose var. ***macdougalii*** (Coult. & Rose) Cronq.
Desert Parsley
Rocky areas among sagebrush.

Lomatium nudicaule (Pursh) Coult. & Rose
Barestem Lomatium
Pinyon-juniper near south boundary of Reserve.

Lomatium triternatum (Pursh) Coult. & Rose var. ***platycarpum*** (Torr.) Cronq.
Narrowleaf Lomatium
Among sagebrush , foothills to middle elevations.

Orogenia linearifolia Wats.
Indian Potato
Middle and higher elevations in fertile soils.

Osmorhiza chilensis H. & A.
Sweet Cicely
Aspen groves.

Osmorhiza depauperata Phil.
Blunt Sweet Cicely
Among aspen and fir at Indian Grove.

Osmorhiza occidentalis (Nutt.) Torr.
Sweet Anise
Aspen thickets north of Bath Rock.

Pastinaca sativa L.
Wild Parsnip
Ditchbanks and meadows NW of Almo.

Perideridia montana (Blankinship) Cronq.
Yampah
Vernally moist areas near Bath Rock.

Asclepediaceae

Asclepias speciosa Torr.
Showy Milkweed
Around farmsteads in and near Almo.

Asteraceae

Achillea millefolium L. var. ***lanulosa*** (Nutt.) Piper
Yarrow
Valleys to mountain peaks.

Agoseris aurantiaca (Hook.) Greene
Orange Dandelion
Indian Grove and upward in elevation.

Agoseris glauca (Pursh) Raf. var. ***dasycephala*** (T. & G.) Jeps.
Mountain Dandelion
High meadows near Graham Peak.

Agoseris glauca (Pursh) Raf. var. ***glauca***
Mountain Dandelion
Meadows in the valley.

Agoseris glauca (Pursh) Raf. var. ***laciniata*** (D. C. Eaton) Smiley
Sagebrush grasslands, foothills to middle elevations.

Agoseris heterophylla (Nutt.) Greene
Annual Agoseris
Along vernal stream in SE4 SE4 Sec 35 T15S R23E.

Antennaria dimorpha (Nutt.) T. & G.
Low Pussytoes
In sagebrush and pinyon juniper, foothills to middle elevations.

Antennaria microphylla Rydb.
Rose Pussytoes
Middle to high elevations.

Arctium minus (Hill) Bernh.
Common Burdock
Disturbed areas along seasonal and permanent streams.

Arnica cordifolia Hook.
Heartleaf Arnica
Aspen and fir at Indian Grove.

Arnica sororia Greene
Meadow Arnica
Grassy areas and among aspens near Bath Rock and northward.

Artemisia arbuscula Nutt.
Low Sagebrush
Ridges and slopes with shallow, rocky soils, from foothills to Graham Peak.

Artemisia biennis (Willd.)
Wormwood
Grazed stream bottoms on lower Circle Creek.

Artemisia dracunculus L.
Terragon
Mixed mahogany, aspen, and pinyon in upper North Circle Creek.

Artemisia ludoviciana Nutt. var. ***ludoviciana***
var. ***latiloba*** Nutt.
var. ***incompta*** (Nutt.) Cronq.
Western Mugwort, Prairie Sagebrush
Valleys to upper elevations. The varieties are sometimes well segregated and at at other times intergradient with one another. An interesting, highly variable population may be found on the south slope of the ridge between Circle Creek and Graham Creek in the SW4 NW4 Sec 29 T15S R24E.

Artemisia nova Nels.
Black Sagebrush
Forming pure stands on foothills. Also mixed with *A. arbuscula* at higher elevations, such as the ridge west of

Indian Grove.

Artemisia tridentata Nutt. subsp. ***tridentata***
Basin Big Sagebrush
Stream terraces, basins, areas with deeper soils.

A. tridentata Nutt. subsp. ***vaseyana*** (Rydb.) Beetle
Mountain Big Sagebrush
Middle to high elevations on gentle terrain or in snow accumulation areas.

Aster ascendens Lindl.
Pacific Aster
Middle elevations among sagebrush and aspens.

Aster foliaceus Lindl.
Leafy Aster
Riparian, in vernally wet areas at Indian Grove.

Aster hesperius Gray
Ditchbank Aster
Lower Circle Creek and in the meadows NW of Almo.

Aster integrifolius Nutt.
Thickstem Aster
Mountain slopes, Indian Grove and northward.

Aster perelegans Nels. & Macbr.
Nuttall Aster
Open slopes above Indian Grove.

Aster scopulorum Gray
Gray Aster
Pinyon-juniper stands on Southwest Hill, near the southern boundary of the Reserve.

Balsamorhiza hookeri Nutt. var. ***hispidula*** (Sharp) Cronq.
Hooker Balsamroot
Foothills and extending along rocky ridgetops to Indian Grove area.

Balsamorhiza saggitata (Pursh) Nutt.
Arrowleaf Balsamroot
Common on sagebrush slopes and among pinyon-juniper. Foothills to mountain tops.

Brickellia californica (Gray)
California Brickellbrush
South-facing slope of the ridge between Circle and Graham Creeks.

Brickellia grandiflora (Hook.) Nutt.
Tasselflower
Around the base of the rock formations and on ledges and cliffs.

****Centaurea maculosa*** Lam.
Spotted Knapweed
Along roadsides at the lower elevations.

Chaenactis douglasii (Hook.) H. & A.
Dusty Maiden
Sagebrush grasslands and pinyon juniper, usually on dry sites.

Chrysothamnous nauseosus (Pallas) Britt.
subsp. ***albicaulis*** (Nutt.) Hall & Clements
Rubber Rabbitbrush
Foothills to middle elevations, open slopes and grasslands.

C. nauseosus (Pallas) Britt.
subsp. ***consimilis*** (Greene) Hall & Clements
Rubber Rabbitbrush
Valley and foothills.

Chrysothamnous viscidiflorus (Hook.) Nutt.
subsp. ***puberulus*** (D.C. Eaton) Hall & Clements
Green Rabbitbrush
Foothills among sagebrush and on ridges. A favorite food of deer when first greening up in the spring.

C. viscidiflorus (Hook.) Nutt.
subsp. ***lanceolatus*** (Nutt.) Hall & Clements
Green Rabbitbrush
Foothills to mountain peaks.

****Cichorium intybus*** L.
Chicory
Meadows NW of Almo.

Cirsium arvense (L.) Scop. var. ***horridum*** Wimmer & Grab.
Canada Thistle
Valley meadows and moist sites in the mountains.

Cirsium neomexicanum Gray var. ***utahense*** (Petrak) Welsh
Utah Thistle
Sagebrush and pinyon juniper from the foothills to middle elevations.

****Cirsium vulgare*** (Savi) Tenore
Bull Thistle
Disturbed places such as roadsides, overgrazed stream bottoms, livestock gathering places.

****Conyza canadensis*** (L.) Cronq.
Horseweed, Canada Fleabane
Along lower Circle Creek from the road crossing downstream.

Crepis acuminata Nutt.
Tapertip Hawksbeard
Sagebrush grasslands, open slopes, aspen groves.

Crepis intermedia Gray
Grey Hawksbeard
Foothills and open stands of pinyon-juniper.

Crepis modocensis Greene subsp. ***modocensis***
Modoc Hawksbeard
Sagebrush areas in Circle Creek basin.

Erigeron asperugineus (D.C. Eat.) Gray
Fleabane
Ridgeline at Graham Peak.

Erigeron compositus Pursh var. ***glabratus*** Macoun
Fernleaf Fleabane
Rock outcrops and rocky ridges at middle elevations.

Erigeron divergens T. & G.
Spreading Fleabane
Around base of rock formations and along washes in the foothills.

Erigeron lonchophyllus Hook.
Spearleaf Fleabane
Sedge meadow just downslope to the east of Emery Canyon Well.

Erigeron nanus Nutt.
Dwarf Fleabane
Open ridge from Finger Rock upslope nearly to Graham Peak.

Erigeron peregrinus (Pursh) Greene subsp. ***callianthemus*** (Greene) Cronq. var. ***eucallianthemus*** Cronq.
Mountain Daisy
Meadows and sagebrush, north slope of Graham Peak and northward in the mountains.

Erigeron pumilus Nutt. subsp. ***concinnoides*** Cronq. var. ***euconcinnoides*** Cronq.
Low Fleabane
Ridges, rock outcrops, and low sagebrush stands.

Erigeron pumilus Nutt. subsp. ***concinnoides*** Cronq. var. ***condensatus*** (D.C. Eaton) Cronq.
Ridgeline from Finger Rock upslope to the southwest face of Graham Peak.

Erigeron speciosus (Lindl.) DC. var. ***macranthus*** (Nutt.) Cronq.
Oregon Fleabane
Aspen groves and mesic sites at middle elevations.

Erigeron tener Gray
Thin Daisy
At base of rock outcrops near Finger Rock. Uncommon in the Reserve.

Eriophyllum lanatum (Pursh) Forbes var. ***integrifolium*** (Hook.) Bailey
Eriophyllum
East-facing slope just north of Graham Peak and northward in the mountains.

Eupatorium occidentale Hook.
Western Eupatorium
On ledges and at the base of cliffs and outcrops along the top of the ridge between Graham and Circle Creeks.

Gnaphalium palustre Nutt.
Cudweed
Along washes and in seasonally wet areas in the foothills.

Grindelia squarrosa (Pursh) Dunal var. ***serrulata*** (Rydb.) Steyerm.
Sawtooth Gumweed
Roadsides, campgrounds, gravelly and compacted areas.

Gutierrezia sarothrae (Pursh) Britt.
Broom Snakeweed
Common among sagebrush in foothill areas.

Haplopappus acaulis (Nutt.) Gray
Stemless Goldenweed
Rocky ridges and on rock formations in the foothills and upward to moderate elevations.

Haplopappus macronema Gray
Whitestem Goldenweed
East-facing slope just north of Graham Peak and northward at high elevations.

Haplopappus nanus (Nutt.) D. C. Eaton
Dwarf Goldenweed
Hot, dry ledges on rock formations, low to middle elevation.

Haplopappus uniflorus (Hook.) T. & G.
Meadow Goldenweed
In sedge meadows along Circle Creek above the road crossing.
Pyrrocoma uniflora

Helianthella uniflora (Nutt.) D.C. Eaton
One-Flower Helianthella
Open slopes at middle to high elevations.

Helianthus annuus L.
Common Sunflower
Roadsides and fencelines in the valley and foothills.

Helianthus nuttallii T. & G.
Nuttall Sunflower
Along streams and ditches in the meadows NW of Almo.

Heterotheca villosa (Pursh) Shinners
Hairy Golden Aster
Around the base of rock formations throughout the Reserve.
Chrysopsis villosa

Hieracium cynoglossoides Arv.-Touv.
Houndstongue Hawkweed
Mahoganies and junipers on south-facing slope just east of Emery Canyon Well.

Iva axillaris Pursh
Poverty Weed
Roadsides and disturbed soils around farmsteads.

Iva xanthifolia Nutt.
Marshelder, Rag Sumpweed
At Circle Creek road crossing.

****Lactuca serriola*** L.
Prickly Lettuce
Roadsides and farmsteads.

Machaeranthera canescens (Pursh) Gray
Hoary Aster
Sagebrush and pinyon-juniper, middle elevations to high ridges.

Madia glomerata Hook.
Tarweed
Disturbed areas, such as the old roadway north of Indian Grove.

Madia gracilis (Smith) Keck
Grassy Tarweed
Along edge of graded road through meadows NW of Almo.

Microseris nutans (Geyer) Schulz-Bip
Nodding Microseris
Pinyon-juniper and sagebrush near south boundary of the Reserve. To be expected in similar habitats elsewhere.

Rudbeckia occidentalis Nutt.
Western Coneflower
Heavily grazed aspen groves and mountain meadows, Indian Grove and northward in the mountains.

Senecio canus Hook.
Grey Groundsel
Ridgeline from Finger Rock northward.

Senecio integerrimus Nutt. var. ***exaltatus*** (Nutt.) Cronq.
Columbia Groundsel
Sagebrush grasslands and open stands of pinyon juniper, foothills to middle elevations.

Senecio multilobatus T. & G.
Lobeleaf Groundsel
Sagebrush grasslands and pinyon-juniper.

Senecio pseudaureus Rydb.
Groundsel
Vernally wet areas at Indian Grove.

Senecio serra Hook.
Saw Groundsel
Aspen groves and open slopes at higher elevations.

Senecio streptanthifolius Greene
Manyface Groundsel
Along the ridge between Circle and Graham Creeks.

Solidago canadensis L.
Canada Goldenrod
Ditchbanks and fencerows in the meadows NW of Almo.

Solidago missouriensis Nutt.
Missouri Goldenrod
Moist, sandy terrace east of Emery Canyon summit.

Solidago sparsiflora Gray
Slender Goldenrod
At the base of rock outcrops and on ledges in the rock formations.

****Sonchus asper*** (L.) Hill
Prickly Sow Thistle
Along Circle Creek below the road crossing.

Stephanomeria spinosa (Nutt.) Tomb.
Thorn Wirelettuce
Sagebrush flats and roadsides in the Basins.

Stephanomeria tenuifolia (Torr.) Hall var. ***myrioclada*** (Eat.) Cronq.
Wirelettuce
At the base of rock formations and on ledges.

Taraxacum officinale Weber
Dandelion
Grassy areas and streamsides.

Tetradymia canescens DC.
Horsebrush
Ridgeline west of Indian Grove.

****Tragopogon dubius*** Scop.
Yellow Salsify
Roadsides and disturbed places from the foothills to relatively high elevations.

****Tragopogon porrifolius*** L.
Purple Salsify
Meadows NW of Almo.

Wyethia amplexicaulis (Nutt.) Nutt.
Mule's Ear
Scattered and fairly uncommon. Emery Canyon near junction of Almo Park road, and on the northeasterly slope just north of the junction of Twin Sisters and Emery Canyon Road.

Xanthium strumarium L.
Common Cocklebur
Roadsides.

Berberidaceae

Berberis repens Lindl.
Oregon Grape
Aspen groves and Douglas Fir, also in mesic areas among Pinyon-Juniper. *Mahonia repens*

Betulaceae

Alnus incana (L.) Moench subsp. ***rugosa*** (Duroi) R.T. Clausen var. ***occidentalis*** (Dippel) C.L. Hitchcock
Mountain Alder
Along Emery Canyon Creek.

Boraginaceae

Amsinckia menziesii (Lehm.) Nels. & Macbr.
Fiddleneck
A roadside weed near Circle Creek.
Amsinckia retrorsa

Asperugo procumbens L.
Catchweed
Fencerows and farmsteads.

Cryptantha ambigua (A. Gray) Greene
Wilkes Cryptantha
Pinyon-juniper areas.

Cryptantha circumcissa (H. & A.) Johnston
Cushion Cryptantha
Dry, sandy areas. Around anthills.

Cryptantha humilis (Greene) Payson
Dwarf Cryptantha
Pinyon-juniper stands, mostly in the foothills.

Cryptantha watsonii (Gray) Greene
Watson Cryptantha
Pinyon-juniper and upward to aspen groves.

Hackelia floribunda (Lehm.) I.M. Johnston
Forget-me-not
Aspen groves and alpine fir stands.

Hackelia macrantha (Eastw.) J. Gentry
Forget-me-not, Stickseed
Upper elevation woods and openings.

Hackelia patens (Nutt.) I.M. Johnston
Spotted Forget-me-not
Foothills to middle elevations on open slopes.

Lappula redowski (Hornem.) Greene
Desert Stickweed
Roadsides and disturbed areas.

Lithospermum ruderale Dougl.
Western Stoneseed
Sagebrush and pinyon-juniper from the foothills to middle elevations.

Mertensia ciliata (Torr.) G. Don
Bluebell
Aspen groves and mesic slopes at higher elevations.

Mertensia oblongifolia (Nutt.) G. Don
Sagebrush Bluebell
Blooming early in sagebrush areas from foothills to middle elevations.

****Myosotis micrantha*** Pallas
Forget-me-not
Vernally moist areas, mostly lower elevations.

Pectocarya penicillata (Hook. & Arn.) DC.
Northern Pectocarya
Among sagebrush in the Twin Sisters area.

Plagiobothrys scouleri (Hook. & Arn.) Johnst. var. ***penicillatus*** (Greene) Cronq.
Popcorn Flower
Meadows and seeps from the valley to Indian Grove.

Brassicaceae

****Alyssum desertorum*** Stapf.
Desert Alyssum
Sagebrush and Pinyon-juniper, low to middle elevations.

Arabis drummondii Gray
Rockcress
Alpine fir forests near Graham Peak.

Arabis glabra (L.) Bernh.
Tower Mustard
Aspen groves and meadows at upper elevations.

Arabis hirsuta (L.) Scop.
var. ***pycnocarpa*** (Hopkins) Rollins var. ***glabrata*** T. & G.
Hairy Rockcress
Along vernal stream in Sec 29 T15S R24E. The first variety grows in dryer sites and the second along the stream.

Arabis holboellii Hornem. var. ***secunda*** (Howell) Jepson
Rockcress
Pinyon-Juniper and sagebrush throughout the Reserve.

Arabis lignifera Nels.
Rockcress
South-facing slopes near the southern boundary of the Reserve. Closely similar to *A. holboellii* and perhaps belonging to var. *pinetorum* of that species.

Arabis microphylla Nutt.
Littleleaf Rockcress
Rock ledges and clefts throughout the Reserve.

Arabis sparsiflora Nutt.
Sicklepod Rockcress
Pinyon-juniper and sagebrush mainly lower elevations.

Barbarea orthoceras Ledeb.
Winter Cress
Riparian areas at middle elevations.

****Camelina microcarpa*** Andrz.
False Flax
Roadsides and in burned areas at lower elevations.

****Capsella bursa-pastoris*** (L.) Medicus
Shepherd's Purse
Farmsteads, roadsides, livestock use areas.

Cardamine pennsylvanica Muhl.
Bittercress
Riparian areas and mountain seeps.

****Cardaria pubescens*** (Meyer) Jarm.
Hairy Whitetop
A roadside weed.

Caulanthus crassicaulis (Torr.) Wats.
Thickstem Wild Cabbage
Pinyon-juniper and sagebrush grasslands.

****Chorispora tenella*** (Pallas) DC.
Musk Mustard, Purple Mustard
Farmsteads, roadsides, disturbed places.

Descurainia californica (Gray) Schulz
California Tansy Mustard
Sagebrush grasslands to aspen groves at middle elevations. This plant varies greatly in abundance from year to year.

Descurainea pinnata (Walt.) Britt. var. ***filipes*** (Gray) Peck
Tansy Mustard
Although scattered throughout the foothill and middle elevations, the typical habitat for this plant is in the needle duff around Pinyons and Junipers on sunny sites.

Descurainea richardsonii (Sweet) Shulz var. ***brevipes*** (Nutt.) Welsh & Reveal
Richardson Tansy Mustard
Aspen and alpine fir, from Indian Grove northward in the mountains.

Descurainea richardsonii (Sweet) Shulz var. ***sonnei*** (Robins) C.L. Hitchcock
Richardson Tansy Mustard
Open slopes, aspen groves, and livestock congregating areas at middle to high elevations.

****Descurainea sophia*** (L.) Webb
Flixweed Tansy Mustard
Roadsides, disturbed places in valleys and foothills.

Draba nemorosa L.
Woods Draba
In soil pockets on the rock formations and in openings among pinyon-juniper stands.

Draba verna L.
Spring Draba
Diminutive, early-blooming annual found from the foothills to middle elevations.

Erysimum asperum (Nutt.) DC.
Wallflower
Sagebrush grasslands, pinyon juniper, and open slopes.

****Lepidium campestre*** (L.) R. Br.
Fieldcress
Ditchbanks and riparian areas NW of Almo.

****Lepidium perfoliatum*** L.
Clasping Pepperweed
Farmsteads and livestock gathering areas at lower elevations. Common around the old Stage Station.

Lepidium virginicum L. var. ***pubescens*** (Greene) Hitchc.
Virginia Pepperweed
Livestock bedding areas in the Pinyon-Juniper.

Nasturtium officinale R. Br. in Ait.
Watercress
In slow-moving sections of Circle Creek.

Rorippa curvisiliqua (Hook.) Bessey
Curved Yellowcress
Riparian areas at middle elevations. Collected by Ray Davis at Emery Canyon Creek in 1934 and still growing there.

Schoenocrambe linifolia (Nutt.) Greene
Plains Mustard
Sagebrush and Pinyon-juniper from foothills to middle elevations.

****Sisymbrium altissimum*** L.
Tumble Mustard, Jim Hill Mustard
A common associate of cheatgrass in burned areas.
Thlaspi arvense L.
Pennycress, Fanweed
Roadsides, farmsteads, disturbed places.

Thlaspi montanum L.
Wild Candytuft
Open areas from Graham Peak northward in the mountains.

Cactaceae

Opuntia polyacantha Haw.
Plains Prickly Pear
Common throughout the Reserve, reaching to moderate elevations on ridgelines.

Pediocactus simpsonii (Engelm.)
Simpson Hedgehog Cactus
Locally abundant along the ridgeline west of Indian Grove and upward.

Caprifoliaceae

Sambucus cerulea Raf.
Blue Elderberry
Scattered individual plants may be found from Twin Sisters through the rock formations and near Finger Rock.

Sambucus racemosa L. var. ***microbotrys*** (Rydb.) Kearney & Peebles
Red Elderberry
Meadows and open slopes from Indian Grove northward in the mountains.

Symphoricarpos oreophilus Gray
Snowberry
Foothills to mountain tops.

Caryophyllaceae

Arenaria fendleri Gray
Sandwort
Rocky ridges at middle to high elevations.
Arenaria kingii

Arenaria congesta Nutt.
Ballhead Sandwort
Graham Peak and northward.

Cerastium nutans Raf.
Nodding Chickweed
Moist areas along wash east of Emery Canyon Well.

Lychnis drummondii (Hook.) Wats.
Drummond Catchfly
Alpine fir forest at Indian Grove and northward.

Silene douglasii Hook.
Douglas Silene
Lee slope of ridge north of Graham Peak.

Silene menziesii Hook. var. ***menziesii***
Catchfly
Aspen groves at middle and higher elevation.

Silene menziesii Hook. var. ***viscosa*** (Greene) Hitchc. & Mag.
Catchfly
Pinyon juniper on north-facing or other mesic sites, mostly foothills.

Stellaria crispa Cham. & Schlecht.
Curled Starwort
Vernally wet areas at Indian Grove.

Stellaria jamesiana Torr.
Sticky Starwort
Middle and upper elevation, from Pinyon-juniper to aspen and fir.

Stellaria longipes Goldie
Longstalk Starwort
Sedge meadows along Circle Creek. Riparian areas.

****Spergularia rubra (L.) Presl.***
Red Sandspurry
Along road edges and other disturbed places at higher elevations.

Chenopodiaceae

Atriplex patula L. var. ***hastata*** (L.) Gray
Fat Hen Saltbush
Farmsteads, roadsides, and vernally moist areas in the foothills and valley.

Atriplex rosea L.
Tumbling Orach
Roadsides and disturbed places.

****Chenopodium album*** L.
Lambsquarter
Fencelines, farmsteads, and roadsides at lower elevation.

Chenopodium capitatum (L.) Asch. var. ***parvicapitatum*** Welch
Mountain Goosefoot
Around the base of rock outcrops in upper Emigrant Basin.

Chenopodium glaucum L.
Oakleaf Goosefoot
Around cattle watering troughs and salt licks.

****Halogeton glomeratus*** (Bieb.) Mey.
Halogeton
Roadsides and heavily grazed areas in the foothills and valley.

****Kochia scoparia*** (L.) Schrad.
Summer Cypress
Disturbed areas in the foothills and valley. At the old Stage Station in Emigrant Canyon.

Monolepis nuttalliana (Schultes) Greene
Nuttall Poverty Weed
Along cattle trails, at salt licks, and near watering troughs.

****Salsola iberica*** Sennen & Pau
Russian Thistle
Roadsides and disturbed places.

Sarcobatus vermiculatus (Hook.) Torr.
Greasewood
Saline areas on stream terraces and in the valley.

Clusiaceae

Hypericum formosum H.B.K. var. ***scouleri*** (Hook.) Hitchcock
Western St. Johnswort
Along streams and irrigation ditches in the meadows NW of Almo. Also Indian Grove.

Convolvulaceae

Convolvulus arvensis L.
Field Bindweed, Morning Glory
A weed in fields and roadsides.

Cornaceae

Cornus sericea L.
Redosier Dogwood
Along the moist wash east of Emery Canyon Well.
Cornus stolonifera

Crassulaceae

Sedum lanceolatum Torr.
Lanceleaved Stonecrop
Along rocky ridge upward from Finger Rock.

Fabaceae

Astragalus agrestis Dougl.
Field Milkvetch
Stream terraces along Circle Creek. Also along the road east of Finger Rock.

Astragalus beckwithii Torr. & Gray
Beckwith Milkvetch
Sagebrush grasslands, low to middle elevation.

Astragalus calycosus Torr. ex S. Wats.
Torrey Milkvetch
Among pinyon-juniper in the foothills and recurring along the ridgeline from Finger Rock to Indian Grove.

Astragalus cibarius Sheld.
Browse Milkvetch
Sagebrush grasslands and pinyon-juniper.

Astragalus convallarius Greene
Skeleton Milkvetch
Sagebrush grasslands, foothills to middle elevations.

Astragalus lentiginosus Dougl. ex Hook. var. ***salinus*** (Howell) Barneby
Freckled Milkvetch
Foothills in sagebrush grasslands and pinyon-juniper.

Astragalus purshii Dougl. ex Hook. var. ***purshii***
Pursh Milkvetch
Pinyon-juniper and sagebrush grasslands.

Astragalus tenellus Pursh
Pulse Milkvetch
Open ridge and slopes from Finger Rock northward.

Glycyrrhiza lepidota Pursh
Wild Licorice
Meadows and rocky places along streams in the foothills and valley.

Lupinus argenteus Pursh var. ***argentatus*** (Rydb.) Barneaby
Silver Lupine
Middle to high elevations in meadows and on mesic slopes. Yielding to the following variety on drier sites and at lower elevations.

Lupinus argenteus Pursh var. ***holosericeus*** (Nutt.) Barneby
Silver Lupine
Foothills to moderate elevation in sagebrush, meadows, and open slopes.

Lupinus leucophyllus Dougl.
Whiteleaved Lupine
Sagebrush grasslands throughout the middle elevations. Especially common in upper Emery Canyon.

****Medicago lupulina*** L.
Black Medic
Meadows and riparian areas.

****Medicago sativa*** L.
Common Alfalfa
Seeded and semi-naturalized throughout the lower part of the Reserve.

****Melilotus alba*** Medicus
White Sweetclover
Roadsides and disturbed places.

****Melilotus officinalis*** (L.) Pallas
Yellow Sweetclover
Roadsides and disturbed places.

Thermopsis rhombifolia (Nutt.) Richards
Thermopsis, Yellow Pea
Meadows along Circle Creek and NW of Almo.
Thermopsis montana Nutt.

Trifolium cyathiferum Lindl.
Cup Clover
Vernally wet areas, riparian. Mostly middle to higher elevation. Common at Indian Grove.

Trifolium microcephalum Pursh
Littlehead Clover
Seep areas and along vernal streams.

****Trifolium pratense*** L.
Red Clover
Introduced in pasture seedings and now quite naturalized in the meadowed riparian areas.

Trifolium repens L.
White Clover
Common in meadows and riparian areas.

Trifolium variegatum Nutt.
Variegated Clover
Wet areas along Circle Creek and in the meadows NW of Almo.

Fumariaceae

Dicentra uniflora Kell.
Steershead
This distinctive flower blooms very early and is easily missed because it grows in leaf litter. At City of Rocks it seems to be most common in sparse thickets of Mountain Mahogany.

Gentianaceae

Frasera speciosa Dougl.
Green Gentian, Elkweed
Snowpocket in the lee of the ridge west of Indian Grove. More common in meadows north of Graham Peak.
Swertia radiata

Gentiana affinis Griseb.
Rocky Mountain Gentian
Stream banks along Almo Creek. Uncommon.

Geraniaceae

Erodium cicutarrium (L.) L'Her.
Storksbill, Filaree
A weed in disturbed areas of the sagebrush flats and valley areas.

Geranium viscosissimum Fisch. & Mey.
var. ***nervosum*** (Rydb.) Hitchc.
Meadows from the valleys to upper elevations.

Grossulariaceae

Ribes aureum Pursh
Golden Currant
Along washes and streams and at base of rock outcrops. Common in foothills and thinning out with elevation. Tasty fruits.

Ribes cereum Dougl. var. ***inebrians*** (Lindl.) Hitchc.
Squaw or Wax Currant
Around rock outcrops and scattered through upper Pinyon-Juniper areas. Also in aspen groves.
Tasteless fruits.

Ribes montigenum McClatchie
Alpine Prickly Currant
In Alpine fir thickets, Indian Grove and northward in the mountains.

Ribes setosum Lindl.
Missouri Gooseberry
Mesic areas at low elevations. Near the base of rock formations. Browsed by cattle and deer so only occasionally bearing fruits.

Ribes viscosissimum Pursh
Sticky Currant
Indian Grove and northward in the mountains.

Hydrophyllaceae

Hesperochiron californicus (Benth.) Wats.
California Hesperochiron
Meadows NW of Almo. This plant is rare during average or dry years, but appears in great abundance in meadows and moist areas following snowy winters.

Hydrophyllum capitatum Dougl. ex Benth. var. ***alpinum*** Wats.
Ballhead Waterleaf
Aspen groves and slopes at middle elevations.

Nemophila breviflora Gray
Basin Nemophila
Aspen groves, especially in areas used heavily by livestock.

Phacelia hastata Dougl. ex Lehm.
Cordilleran Phacelia
Around the base of rock formations.

Lamiaceae

Agastache urticifolia (Benth.) Kuntze
Horsemint
Aspen groves and open slopes middle to high elevations.

Dracocephalum parviflorum Nutt.
Small-Flowered Dragon Head
Known only from Indian Grove following the wet spring of 1991. The area where this plant was found was not grazed by livestock until August that year, due to the persistence of green forage at lower elevations. The present status of this plant in the Reserve is unknown.

****Marrubium vulgare*** L.
Horehound
Roadsides and disturbed places, foothills to middle elevations. Common near Emery Canyon Well and the Stagecoach Station.

Mentha arvensis L.
Field Mint
Riparian areas, wet meadows.

****Nepeta cataria*** L
Catnip
In the wash just east of Emery Canyon Well.

Prunella vulgaris L.
Common Selfheal
Riparian meadows and streamsides.

Limnanthaceae

Floerkia proserpinicoides Willd.
False Mermaid
In and near vernal streams and seep areas.

Linaceae

Linum lewisii Pursh
Wild Flax, Blue Flax
Foothills to moderate elevations on open slopes, in meadows, and along roadways. *Linum perenne* L.

Loasaceae

Mentzelia albicaulis Dougl.
Whitestem Blazing Star
Pinyon-juniper woods, open slopes at low to middle elevation.

Malvaceae

Iliamna rivularis (Dougl.) Greene
Mountain Hollyhock
Aspen groves and open slopes from Finger Rock northward.

****Malva neglecta*** Wallr.
Roundleaf Mallow
A weed of roadsides and around farmsteads.

Sidalcea neomexicana Gray
New Mexico Checkermallow
Aspen groves.

Sphaeralcea grossulariifolia (H. & A.) Rydb.
Gooseberry-Leaved Globe Mallow
Sagebrush grasslands and pinyon-juniper from foothills to the valley.

Onagraceae

Camissonia parvula (Nutt.) Raven
Little Camissonia
Sagebrush grasslands near Twin Sisters. A tiny plant that is almost invisible except in wet years.

Camissonia subacaulis (Pursh) Raven
Suncups, Stemless Camissonia
Meadows at Indian Grove.
Oenothera heterantha

Epilobium brachycarpum Presl.
Panicled Willow Herb
Widespread from middle to moderate elevation. Common just north of Bath Rock.

Epilobium ciliatum Raf.
Willow Herb
Riparian areas and vernal springs and seeps.

Gayophytum decipiens Lewis & Szecyk
Groundsmoke
Old fields and nearby pinyon-juniper near the east entrance to City of Rocks Reserve.

Gayophytum diffusum T. & G.
Groundsmoke
Sagebrush openings among aspen groves.

Gayophytum ramosissimum Nutt.
Groundsmoke
Roadsides and open slopes at higher elevations.

Oenothera biennis L.
Common Evening Primrose
Ditchbanks and meadows in the valleys.

Oenothera caespitosa Nutt. var. ***marginata*** (Nutt.) Munz
Evening Primrose
Scattered populations on south-facing slopes in the foothills. A group of plants just north of the former gravel pit (near east entrance) produces huge flowers in wet years.

Orobanchaceae

Orobanche fasciculata Nutt.
Clustered Broomrape
A parasite on sagebrush in the foothills to middle elevations.

Paeoniaceae

Paeonia brownii Dougl.
Brown's Peony, Wild Peony
Aspen and pinyon-juniper at middle elevations.

Plantaginaceae

****Plantago lanceolata*** L.
English Plantain
Valleys to middle elevations in meadows and along streams.

Plantago major L.
Meadows and riparian areas from valleys to middle elevations.

Polemoniaceae

Collomia linearis Nutt.
Narrowleaf Collomia
Foothills to Graham Peak.

Eriastrum sparsiflorum (Eastw.) H. Mason var. ***wilcoxii*** (A. Nels.) Cronq.
Great Basin Eriastrum
Sagebrush grasslands near Twin Sisters and southward.

Gilia aggregata (Pursh) Sprengel var. ***macrosiphon*** Kearney & Peebles
Scarlet Gilia
Middle to upper elevations on open slopes and roadcuts.
Ipomopsis aggregata

Gilia inconspicua (Smith) Sweet
Shy Gilia
Sagebrush grasslands in Emigration Basin.

Gilia tenerrima A. Gray
Soft Gilia
Pinyon-juniper stands and around rock formations.
Especially common near Twin Sisters
Leptodactylon pungens (Torr.) Nutt.
Prickly Phlox
Open ridges among sagebrush, foothills to moderate elevations.

Linanthus harknessii (Curran) Greene
Three-Seed Linanthus
Sagebrush grasslands near Twin Sisters.

Microsteris gracilis (Hook.) Greene var. ***humilior*** (Hook.) Cronq.
Microsteris
Abundant in sagebrush grasslands and pinyon juniper to moderately high elevations. Common around anthills.

Navarettia intertexta (Benth.) Hook. var. ***propinqua*** (Suksd.) A. Brand
Great Basin Navarettia
Meadows and grassy slopes, Emery Canyon and eastward toward Bath Rock.

Phlox hoodii Richards var. ***canescens*** (T. & G.) Peck
Carpet Phlox
Foothills to middle elevations in sagebrush and pinyon-juniper.

Phlox longifolia Nutt.
Longleaf Phlox
Sagebrush grasslands, openings in pinyon-juniper woods from valleys to moderate elevations.

Phlox multiflora Nels.
Rocky Mountain Phlox
Graham Peak and northward in the mountains.

Phlox pulvinata (Wherry) Cronq.
Cushion Phlox
Graham Peak and windswept ridges northward.

Polemonium pulcherrimum Hook. var. ***pulcherrimum***
Jacob's Ladder
Alpine fir forest at Indian Grove and northward.

Polygonaceae

Eriogonum cernuum Nutt.
Nodding Buckwheat
Roadsides and around the base of rock outcrops in the foothills to middle elevations.

Eriogonum heracleoides Nutt.
Whorled Buckwheat
Sagebrush in the Basins and upward on mountain slopes to high elevations.

Eriogonum macrothecum Nutt. var. ***laxiflorum*** Hook.
Slender Buckwheat
Sagebrush grasslands, pinyon-juniper and open slopes to moderate elevations.

Eriogonum ovalifolium Nutt.
Cushion Buckwheat
Open places in the foothills.

Eriogonum umbellatum Torr.
Sulfur Buckwheat
Sagebrush grasslands, pinyon juniper, then upward on open slopes to the mountain peaks.

****Polygonum aviculare*** L.
Prostrate Knotweed
A weed of roadsides and farmsteads.

Polygonum bistortoides Pursh
Meadow Bistort
Meadows at Emery Canyon and northward.

Polygonum douglasii Greene var. ***douglasii***
Douglas Knotweed
Sagebrush slopes and open areas from middle to high elevation.

Polygonum douglasii Greene var. ***latifolium*** (Engelm.) Greene
Douglas Knotweed
A taller, more robust and broader-leaved variant. Mesic areas such as meadows at Indian Grove, lodgepole and aspen thickets.

Rumex crispus L.
Curly Dock
Meadows and riparian areas from the valleys to middle elevation.

Rumex paucifolius Nutt.
Alpine Sorrel
Meadows at Emery Canyon and northward.

Rumex salicifolius Weinm. subsp. ***triangulivalvis*** Danser
Willowleaf Dock
Along washes and areas where water accumulates such as cattle guards.

Portulacaceae

Calyptridium umbellatum (Torr.) Greene
Pussy Paws
East-facing slope north of Graham Peak.
Spraguea umbellata

Claytonia lanceolata Pursh
Spring Beauty
From the vicinity of Bath Rock upward in the mountains to the alpine fir forests.

Claytonia perfoliata Donn.
Miner's Lettuce
Mesic sites from the foothills to moderate elevations.
Montia perfoliata

Lewisia pygmaea (Gray) Robins
Least Lewisia
Snowdrift areas on the west flank of Graham Peak. More common northward on the higher peaks.

Montia chamissoi (Ledeb.) Rob. & Fern.
Water Springbeauty
In and along streams and seeps.

Montia fontana L. var. ***tenerrima*** (Gray) Fern. & Wieg.
Littleseed Miner's Lettuce
Vernal stream in SE4 NW4 Sec 29 T15S R24E. Not seen elsewhere, though to be expected in similar habitats.

Montia linearis (Dougl.) Greene
Narrowleaf Miner's Lettuce
Vernally flooded areas in the meadows NW of Almo.

Primulaceae

Dodecatheon pulchellum (Raf.) Merr.
Shooting Star
Along vernal stream in SE4NW4 Sec 29 T15S R24E.

Glaux maritima L.
Common Sea Milkwort
Saline riparian areas along Circle Creek.

Pyrolaceae

Pyrola secunda L.
One-Sided Wintergreen
Indian Grove northward. Rare and hard to find; more common at higher elevations.

Ranunculaceae

Aconitum columbianum Nutt.
Monkshood
Along Emery Canyon Creek and near seeps.

Actaea rubra (Ait.) Willd.
Baneberry
Rather uncommon, known from a few seep areas near Bath Rock.

Aquilegia coerulea James
Colorado Columbine
Alpine fir forests from Graham Peak northward.

Aquilegia formosa Fisch.
Western Columbine
Streambanks and seep areas from the valleys to middle elevations.

Ceratocephalus testiculatus (Crantz) Roth.
Bur Buttercup
Valleys to middle elevations, mostly in disturbed places.
Ranunculus testiculatus

Clematis ligusticifolia Nutt. in T. & G.
Western Virgin's Bower
Around the base of rock formations at Twin Sisters.

Delphinium andersonii Gray
Anderson Larkspur
Sagebrush and pinyon-juniper, mainly south of Twin Sisters.

Delphinium depauperatum Nutt.
Slim Larkspur
Moist stream terraces and meadows.

Delphinium nuttallianum Pritz.
Nuttall Larkspur
Common in sagebrush and openings among pinyon-juniper from foothills to middle elevations.

Delphinium occidentale Wats.
Tall Larkspur
Aspen groves, meadows, and open slopes from Finger Rock northward.

Myosurus minimus L.
Mousetail
In and along vernal stream in SE4NW4 Sec 29 T15S R24E.

Ranunculus andersonii Gray
Pink Buttercup
Mostly on open, sparsely vegetated slopes from the foothills to middle elevations. One of the earliest plants to bloom at City of Rocks.

Ranunculus aquatilis L.
Water Buttercup
Growing in lower Circle Creek.

Ranunculus glabberimus Hook. var. ***ellipticus*** Greene
Sagebrush Buttercup
Common early blooming plant in sagebrush and pinyon-juniper from foothills to middle elevations.

Ranunculus macounii Britt.
Macoun Buttercup
Riparian areas.

Ranunculus sceleratus L.
Celery-Leaved Buttercup
Along lower Circle Creek and near the spring at the Stagecoach Station.

Thalictrum fendleri Engelm.
Fendler Meadowrue
Aspen groves.

Rhamnaceae

Ceanothus velutinus Dougl.
Snowbrush Ceanothus
In the lee of high ridges.

Rosaceae

Amelanchier alnifolia Nutt.
Serviceberry
Shady, moist places near seeps.

Amelanchier utahensis Koehne
Utah Serviceberry
Open ridges, rock formations, and pinyon-juniper areas to moderate elevations.

Cercocarpus ledifolius Nutt.
Mountain Mahogany
Around rock formations and on upper slopes and ridges.

Geum macrophyllum Willd. var. ***perincisum*** (Rydb.) Raup.
Largeleaf Avens
Riparian areas and seeps.

Holodiscus dumosus (Nutt.) Heller
Rock Spiraea, Mountain Spray
On and around rock formations.

Potentilla anserina L.
Silverweed Cinquefoil
Meadows along lower Circle Creek.

Potentilla arguta Pursh
Tall Cinquefoil
Open slopes from Indian Grove northward.

Potentilla biennis Greene
Biennial Cinquefoil
Around the base of rock formations, especially at Twin Sisters and to the southwest.

Potentilla glandulosa Lindl. var. ***intermedia*** (Rydb.) Hitchc.
Gland Cinquefoil
In rock crevices, on ledges, mainly the shadier exposures of outcrops at low and middle elevation.

Potentilla gracilis Dougl. var. ***pulcherrima*** (Lehm.) Fern.
Showy Cinquefoil
Meadows at Emery Canyon.

Prunus virginiana L. var. ***melanocarpa*** (A. Nels.) Sarg.
Chokecherry
Around rock formations, washes, and open slopes.

Purshia tridentata (Pursh) DC.
Bitterbrush
Sagebrush grasslands and open slopes from the foothills to moderate elevations.

Rosa woodsii Lindl. var. ***ultramontana*** (Wats.) Jeps.
Wood's Rose
Foothills to moderate elevations, sometimes climbing in pinyon or juniper trees.

Rubiaceae

Galium aparine L.
Catchweed Bedstraw
Around the base of pinyons and junipers and beneath sagebrush on shadier slopes.

Galium bifolium S. Wats.
Twinleaf Bedstraw
Meadows and riparian areas.

Galium triflorum Michx.
Sweetscented Bedstraw
Among willow thickets along lower Circle Creek.

Salicaceae

****Populus alba*** L.
White Poplar
Around farmsteads in the valley.

Populus angustifolia James
Narrowleaf Cottonwood
Scattered through the Reserve near springs and along vernal streams. Most abundant along the vernal stream in the center of Sec29 T15S R24E. The few cottonwoods remaining are being overtaken by pinyon and juniper in response to a declining water table.

****Populus x canadensis*** Moench.
Carolina Poplar
Introduced around farmsteads. Near the old rock house at Circle Creek crossing.

Populus tremuloides Michx.
Quaking Aspen
In the rock formations, Circle Creek, and upward throughout the mountains.

Salix boothii Dorn
Booth Willow
Circle Creek and riparian areas NW of Almo.

Salix drummondiana Barratt
Drummond Willow
Along Emery Canyon Creek mixed with alders.

Salix exigua Nutt. subsp. ***exigua*** var. ***stenophylla*** (Rydb.) Schneid.
Sandbar Willow
Lower Circle Creek and along the wash east of Emery Canyon Well.

Salix geyeriana Anderss.
Geyer Willow
Circle Creek and riparian areas NW of Almo.

Salix lasiandra Benth.
Whiplash Willow
Riparian areas. Becoming almost tree-like along Almo Creek.

Salix lutea Nutt.
Yellow Willow
Circle Creek and other riparian areas.

Salix scouleriana Barratt
Scouler Willow
Scattered through the aspen groves, particularly around seeps and vernally wet areas.

Santalaceae

Commandra umbellata (L.) Nutt. var. ***pallida*** (DC.) Jones
Bastard Toadflax
Widespread in sagebrush areas.

Saxifragaceae

Heuchera cylindrica Dougl. var. ***alpina*** Wats.
Roundleaf Alumroot
Graham Peak and northward.

Heuchera parvifolia Nutt. var. ***utahensis*** (Rydb.) Garrett
Utah Alumroot
Rock outcrops at middle elevations.

Heuchera rubescens Torr.
Pink Alumroot
Everywhere on the rock outcrops.

Lithophragma glabrum Nutt.
Fringecup Woodland Star
Sagebrush and pinyon-juniper to middle elevation.
Lithophragma bulbifera

Lithophragma parviflorum (Hook.) Nutt.
Smallflowered Woodland Star
Sagebrush, banks of vernal streams, pinyon-juniper.

Lithophragma tenellum Nutt.
Slender Woodland Star
Sagebrush and pinyon-juniper.

Scrophulariaceae

Castilleja angustifolia (Nutt.) G. Don var. ***dubia*** A. Nels.
Desert Paintbrush
With Basin Big Sagebrush in the foothills to the basins.
Castilleja chromosa

Castilleja angustifolia (Nutt.) G. Don var. ***flavescens*** (Pennell) N. Holmgren
Northwestern Paintbrush
Along the ridge from Finger Rock to Indian Grove.

Castilleja exilis A. Nels.
Annual Paintbrush
Along Little Cove Creek (intermittent) and in meadows eastward. Abundant following snowy winters, otherwise uncommon in the Reserve.

Castilleja flava Wats.
Yellow Paintbrush
Foothills to moderate elevations in the sagebrush.

Castilleja linariifolia Benth.
Wyoming Paintbrush
Among sagebrush. Most common on the north-facing slope of Southwest Hill near the southern boundary of the Reserve.

Castilleja miniata Dougl. ex Hook.
Scarlet Paintbrush
Graham Peak and northward in the mountains.

Castilleja pallescens (Gray) Greenman var. ***inverta*** (Nels. & Macbr.) Edwin
Pale Paintbrush
Rocky, windswept ridge at Graham Peak and northward.

Collinsia parviflora Dougl. ex Lindl.
Blue-Eyed Mary, Chinese House
Foothills to moderate elevations in numerous habitats.

Cordylanthus ramosus Nutt. ex Benth.
Bushy Bird's Beak
Foothills and valleys in sagebrush. Abundant following wet winters.

Limosella aquatica L.
Mudwort
In and around overflow pond near cattle trough NE of Twin Sisters.

Mimulus guttatus DC.
Yellow Monkey Flower
Springs, seeps, riparian areas and vernal streams.

Mimulus lewisii Pursh
Lewis Monkey Flower
Near the spring in Indian Grove.

Orthocarpus hispidus Benth.
Owl Clover
Ditchbanks and meadows NW of Almo.

Orthocarpus luteus Nutt.
Yellow Owl Clover
Along irrigation ditch at Little Cove Creek.

Pedicularis contorta Benth.
White-Coiled Lousewort
East-facing slope just north of Graham Peak.

Penstemon attenuatus Dougl. ex Lindl.
var. ***militaris*** (Greene) Cronq.
Taperleaved Penstemon
Aspen groves and open slopes at moderate to high elevations.

Penstemon cyananthus Hook. var. ***subglaber*** (Gray) N. Holmgren
Wasatch Penstemon
Foothills to moderate elevations. Locally abundant north of Finger Rock along the road.

Penstemon humilis Nutt. ex A. Gray
Low Penstemon
Pinyon-juniper, sagebrush, and rock outcrops from the foothills to middle elevations.

Penstemon radicosus A. Nels.
Matroot Penstemon
Sagebrush slopes on Southwest Hill.

Penstemon rydbergii A. Nels.
Rydberg Penstemon
Meadows from Emery Canyon north through Indian Grove and into the higher mountains.

Scrophularia lanceolata Pursh
Lanceleaf Figwort
Aspen groves and open slopes from Finger Rock northward.

Verbascum thapsus L.
Flannel Weed, Mullein
Roadsides and disturbed places, foothills to middle elevations.

Veronica americana Schwein.
American Brooklime
Circle Creek, springs and seeps.

****Veronica anagallis-aquatica*** L.
Water Speedwell
Streams in the valley NW of Almo.

****Veronica biloba*** L.
Speedwell
A weed of livestock bedding areas and roadsides.

Veronica peregrina L. var. ***xalapensis*** (H.B.K.) St. John & Warren
Purslane Speedwell
Streambanks and wet areas NW of Almo.

Veronica serpyllifolia L. var. ***humifusa*** (Dickson) M. Vahl.
Thymeleaved Speedwell
Along Emery Canyon Creek and at Indian Grove.

Solanaceae

****Hyoscyamus niger*** L.
Henbane
Roadside weed in upper Emery Canyon.

Nicotiana attenuata Torr. ex S. Wats.
Coyote Tobacco
Appearing for a few years on newly disturbed sites, such as roads or clearings in sagebrush.

****Solanum dulcamara*** L.
European Bittersweet, Nightshade
Introduced by dumping of waste along the wash near the east entrance of City of Rocks.

****Solanum triflorum*** Nutt.
Cutleaf Nightshade
A weed of disturbed roadside areas.

Valerianaceae

Plectritis macrocera Torr. & Gray
Longhorn Plectritis
In the rock formations and pinyon-juniper from foothills to middle elevation. Becoming very abundant when spring rains are generous.

Valeriana acutiloba Rydb. var. ***pubicarpa*** (Rydb.) Cronq.
Cordilleran Valerian
In meadows and aspen groves from Graham Peak northward.

Valeriana edulis Nutt. ex Torr. & Gray
Edible Valerian
Around Emery Canyon Well and eastward along the wash.

Valeriana occidentalis A.A. Heller
Western Valerian
Aspen thickets at Indian Grove.

Verbenaceae

Verbena bracteata Lag. & J.D. Rodriguez
Prostrate Verbena
Roadsides, especially in areas that are graded annually.

Violaceae

Viola adunca Sm. var. ***adunca***
Blue Violet
Aspen groves, grassy areas, and riparian zones at middle and higher elevation.

Viola nuttallii Pursh var. ***major*** Hook.
Nuttall Violet
Foothills to moderate elevations in many habitats.

Viola nuttallii Pursh var. ***vallicola*** (Nels.) Hitchc.
Yellow Violet
Foothills to moderate elevations.

Viola purpurea Kell.
Goosefoot Violet
Foothills to moderate elevations.

CLASS LILIOPSIDA

Cyperaceae

Carex aquatilis Wahl.
Water sedge
Riparian, mainly NW of Almo.

Carex douglasii F. Boott
Douglas Sedge
Meadows, dry slopes, roadways, and open areas from the valley to moderate elevations.

Carex hoodii F. Boott
Hood Sedge
Meadows and aspen groves.

Carex microptera Mackenzie
Smallwing Sedge
Riparian areas and springs and seeps.

Carex multicostata Mackenzie
Many-Ribbed Sedge
Meadows and riparian areas NW of Almo.

Carex nebrascensis Dewey
Nebraska Sedge
Forming thick turf in places along Circle Creek, below the springs at the Stage Station, and in Emery Canyon. Meadows and riparian areas.

Carex petasata Dewey
Liddon Sedge
Around the base of rock outcrops in shaded but rather dry sites.

Carex praegracilis W. Boott
Blackcreeper Sedge
Meadows and riparian areas in the valley to middle elevation.

Carex raynoldsii Dewey
Raynolds Sedge Meadows from Indian Grove northward in the mountains.

Carex rossii F. Boott
Ross Sedge
Among alpine fir at Indian Grove.

Carex vallicola Dewey
Valley Sedge
Aspen groves and open slopes at middle and higher elevations.

Eliocharis bolanderi A. Gray
Bolander Spike Rush
Edge of aspen groves north of Bath Rock and open, vernally wet slope north of Emery Canyon Creek.

Eliocharis palustris (L.) R. & S.
Creeping Spike Rush
Edges of ponds along Circle Creek and near the Stage Station.

Eliocharis pauciflora (Lightf.) Link
Few Flowered Spike Rush
Vernal streams, meadows in the valley and foothills.

Eliocharis microcarpus C. Presl.
Panicled Bulrush
Along Circle Creek.

Eliocharis pungens Vahl.
Common Threesquare
Edges of ponds and along streams.

Iridaceae

Iris missouriensis Nutt.
Missouri Iris
Meadows from the valleys to Circle Creek Basin.

Sisyrinchium idahoense E.P. Bicknell
Blue-Eyed Grass
Riparian meadows.

Juncaceae

Juncus balticus Willd. var. ***montanus*** Engelm.
Northern Rush
Meadows and seeps from the valleys to moderate elevations.
Juncus arcticus

Juncus bufonius L.
Toad Rush
Meadows and vernally wet areas.

Juncus confusus Coville
Colorado Rush
Meadows, springs, and seeps.

Juncus ensifolius Wikstra. var. ***montanus*** (Engelm.) Hitchc.
Swordleaf Rush
Indian Grove and northward in moist areas.

Juncus ensifolius Wikstra. var. ***brunnescens*** (Rydb.) Cronq.
Swordleaf Rush
Riparian areas and meadows NW of Almo. Also lower Circle Creek.

Juncus mertensianus Bong.
Mertens Rush
Along vernal stream at Indian Grove and northward at higher elevations.

Juncus torreyi Coville
Torrey Rush
At the spring near the Stage Station.

Liliaceae

Allium acuminatum Hook.
Tapertip Onion
Foothills to middle elevations in many habitats.

Allium brandegei S. Wats.
Brandegee Onion
Sagebrush grasslands and pinyon- juniper in the basins and near rock outcrops.

Calochortus eurycarpus S. Wats.
Sego Lily, Mariposa Lily
Open slopes, edges of meadows, moderate elevations. Indian Grove.

Calochortus nuttallii Torr. & Gray
Sego Lily
Foothills to middle elevations, mostly in sagebrush.

Fritillaria atropurpurea Nutt.
Leopard Lily
Fairly common on north facing slopes in the foothills, pinyon-juniper and sagebrush.

Fritillaria pudica (Pursh) Spreng.
Yellow Bell, Spring Bell
An early bloomer from foothills to moderate elevations, numerous habitats.

Smilacina racemosa (L.) Desf.
False Solomon's Seal
Around the base of cliffs and rock outcrops.

Smilacina stellata (L.) Desf.
False Solomon's Seal
Riparian areas, often among willow thickets.

Veratrum californicum Dur.
False Hellebore, Skunk Cabbage
Moist to seasonally dry areas along streams and in higher meadows.

Zigadenus paniculatus (Nutt.) S. Wats.
Death Camus
Foothills to middle elevations in sagebrush grasslands.

Zigadenus venenosus S. Wats. var. ***venenosus***
Death Camas
Meadows in Emery Canyon.

Orchidaceae

Habenaria dilatata (Pursh) Hook. var. ***leucostachys*** (Lindl.) Ames
Bog Orchid
Riparian areas NW of Almo.

Habenaria hyperborea (L.) R. Br.
Northern Green Orchid
Lower Circle Creek in meadows. Uncommon and not appearing every year.

Lemnaceae

Lemna minor L.
Duckweed
Common floating on the surface of still waters.

Poaceae

Achnatherum hymenoides (Roemer & Schultes) Barkworth
Indian Rice Grass
Foothills to middle elevations on open sites.
Oryzopis hymenoides, Stipa hymenoides.

Achnatherum lettermanni (Vasey) Barkworth
Letterman Needle Grass
Graham Peak on lee slope and open places at Indian Grove. *Stipa lettermanni*

Achnatherum nelsonii (Scribner) Barkworth
Columbia Needle Grass
Open slopes and meadows from middle elevations to the high mountains.
Stipa nelsonii, S. columbiana

Achnatherum nevadense (R.L. Johnson) Barkworth
Nevada Needle Grass
Open slopes, snow pockets, and meadows at moderate to high elevation. *Stipa nevadensis*

****Agropyron desertorum*** J.A. Schultes
Crested Wheatgrass
Introduced throughout the Reserve in the old fields and along roadways.

Agrostis exarata Trin.
Spike Redtop
Meadows, riparian, from Indian Grove northward.

Agrostis scabra Willd.
Ticklegrass
Openings in alpine fir stands and roadsides mainly from Graham Peak northward.

****Agrostis stolonifera*** L.
Redtop, Creeping Bentgrass
Introduced and naturalized in riparian areas.

Alopecurus aequalis Sobol.
Short-Awned Foxtail
In and near small streams, especially at Indian Grove.

****Apera interrupta*** (L.) Beauv.
Windgrass
Ditchbanks and roadsides in seasonally wet areas, mainly NW of Almo.

****Avena fatua*** L.
Wild Oats
Roadsides, fields, ditchbanks and disturbed places.

Beckmannia syzigachne (Steudel) Fern.
Sloughgrass
In standing water along Almo Creek.

Bromus carinatus Hook. & Arn.
California Brome
Aspen groves, meadows, and open slopes from middle to high elevations.

****Bromus commutatus*** Schrader
Hairy Chess
Roadsides and disturbed places.

****Bromus inermis*** Leysser
Smooth Brome
Introduced in seedings and persisting in favorable sites, especially at middle or higher elevations.

****Bromus japonicus*** Thunb.
Japanese Chess
Roadsides and disturbed places.

Bromus tectorum L.
Downy Chess, Cheatgrass
Foothills to moderate elevations. Most abundant in burned or otherwise disturbed areas, but invading and succeeding within native communities as well.

Dactylis glomerata L.
Orchard Grass
Introduced in seedings and naturalized, mostly in riparian meadows and around farmsteads. Also in sagebrush grasslands, as at Twin Sisters.

Danthonia californica Boland
California Oatgrass
Moist meadows and vernally flooded areas from the valley to moderate elevations.

Danthonia unispicata (Thurber) Munro
One-Spike Oatgrass
Pinyon-juniper and sagebrush grasslands. Highly palatable to cattle and only abundant therefore in seldom grazed places.

Deschampsia danthonioides (Trin.) Munro
Annual Hairgrass
Along vernal streams and roadsides in wet areas.

Deschampsia elongata (Hook.) Munro
Slender Hairgrass
Around springs and seeps and in meadows at middle to high elevations.

Distichlis spicata (L.) Greene
Saltgrass
Saline areas along streams and in the valley. Found along the road just south of Emery Canyon/Twin Sisters junction.

Echinochloa crusgalli (L.) Beauv.
Barnyard Millet
Roadsides in relatively moist places.

Elymus elymoides (Raf.) Swezey var. ***elymoides***
Squirreltail Grass
Foothills to middle elevations, sagebrush grasslands and pinyon-juniper. Recurring at high elevations.
Sitanian hystrix, Sitanian purpurea

Elymus glaucus Buckley
Blue Wildrye
Aspen groves and meadows at middle and higher elevations.

Elymus lanceolatus (Scrib. & J.G. Smith) Gould
Thickspike Wheatgrass
Foothills to middle elevations, sagebrush and pinyon-juniper.
Agropyron lanceolatum

Elymus trachycaulus (Link) Gould var. ***trachycaulus***
Slender Wheatgrass
Middle to high elevations in open places and aspen groves. An awned variant can be found, possibly a result of crossing with *E. glaucus*.
Agropyron trachycaulum.

Elymus trachycaulus (Link) Gould var. ***latiglume*** (Scrib. & Smith) A.A. Beetle
Shady rock ledges at middle and higher elevations.
Agropyron trachcaulum var. *latiglumis*

Elytrigia repens (L.) Nevski
Quackgrass
Roadsides and ditchbanks in the valleys and basins.

Festuca confinis Vasey
Spike Fescue
Middle and higher elevations on open slopes and ridges.
Hesperochloa kingii, Festuca kingii

Festuca idahoensis Elmer
Idaho Fescue
Mesic slopes and openings among aspen and mahogany at middle elevations.

Festuca pratensis Huds.
Meadow Fescue
Introduced in pasture seedings and quite naturalized now in riparian areas and moist meadows.

Festuca rubra L. var. ***rubra***
Red Fescue
An introduced pasture grass that has become naturalized in riparian areas.

Glyceria striata (Lam.) A.S. Hitchc. var. ***stricta*** (Scribn.) Fern.
Fowl Mannagrass
Springs, seeps, and streambanks.

Hesperostipa comata (Trin.. & Rupr.) Barkworth var. ***comata***
Needle and Thread Grass
Foothills on open slopes.
Stipa comata

Hordeum brachyantherum Nevski
Meadow Barley
Meadows in the valleys and upward to moderate elevations. Common at Emery Canyon and Indian Grove.

Hordeum jubatum L.
Foxtail Barley
Meadows and roadsides, mostly low to middle elevation.

Koeleria macrantha (Ledeb.) Schultes
Junegrass
Open slopes a middle and higher elevations.
Koeleria cristata, K. nitida

Leymus cinereus (Scrib. & Merr.) Love
Great Basin Wildrye
Middle and higher elevations on open slopes.
Elymus cinereus

****Lolium perenne*** L.
Perennial Ryegrass
Roadsides and meadows, mostly in the valleys.

Melica bulbosa Geyer ex Porter & Coult.
Oniongrass
Middle to high elevations in aspen groves and on open sites.

Muhlenbergia richardsonis (Trin.) Rydb.
Mat Muhly
Valleys to middle elevations in open sites.
Common along the old roadway at Indian Grove.

Phalaris arundinacea L.
Reed Canary Grass
Riparian areas at the edge of permanent water.

Phleum alpinum L.
Alpine Timothy
Graham Peak northward in meadows and along roadsides.

****Phleum pratense*** L.
Timothy
Meadows from the valleys to middle elevations.
Introduced in old pasture seedings and now quite naturalized.

****Poa annua*** L.
Disturbed moist places. Common in cattle bedding areas along Emery Canyon Creek.

Poa bolanderi Vasey
Bolander Bluegrass
Indian Grove and northward in the mountains.

****Poa bulbosa*** L.
Bulbous Bluegrass
Disturbed places in the valley and upward to middle elevations.

Poa cusickii Vasey var. ***epilis*** C.L. Hitchc.
Cusick Bluegrass
Graham Peak and northward.

Poa nervosa (Hook.) Vasey var. ***wheeleri*** (Vasey) C.L. Hitchcock
Wheeler Bluegrass
Aspen groves, Douglas Fir, and higher forests.

Poa pratensis L.
Kentucky Bluegrass
Valleys to mountains in many habitats. Forms a turf in heavily grazed areas.

Poa rupicola Nash
Timberline Bluegrass
Open ridges, Graham Peak and northward.

Poa secunda Vasey
Sandberg's Bluegrass
Valleys to high elevations, assuming many forms.

Polypogon monspeliensis (L.) Desf.
Rabbit's Foot Grass
Moist places from the valleys to moderate elevations. At the springs near the Stage Station.

Pseudoroegneria spicata (Pursh) Love
Bluebunch Wheatgrass
Foothills to rather high elevations in sagebrush grasslands.
Agropyron spicatum

Puccinellia distans (L.) Parl.
Alkali Grass
Valley meadows and roadsides, often on noticeably saline sites.

Puccinellia nuttalliana (Schultes) Hitchc.
Alkali Grass
Around the spring at the Stage Station.

Sporobolus aeroides (Torr.) Torr.
Alkali Sacatan
Meadows and flats in the valleys.

Sporobolus cryptandrus (Torr.) Gray
Sand Dropseed
Around rock formations in open sites.

****Thinopyrum ponticum*** (Podp.) Barkworth & Dewey
Tall Wheatgrass
Seeded along roadsides and in valley pastures.

Torreyochloa pauciflora (Presl.) Church
Weak Mannagrass
In standing waters along Almo and Circle Creeks.

Trisetum montanum Vasey
Rocky Mountain Trisetum
Aspen and conifer forests from Indian Grove northward in the mountains.

Trisetum spicatum (L.) Richter
Spike Trisetum
Open slopes and ridges at moderate and high elevations.

Vulpia microstachys (Nutt.) Benth. var. ***pauciflora*** (Scrib.) Leonard & Gould
Annual Fescue
Soil pockets on rock outcrops, pinyon-juniper, and sagebrush. Becoming locally abundant during wet years.

Vulpia octoflora (Walter) Rydb.
Six-Weeks Fescue
Among sagebrush stands. Not very common at City of Rocks.

Potamogetonaceae

Potamogeton pusillus L.
Dwarf Pondweed
In slow-moving water on Circle Creek.

Typhaceae

Typha latifolia L.
Common Cattail
Springs at Stage Coach Station and in riparian areas NW of Almo.

Zannichelliaceae

Zannichellia palustris L.
Horned Pondweed
Growing in livestock tanks and ponds.